

Genetic structure of a Chilean oat core collection based on GBS SNPs

Mónica Mathias-Ramwell, María-Elena Reyes, Francisco Bustamante-Gutierrez, Javier Flores-Vera, Iván Maureira-Buttler, Haroldo Salvo-Garrido*.

Oat in Chile



- **Southern Chile: 126.833 ha.**
- **63% in “La Araucanía” Region.**
- **Major agricultural export product of “La Araucanía”.**
- **Chile 4° exporter of oat-food.**
- **National average yield: 5.4 ton/ha.**
- **High tech. farmers: 14 ton/ha**

Current challenges..

- **Better adapted to climate changes**
- **To increase or maintain yield**
- **To improve nutritional quality (beta-Glucan, protein)**
- **To improve pest resistant**
- **To improve lodging resistance**

Oat Core Collection (n=190)

ORIGIN	CODE	CULTIVARS (No.)	PURE LINES (No.)	LANDRACES
GERMANY	AL	4	-	-
AUSTRALIA	AU	12	-	-
AUSTRIA	AT	1	-	-
CANADA	CA	6	1	-
CHILE	CL	13	52	1
ESCOTLAND	UK	1	-	-
FRANCE	FX	3	-	-
HOLLAND	NL	1	-	-
NEW ZEALAND	NZ	3	3	-
USA	US	12	72	-
ARGENTINA	AR	-	2	-
BRAZIL	BR	-	2	-
ITALIA	IT	-	1	-
TOTAL (No.)		56	133	1

Phenotypic characterization

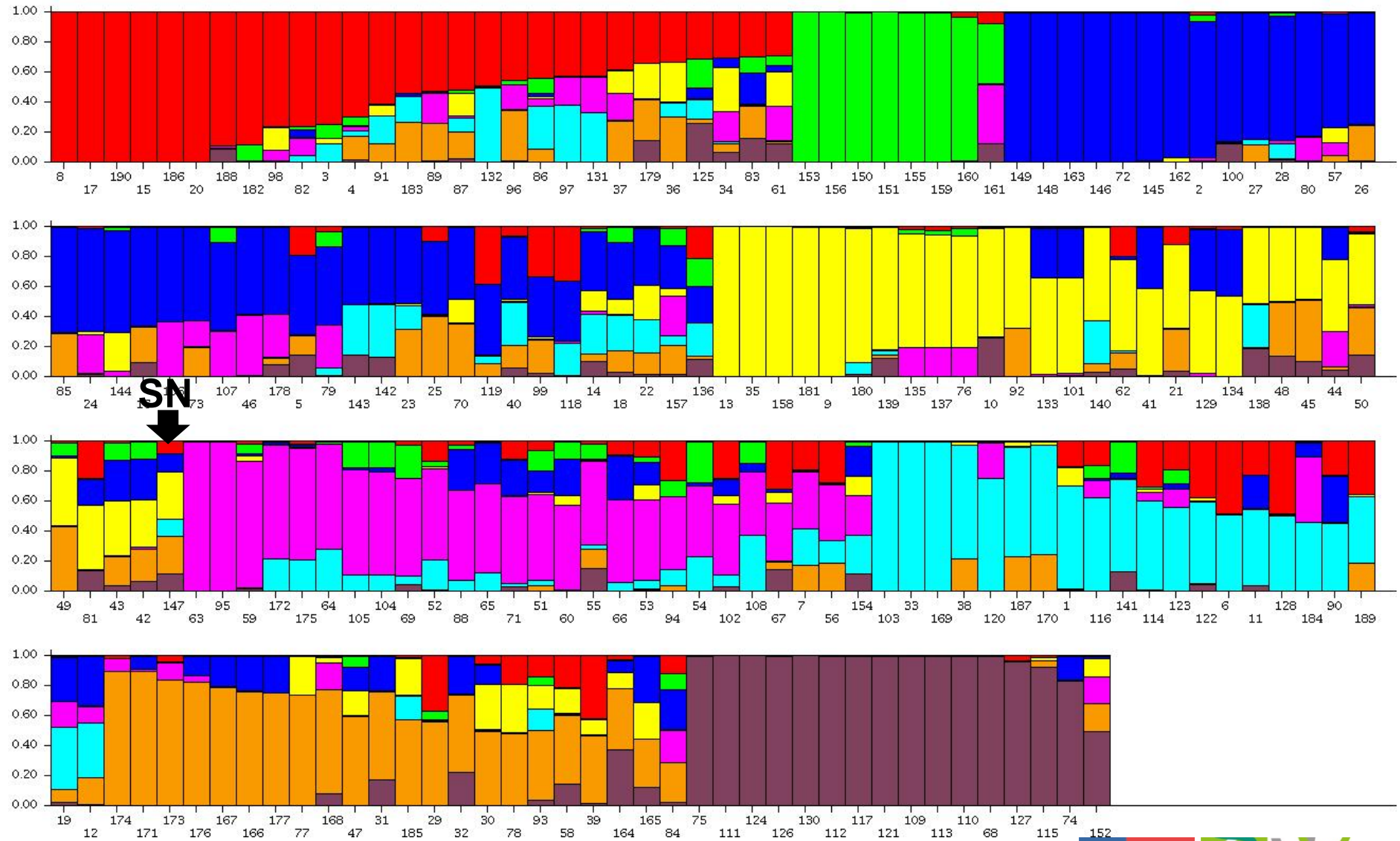
- Southern Chile environments
- Different years



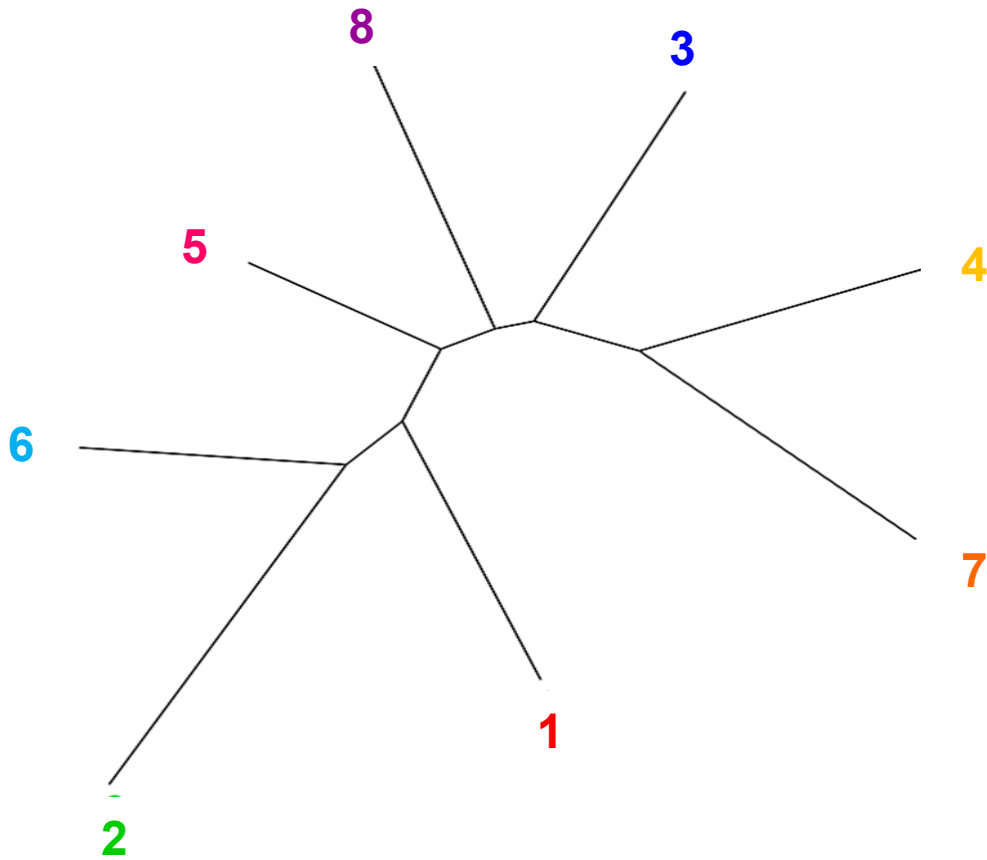
Genotyping by Sequencing - GBS

- Core collection: 190 genotypes.
- Illumina next generation sequencing platform (Cornell University).
- 40,000 ----- > 20,500 SNPs
- A final 1,286 SNPs used in analysis.

Population structure

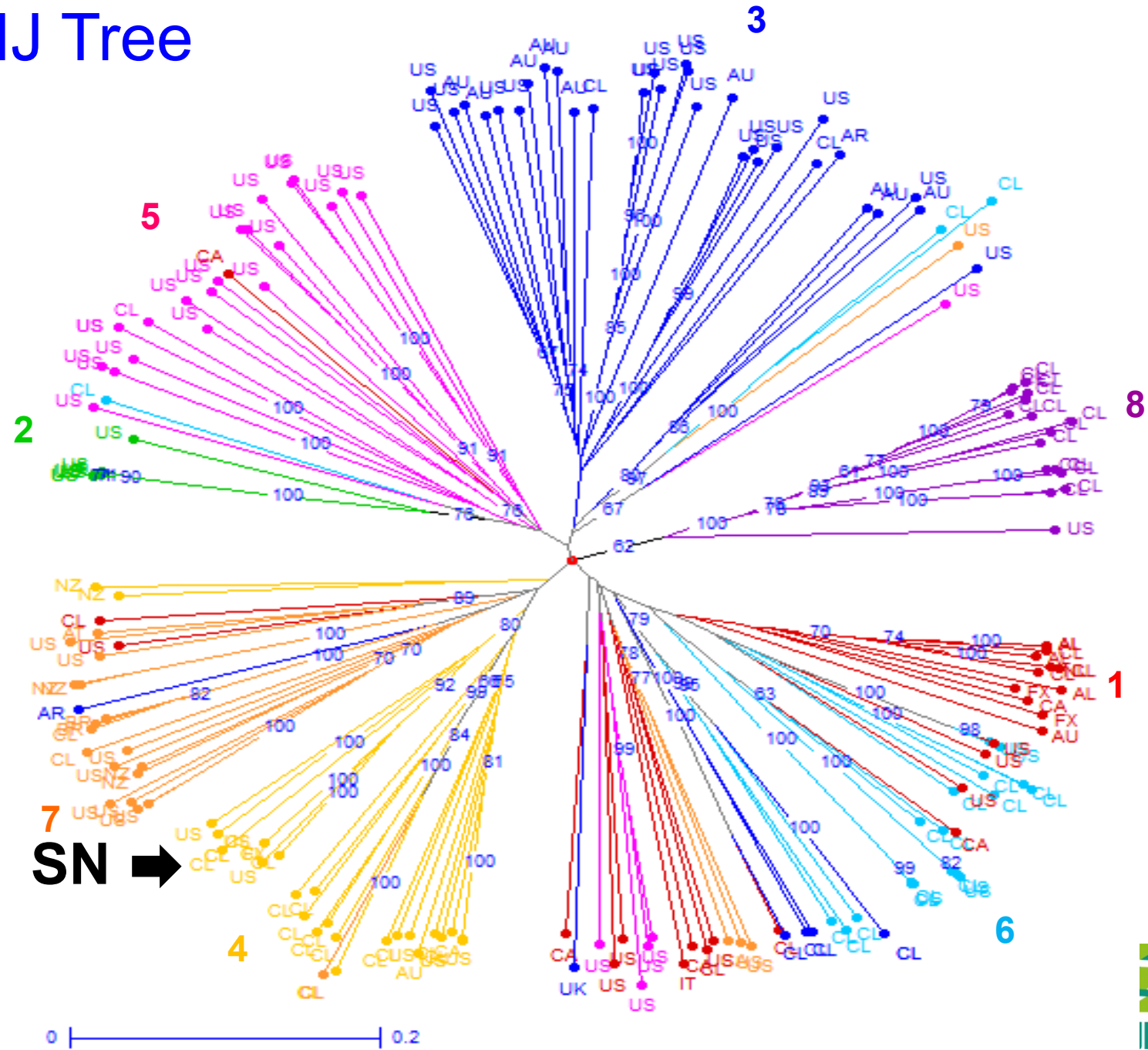


Clusters



CLUSTER	H_E	F_{ST}	Membership
1	0.13	0.76	0.14
2	0.01	0.98	0.06
3	0.27	0.53	0.18
4	0.14	0.74	0.13
5	0.25	0.51	0.12
6	0.16	0.71	0.11
7	0.20	0.64	0.12
8	0.19	0.68	0.11

NJ Tree



Preliminary association studies

Ej:

Yield

Days to heading

Plant height →

Lodging resistance

Pathogens

Stained grain

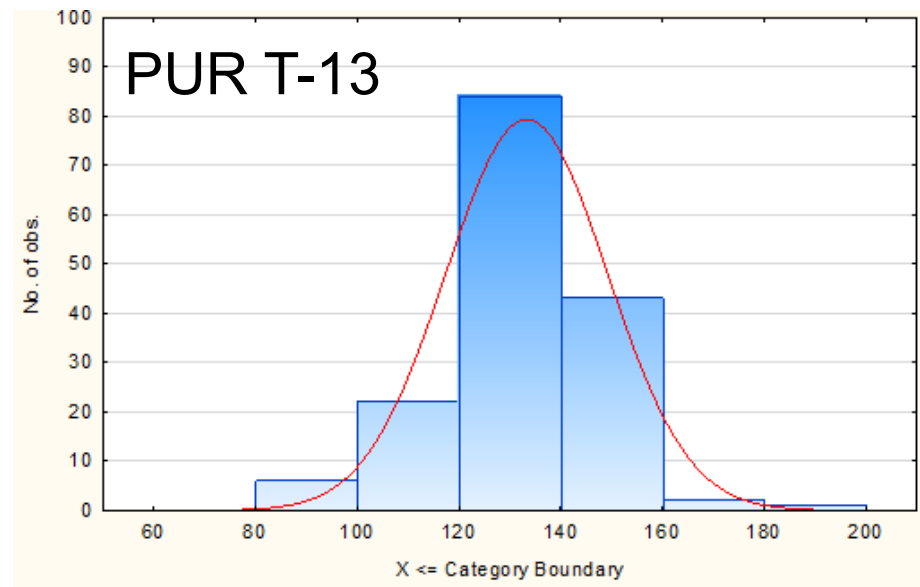
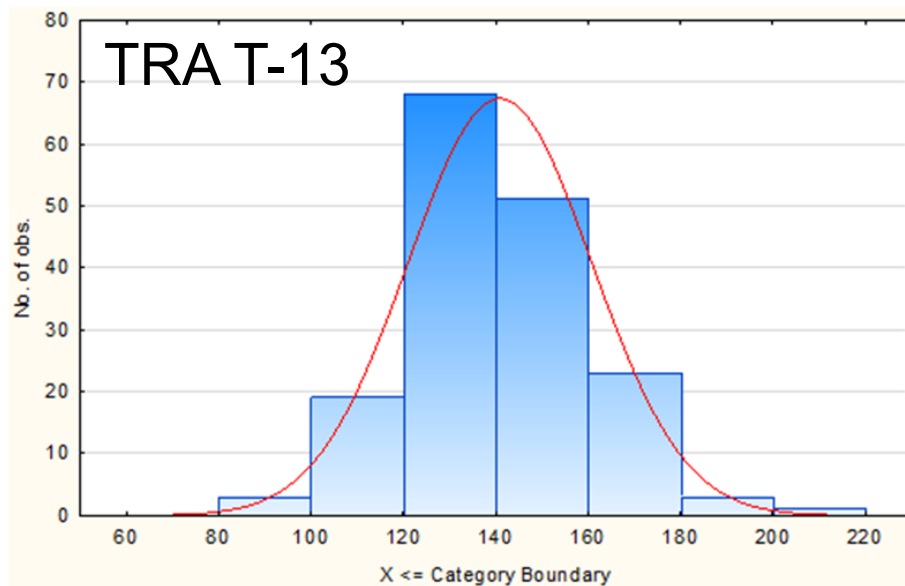
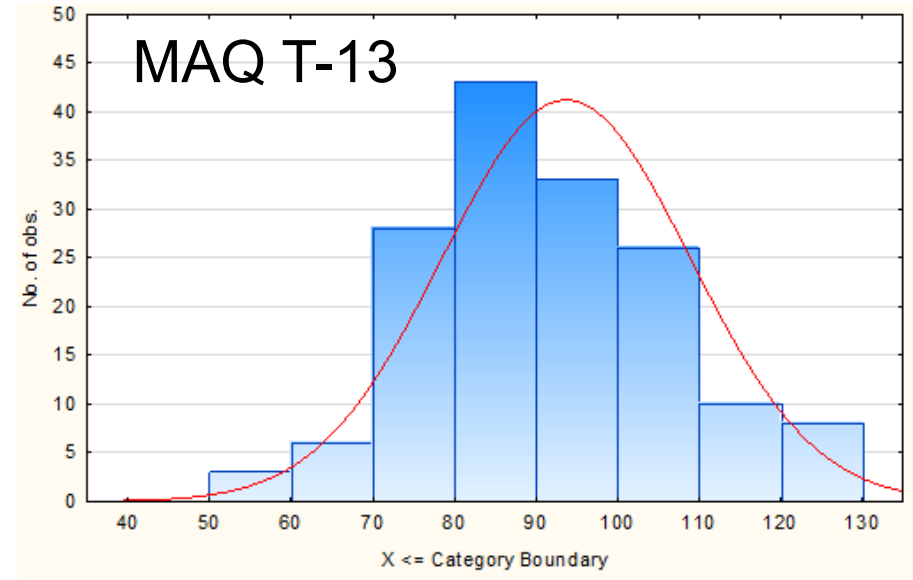
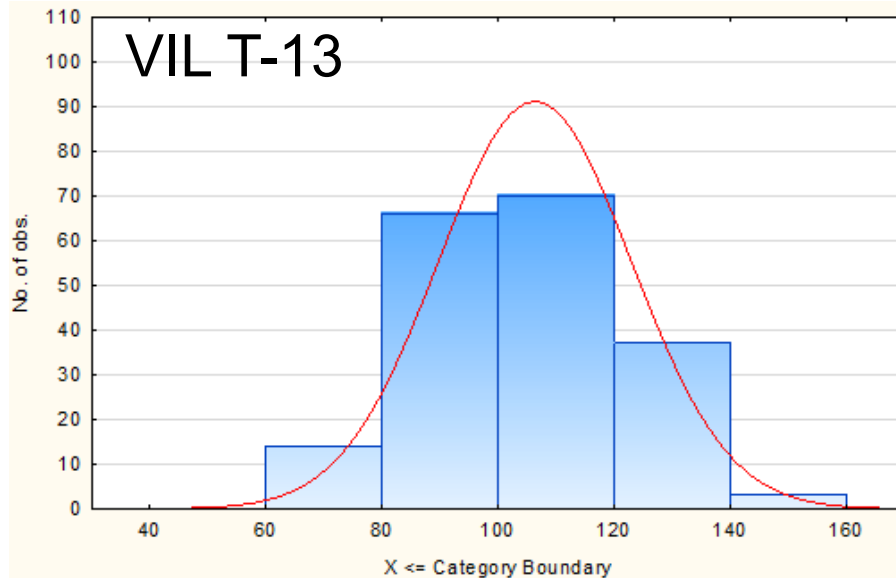
Milling quality

Nutritional quality

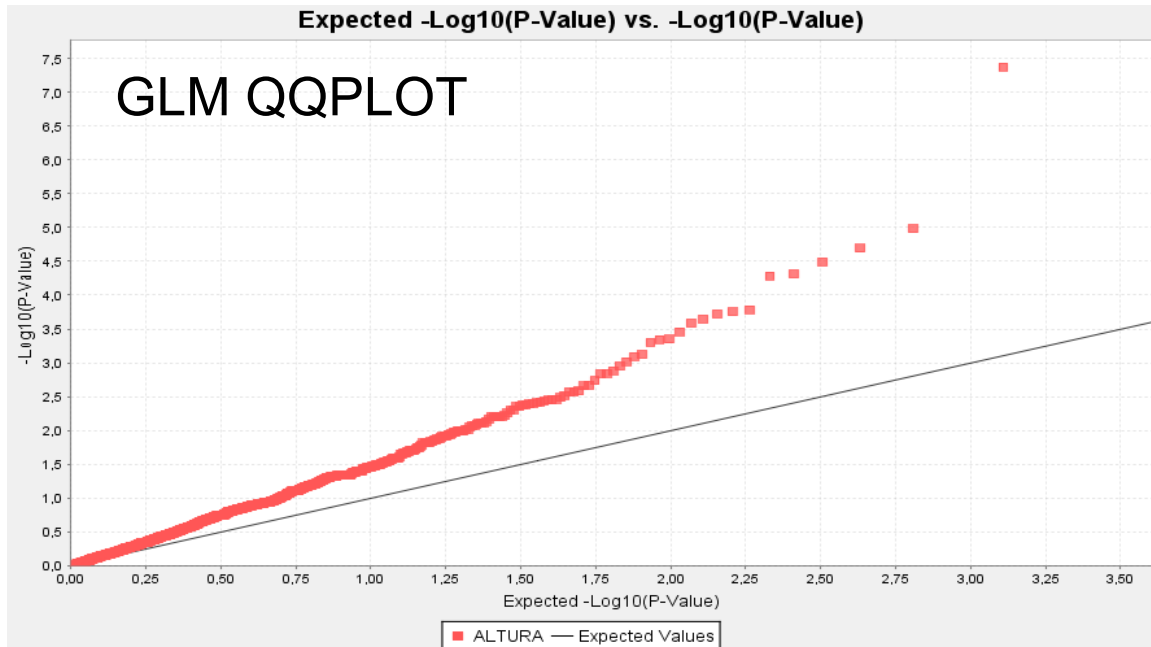


50.000 data

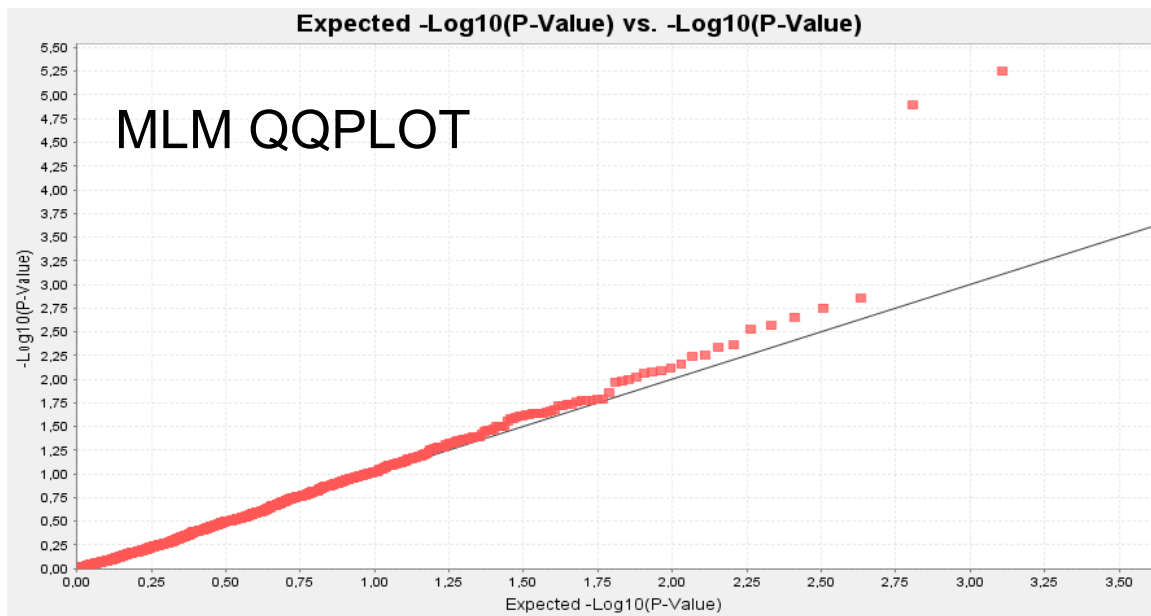
Plant height (cm)



GLM and MLM models for plant height data



4 SNPs



2 SNPs

Preliminary SNPs associated to plant height

MARKER	LOCALITY	YEAR	marker_p	perm_p	markerR2	EFFECT
S1_34248049	Vilcún	2012	0.000000	0.002	0.125	-37.74
	Vilcún	2013	0.000003	0.007	0.079	-20.48
	Purranque	2013	0.000002	0.021	0.092	-25.93
	Traiguén	2013	0.000000	0.01	0.129	-36.29
S1_81606063	Purranque	2012	0.000000	0.011	0.140	15.16
		2013	0.000000	0.002	0.135	18.77

$P \leq 3.88e-5$

Bonferroni: 1286 SNPs

Conclusions and perspective..

- The Oat Core collection is structured in eight sub-populations.
- Preliminarily, 2 SNPs were associated to plant eight, and explaining among 7 to 14% of variation.
- SNPs will be validated with more field and re-sequencing.
- Crosses designed based on genetic structure, are generating recombinants with increased heterosis.



...Many thanks...

- María Elena Reyes
- Carlos Toro
- Julio Arias
- Juan Rojas
- Alejandro Huenqueo
- Francisca Acevedo
- Ivan Maureira
- Braulio Soto
- Paulina Torres
- Javier Flores
- Francisco Bustamante

