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**AG BIOTECHNOLOGY IN
MONTANA**
MSU Crop and Pest School
January 5, 2005
Bozeman, MT
Dr. Mike King

**MONTANA'S
BIOBASED
ECONOMY**
What's it Mean to
You?

**“Start with the
End in Mind”**
Stephen Covey

**MONTANA'S BIOBASED
ECONOMY**
•Prosperous, Diversified Rural Economy
•Regional Centers (Hubs)
•Concentrate and Focus on What We
Do Best

**The Case for
Agricultural
Biotechnology in
Montana**

The Case for Ag Biotechnology in
Montana
Agricultural Biotechnology:
•Is Safe, Proven and Becoming Even Safer



Agricultural Biotechnology

Safety of biotechnology crops

- Biotechnology products have been thoroughly evaluated by biotech developers and regulatory agencies.
 - **FDA** holds biotechnology-derived food to the same high standards as traditional foods.
 - **EPA** reviews biotech products for environmental impact, effect on threatened species and human safety.
 - **USDA** monitors field testing of biotech crops.

Agricultural Biotechnology

Safety of biotechnology crops & food

“Too many opponents of biotechnology willfully choose to emphasize the highly unlikely potential risks rather than recognize the years of experience, research and regulatory oversight that govern the safe use of these new technologies.”

Norman Borlaug, Nobel Peace Prize Laureate

The Case for Ag Biotechnology in Montana

Agricultural Biotechnology:

- Is Safe, Proven and Becoming Even Safer
- Will Improve Our Quality of Life
- Will Improve Our Environment
- Will Revitalize Our Rural Economy, Expand Our Tax Base and Provide More Revenue for Our State.

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Opposition to Agricultural Biotechnology is Diminishing:

- India recently ok'd Bt cotton
- Japan will no longer segregate GMO corn from non-GMO corn
- South Korea and South Africa recently approved grain corn containing the Herculex I Insect Protection trait for food use
- A GMO food labeling initiative on the Oregon ballot in Nov 2002 lost decisively
- In the Northeastern region of Spain, more than 40,000 acres of Bt maize has been grown every year since 1998. 4% of total
- October 2004. Brazil OK's GM soybeans
- China ready to introduce GM rice.
- EU added first GM strains to its common seed catalog 9/04

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“Honest disagreement is often a sign of progress”

Mahatma Gandhi

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Montana

- Fits Our State Well
- If We Don'tOur Competitors Will Eat Our Lunch!!
- We Need It!!

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**Agricultural Biotechnology Fits
Our State Well:**

- Geography – Isolation and Land Area are **ASSETS!!**
- Climate – Dry, Cold Winters.
- Crops – Little or No Out-Crossing

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If We Don't Embrace Ag Biotechnology in
Montana... Our Competitors Will Eat Our
Lunch

"A 'wait and see' strategy could mean missing out on
perhaps the most potent source of innovation and
growth in the entire food business"

The McKinsey Report. "Food Biotechnology: Can You Afford to be Left Out?"

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WHO ARE OUR COMPETITORS???

- Neighboring States, e.g. ND, ID, WA, KS
- Neighboring Countries, e.g. Canada, Mexico
- The Rest of the World, e.g.
 - Cuba – fructose from sugar cane
 - China – Currently 2nd to the US in Ag Biotech Spending. Increasing their public spending by 5X, \$500 million.

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WE NEED IT!

- Lower Input Costs – Improved Profitability
- Stress Tolerance
- New, High Value Crops

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Lower Input Costs – Improved Profitability

- RR Sugar beets
- Nematode Resistant Sugar beets - \$1.0 billion lost in US
- Scab Resistant Wheat and Barley – \$2.7 billion loss from 1998 to 2000 (Syngenta says 2010 commercial release)
- Wheat Streak Resistant Wheat (MSU)
- Corn Rootworm BT corn

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STRESS TOLERANCE

- Drought Tolerance
- Cold Tolerance
- Salt Tolerance

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New High Value Crops

- Less Reliance on Rail
- Local Processing
- Rural Re-vitalization
- Could favor smaller, intensively managed farms

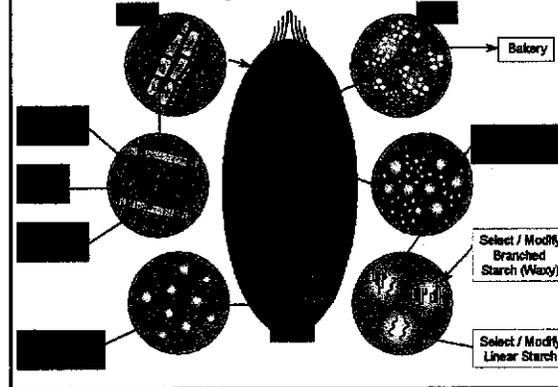
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New High Value Crops

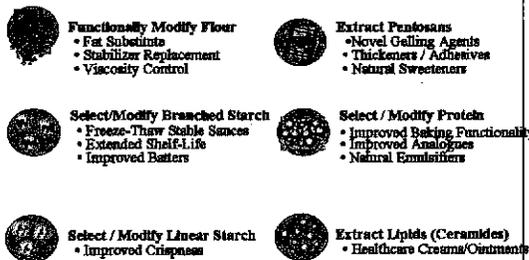
Add Value to Wheat - Industrial, Animal Feed, Food

- Ethanol- Some Germans tout wheat as the best
- Strawboard - since 1995 North Dakota Primeboard
- Packaging materials- EarthShell Packaging, biodegradable dishware from wheat starch
- Wheat Fractionation
- Food Ingredients - e.g. wheat beer, 10.5 M lbs in 2004

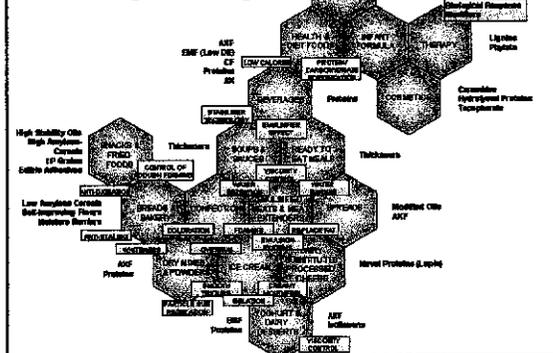
Functional Ingredients Derived from Wheat

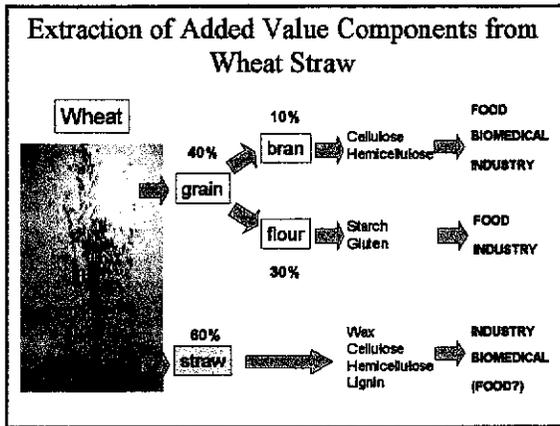
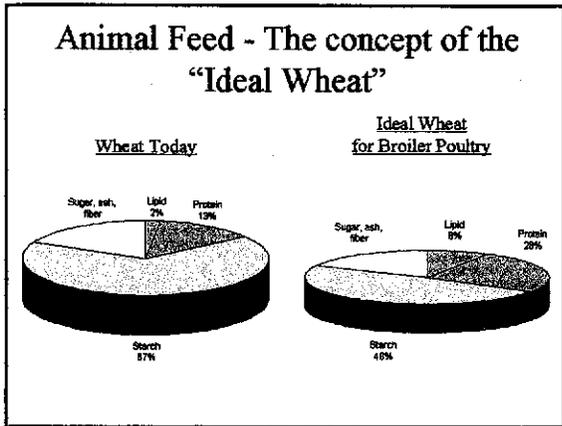


Cereal Derived Ingredients



DuPont Agricultural Food Ingredients Interlocking Core Technologies





- ### Biorefining from Crops Examples
- Cellulose
 - Hemicelluloses
 - Emulsifiers, adsorbents, encapsulants, gels, thickeners
 - Lignins
 - Phenols
 - surfactants, resins, polymers, antioxidants, UV filters, intermediates, pharmaceuticals
 - Waxes
 - Oils
 - resins, polymers, cosmetics, films, fuels, lubricants

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New High Value Crops

Sugar Beets -

- Fructans
- Low calorie sugar
- Sugar alcohols - mannitol and sorbitol

Corn -

- Polyactic Acid, Dow/Cargill, Blair NE
- Serona- DuPont, clothing fiber from corn
- Ingeo fiber, Dow/Cargill, blankets, apparel, Wickers Performancewear.

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New High Value Crops

Alfalfa - plastic polymer, PEH, polyhydroxybutyrate. U of Minn.

Pharmaceutical Proteins from Plants - e.g. SemBioSys, Saskatoon

Animal and human vaccines

drugs e.g. insulin, taxol, natural sedatives.

Neutraceuticals - health foods from plants, Solae - DuPont plus Bunge

\$800 annual revenue. Low-linolenic soybeans, VISTIVE from Monsanto/Cargill, NUTRIUM Bunge and DuPont, 1 billion pounds by 2009. Trans-fat free canola, Dow AgroSciences. Natreon

Improved Paper Pulp - many plants, e.g. poplar and cottonwood.

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Crops Being Transformed, Worldwide. One Newsletter, One Year, 2002.

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Crops Being Transformed, Worldwide. One Newsletter, One Year, 2002.

Corn and Potatoes – too many to count!

Small Grains – 47 separate reports

Canola/Mustard/Rapeseed – 21

Pulse crops – 13

Sunflower – 7

Alfalfa – 4

Flax – 2

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New High Value Crops

101 Cultivated Plants

6 Weeds!

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Small Grain – oats, millet, wheat, rye, barley

Corn and Rice

Vegetables – Cauliflower, squash, spinach, eggplant, yams, asparagus, sweet potato, artichoke, onions, celery, cabbage, chickpea, cukes, potato, cassava, tomato, peas, pepper

Fruits – papaya, pineapple, peaches, muskmelon, grapes, citrus, kiwi, strawberry, pear, apple, guava, banana

Grasses – buffalograss, bentgrass, Russian wildrye, blue gamma grass

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Flowers – dahlia, begonia, geraniums, orchids, azalea, zinnia, carnation, rose, asters, chrysanthemum, lily

Trees – chestnut, teak, eucalyptus, yew, poplar, pines, oak, spruce, highbush blueberry, fir, loblolly pine, larch, walnut, avocado, rubber

Medicinal Plants – ginseng, St. Johnswort, Echinacea

Spices – sage, garlic, fenugreek, mint

Oilseeds – flax, soybean, brassicas, sunflower, cotton, oil palm, olive

Other – buckwheat, jute, carob, bamboo, coffee, tobacco, tea

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WHO'S WORKING ON THESE??

Patents –

Texas A&M, Bayer, Japan Tobacco Co., Samyang Genex Corp.
CBD Technologies (Israel), DeKalb (Monsanto), Mitsui, Novartis, The State of Oregon, Metabogel Ltd., Meristem Therapeutics, Biopolymers Pty Ltd, Northwest Plant Breeding Co., Epicyte Pharmaceuticals (w Scripps Institute), MPB Cologne GmbH(German), Pioneer Hi-Bred (DuPont), Sapparo Breweries, Danisco A/S

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Other Companies Involved

MaxyGen (MaxyAg), Syngenta, Cargill/Dow, Athenix, Novozymes, AgraQuest, Delta and Pine Land Large Scale Biology Corp., DeltaMax Cotton Ltd. Okanagen Biotechnology, Imerge Biotherapeutics University of Missouri, Kangwon National University Arcadia Biosciences, CropDesign (Ghent, Belgium)
(Not an exhaustive list by any means!)

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What's the Patent Situation?

Ag Biotech Patents 1996 to 2000, approximately 6-8,000 patents worldwide

- 39% US Commercial Firms
- 26% Foreign Commercial Firms
- 22% US Non- Profits and US Universities
- 5% Foreign Universities and Non-Profits
- 3% US Federal Government
- 3% Foreign Governments

10 Largest Firms Control about 40% of the patents.

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Patent Issues with GM Plants

Drought Resistance Gene(s) Example

- Marker gene (Private company)
- Promoter for Marker gene (Private Company)
- Terminator for marker gene (Private Company)
- Intron for marker (Cornell University)
- Gene of Interest (Washington University)
- Promoter for gene of interest (Private Company)
- Terminator for gene of interest (Private Company)
- Gene gun technology (Private Company)

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- Fits Our State Well
- If We Don'tOur Competitors Will Eat Our Lunch!
- We Need It!!

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How Do We Bring This to Reality?

- Continuous Education of Our Non-Ag Citizens
- Teamwork
- Financial Resources
- A Strong, well funded University System
- VISIONARY, COMMITTED LEADERSHIP

MONTANA'S BIOBASED ECONOMY

What's it Mean to
You?

WHAT'S IN IT FOR YOU????

**A Bright Future! Especially in
Montana!**

Opportunity and Careers

Science – Biology, Computers, Math, Chemistry

Industrial Products

Agriculture

Education

Agriculture, Foods

Management, Politics

THANK YOU!

Any Questions??

**OPPORTUNITIES FOR NON-GMO
CROPS!!**

"Talk to us
about innovative
marketing options
for Non-GMO
Soybeans"

HONEYFORD ELEVATOR
Gilley, Iowa-OK Bulkhead
Authorized agent and distributor for

THOMPSONS

For more details go to www.thompsonselevator.com
or call 800-475-7242
*Soybean yield: 40-50 bushels per acre
*Soybean oil: 18-20% of total weight