International Life Sciences Institute Crop Composition Database (Version 7.0): An Open Resource for High Quality Compositional Data

V.J. BARTHET; A. EDWARDS; A.F. ROBERTS; B. BAJAJ; B. FAST; D.W. ROBERTS; J.R. SRINIVASAN; J. HELM; J. MCDONALD; M. BEDAIR; N. GILLIKIN AND T. SULT

Disclosure Statement

Dr. Véronique J. Barthet works for Canadian Grain Commission and has no actual or potential conflict of interest in delivering this presentation.

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Concept of "Substantial Equivalence" (OECD 1991)

"A novel food is `the same as' and `as safe as' conventional food if it demonstrates the same characteristics and composition as the conventional food".

Are differences biologically relevant?

"The statistical significance of any observed differences should be assessed in the context of the **range of natural variations** for that parameter to determine its biological significance."

Codex Alimentarius. 2003. Guideline For The Conduct Of Food Safety Assessment Of Foods Derived From Recombinant-DNA Plants. CAC/GL 45-2003.

History and Database Development

- Published data was old and of unknown quality
- There was a need for an up-to-date and easily accessible source of information
- Knowledge of the diversity in crop nutritional composition would benefit research in food, plant, and animal sciences
- Companies (and public sector organizations) were willing to share their high quality composition data

ILSI Crop Composition Database (ILSI-CCDB)

- Open access: www.cropcomposition.org
- Owned and managed by the ILSI Research Foundation
- Nutritional composition data
- Conventionally bred crops
- Non-biased, high quality data
- Data can be traced and filtered

Goal of the ILSI-CCDB

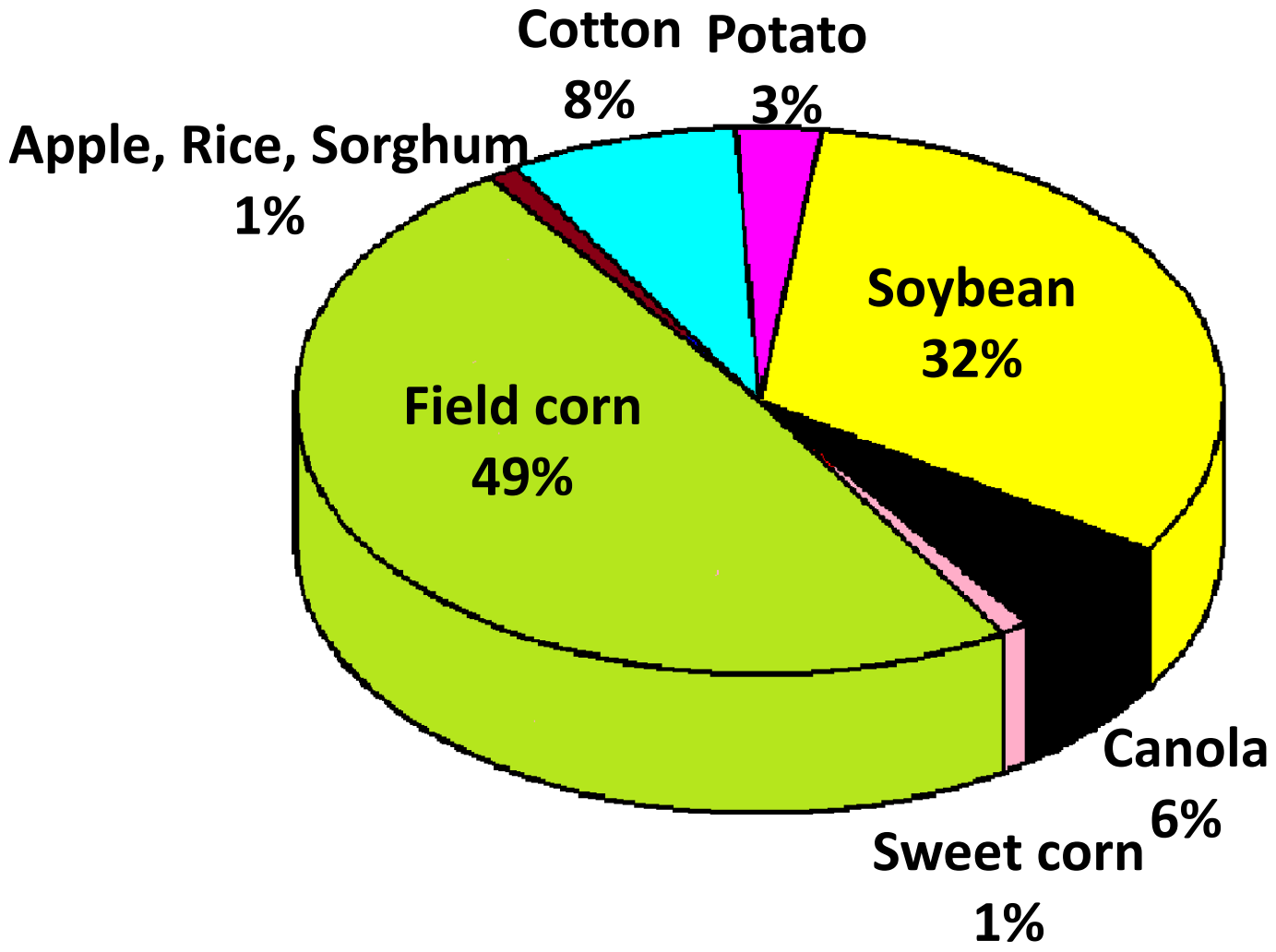
- To provide science-based information on the natural variability of crop composition (nutrients and anti-nutrients)
- To be a source of reference data for non-GM crops (but not wild species)
- To allow the assessment of similarities and differences of new varieties
- To be an essential part of informing the safety assessment for new crops used as food and feed

ILSI-CCDB Versions

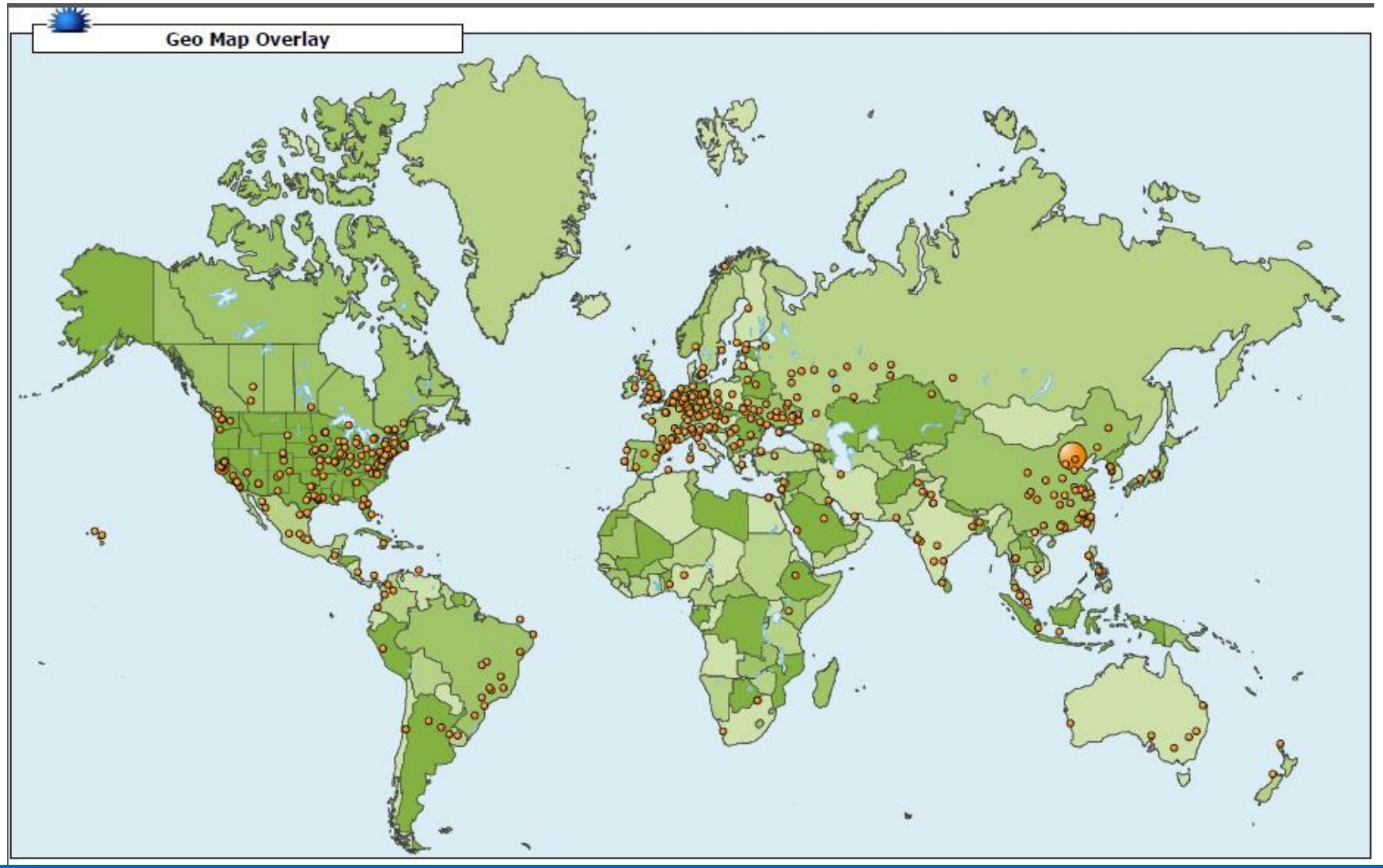
Version	Year of Release	Features
1.0	2003	Corn, soybean
2.0	2004	Additional data for corn, soybean New crop: cotton
3.0	2006	Additional data for corn, soybean, cotton
4.0	2010	New platform (functionality, speed, efficiency) Multiple units of measure Improved reporting output
5.0	2014	Additional data for field corn, soybean, cotton New crops: canola, rice, sweet corn 7-fold increase in overall data
6.0	2016	Additional data for corn, soybean, cotton, canola New crops: potato, sorghum
7.0	**2019**	**Additional data for field corn, soybean, cotton, canola, rice, potato** **New crop: apple**

ILSI-CCDB VERSION 7.0: Data Distribution

1,245,597 data points



ILSI-CCDB Users



2018 USAGE

- 4321 users
- 127 countries

ILSI-CCDB Data Acceptance Criteria

Sample production (clearly defined experimental design)

- Controlled field trials
- Known plot location, region, country (worldwide locations)
- Known agronomic conditions (seeding date, harvesting date, inputs, etc.)
- Known genetic data (genus and variety)

Sample collection

- Composite sample from representative plants from one plot
- Adequate storage to ensure no nutrient degradation
- Known sample chain of custody from harvest to analysis including storage conditions (sample traceability)

ILSI-CCDB Data Acceptance Criteria (cont'd)

Sample analysis

- Samples analyzed within 12 months
- Analyses using validated methods & certified/historically verified standards
- Performed by accredited/certified/experienced laboratories

Data

- One data point from the analysis of a single composite sample
- Data submitter must retain the records and data after submission to the database
- Quality check is performed on all submitted data before publication and potential outliers must be evaluated and verified

ILSI-CCDB Data Providers

BASF Plant Science, L.P.

Bayer CropScience

Corteva Agriscience

International Rice Research Institute, Philippines

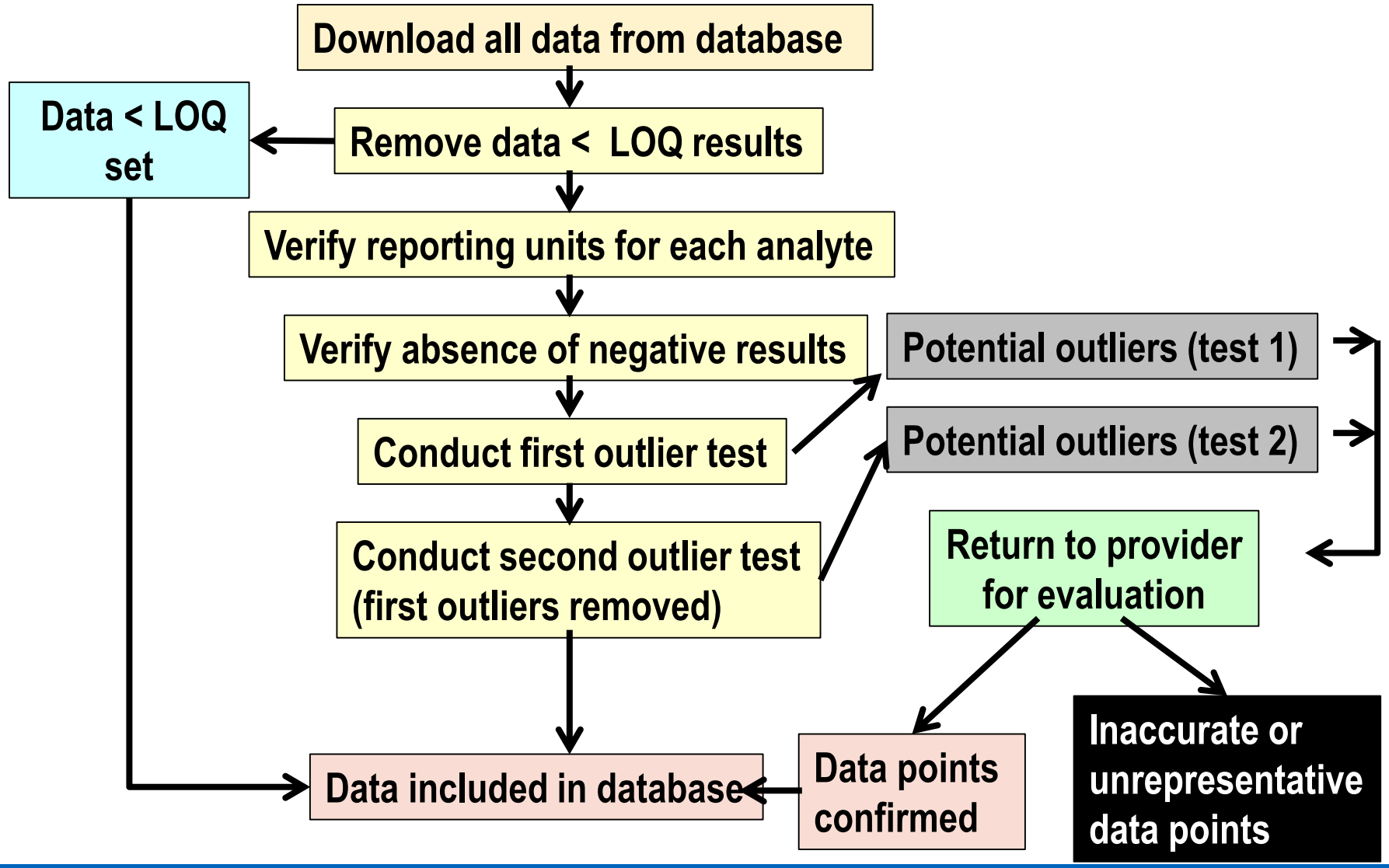
J.R. Simplot Company

Okanagan Specialty Fruits Inc., a Subsidiary of Intrexon Corporation

Syngenta Crop Protection

National Institute of Agricultural Sciences, Rural Development Administration, Korea (in progress)

Quality Check Process Summary



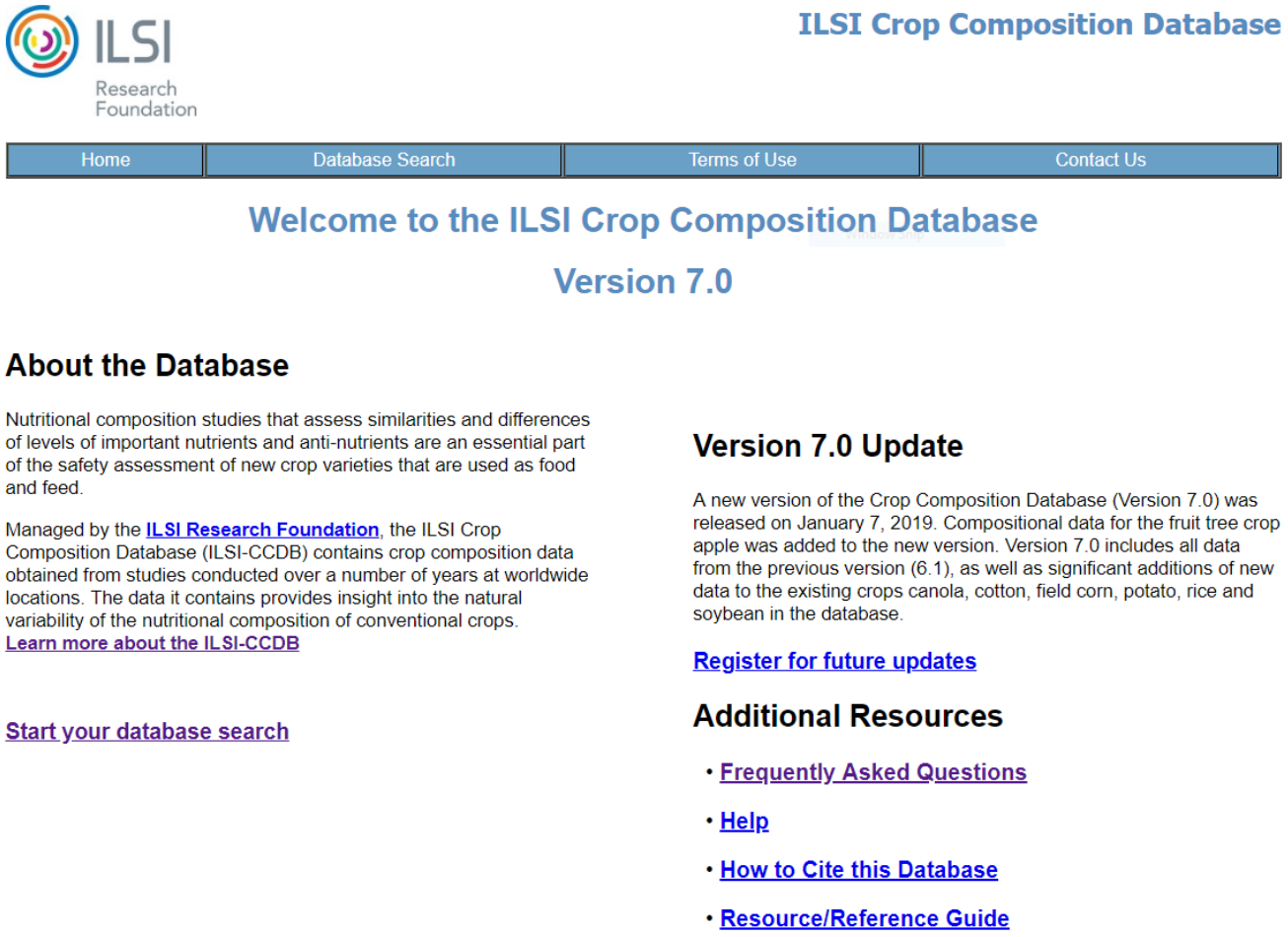
Analyte selection
based on historical precedence & reference data

- **Proximates analysis:** easy way to track and detect quality
  - Crude protein, crude fat, ash, moisture & total carbohydrates (by calculation)
- **Additional analyses for proximates:**
  - Carbohydrates: dietary fibers & sugars
  - Proteins: amino acids
  - Ash: minerals
  - Fat: fatty acids, phospholipids
- **Other nutrients**: vitamins and pro-vitamins
- **Bioactive compounds:** phenolics, tannins, sterols, etc.
- **Anti-nutrients:** phytic acid, trypsin inhibitor, glucosinolates

	Apple	Canola	Cotton	Field corn	Sweet Corn	Rice	Soybean	Potato	Sorghum
Amino Acids (18)		●	●	●	●	●	●	●	●
Bioactives (25)	●	●	●	●	●	●	●	●	●
Carbohydrates (6)	●		●	●	●		●	●	●
Fatty Acids (42)		●	●	●	●	●	●		●
Fiber (6)	●	●	●	●	●	●	●	●	●
Glucosinolates (16)		●							
Minerals (14)	●	●	●	●	●		●	●	●
Others (4)			●	●	●	●	●		●
Phospholipids (6)							●		
Proximates (7)	●	●	●	●	●	●	●	●	●
Vitamins (17)	●	●	●	●	●	●	●	●	●

ILSI Research Foundation

ILSI Crop Composition Database
www.cropcomposition.org



Canola data in ILSI-CCDB

69,722 canola data points for 106 analytes

Amino Acids: 18 analytes
e.g. Lysine, N = 992 (0<LOQ), mean 15.7 (10.7 to 20.9) mg/g (DW)

Bioactives: 11 analytes
e.g. Brassicasterol, N = 496 (0<LOQ), mean 0.0282 (0.0057 to 0.0477) % (DW)

Glucosinolates: 13 analytes
e.g. Total Gluc.: N = 877 (0<LOQ), mean 7.78 (0.41 to 31.98) µmol/g (DW)

Minerals: 12 analytes
e.g Magnesium: N = 1003 (0<LOQ), mean 3,713.60 (2,210.30 to 5,310.00) ppm (DW)

Canola data in ILSI-CCDB (cont'd)

Proximate: 5 analytes
e.g oil: N = 1000 (0<LOQ), mean 41.6 (24.6 to 55.2) % (DW)

Vitamins: 12 analytes
e.g. α-tocopherol: N = 913 (0<LOQ), mean 0.1003 (0.0096 to 0.1796) mg/g (DW)

Fibers: 4 analytes
e.g. Crude fiber: N = 651(0<LOQ), mean 29.1 (11.2 to 37.8) % (DW)

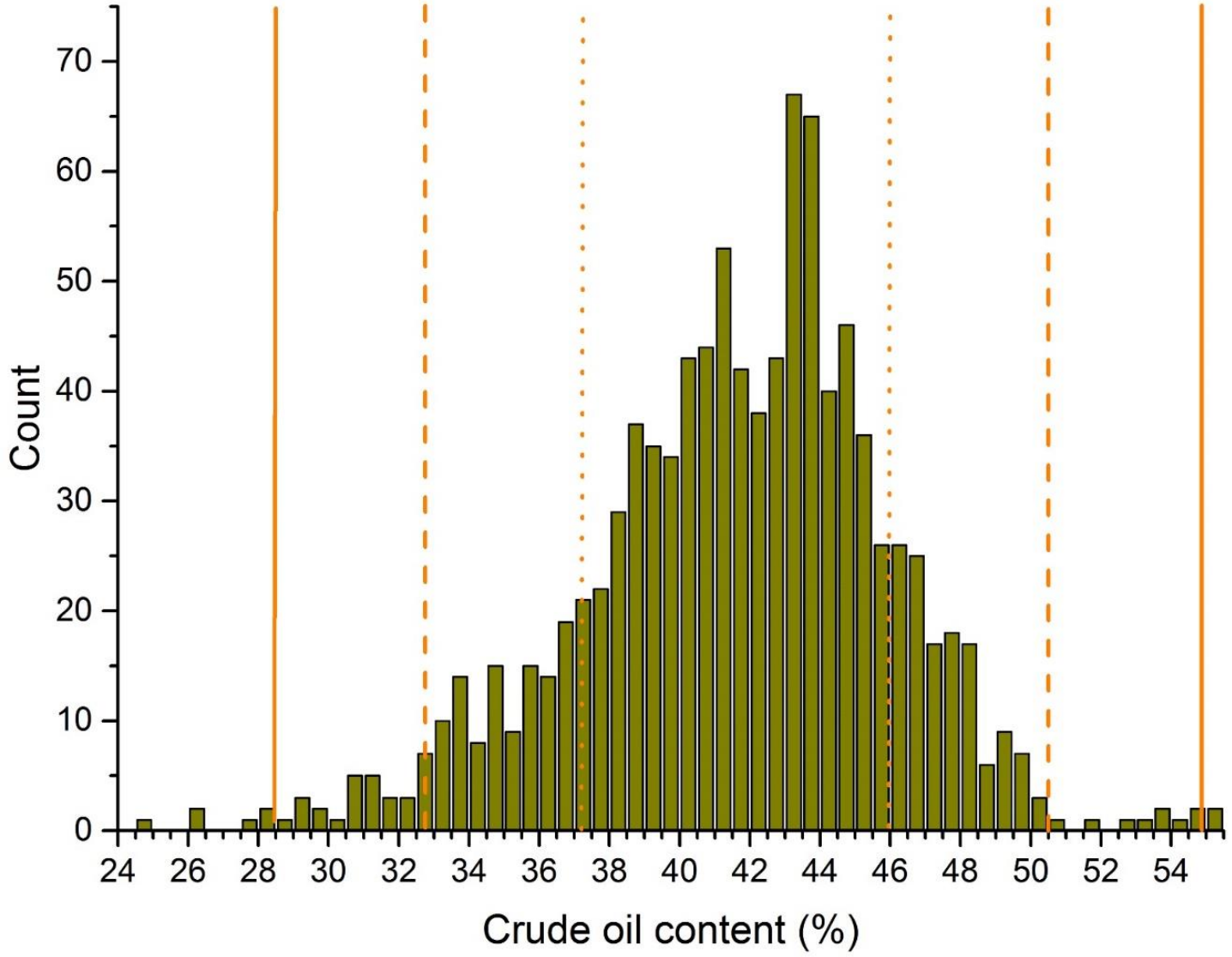
Fatty acids: 28 analytes
e.g. α-Linolenic acid: N = 470 (0<LOQ), mean 3.2 (0.67 to 4.97) % (DW)
e.g. Erucic acid: N = 469 (379<LOQ), mean 0.157 (0.022 to 0.843) % (DW)

Summary Statistics - example

	Crude Fat	Crude Protein	Alanine	α-Linolenic acid
Mean	41.59	26.50	11.23	3.20
St. Deviation	4.40	3.06	1.28	0.70
N	1000	1001	992	470
St Error of the mean (SEM)	0.139	0.096	0.040	0.032
Lower 95% Conf. Limit*	41.32	26.32	11.15	3.14
Upper 95% Conf. Limit*	41.86	26.69	11.31	3.27
Minimum	24.60	15.6	7.33	0.67
Median	41.99	26.50	11.30	3.09
Maximum	55.20	35.7	14.52	4.97
Normality test KS*	0.04669	0.01723	0.03891	0.06519
Normality test p-value*	<0.0001	> 0.10	0.0012	<0.0001
Passed normality test?*	No	Yes	No	No

*calculated using SAS software

Crude fat content distribution



Methods used for crude fat analysis

PR0003:

- AOAC Official Method 922.06
- Acid hydrolysis followed by hot solvent extraction with petroleum ether

PR0020:

- AOCS Official Method Am 5-04/ANKOM XT15 Extractor, Operator's Manual pp. 10-17 (2008)
- Single extraction with hot petroleum ether

PR0023:

- AOAC Official Method 960.39 or 948.22
- Extraction with petroleum ether

Future Vision of ILSI-CCDB

- New data
  - New crops (e.g., sugarcane, cowpea, cassava)
  - New data on existing crops from new providers (e.g. rice)
  - Data from world areas currently not represented or under-represented (e.g. more South America, Africa and Asia)
- Improve existing UI and Data Visualization
- Seek collaboration with other crop experts and data providers
- Outreach
  - Increase usage
  - Increase awareness

For more information on ILSI-CCDB

www.cropcomposition.org

www.ilsirf.org

Email: ccdb@ilsi.org

Ridley et al. 2004. Development of the International Life Sciences Institute Crop Composition Database. Journal of Food Composition and Analysis 17:423-438

Alba et al. 2010. Improvements to the International Life Sciences Institute Crop Composition Database. Journal of Food Composition and Analysis 23:741-748

Sult et al. 2016. Report: Release of the International Life Sciences Institute Crop Composition Database Version 5. Journal of Food Composition and Analysis 51:106-111

Thank you
Any questions