Incorporation of C&E data in EURISCO

Forages 2020 workshop, Alnarp, Sweden

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BACKGROUND

C&E data – state of the art

- Previously not available in EURISCO
- Of high importance to users of PGR data

  → Determines value of germplasm for breeding and research
- Difficult to handle due to lots of “standards”

  → Different descriptor names/synonyms

  → Different rating scales
    - Nominal, ordinal, metric scale

  → Different amounts of meta information
    - When, where, how, by whom?
    - Experiment set-up, treatment etc.

C&E data – state of the art

- 2009 Suitable proposal compiled by the ECPGR Doc&Info Network As simple as possible

  → **“minimum consensus”**

- 2014 D&I meeting

  → **<u>Pragmatic approach</u>**

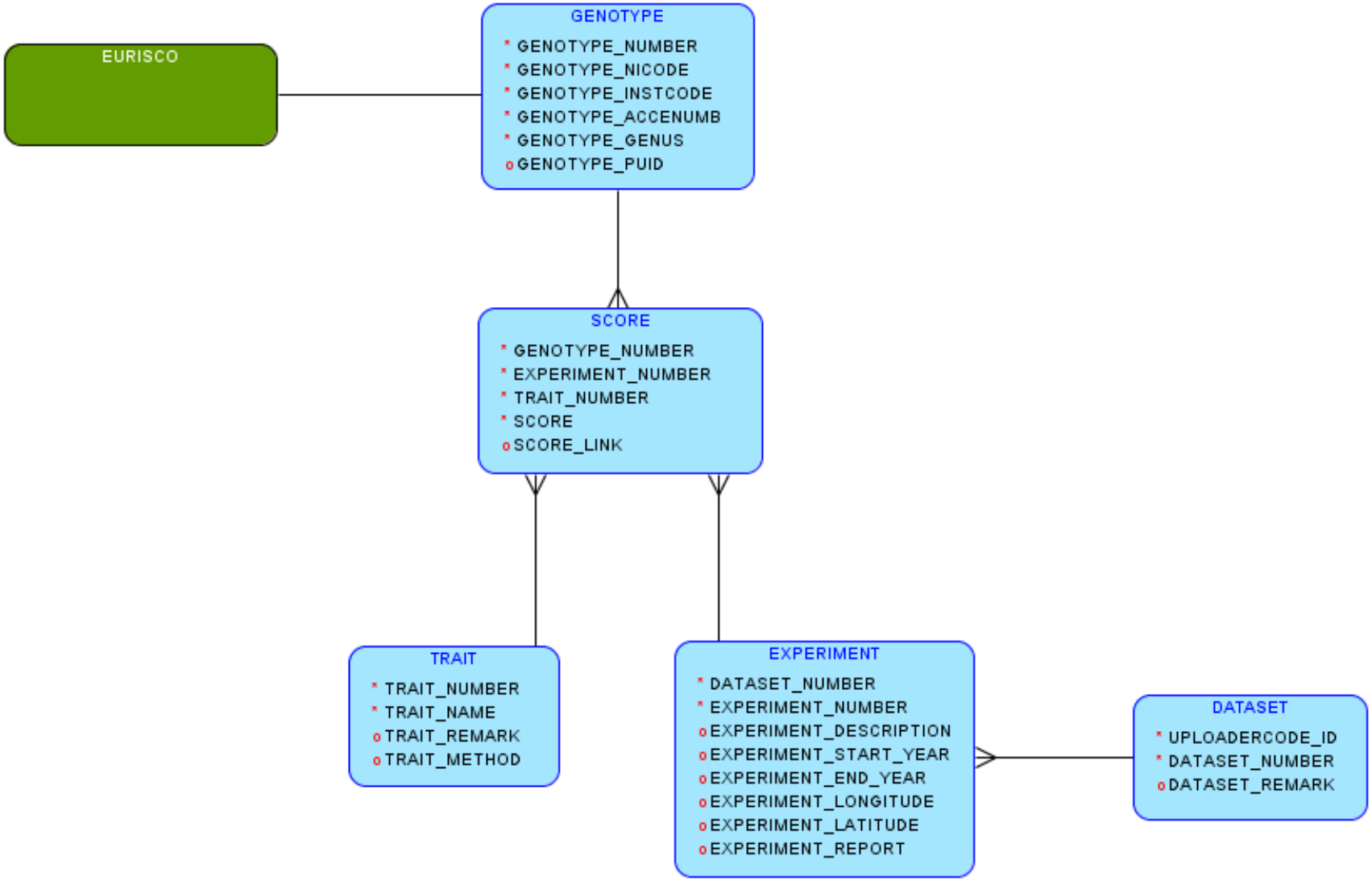
  - No standardisation of trait, scale or experimental design
  - Only standardisation of exchange format (as simple as possible)
  - Import of existing data as-is → reach critical mass
  - Use proposal of 2009 (+ small adjustments)

DATA MODEL

Data model for C&E data I

- **GENOTYPE**
  - Identified by EURISCO descriptors
- **DATASET**
  - May comprise different experiments
- **EXPERIMENT**
  - Multiple genotypes are scored for different traits
- **TRAIT**
  - Characteristic feature to be scored
- **SCORE**
  - Value of a trait for a genotype

Data model for C&E data II



TEMPLATES

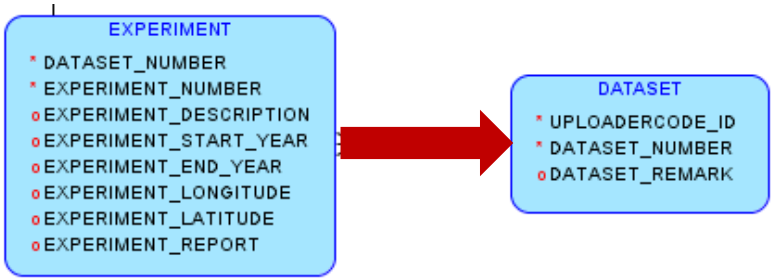
DATASET

- Enables to upload multiple experiments at once
- **Fields**:
  - **UPLOADERCODE***:
    - ID of registered authorised data provider
    - Provided by EURISCO
  - **DATASET_NUMBER***:
    - To link experiments with datasets
    - Unique and persistent for the data provider
  - DATASET_REMARK:
    - General remark for all scores in the dataset

UPLOADERCODE	DATASET_NUMBER	DATASET_REMARK
deu_uploader01	1	This dataset contains forage grass accessions.
…	…	…
…	…	…

EXPERIMENT I

- Meta data helping to interpret C&E data
  - Experiment set-up
  - Weather conditions
  - Soil conditions
  - Experiment location
  - …
- **Fields**:
  - **DATASET_NUMBER***:
    - Reference of the dataset
  - **EXPERIMENT_NUMBER***:
    - To link scores with experiments
    - Unique and persistent for the data provider



EXPERIMENT II

- **Fields (cont.):**
  - EXPERIMENT_DESCRIPTION:
    - Brief English description
    - Information necessary for interpreting the scores, e.g. set-up
  - EXPERIMENT_START_YEAR:
    - Year in which the experiment was performed (or started)
  - EXPERIMENT_END_YEAR:
    - Year in which the experiment ended
  - EXPERIMENT_LONGITUDE:
    - Longitude of experimental site
  - EXPERIMENT_LATITUDE:
    - Latitude of experimental site
  - EXPERIMENT_REPORT:
    - Reference to a report (either report file or report URL)

EXPERIMENT III

DATASET_NUMBER	EXPERIMENT_NUMBER	EXPERIMENT_DESCRIPTION	EXPERIMENT_START_YEAR	EXPERIMENT_END_YEAR	EXPERIMENT_LONGITUDE	EXPERIMENT_LATITUDE	EXPERIMENT_REPORT
1	1	Characterisation data of Lolium perenne	1999		11.278414	51.826059	http://...
1	2	Characterisation data of Lolium perenne	2000		11.278414	51.826059	http://...
1	3	Characterisation data of Lolium perenne	2001		11.278414	51.826059	http://...
1	4	Evaluation data of Lolium perenne (4 replications per accession)	2002	2005	11.278414	51.826059	http://...
...	...	...	...		...	...	...

TRAIT I

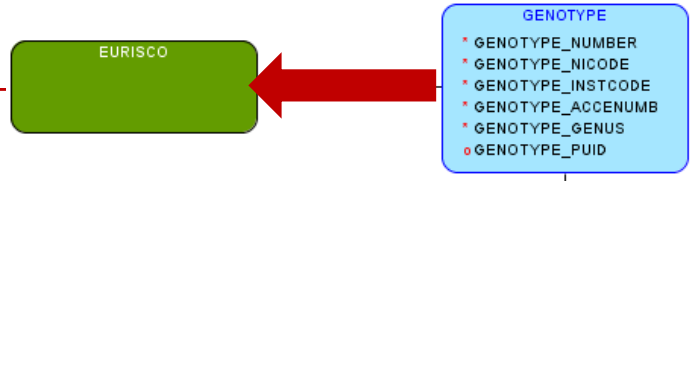
- Describes phenotypic traits and the methods used for scoring
- **Fields:**
  - **TRAIT_NUMBER***:
    - Unique, temporary number of the trait in the dataset
  - **TRAIT_NAME***:
    - English name of the trait
  - TRAIT_REMARK:
    - General remark helping to interpret the trait
  - TRAIT_METHOD:
    - English description of the used method + scale

TRAIT II

TRAIT_NUMBER	TRAIT_NAME	TRAIT_REMARK	TRAIT_METHOD
1	Sowing date	…	Date
2	Emerging date	…	Date
3	Growing before winter	…	Rating value from 1 (min) – 9 (max)
4	Stem height min	In flowering time, the shortest plant	Measurement [cm]
…	…	…	…

GENOTYPE I

- All accessions for which C&E data will be uploaded
- **Fields**:
  - **GENOTYPE_NUMBER***:
    - Unique, temporary number of the genotype in the dataset
  - **GENOTYPE_NICODE***:
    - National Inventory code from EURISCO
  - **GENOTYPE_INSTCODE***:
    - Holding institute code from EURISCO
  - **GENOTYPE_ACCENUMB***:
    - Accession number from EURISCO
  - **GENOTYPE_GENUS***:
    - Genus from EURISCO
  - GENOTYPE_PUID:
    - Placeholder for a permanent unique identifier (still under discussion)

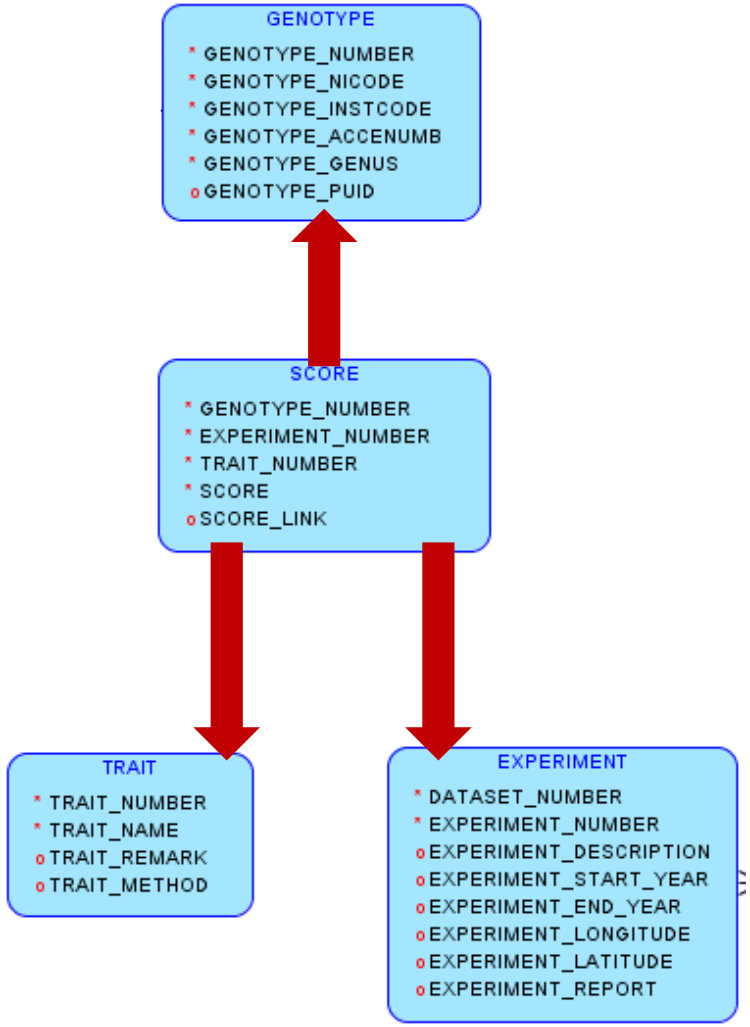


GENOTYPE II

GENOTYPE_NUMBER	GENOTYPE_NICODE	GENOTYPE_INSTCODE	GENOTYPE_ACCENUMB	GENOTYPE_GENUS	GENOTYPE_PUID
1	DEU	DEU271	GR 142	Lolium	
2	DEU	DEU271	GR 476	Lolium	
3	DEU	DEU271	GR 550	Lolium	
4	DEU	DEU271	GR 2670	Lolium	

SCORE I

- Observed phenotypic values of the accessions
- **Fields**:
  - **GENOTYPE_NUMBER***:
    - Reference to a genotype
  - **EXPERIMENT_NUMBER***:
    - Reference to an experiment
  - **TRAIT_NUMBER***:
    - Reference to a trait
  - **SCORE***:
    - Observed score
  - SCORE_LINK:
    - Link to a publication on accession level



SCORE II

GENOTYPE_NUMBER	EXPERIMENT_NUMBER	TRAIT_NUMBER	SCORE	SCORE_LINK
1	1	1	19990313	http://...
1	1	3	7	http://...
4	4	1	20020401	…
4	4	4	21	http://...
…	…	…	…	…
…	…	…	…	…

Putting all this together

GENOTYPE_NUMBER	GENOTYPE_NICODE	GENOTYPE_INSTCODE	GENOTYPE_ACCENUMB	GENOTYPE_GENUS	GENOTYPE_PUID
1	DEU	DEU271	GR 142	Lolium	
2	DEU	DEU271	GR 476	Lolium	
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GENOTYPE

TRAIT

TRAIT_NUMBER	TRAIT_NAME	TRAIT_REMARK	TRAIT_METHOD
1	Sowing date	…	Date
2	Emerging date	…	Date
3	Growing before winter	…	Rating value from 1 (min) – 9 (max)
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GENOTYPE_NUMBER	EXPERIMENT_NUMBER	TRAIT_NUMBER	SCORE	SCORE_LINK
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1	1	3	7	http://…
4	4	1	20020401	…
4	4	4	21	http://…
…	…	…	…	…
…	…	…	…	…

SCORE

DATASET_NUMBER	EXPERIMENT_NUMBER	EXPERIMENT_DESCRIPTION	EXPERIMENT_START_YEAR	EXPERIMENT_END_YEAR	EXPERIMENT_LONGITUDE	EXPERIMENT_LATITUDE	EXPERIMENT_REPORT
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…	…	…	…		…	…	…

EXPERIMENT

UPLOADERCODE	DATASET_NUMBER	DATASET_REMARK
deu_uploader01	1	This dataset contains forage grass accessions.
…	…	…
…	…	…

DATASET

PROCEEDING

Proceeding for data upload I

- Prerequisite:
  - Only non-confidential C&E data
  - Only data of accessions listed in EURISCO

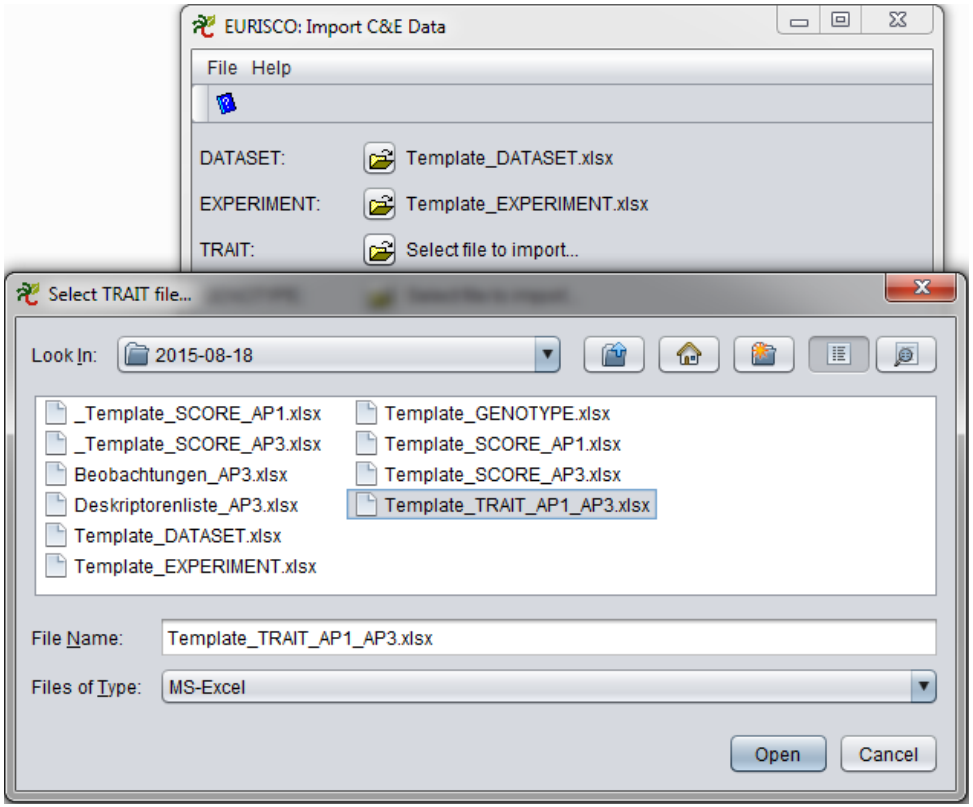
- Impact
  - NFPs responsible for data upload
    → May nominate users for (sub) accounts
    → Currently being clarified by ECPGR Secretariat

- Data formatting
  - According to the templates in MS Excel (.xlsx) files
  - One file for each template

Proceeding for data upload II

- **Three steps**

1. File parsing and upload via Java tool *(data owner)*
2. Data integrity checks *(EURISCO management)*
3. Approval / withdrawals of data for publishing on the EURISCO website *(data owner/NFP)*



DATA VISUALISATION

EURISCO web interface

Currently:

- EURISCO backend completely extended for C&E data
  - Exchange format
  - Database schema
  - Upload tools
  - Data integrity checks

Future direction:

- Extension of EURISCO web interface for C&E data

  in progress
  - Still interested in getting additional use-cases for
    - Presentation of C&E data
    - Searching/filtering C&E data
    - Analysis of C&E data

Examples I

Presentation of C&E data

- Wizard-based (step-by-step) selection of C&E data?
  - By taxonomy
  - By trait
  - By experiment
  - Download of selected data (incl. metadata)?

Searching/filtering C&E data

- Descriptive statistics (**on experiment level only**)?
  - Min, max, avg, stddev, …
  - Box plots, histograms, scatterplots, …

Analysis of C&E data

- Comparisons?
  - Different countries of origin
  - …

Examples II

Searching/filtering C&E data

Go | Actions

1 - 15

Trait Name	Unit	Minimum	Maximum	Average	Stddev	Variance	First Quartile	Median	Third Quartile
Length_primary_root_day_2	cm	.0769	5.0049	1.6267	1.0375	1.0765	.8328	1.3749	2.22075
Length_primary_root_day_3	cm	.145	8.2812	2.9827	1.7086	2.9193	1.63035	2.7457	4.010925
Length_primary_root_day_6	cm	.5243	19.8785	9.9115	3.4562	11.9454	7.6231	9.9545	12.1373
Length_primary_root_day_8	cm	.5973	23.1517	14.9772	4.6948	22.0415	11.8333	15.5338	18.4976
Length_primary_root_day_10	cm	2.7703	24.9071	18.5805	4.4733	20.0107	15.7547	20.2375	21.9946
Length_lateral_roots_day_2	cm	0	.542	.0036	.0379	.0014	0	0	0
Length_lateral_roots_day_3	cm	0	.6299	.0057	.0444	.002	0	0	0
Length_lateral_roots_day_6	cm	0	42.247	4.1527	5.8309	33.999	0	1.8464	6.096825
Length_lateral_roots_day_8	cm	0	130.4067	28.495	24.3938	595.056	10.6366	22.1419	37.7196
Length_lateral_roots_day_10	cm	2.4513	235.7843	66.2073	51.863	2689.7719	27.4616	50.745	88.5509
Total_root_length_day_2	cm	.0769	5.0049	1.6307	1.0403	1.0822	.8328	1.3749	2.22995
Total_root_length_day_3	cm	.145	8.2812	2.9884	1.7113	2.9286	1.636425	2.7457	4.027575
Total_root_length_day_6	cm	.5243	59.3962	14.0647	8.3458	69.652	8.49165	11.8062	17.34515
Total_root_length_day_8	cm	5.0457	151.2535	43.4908	27.7073	767.693	22.3352	37.1098	55.4076
Total_root_length_day_10	cm	10.5623	268.6712	85.2913	55.3723	3066.0905	43.067	69.7821	110.9772

1 - 15

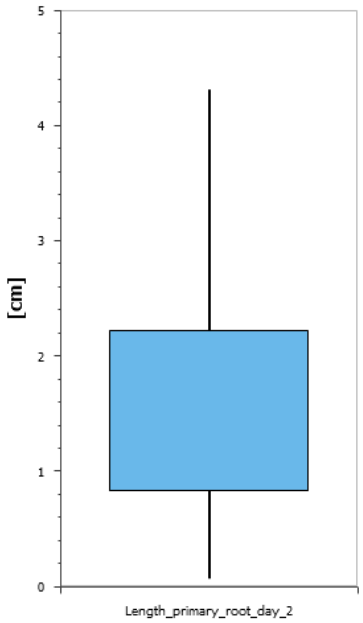
0.30 s

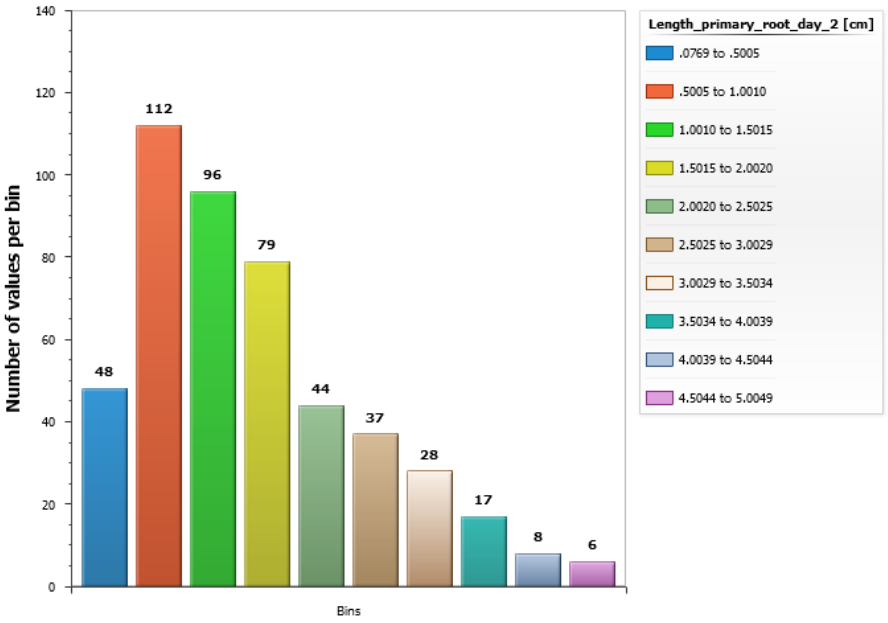
Examples III

Searching/filtering C&E data

Select trait: Length_primary_root_day_2

Trait	Unit	Minimum	Maximum	Average	Stddev	Variance	First Quartile	Median	Third Quartile
Length_primary_root_day_2	cm	.0769	5.0049	1.6267	1.0375	1.0765	.8328	1.3749	2.22075



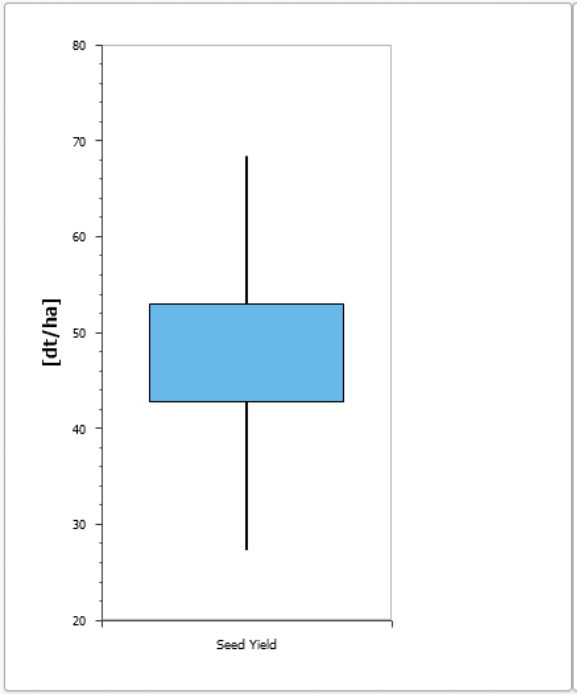


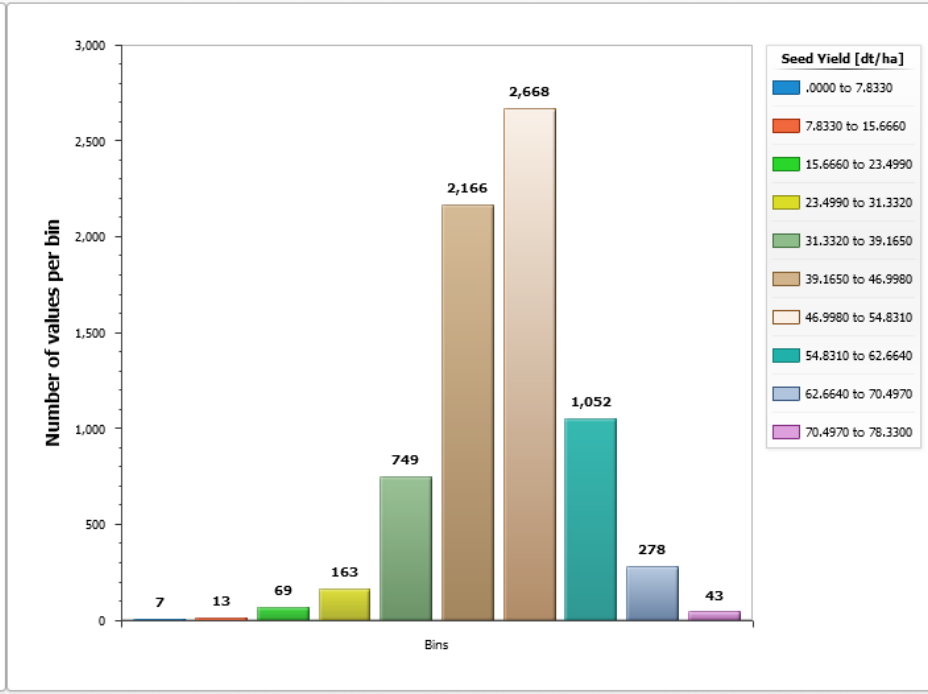
Examples IV

Searching/filtering C&E data

Select trait: Seed Yield

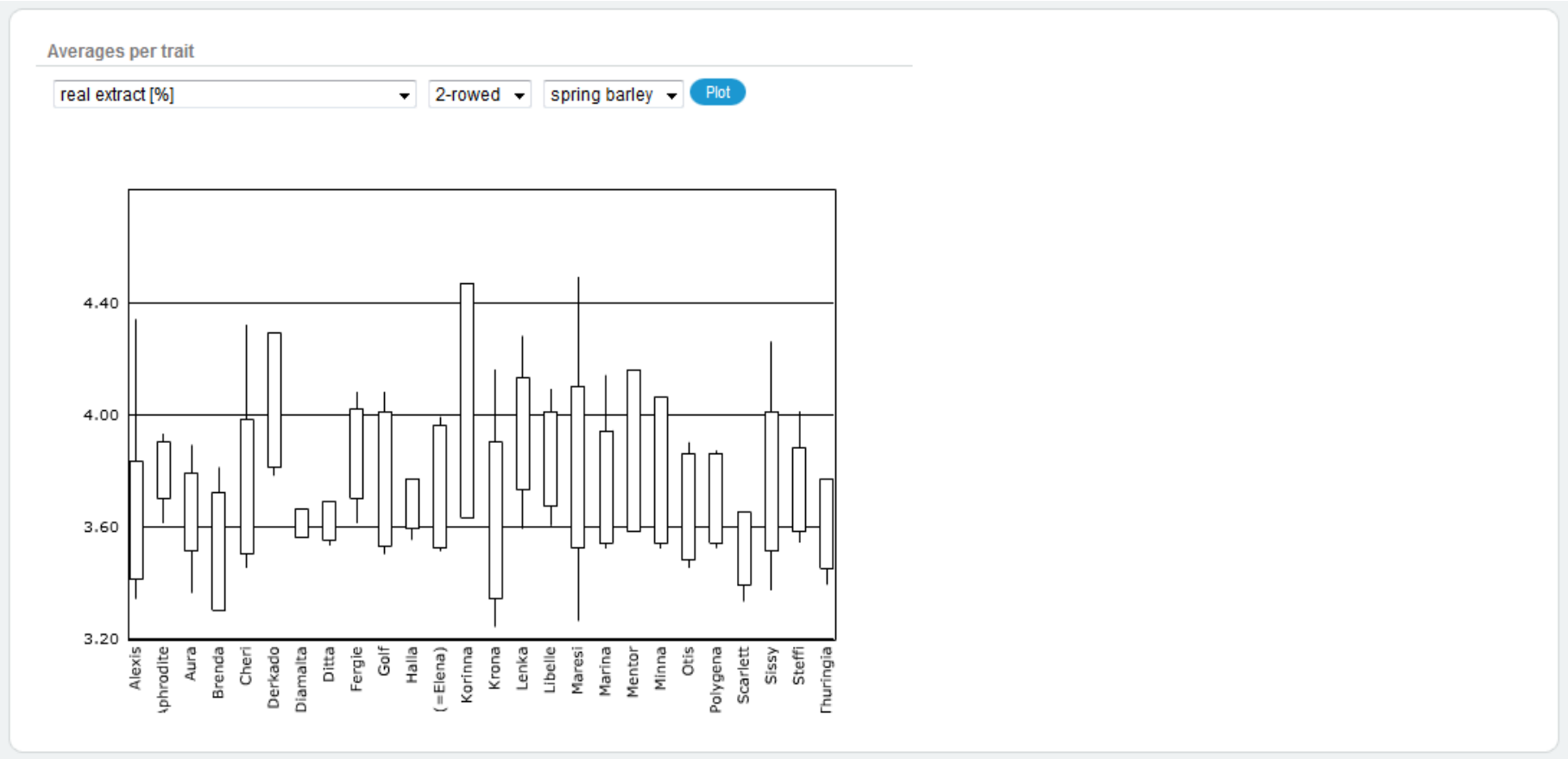
Trait	Unit	Minimum	Maximum	Average	Stddev	Variance	First Quartile	Median	Third Quartile
Seed Yield	dt/ha	0	78.33	47.8293	8.854	78.3934	42.76725	48.177	52.983975





Examples V

Analysis of C&E data

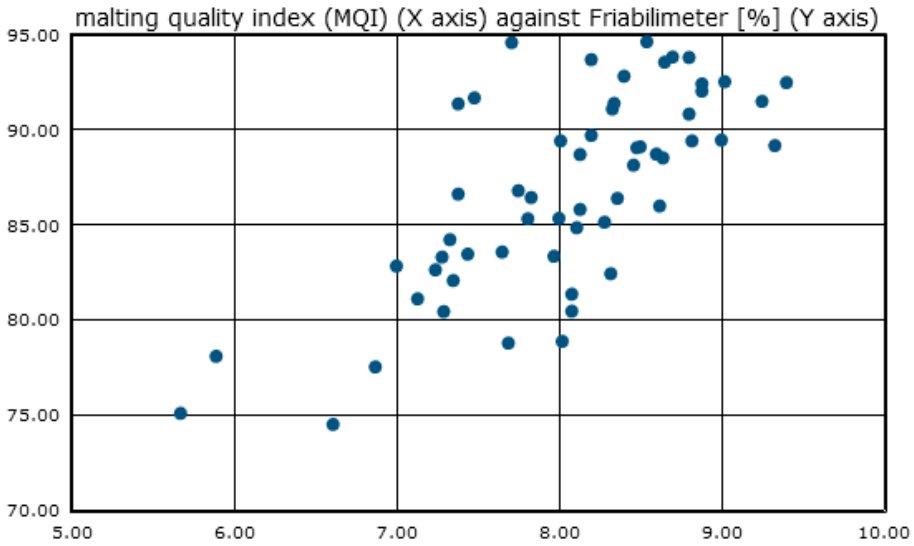


Examples VI

Analysis of C&E data

Scatterplot

malting quality index (MQI) | Friabilimeter [%] | 2-rowed | spring barley | Plot



What are your requirements?