GMOs and Grain Marketing: Issues Impacting Wisconsin's Farmers, Elevators and Processors for 2000

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The intensity of the GMO debate has increased significantly in recent months, resulting in confusion among both producers and handlers of grain as to the relative importance of GMO versus non-GMO grain production. This paper is intended to serve as a resource, to assist in addressing production decisions, and to provide information to growers and handlers of grain for commonly asked questions regarding biotechnology crops for 2000. This paper does not address all GMO issues. Mention of registered trademarks, products or websites, does not constitute an endorsement by the authors or by the University of Wisconsin.

What are GMOs?

GMOs stands for "genetically modified organisms." The term is used in the press to mean genetically engineered or transgenic plants.

Biotechnology or gene transfer allows us to use beneficial genes or characteristics from one organism and to place the genes with the beneficial characteristics into another species.

Transgenic refers to the transfer of a gene or genes from one species into another host species. The introduced genes produce a new protein, which gives the desired qualities in the host plant, animal, or bacteria.

When a desirable gene is discovered in another microorganism, plant or animal and transferred into a crop plant, the resulting crop hybrid or variety is designated a genetically engineered or transgenic crop.

1. Crops that we have grown for decades have had "improved" genetics, but traditional crop breeding has been the primary tool for these genetic improvements.
   - ❑ Improved genetics have increased yields, disease resistance, insect resistance, etc.
   - ❑ These genes came from the same or closely related wild species.
2. Examples of biotechnology and gene transfer in agriculture and medicine.
   - ❑ Inserting the gene for human insulin into a yeast cell.
   - ❑ Edible vaccines that have been transferred in crops like bananas.
   - ❑ Bt corn and Roundup Ready crops may reduce pesticide carryover, use, risk of water contamination, and human exposure to toxic pesticides.
   - ❑ Transgenic cows whose milk protects humans against Hepatitis B.
   - ❑ Transgenic goats whose milk contains a protein AT111 that helps doctors control clotting during open-heart surgery.
   - ❑ Corn rootworm resistant corn.
   - ❑ An antibody produced in transgenic corn that fights cancer.
   - ❑ New research to produce transgenic pharmaceutical proteins, vaccines and industrial enzymes in crops.
   - ❑ Soybeans with healthier fatty-acid profiles.
   - ❑ Crops with lower levels of mycotoxins.
3. Agriculture may expect greater acceptance of GMOs as consumers see greater benefits from biotechnology. The current perception is that biotechnology or gene transfer allows us to use beneficial genes or characteristics from one organism and to place the genes with the beneficial characteristics into another species.
4. Good science should be the guide as more biotechnology products are developed.

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Grain Markets

The GMO debate has often been presented as an issue for U.S. exports. However, it is more than an export market issue. Domestic food markets are also affected by concerns over GMO products.

Corn

To date, GMO versus non-GMO products have been of little concern in the domestic feed industry. In 1998 and 1999, 58% of the U.S. corn crop was used by the domestic feed industry (Table 1).

Seventeen percent of 1998 U.S. corn production was exported, which approximately 80-90% was also fed to livestock. Exports in the 1999/2000 marketing year will likely account for about 20% of 1999 U.S. corn production. While a majority of this will also be fed, it is unclear at this time whether foreign feed markets will demand non-GMO feed.

Six percent of the 1998 corn crop was used to produce sweeteners, and 8% went to other food uses. Similar percentages are expected in the coming year for 1999 production. The 14% of U.S. corn used in the domestic food is of concern regarding marketing transgenic corn.

Six percent of the 1998 corn crop was used for ethanol production, and this may increase slightly in 1999. Joint products and by-products of ethanol production are important exports to the European Union (EU). If the EU demands non-GMO by-products, then the ethanol market could demand non-GMO corn even though the production of ethanol itself is a non-issue.

An additional 5% of the 1998 corn crop carried over to this year. For 1999 production, it is currently anticipated that 2% will be carried into the next year as additional stocks.

If we assume that the entire U.S. food market (including sweeteners), all exports, and the ethanol market (because of joint products and byproducts) were to demand non-GMO corn, then somewhere between 37 and 40% of the demand for U.S. corn would be for non-GMO corn. While domestic feed markets may eventually be affected, it is likely that this represents the upper limit on non-GMO corn demand for the coming crop year.

Soybeans

In 1998, 58% of U.S. soybean production was crushed for meal and oil. Nineteen percent of the meal and 13% of the oil was exported. Another 29% of the soybeans were exported as whole beans.

Total crush for the 1999 crop is expected to be 60%, with over 19% of the meal and 10% of the oil exported. In addition, 32% of the 1999 soybean crop is expected to be exported as whole beans.

Since soybean meal and soy oil are joint products, if either market demands non-GMO soybeans as inputs the other market will be affected. Further, because much more of U.S. soybean production is exported relative to corn, export demands for non-GMO will have a greater influence on the amount of non-GMO soybeans that need to be produced. This makes it much more difficult to come up with an expected upper limit percentage of U.S. soybeans that might be demanded as non-GMO. However, the percentage of soybeans demanded as non-GMO may be significantly greater than that for corn.

Table 1. US Corn and Soybean Market Use[1]

	Corn (%)			Soybean (%)	
Use	1998	1999	Use	1998	1999
Domestic Feed	58	58	Crushed	58	60
Export	17	20	Meal Export	19	19
Sweetener	6	6	Oil Export	13	10
Other Food	8	8	Bean Export	29	32
Ethanol	6	8			

[1]Source: Personal communication with T.R. Fortenbery

Production Considerations

(Lauer, 1999)

1. All GMO seed sold in the U.S. is approved for sale and use in the U.S. Grain that will either be fed on the farm on where it is produced, or sold into a local feed market in Wisconsin is not likely to be affected by the GMO debate in coming months. Most of the concerns articulated thus far involve grain either headed for the export market or going into the U.S. food processing industries. Two U.S. baby food manufacturers, Gerber and Heinz, announced that they will take GMO ingredients out of their products.
2. Know where you plan to market your crop.
3. Corn hybrids that are not transgenic are: high oil corn, Clearfield (IMI) corn, white corn, and waxy corn. STS soybeans are not transgenic.
4. GMO crops include: all Bt corn hybrids, Liberty Link corn, Roundup Ready corn, high oleic acid soybeans, and Roundup Ready soybeans.
5. Correctly identify the specific type of GMO hybrid you plan to plant on your farm.
6. Check Appendix A for the import Status of GMOs as of 20 December 1999.
7. Non-export approved GMOs must be considered for use in domestic feeding systems first.
8. Many GMO corn hybrids are outstanding in yield potential and general agronomic traits.
   - ❑ The decision to switch from top performing GMO hybrids in exchange for approved hybrids should not be made lightly.
9. Evaluate carefully the costs and benefits of your seed and pest management program for both GMO and non-GMO varieties and hybrids.
   - ❑ Consider yields, weed, insect, and disease management, crop management flexibility, marketing risks, premiums.
10. Pollen from a field with a GMO corn hybrid can "contaminate" a non-GMO hybrid in a neighboring field.
    - ❑ Contamination will probably be low, but tests may unexpectedly detect GMOs.
    - ❑ Most corn pollen falls within 50 feet of the field. However, the isolation requirement for certified corn hybrid seed production is 660 feet.
    - ❑ Field observations have reported pollen drift as far as a couple of miles.
    - ❑ It is difficult to certify that a non-GMO hybrid will not be contaminated if growing in an area where GMO hybrids are produced.
    - ❑ Segregating cornfields at greater distances is contrary to a wise insect-resistance management program. Current research indicates non-GMO blocks must be planted within blocks that are within one-half mile of GMO hybrids, for resistance management considerations.
11. Soybeans are self-pollinated and GMO pollen should not contaminate neighboring fields.

Tests for Transgenic Grains and Marketing

1. ELISA tests have been developed for specific gene transfer events. They are sensitive, quick and easy to use. Each truckload arriving at the elevator could be potentially sampled and tested.
2. Sensitivity of current tests.
   - ❑ While the USDA has not approved official tests, the grain industry has moved ahead with testing procedures that are commercially available. (Please see table 2.)
   - ❑ A truckload of grain contains about 6.2 million kernels of grain. 6,200 kernels would equal 0.1% of a truckload.
   - ❑ If GMO content of a truckload is assumed to be 0.1% and that content is spread uniformly throughout the load, a sample size of 100 kernels offers only a 9.5% chance of including a single GMO kernel. If sample size is increased to 1,000 kernels, then the sample has 63% probability of containing a single GMO kernel. A sample size of at least 10,000 kernels is required to have 99.99% chance of containing at least one GMO kernel.
   - ❑ Sample selection, not test sensitivity, is sometimes the limiting factor in test confidence.

Table 2. GMO Testing Comparison[1]

Test type	Polymerase Chain Reaction	Enzyme-Linked Immunosorption Assay
Acronym	PCR	ELISA
Test duration	1 – 2 days	A few minutes
Min. sample size required	2,500 grams (10,000 kernels)	25 grams (100 kernels)
Cost per test	$250 - $300	Approx. $4 - $100
Coverage	Detects virtually all GMOs	Specific to a single event protein
Test sensitivity	Raw commodities to <0.01%	To <0.1%
Companies involved:	Central-Hanse Analytical Laboratories, Inc., Belle Chase, LA, Genetic ID, Fairfield, IA	Central-Hanse Analytical Laboratories, Inc., Belle Chase, LA, EnviroLogix, Inc., Portland, ME, SDI, Newark, DE

[1]Sources: Individual company information materials, *Seed Today* magazine.

3. Test Availability. The Department of Agriculture, Trade and Consumer Protection will work to assist prodcuers in a number of ways.
   - ❑ Once an official test has been approved by the USDA Federal Grain Inspection Service, the DATCP Grain Inspection Program can test for the presence of GMOs in the harvested crop.

     Contact: Mike Lester (DATCP) (608) 224-5105

     Plant Industry Lab (608) 266-7132

     Superior (Grain Inspection) (715) 392-7850

     Milwaukee (Grain Inspection) (414) 747-3077

Liability and Contracts

(Harl, 1999)

1. Several processors have signaled that grain products must be kept separate and that there may be differential pricing for GMOs and non-GMOs.
   - ❑ Growers, elevators and exporters will need to keep products separate if they are to sell into non-GMO markets.
   - ❑ For non-GMO markets in 2000, it is expected that producers will have to actually designate which loads are GMO and which loads are non-GMO. Quick tests are being developed that can identify GMO events.
2. Segregating not a simple task
   - ❑ Several seed companies concede that some hybrids sold as non-GMO seed may contain low levels of GMO germplasm.
   - ❑ Growers may want to save a pound of each non-GMO seed lot if they plan to market non-GMO grain.
   - ❑ Contamination from pollen drift into non-GMO cornfields may add to the level of GMO germplasm.
   - ❑ Risk of contamination from planters, grain carts, storage bins, trucks, and combines must be managed.
3. Producers should be careful. If they are asked to promise that the crop is non-GMO, they should be very careful what they sign or even what oral comments are made.

   Producers can realistically:
   - ❑ State that GMO seed, as designated by the seed company, WAS NOT planted in a particular field.
   - ❑ State that non-GMO seed, as designated by the seed company, WAS planted.

- ❑ State that care was taken in avoiding contamination in bins, augers, and in the combine.
- ❑ Keep accurate field records and maps.

Producers should be careful not to:

- ❑ State that the crop in question has no GMO germplasm.
- ❑ State that no contamination has occurred from mechanical handling and storage of the crop.
- ❑ State that no contamination has occurred from pollen drift.

4. Uniform Commercial Code imposes implied warranties.
   - ❑ An implied warranty of merchantability is imposed on all goods sold by merchants. Nearly half of the states treat farmers as merchants.
   - ❑ An implied warranty of fitness is imposed on the producer as seller if the seller has reason to know any particular purpose for which the goods are required if the buyer is relying on the seller's skill and judgment in providing the goods.
   - ❑ An implied warranty of merchantability may be excluded or modified by the seller if done orally or in writing, in language that mentions merchantability. If in writing, the disclaimer must be conspicuous.
   - ❑ An implied warranty of fitness can be excluded or modified only by conspicuous, written provisions in the contract.
   - ❑ A seller may be excused from implied warranties if the goods are sold "as is," "with all faults," or if the buyer has examined or refused to examine the goods before signing the contract. A professional buyer will be held to a higher standard of observation than a nonprofessional.
5. So what does this all mean?
   - ❑ Check with likely purchasers. What are they requiring? Some may not yet know. Check carefully the language in any statement you're asked to sign. Use caution in responding orally.
   - ❑ Remember, even a non-GMO crop may not be 100% free of GMO germplasm. But the GMO level may be at an acceptably low level. This is a key problem because no one has set a tolerance, an acceptable level for GMO contamination (e.g. can 0.001% GMO contaminated grain be certified as GMO free?). Without tolerances, no one knows for sure where the line will be drawn. The European Union is wrestling with acceptable tolerance levels.

Potential Premiums/Local Markets

1. While price differentials for GMO and non-GMO have not been wide spread this year (although there were a few), they may become more common next year. However, this will be a function of the supply/demand relationships for non-GMO grain, and will still generally be a local phenomenon unless domestic feed demand for non-GMO products grows.
2. Producers who are selling their grain in markets where export or food processing generates a substantial part of demand (i.e., the Mississippi River, Milwaukee, or rail sub-terminals) should be careful about planting GMO seed unless they have a guaranteed commitment, in writing, that delivery will be accepted. This includes knowing whether any discounts will be applied to GMO grain at the delivery point.
3. Producers should be careful about assuming that significant premiums will exist in their markets for non-GMO grain in the coming year unless they get the premium guaranteed in writing. If 50% of the domestic corn crop is planted from non-GMO seed, and demand for non-GMO only represents 40% of total production as suggested above, significant non-GMO premiums are not likely.
4. Know your local markets.
   - ❑ Local elevators are subject to market forces.
   - ❑ While no major grain company has the intention to discount GMO corn or soybeans, none have ruled it out if markets change.
   - ❑ If you forward contract, check the contract for language that distinguishes between GMO and non-GMO.

Segregation Considerations

There are many uncertainties in trying to decide whether or not to segregrate grain.

- ❑ How much will it cost to segregate non-GMO grain all the way through the markets to end-users?
- ❑ How much, if any, of the premium will reach farmers?
- ❑ Premiums will be determined by the market and farmers must decide whether or not to segregate before the markets gives a clear signal.

1. Segregating crops involves separate storage, handling and documentation of separation. This is called "Identity Preservation."
2. "Identity Preservation" implies the crop has special characteristics and has been protected from contamination.
3. "Identity Preservation" is currently practiced by producers of seed, blue and white corn, malting barley, organic crops and other value-enhanced crops.
4. Identity Preservation requires new perspectives and attitudes, it is about:
   - ❑ Meeting the needs of customers.
   - ❑ Maintaining specific quality levels, and avoiding mixing of crops.
5. Consider growing and storing non-GMO crops in separate locations or farms.

   It is easier to maintain and prove crop separation if the entire non-GMO crop is grown and stored on a separate farm that you may own or rent.

On-Farm Costs

1. Farmers who wish to supply non-GMO crops will incur additional cleaning, handling, storage and transportation costs.
   - ❑ Cleaning equipment takes extra time. Time requirements will be similar to that those to produce certified seed. Thoroughly clean combines, trucks, grain conveyors, driers, grain carts, gravity boxes and bins as you switch from one crop or even hybrid to another.
   - ❑ Consider cleaning your equipment before harvest and harvesting non-GMOs crops first if crop maturity allows.
   - ❑ On farm storage may allow a great opportunity to segregate non-GMO grain during harvest.
   - ❑ However, segregating grain may leave a grain bin only partially full. This may increase storage costs or force selling other grain at harvest.
   - ❑ Consider taking samples of harvested crop and delivered grain and preserving samples until you are sure the final buyer is satisfied that grain standards have been met.
   - ❑ Knowing the additional costs and any potential liabilities are important factors for growers to evaluate when determining if the returns from non-GMO premiums exceed the additional handling and management costs.

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NPM Layout by M. Broeske, Nutrient and Pest Management (NPM) Program Cooperative Extension, University of Wisconsin-Extension, College of Agricultural and Life Sciences, UW-Madison.

Appendix A

Corn grain import status of transgenic corn hybrids as of 20 December 1999.

			Approval Status by Country			
Trait (Developer)	Event*	Brand	U.S.	Japan	Europe	Canada
Bt (Norvartis/Ciba) Novartis, Ciba	176	Maximizer/ Knockout	Yes	Yes	Yes	Yes
Bt (Mycogen) Mycogen	176	NatureGard	Yes	Yes	Yes	Yes
Bt (Monsanto) Pioneer, Cargill, Dekalb, Golden Harvest, Others	Mon810	YieldGard	Yes	Yes	Yes	Yes
Bt, LL stack (Monsanto) Novartis	Bt11	YieldGard	Yes	Yes	Yes	Yes
Bt (Dekalb) Dekalb	DBT418	Bt-Xtra	Yes	No	No	Yes
LL (Pioneer) Pioneer others	T25	Liberty Link	Yes	Yes	Yes	Yes
LL (Holdens) Used in Holdens inbreds by many companies	T14	Liberty Link	Yes	Yes	No	Yes
LL (Dekalb) Dekalb	DLL25 (B16)	Liberty Link	Yes	No	No	Yes
Bt, LL stack (Monsanto/Pioneer) Pioneer	Mon810/ T25	YieldGard	Yes	Yes	No	Yes
Bt, LL stack (AgrEvo) AgrEvo, Garst, Others	Cry9c/ T14	StarLink	Yes	No	No	No
Roundup Ready Corn (Monsanto) Dekalb	GA21	Roundup Ready	Yes	No	No	No

Lauer, 1999.
Sources: Jerry Harrington (Pioneer), Scott Stein (DeKalb), Jeff Pomeroy (Garst) and Gary Wieneke (Novartis)

** Event refers to transgenic event: when a specific type of gene is inserted to create the trait desired.*

Appendix B

Web Sites for Additonal Information

(Taken from Farm Chemicals Magazine)

Listing these web-sites does not endorse the site or company products.

- ❑ American Seed Trade Association www.amseed.com
  Features The Grain Handlers Database
- ❑ Adventis www.adventis.com
- ❑ American Crop Protection Association
  www.acpa.org/public/issues/biotech/indexbiotech.html
- ❑ American Soybean Association www.oilseeds.org/asa
- ❑ Corn Refiners Association www.corn.org
- ❑ Iowa State University
  www.extension.iastate.edu/pages/grain
- ❑ Monsanto www.farmsource.com
- ❑ National Corn Growers Association www.ncga.com
- ❑ National Grain and Feed Association www.ngfa.org
- ❑ Novartis Seeds www.seeds.novartis.com
- ❑ Pioneer Hi-Bred Int'l www.pioneer.com/usa/gmo
- ❑ Purdue University *(Grain Quality Fact Sheet #42)*
  www.agcom.purdue.edu/AgCom/Pubs/grain.html
- ❑ University of Minnesota
  www.bae.umn.edu/extens/postharvest/tempstor.html#SegCrops
- ❑ USDA www.aphis.usda.gov/biotechnology

Testing Information Websites

- ❑ EnviroLogix Inc. www.envirologix.com
- ❑ Genetic ID Inc. www.genetic-id.com
- ❑ Strategic Diagnostics Inc www.sdix.com