



ENHANCEMENTS OF THE INTERNATIONAL LIFE SCIENCES INSTITUTE CROP COMPOSITION DATABASE

www.cropcomposition.org

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Chair, ILSI International Food Biotechnology Committee

April 27, 2007

ILSI: A Unique Partnership





ILSI Crop Composition Database

- **History**
- **Data Quality and Integrity**
- **Benchmarking**
- **Outcomes**
- **Updates and Improvements**



Why Was the Database Developed?

- Companies had a lot of high quality composition data
- Most publicly available data for crops rely on data sources that are 20 or more years old
- Methods are not always known or had unknown performance parameters
- To create a single, easily accessible, and up-to-date source of information
- To obtain a richer understanding of the diversity in composition of crops



ILSI Crop Composition Database

- **Task Force convened by the ILSI International Food Biotechnology Committee**
- **Members of the Task Force:**
 - **Bayer CropScience**
 - **BASF (2004)**
 - **Dow AgroSciences**
 - **Monsanto**
 - **Pioneer/DuPont**
 - **Renessen**
 - **Syngenta**



Steps in the Development of the Database

- Task Force formed by IFBiC February 2001
- Database structure, data entry and selected software developers
- Maize and soybean prototype database was tested and revised based on user suggestions
- Version 1.0 launched – May 2003
- Version 2.0 launched – April 2004
- Article describing database published in *J. Food Comp. Anal.* (2004) 17, 423 - 438.
- Version 3.0 launched – April 2006



The ILSI database is...

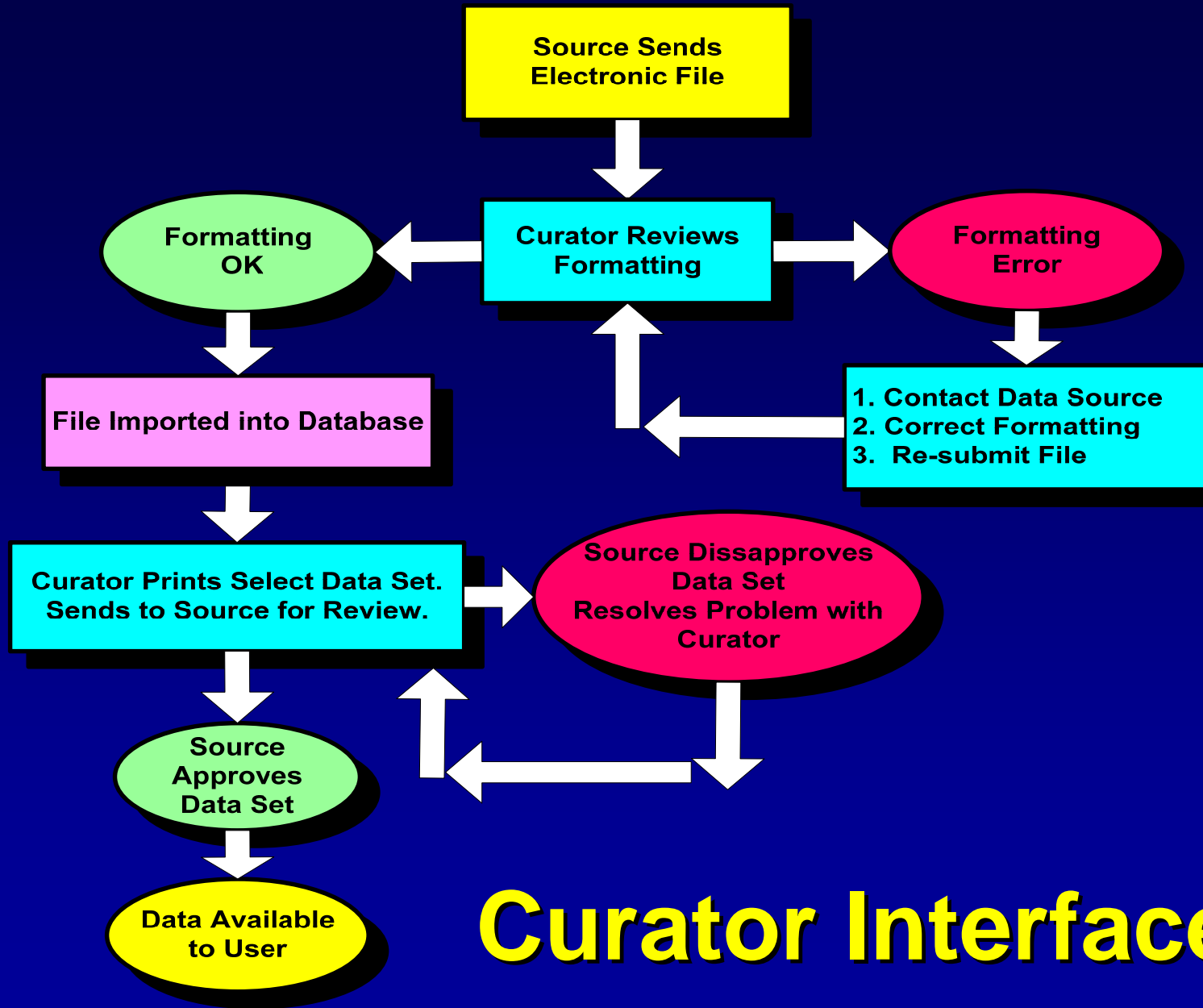
- a compilation of data on the nutrients, anti-nutrients, and secondary metabolites
- for conventional maize, soybean and cottonseed samples
- obtained from controlled field trials
- in multiple worldwide locations
- covering 1995 and 1997-2004

- Each grain/seed sample represents a composite sample that has been collected from representative plants throughout the plot.
- Forage sample represents a composite sample from a minimum of two whole plants.



Data Integrity

- **Database access limited to Curator (Password protected)**
- **Data submitted in a defined format**
- **A portion of the data is returned to source for checking**
- **The unit of measure is defined for each analyte**
- **A complete set of quality documents was created and all changes were tracked**



Curator Interface



Data Quality

Inclusion criteria require that.....

- samples are traceable to source - records and data retained**
- samples are analyzed using validated internationally recognized analytical methods**
- and that each data point is associated with a method**
- is audited before being incorporated**



Vitamins, Bioactives etc.

Beta-carotene	Trypsin Inhibitor	Calcium
Beta-tocopherol	Diadzein	Copper
Delta-tocopherol	Genistein	Iron
Gamma-tocopherol	Glycitein	Magnesium
Total tocopherols	Raffinose	Manganese
Folic acid	Stachyose	Phosphorus
B1 (Thiamin)	Phytic acid	Potassium
B2 (Riboflavin)		Sodium
Vitamin E		Zinc



Examples of Analyte Categories and Units in ILSI Database

<u>Analyte Category</u>	<u>Analyte Example</u>	<u>Primary Unit of Measure^a</u>	<u>Crop Types</u>
Amino Acid	Lysine	mg/g FW	maize, soy, cotton
Bioactive	Total Isoflavones	ppm FW	soy
Carbohydrates	Starch	% FW	maize
Fatty Acids	18:1 Oleic	% Total FA	maize, soy, cotton
Fiber	Acid detergent fiber	% FW	maize, soy, cotton
Mineral	Iron	ppm FW	maize, soy, cotton
	Calcium	ppm FW	maize, soy, cotton
	Phosphorus	ppm FW	maize, soy, cotton
Other metabolites	Ferulic acid	ppm FW	maize
Proximate	Crude protein	% FW	maize, soy, cotton
	Moisture	% FW	maize, soy, cotton
Vitamins	B1 (Thiamin)	mg/100g FW	maize, soy

^a For the units of measure used in the table: FW = fresh weight, ppm = parts per million, FA = fatty acids.



Comparison of Maize Grain Data from ILSI and USDA Nutrient Databases

<u>Grain</u>	<u>ILSI*</u>	<u>USDA*</u>
Moisture	11.3%	10.37%
Protein	9.11%	9.42%
Calcium	41.1 ppm	70 ppm
Phosphorus	2903 ppm	2100 ppm
Thiamin (B ₁)	0.466 mg/100g	0.39 mg/100 g
Leucine	11.89 mg/g	11.55 mg/g

* Data calculated on fresh weight basis:

- ILSI (n = 894 to 1434)
- USDA (n = 4 to 35)



Benchmarking Against OECD Consensus Document

Reference	OECD Literature Range	ILSI Range	ILSI Average
<i>Proximates</i>			
Protein	6 – 12.7	6.15 – 16.87	10.27
Fat	3.1 – 5.8	1.74 – 5.82	3.56
Ash	1.1 – 3.9	0.61 – 6.28	1.44
CHO	82.2 – 82.9	77.4 – 89.5	84.6
<i>Fiber</i>			
ADF	3.0 – 4.3	1.82 – 11.3	4.05
NDF	8.3 – 11.9	5.59 – 22.6	11.2

- All data expressed in % dry weight.
- OECD data from: “Consensus Document on Compositional Considerations for New Varieties of Maize (*Zea Mays*): Key Food and Feed Nutrients, Anti-nutrients and Secondary Plant Metabolites” August 2002.
- ILSI data comprise 1174 - 1434 data points per value



Scope of Maize, Soybean and Cottonseed Data (April 2006)

- **Years: 1995, 1997 - 2004**
- **Geographic Regions**
 - **North America (United States, Canada)**
 - **United States (AL, AR, AZ, CA, CO, GA, HI, IA, IL, IN, KS, LA, MN, MO, MS, NE, NC, OH, PA, PR, SC, SD, TX, WI)**
 - **South America (Argentina, Brazil, Chile)**
 - **Europe (Bulgaria, France, Germany, Hungary, Italy, Spain)**
 - **Asia (Philippines)**
 - **Australia**
- **Number of Analytes: 114**
- **Number of Datasets: 2,991**
- **Number of Data points: 117,825**



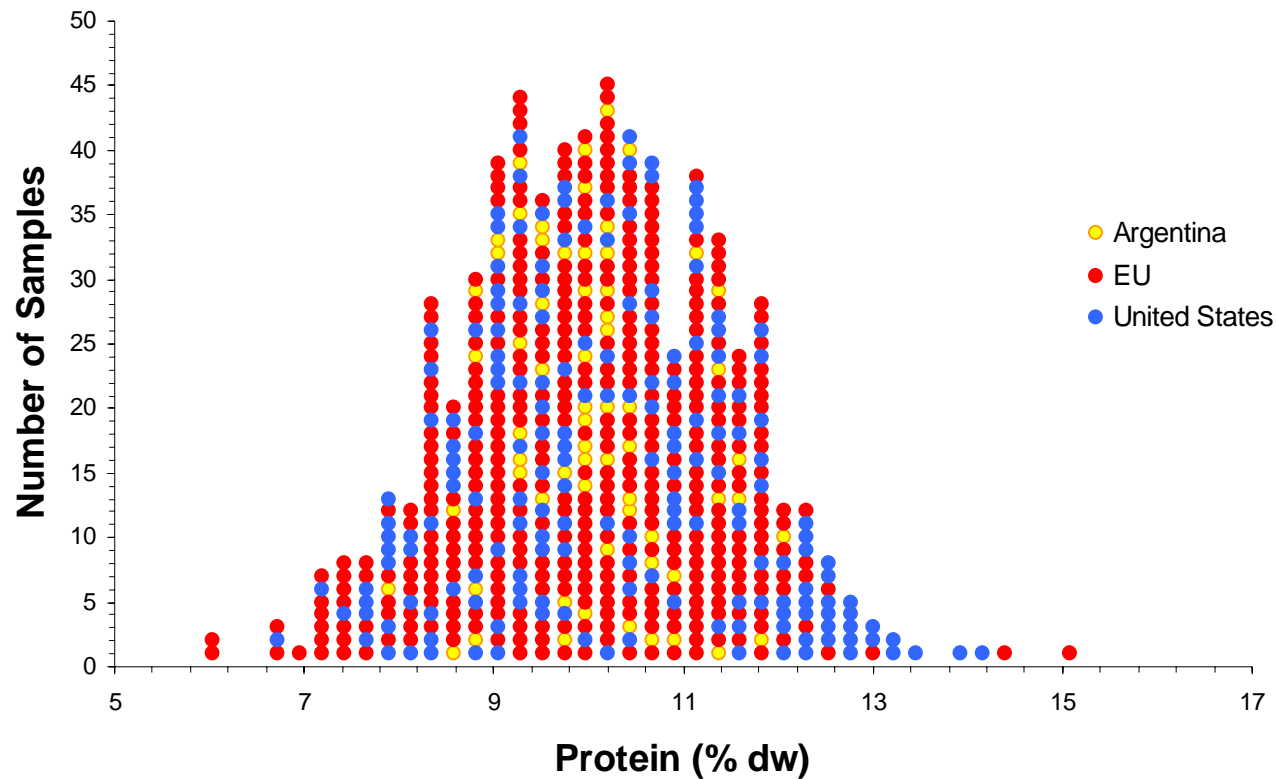
Functionality and Data Mining

- **Individual data points represent single samples (no averaging)**
- **Functional compounds described as Bioactives**
- **Data base allows searching:**
 - **by country**
 - **by state**
 - **by year**



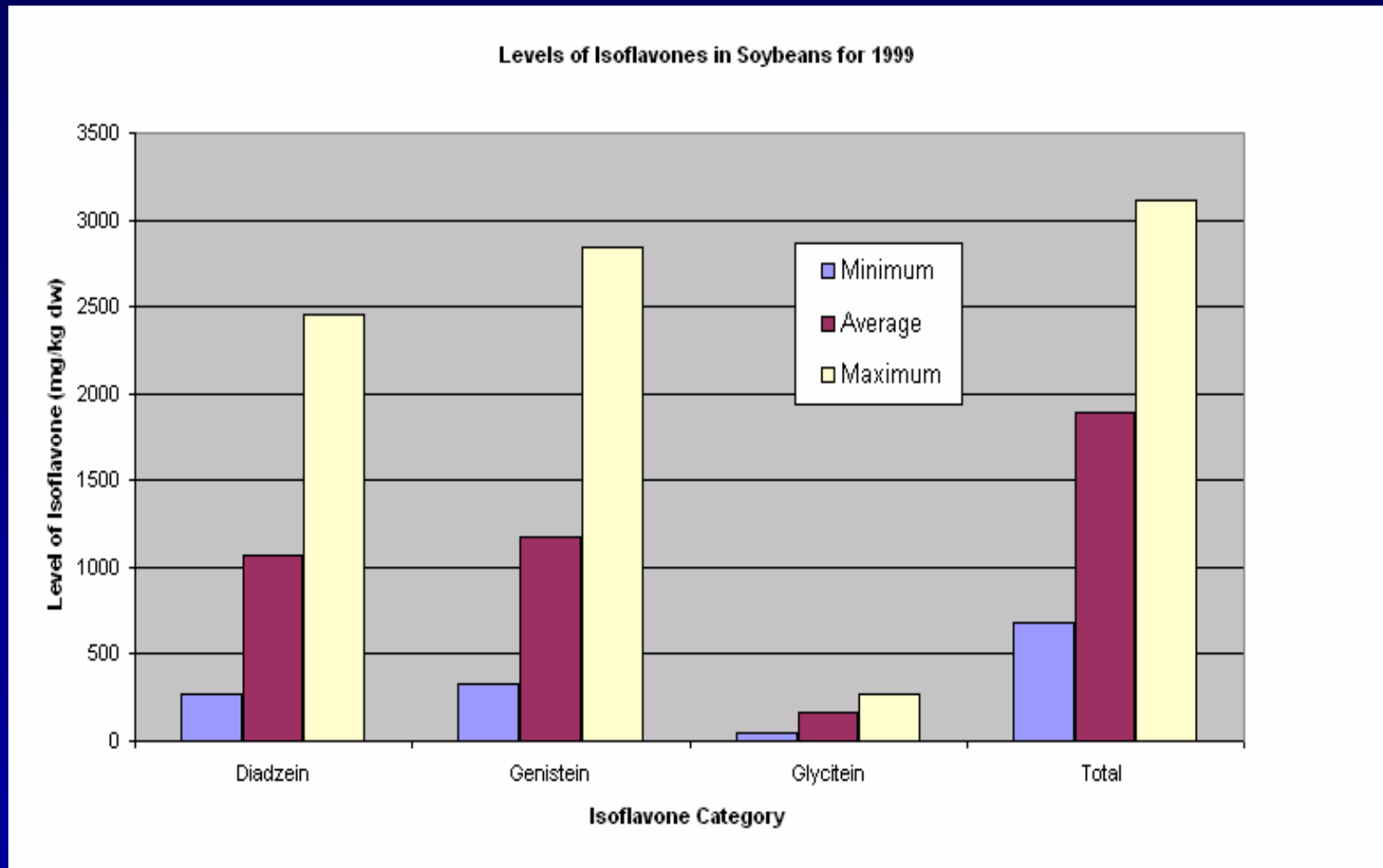
Distribution of Maize Protein Values

Distribution of Protein Values in ILSI Database





Levels of Isoflavones in Soybeans in 1999





Summary and Outcomes for ILSI Database

Attributes of the ILSI Database:

- Unique features are the wide scope and high quality of the data
- Should be of interest to a broad range of disciplines in food, plant and animal sciences
- A key reference for establishing the natural variability in composition
- Important as a baseline for comparing new, nutritionally enhanced crops



User Interface

- **Web interface**
(www.cropcomposition.org)
- **Public access**
- **Database is searched based on user selected criteria (crop, tissue, year, location, and analyte category)**
- **Data can be displayed in summary or individual data point format**



International Life Sciences Institute

Crop Composition Database

Welcome to the ILSI Crop Composition Database Web site!

Version 3.0

The ILSI Crop Composition Database is a project of the [International Life Sciences Institute](#).

The first three versions of the database have represented a compilation of crop analyses from a number of companies engaged in agricultural life sciences. Through ILSI, the participants have standardized and pooled their crop data in order to make the data available to scientists from academia, government agencies, and industry, and to the general public.

It is envisioned that future versions of the database will include other publicly available data that meet the acceptability criteria of ILSI and are submitted from scientists and other researchers representing a variety of public and private organizations.

NOTE: With the Version 3.0 upgrade, additional crop data has been added to the database. Search results may be different than previous versions due to the additional crop data. You will not be able to go back to Version 1.0 or 2.0 to replicate earlier search results now that Version 3.0 has been released.

ILSI Crop Composition Database

- [Search](#) the Crop Composition Database
- [Online Help](#)
- [Sources of Data](#)
- [Database Structure](#)
- [Demonstration](#) Search
- [Updates/corrections](#) to the database
- [How to Submit Data](#)
- [Questions & Feedback](#)
- [Web Site Questionnaire](#)
- [Support the database](#)
- [Resource Guide](#)

Other Web Sites of Interest

- [Food and Agriculture Organization and related databases \(INFOODS\)](#)
- [USDA food composition database](#)
- [OECD consensus documents](#)
- [Article describing this database in the Journal of Food Composition and Analysis](#)



International Life Sciences Institute

Crop Composition Database

Primary Search Criteria Selection

- You may select one, many, or all values from each field list.
- To select one item from a field list, use your mouse to select the individual item.
- To select many items from a field list, hold down the Ctrl (Control) key and use your mouse to select more than one item in the list.
- Note that "Field Corn" is the default crop type, "Grain" is the default tissue type and "Argentina" is the default country.
- "All" is the default value for the crop year and state field lists.
- To select all items from the crop year, country or state field lists, choose the value 'All' from the desired field lists.
- Note that 'Amino Acid' is the default analyte category value for the last field list.
- Click [here](#) for IMPORTANT information about crop types and tissue types.
- When you have completed your primary search criteria selections, you can proceed in one of two ways by using the buttons at the bottom of the screen.
- The "Restrict Searching by Analysis Method or by Value Range" button allows you to further refine your search criteria selections.
- The "Bypass Restriction by Analysis Method or by Value Range" button allows you to skip further refinement of search criteria and proceed with confirming your search criteria selections.

Crop Type:	CORN_FIELD - Corn - Field - Maize - Zea mays COTTON - Cotton - Gossypium hirsutum SOYBEANS - Soybeans - Glycine max
Tissue Type:	ACID DELINTED SEED FORAGE FUZZY SEED
Crop Year:	All 1995 1996
Country:	All AR - ARGENTINA AU - AUSTRALIA
State:	All AK - ALASKA AL - ALABAMA
Analyte Category:	AMINO ACIDS BIO-ACTIVES CARBOHYDRATES

Restrict Searching by Analysis Method or by Value Range

Bypass Restriction by Analysis Method or by Value Range

Generated: Wed Dec 14 12:12:45 2005

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ILSI Crop Composition Database

Search Results

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Note: The number of significant figures displayed in the table reflects the actual result submitted, and does not imply a specific accuracy for the analytical result. Please consult the individual method references for accuracy and precision information on each method. Further information on accuracy, repeatability and uncertainty estimates for analytical methods can be found in Thompson et al., Pure Appl. Chem., Vol. 74, No. 5, pp. 835-855, 2002, and at <http://www.measurementuncertainty.org/>.

Generated: Tue Aug 19 10:01:13 2003

Selection Criteria

Crop Type:	Corn - Field - Maize - Zea mays
Tissue Type:	Grain
Crop Year:	1998
Country:	UNITED STATES
State:	IOWA, ILLINOIS

Analyte Values - Minimum, Maximum and Average

Note that Below LOQ values are not included in the table below.

Analyte	Minimum	Maximum	Average	n	Units
Fatty_Acids - 18:0 Stearic	1.74	2.56	2.11	7	% Total FA
Proximates - Total Fat	2.770	3.710	3.443	7	% FW

Search Results - Data Values

Analyte	Value	Units	State	Analysis Method Code
Fatty_Acids - 18:0 Stearic	2.17	% Total FA	ILLINOIS	A0033
Fatty_Acids - 18:0 Stearic	1.98	% Total FA	ILLINOIS	A0033
Fatty_Acids - 18:0 Stearic	1.74	% Total FA	IOWA	A0033
Fatty_Acids - 18:0 Stearic	2.45	% Total FA	IOWA	A0033
Fatty_Acids - 18:0 Stearic	1.82	% Total FA	ILLINOIS	A0033
Fatty_Acids - 18:0 Stearic	2.56	% Total FA	IOWA	A0033
Fatty_Acids - 18:0 Stearic	2.05	% Total FA	IOWA	A0033
Proximates - Total Fat	3.550	% FW	ILLINOIS	A0005
Proximates - Total Fat	3.660	% FW	IOWA	A0005
Proximates - Total Fat	3.360	% FW	ILLINOIS	A0005
Proximates - Total Fat	3.600	% FW	ILLINOIS	A0005
Proximates - Total Fat	2.770	% FW	IOWA	A0005
Proximates - Total Fat	3.450	% FW	IOWA	A0005
Proximates - Total Fat	3.710	% FW	IOWA	A0005

Analysis Methods

Code	Analysis Method
A0005	AOAC Official Method 960.39 (1995)
A0033	AOCS Official Method Ce 1-62 (1981)

New Search

<< Back to Select Specific Analytes



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Crop Composition Database

Search Results -- Version 3.0

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Generated: Mon Apr 23 11:07:22 2007

Selection Criteria

Crop Type:	Soybeans - Glycine max
Tissue Type:	Grain, Seed
Crop Year:	All
Country:	All
State:	All

Search Results - Attributes Common to All Values

Attribute	Value
Crop Type	Soybeans - Glycine max
Tissue Type	Seed

Analyte Values - Minimum, Maximum and Average

Note that Below LOQ values are not included in the table below.

Analyte	Minimum	Maximum	Average	n	Units
Fatty_Acids - 12:0 Lauric	0.082	0.132	0.107	2	% Total FA
Fatty_Acids - 14:0 Myristic	0.071	0.238	0.098	20	% Total FA
Fatty_Acids - 14:1 Myristoleic	0.121	0.125	0.123	2	% Total FA
Fatty_Acids - 16:0 Palmitic	9.55	15.77	11.12	234	% Total FA
Fatty_Acids - 16:1 Palmitoleic	0.086	0.194	0.127	122	% Total FA
Fatty_Acids - 17:0 Heptadecanoic	0.085	0.146	0.114	97	% Total FA
Fatty_Acids - 17:1 Heptadecenoic	0.073	0.087	0.080	2	% Total FA
Fatty_Acids - 18:0 Stearic	2.70	5.88	4.01	234	% Total FA
Fatty_Acids - 18:1 Oleic	14.3	32.2	20.7	234	% Total FA
Fatty_Acids - 18:2 Linoleic	42.3	58.8	53.3	234	% Total FA
Fatty_Acids - 18:3 Linolenic	3.00	12.52	8.34	234	% Total FA
Fatty_Acids - 20:0 Arachidic	0.163	0.482	0.323	233	% Total FA
Fatty_Acids - 20:1 Eicosenoic	0.140	0.350	0.204	221	% Total FA
Fatty_Acids - 20:2 Eicosadienoic	0.077	0.245	0.154	16	% Total FA
Fatty_Acids - 22:0 Behenic	0.277	0.595	0.402	233	% Total FA
Fatty_Acids - 8:0 Caprylic	0.148	0.148	0.148	1	% Total FA

Analysis Methods

Code	Analysis Method
A0033	AOCS Official Method Ce 1-62 (1981)
A0034	AOCS Official Method Ce 1-62 (1997)

Seed Vendor
Asgrow
Asociados Don Mario



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Crop Composition Database

Search Results (Individual Data Points) -- Version 3.0

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Generated: Mon Apr 23 11:27:16 2007

Search Results - Data Values

Analyte	Value	Units	Crop Year	Country	Analysis Method Code
Fatty_Acids - 10:0 Capric	<LOQ (.01)	% FW	1998	ITALY	A0033
Fatty_Acids - 10:0 Capric	<LOQ (.02)	% FW	2000	BRAZIL	A0034
Fatty_Acids - 10:0 Capric	<LOQ (.02)	% FW	1999	ARGENTINA	A0034
Fatty_Acids - 10:0 Capric	<LOQ (.02)	% FW	1999	ARGENTINA	A0034
Fatty_Acids - 10:0 Capric	<LOQ (.01)	% FW	1998	FRANCE	A0033
Fatty_Acids - 10:0 Capric	<LOQ (.01)	% FW	1998	ITALY	A0033
Fatty_Acids - 10:0 Capric	<LOQ (.01)	% FW	2000	BRAZIL	A0034
Fatty_Acids - 10:0 Capric	<LOQ (.01)	% FW	1998	ARGENTINA	A0034
Fatty_Acids - 10:0 Capric	<LOQ (.01)	% FW	1998	FRANCE	A0033
Fatty_Acids - 10:0 Capric	<LOQ (.02)	% FW	2000	BRAZIL	A0034
Fatty_Acids - 10:0 Capric	<LOQ (.02)	% FW	1999	ARGENTINA	A0034
Fatty_Acids - 10:0 Capric	<LOQ (.01)	% FW	2000	BRAZIL	A0034
Fatty_Acids - 10:0 Capric	<LOQ (.01)	% FW	1998	ITALY	A0033

Fatty_Acids - 8:0 Caprylic	<LOQ (.02)	% FW	2000	BRAZIL	A0034
Fatty_Acids - 8:0 Caprylic	<LOQ (.02)	% FW	1999	ARGENTINA	A0034
Fatty_Acids - 8:0 Caprylic	<LOQ (.02)	% FW	2000	BRAZIL	A0034
Fatty_Acids - 8:0 Caprylic	<LOQ (.01)	% FW	2000	BRAZIL	A0034
Fatty_Acids - 8:0 Caprylic	<LOQ (.01)	% FW	1998	FRANCE	A0033
Fatty_Acids - 8:0 Caprylic	<LOQ (.01)	g/100g FW	1999	UNITED STATES	A0034
Fatty_Acids - 8:0 Caprylic	<LOQ (.01)	g/100g FW	1999	UNITED STATES	A0034
Fatty_Acids - 8:0 Caprylic	<LOQ (.02)	% FW	1999	ARGENTINA	A0034
Fatty_Acids - 8:0 Caprylic	<LOQ (.02)	% FW	1999	ARGENTINA	A0034
Fatty_Acids - 8:0 Caprylic	<LOQ (.02)	% FW	2000	BRAZIL	A0034
Fatty_Acids - 8:0 Caprylic	<LOQ (.02)	% FW	1999	ARGENTINA	A0034
Fatty_Acids - 8:0 Caprylic	<LOQ (.02)	% FW	2000	BRAZIL	A0034
Fatty_Acids - 8:0 Caprylic	<LOQ (.02)	% FW	2000	BRAZIL	A0034
Fatty_Acids - 8:0 Caprylic	<LOQ (.01)	% FW	1998	FRANCE	A0033
Fatty_Acids - 8:0 Caprylic	<LOQ (.01)	% FW	1998	ITALY	A0033
Fatty_Acids - 8:0 Caprylic	<LOQ (.02)	% FW	1999	ARGENTINA	A0034
Fatty_Acids - 8:0 Caprylic	<LOQ (.01)	% FW	1998	ITALY	A0033

<< Back to Search Results Summary

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Releases

Version 1.0 - Released May 20, 2003

- **Data in Version 1.0 was audited**
- **Any errors documented as corrected.**

Version 2.0 - Released April 5, 2004

- **Additional data for corn and soybean**
- **Error in the units for riboflavin and folic acid corrected**
- **Improved screening of all future datasets**

Article describing database published in *J. Food Comp. Anal.* (2004) 17, 423 - 438.



Release 3.0

Version 3.0 - Released April 10, 2006

- **Additional composition data added that includes conventional corn, cotton and soy.**
- **Search results may be different than previous versions due to the additional crop data.**
- **Users will not be able to go back to Version 1.0 or 2.0 to replicate earlier search results**



Considered a valuable resource by:

- **Government Agencies**
 - e.g. by European Food Standards Authority
- **Scientific/Academic Institutions**
- **FAO Food and Nutrition Division**
- **OECD Task Force for the Safety of Novel Foods and Feeds**
- **ILSI Task Force on Improved Nutrition Crops**



Future Enhancements

Version 4.0 – Slated for launch early in 2008

- **Fatty acid and amino acid values will be available both as % of total and % dry weight**
- **Users will be able to search the data by the desired database version**
- **Crop type/tissue type combination will be verified in initial search screen to avoid errors**
- **Summary results table will indicate the numerical values below the limit of quantitation (LOQ) in a dataset search**



Other Desired Enhancements

- **Addition of tags to allow interoperability with FAO's INFOODS database**
- **Entry of additional data for present crops**
- **Composition data for rice and wheat**
- **Addition of data from research and/or Govt organizations**
- **Addition of data for minor crops**



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