Isolation and Contamination Issues in Organic Seed Production

Crops and testing methodology

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Promiscuous outcrossers

- Chenopods
- Corn
- Amaranth family
- Brassica family
- Cucurbits
- Carrot family

Promiscuous outcrossers

- Chenopods
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Wind pollinated

- Brassica family
- Cucurbits
- Carrot family

Insect pollinated

Recent "hotbutton" crops

- *Canola*
- *Sugar beet*

Canola

- Prohibited in Willamette Valley except as seed crop
- Promoted as a biodiesel source
- *B. napus* – outcrosses with vegetable Brassicas (*B. rapa*)
- Does not produce viable hybrids with *B. oleracea*
- 2 mile isolation of vegetable from weedy *B. rapa*

Rapeseed production district

- After hearings in December 2007:
  - Control order retained
  - Sunset review clause removed
  - Option for hearing request added
  - Remains an administrative, not legislative rule
- Issue has lost urgency with unfavorable economic analysis & high price of wheat

Hypothetical threat to organic seed growers

- Some conventional canola seed lots are contaminated with GMO canola*
  - … three varieties of 14 tested exceeded the 0.25% maximum allowable contamination…
  - … level of herbicide resistance contamination in conventional seed lots exceeded the 0.25% limit in approximately half of the 27 samples tested…
- Canola is volunteers very easily
- Direct outcross to Chinese cabbage
- Aborted seed from English cabbage cross
  - Both detectable at very low levels

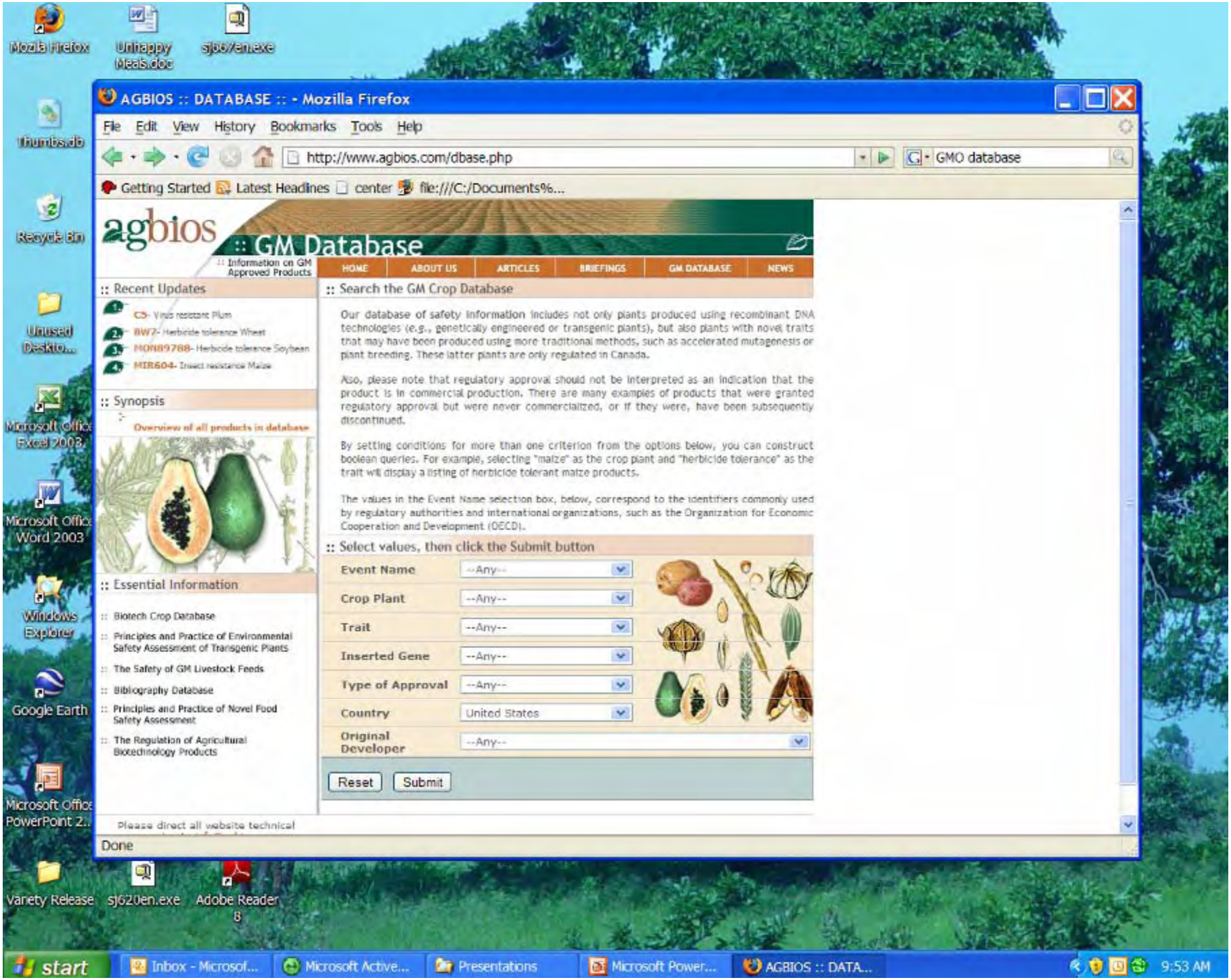
*Hall et al., 2003

Sugar Beet

- Table beet, chard – same species
- Wind pollinated
- 3 mile isolation
- Conversion of majority of sugar beet seed supply to Roundup Ready in 2008
- Hybrids may detectable based on morphology
  - Vigor, foliage/root color, root shape

Potential New GMO crop issues

- *BT cabbage*
  - *Seed production to be initiated*
- *Field corn*
  - *Used by dairies*
  - *Both conventional and GMO a contamination issue in sweet corn*
- *Other vegetable crops?*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1. C5- Virus resistant Plum
2. BW7- Herbicide tolerance Wheat
3. MON89788- Herbicide tolerance Soybean
4. MIR604- Insect resistance Maize
:: Synopsis
Overview of all products in database
:: Essential Information
:: Biotech Crop Database
:: Principles and Practice of Environmental Safety Assessment of Transgenic Plants
:: The Safety of GM Livestock Feeds
:: Bibliography Database
:: Principles and Practice of Novel Food Safety Assessment
:: The Regulation of Agricultural Biotechnology Products
Please direct all website technical
:: Search the GM Crop Database
Our database of safety information includes not only plants produced using recombinant DNA technologies (e.g., genetically engineered or transgenic plants), but also plants with novel traits that may have been produced using more traditional methods, such as accelerated mutagenesis or plant breeding. These latter plants are only regulated in Canada.
Also, please note that regulatory approval should not be interpreted as an indication that the product is in commercial production. There are many examples of products that were granted regulatory approval but were never commercialized, or if they were, have been subsequently discontinued.
By setting conditions for more than one criterion from the options below, you can construct boolean queries. For example, selecting "maize" as the crop plant and "herbicide tolerance" as the trait will display a listing of herbicide tolerant maize products.
The values in the Event Name selection box, below, correspond to the identifiers commonly used by regulatory authorities and international organizations, such as the Organization for Economic Cooperation and Development (OECD).
:: Select values, then click the Submit button
Event Name --Any--
Crop Plant --Any--
Trait --Any--
Inserted Gene --Any--
Type of Approval --Any--
Country United States
Original Developer --Any--
Reset Submit
Done
start
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Microsoft Active...
Presentations
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AGBIOS :: DATA...
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Field Test Release Applications in the U.S. - Mozilla Firefox
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http://www.isb.vt.edu/cfdocs/fieldtests1.cfm
GMO database
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Information Systems for Biotechnology
ISB News Reports
Regulatory Information
Risk Assessment
Research Resources
Meetings & Notices
WWW Links
More on ISB
Field Test Release Applications in the U.S.
Updated: February 12, 2008
Database Provided by APHIS Biotechnology Regulatory Services
Background & Limitations
Step 1. Select the type of permit applications you wish to find:
All Field Test Applications (Notifications and Release Permits) (14331 records)
Notifications Only (12869 records) What is a notification?
Full Release Permits Only (1462 records) What is a full release permit?
Or
Go To Charts
Go To Lists
Go To Tables
Complete information is available at APHIS Biotechnology Regulatory Services
Step 2. Search records in the class selected above by choosing one or more of the following categories. Choose only those categories you wish to search; the default value of unselected categories is "All". Some of the categories are mutually exclusive, as indicated by OR. The complete database is available for downloading in various compressed formats directly from APHIS at http://www.aphis.usda.gov/brs/application_status.html. Tips on searching the data.
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Institution
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Status
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GMO detection

- Direct detection
  - Herbicides
- ELISA (immunology)
  - Protein detection
- PCR
  - DNA detection

Direct detection

- Germinate seedlot & spray with herbicide
- Germinate in dilute herbicide solution
- Advantages
  - Cheap ($20-30)
  - Easy for grower to perform
  - Straightforward
  - Can process large seed lots
- Disadvantages
  - Time (~2 weeks)
  - Limited to Roundup Ready or Liberty Link
  - Seeds must be viable

ELISA (enzyme-linked immunosorbent assay)

- Antibodies reacted against protein produced by transgene
- “Strip” and “Plate” tests
- Advantages
  - Rapid
  - Relatively cheap
  - Easy to use
- Disadvantages
  - Strip test is not quantitative
  - May not detect denatured (processed) protein


Trait
RUR Test Strips
Part #: 3000082
Lot #: 7B1050
Exp.: 02/08
Quantity: 50 Tests
Lot: 073176
QuickStix Strips
for Roundup Ready
EnviroLogix
Cat. No. KR 011
QuickStix™
Extraction Buffer
Exp:09/30/06


073176 RR
073176 RR

Strip vs Plate

- Extremely rapid (2-5 minutes)
- Very user friendly (think pregnancy test)
- Self-contained
- Gives presence/ absence only

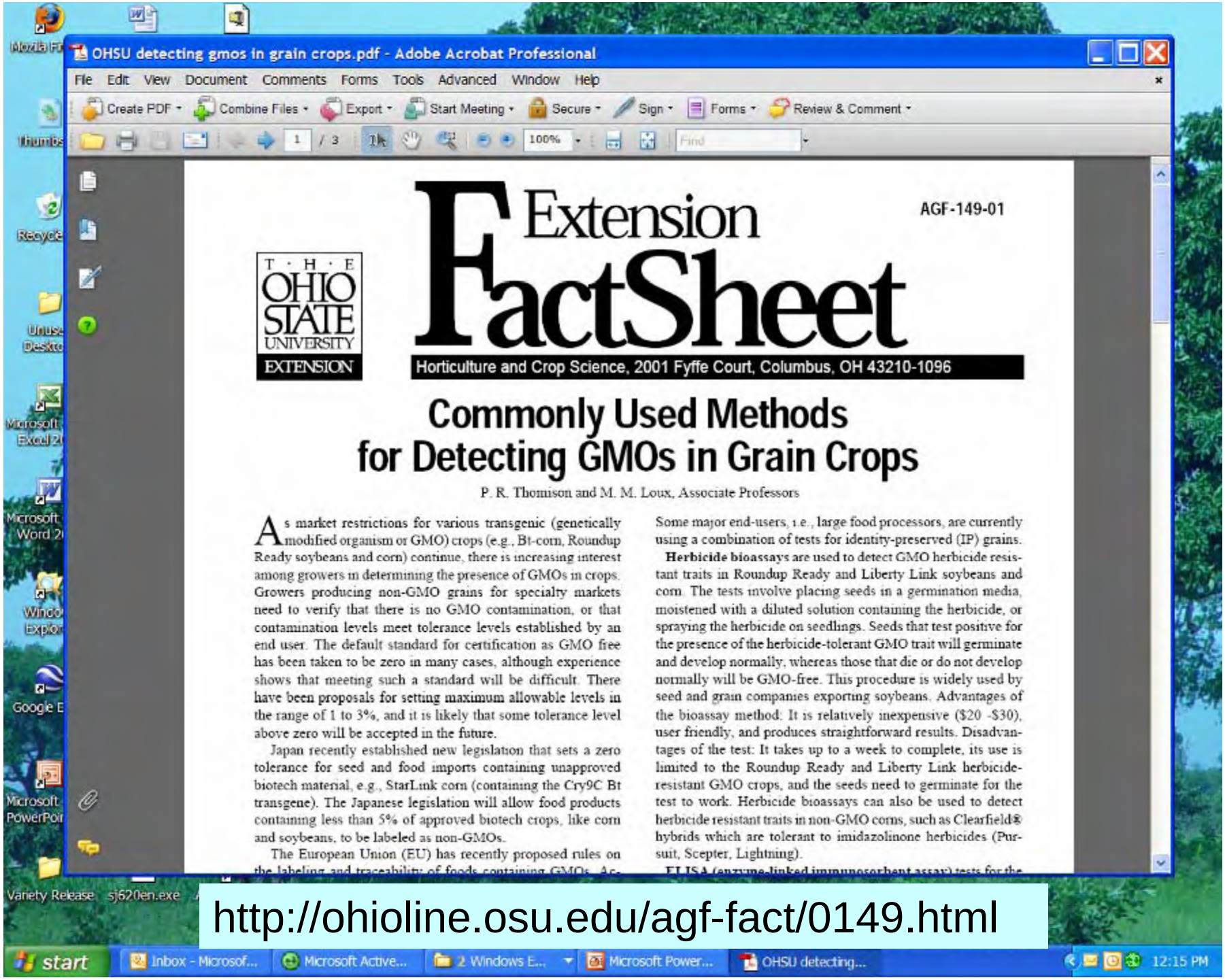
- Moderately rapid (~4-8 hours)
- Requires more training
- Requires special equipment
- Can produce quantitative results

PCR (Polymerase Chain Reaction) test

- Detects gene whether gene is functional or not
- Can detect in nonviable seed
- Exquisite sensitivity but increased risk of false positives
- More sensitive to contamination
- Most expensive of the procedures ($75-300)
- Must be done in a lab by trained technicians
- Can be done in as little as a day, but turnaround more likely to be 2-3 days
- Can be quantitative or qualitative

Comparison of tests

- For each GMO trait, need separate test
- Direct screen cheapest, but limited
- ELISA quick & relatively cheap – gives an yes/no answer
- PCR most powerful and sensitive, but most expensive


OHSU detecting gmos in grain crops.pdf - Adobe Acrobat Professional
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THE OHIO STATE UNIVERSITY EXTENSION
Extension FactSheet
AGF-149-01
Horticulture and Crop Science, 2001 Fyffe Court, Columbus, OH 43210-1096
Commonly Used Methods for Detecting GMOs in Grain Crops
P. R. Thomison and M. M. Loux, Associate Professors
As market restrictions for various transgenic (genetically modified organism or GMO) crops (e.g., Bt-corn, Roundup Ready soybeans and corn) continue, there is increasing interest among growers in determining the presence of GMOs in crops. Growers producing non-GMO grains for specialty markets need to verify that there is no GMO contamination, or that contamination levels meet tolerance levels established by an end user. The default standard for certification as GMO free has been taken to be zero in many cases, although experience shows that meeting such a standard will be difficult. There have been proposals for setting maximum allowable levels in the range of 1 to 3%, and it is likely that some tolerance level above zero will be accepted in the future.
Japan recently established new legislation that sets a zero tolerance for seed and food imports containing unapproved biotech material, e.g., StarLink corn (containing the Cry9C Bt transgene). The Japanese legislation will allow food products containing less than 5% of approved biotech crops, like corn and soybeans, to be labeled as non-GMOs.
The European Union (EU) has recently proposed rules on
Some major end-users, i.e., large food processors, are currently using a combination of tests for identity-preserved (IP) grains.
Herbicide bioassays are used to detect GMO herbicide resistant traits in Roundup Ready and Liberty Link soybeans and corn. The tests involve placing seeds in a germination media, moistened with a diluted solution containing the herbicide, or spraying the herbicide on seedlings. Seeds that test positive for the presence of the herbicide-tolerant GMO trait will germinate and develop normally, whereas those that die or do not develop normally will be GMO-free. This procedure is widely used by seed and grain companies exporting soybeans. Advantages of the bioassay method: It is relatively inexpensive ($20 -$30), user friendly, and produces straightforward results. Disadvantages of the test: It takes up to a week to complete, its use is limited to the Roundup Ready and Liberty Link herbicide-resistant GMO crops, and the seeds need to germinate for the test to work. Herbicide bioassays can also be used to detect herbicide resistant traits in non-GMO corns, such as Clearfield® hybrids which are tolerant to imidazolinone herbicides (Pursuit, Scepter, Lightning).
http://ohioline.osu.edu/agf-fact/0149.html
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