

Visualization, Tools, and Resources for Wheat at GrainGenes

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IWGSC data in GrainGenes

GrainGenes
A Database for Triticeae and Avena

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Species Portals on GrainGenes

- Annual Wheat Newsletter
- Barley Boulevard
- Barley Genetics Newsletter
- Oat Newsletter

Upcoming Events

- Bridging the Gap: Using Functional Genomics to Unlock Yield Potential Jan 11 2019
- 2019 - PAG XXVII - Plant & Animal Genome Conference Jan 12 2019 to Jan 16 2019
- 15th Gatersleben Research Conference, Applied Bioinformatics in Crops, Gatersleben, Germany Mar 18 2019 to Mar 20 2019
- IFTBC : International Forage and Turf Breeding Conference Mar 24 2019 to Mar 27 2019
- 1st International Wheat Congress, Saskatoon, Saskatchewan, Canada Jul 21 2019 to Jul 26 2019

About GrainGenes

USDA

GrainGenes is a digital platform that serves small grains research communities as their central data repository and as a facilitator for community activities. It has been hard-funded by the U.S. Department of Agriculture-Agricultural Research Service to ensure long-term data sustainability and interactivity, primarily for wheat, barley, oat, and rye. Please let us know how GrainGenes can improve its interface, tools, and services by using the Feedback button.

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Quick Links

- Browse GrainGenes
- Genome Browsers

Hot Topics

All IWGSC reference sequence resources available

The International Wheat Genome Sequencing Consortium is please data related to the reference sequence of bread wheat, IWGSC RefSeq v1.0 genome assembly (2018) without restriction.

You can reach the Science article for the assembly here.

The following resources are now publicly available, without restriction:

- Wheat Chinese Spring IWGSC RefSeq v1.0 genome assembly (2018)
- Aegilops tauschii Aet v4.0 genome assembly (2017) [PubMed]
- Wild Emmer Wheat Zavitan WEWSeq v.1.0 genome assembly (2017) [PubMed]
- Wheat PanGenome (2017) [PubMed]
- Wheat Physical EST Maps (2004) [PubMed]
- D Genome Physical Map
- GrainMaps

A new mobile app for plant breeding and Verify

Researchers at Kansas State University and Cornell University have released an Android application called "Verify" that will help plant breeders decreasing the amount of time and energy it takes to manage samples. Verify makes integrating and utilizing barcodes a simple process by providing an intuitive interface with a new barcode processing library.

"The first near-complete assembly of the bread wheat genome, Triticum aestivum" by the Salzberg Group

Steven Salzberg's group at Johns Hopkins published "the first near-complete assembly of the hexaploid bread wheat genome, Triticum aestivum" in the journal *Genome Science*. The link to the paper at the journal site can be found at <https://doi.org/10.1093/gigascience/gix097>.

Triticum aestivum Chinese Spring pseudomolecules now available for BLAST on the NSF-IOS-1238231 Project site

The National Science Foundation-funded NSF-IOS-1238231 project has released unmasked pseudomolecules (v1.0) of *T. aestivum* Chinese Spring (CS). They are available for BLAST searches at the project website (<http://aegilops.wheat.ucdavis.edu/ATGSP/>). The BLAST input portal is at the DATA page link at this URL. (The download function is still under construction.) Successful searches will return alignments including coordinates of the target sequences on the pseudomolecules.

Aegilops tauschii reference genome sequence now available for BLAST on the NSF-IOS-1238231 Project site

Aegilops tauschii is the wild species that contributed the D genome to bread wheat and this National Science Foundation-funded project has released the reference sequence of its genome. Masked and unmasked pseudomolecules of *Ae. tauschii* acc. ALS/78 and a database of complete transposable elements annotated in the *Ae. tauschii* genome are available for BLAST and JBrowse searches at the project website (<http://aegilops.wheat.ucdavis.edu/ATGSP/>). The BLAST input portal is at the DATA page link at this URL.

GrainGenes Updates

- November 2018: GrainGenes has an active GitHub account to share scripts
- October 2018: Spring Wheat Nested

The GrainGenes Genome Browsers

Wheat

- Wheat Chinese Spring IWGSC RefSeq v1.0 genome assembly (2018)
- Aegilops tauschii Aet v4.0 genome assembly (2017) [PubMed]
- Wild Emmer Wheat Zavitan WEWSeq v.1.0 genome assembly (2017) [PubMed]
- Wheat PanGenome (2017) [PubMed]
- Wheat Physical EST Maps (2004) [PubMed]
- D Genome Physical Map
- GrainMaps

GrainGenes @GrainGenes

Postdoctoral Research Associate
Contributor at GrainGenes in Atlanta

Embed View on Twitter

SNPVerify: a w... Abstract. Many s... academic.oup.com

Dec 12, 2018

1 2 3 4 5 6 7 next last >

The GrainGenes home page - December 17, 2018.

Wheat Chinese Spring IWGSC RefSeq v1.0 genome assembly (2018)

SNP leaf rust response

Primary Data

Name	leaf rust response
Type	SNP
Score	0.00435157240824644
Description	Excalibur_c20133_87
Position	chr1A:298037397..298037397
Length	1 bp

Attributes

Description	Excalibur_c20133_87
Gwas	Excalibur_c20133_87
Id	Excalibur_c20133_87
Marker	Excalibur_c20133_87
Phenotype_trial	AMPANEL_LR_2012_StPaul
Pvalue	0.00435157240824644
Qvalue	0.382616433860993
Seq_id	chr1A
Source	rrBLUP
Trait	leaf rust response

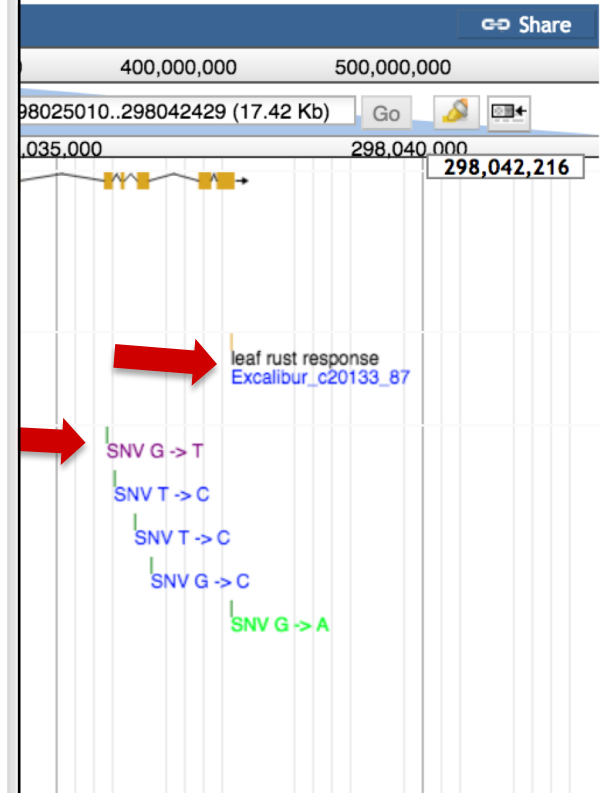
Region sequence

FASTA

```
>chr1A chr1A:298037397..298037397 class=SNP length=1  
G
```

OK

under THE TORONTO AGREEMENT and their analysis cannot be



Primary Data

Name leaf rust response

Type SNP

Score

Description

Position

Length

Attributes

Description

Gwas

Id

Ma

Ph

Pva

Qva

Sec

Sol

Tra

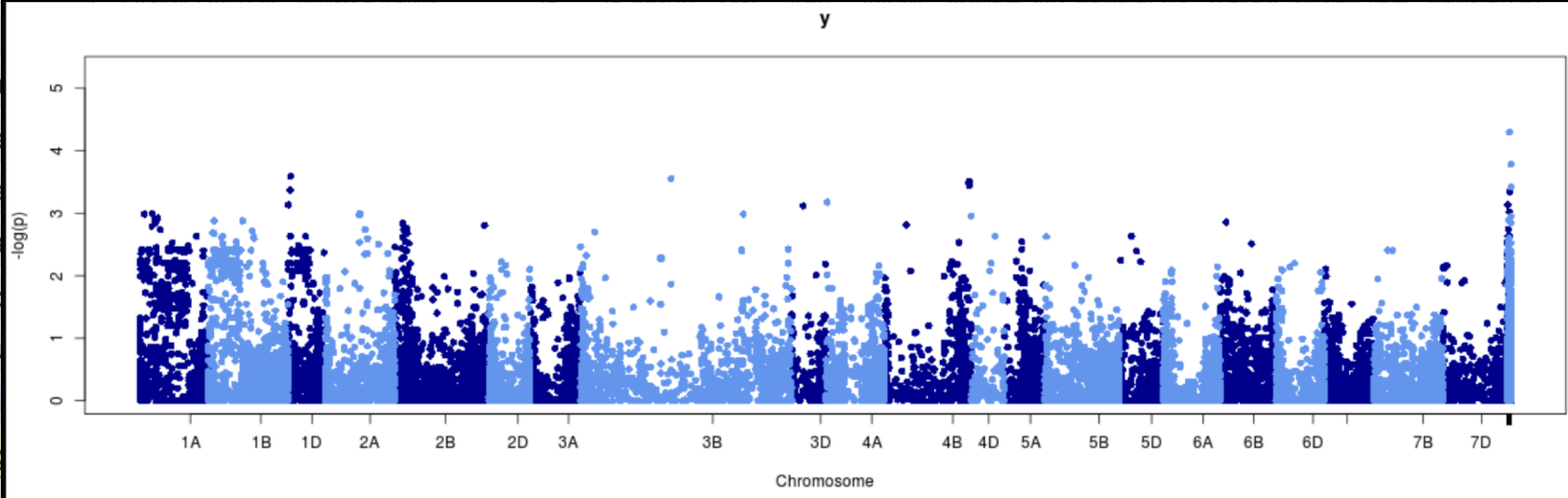
Res

Links to T3 from SNPs found via GWAS
 (triticaeatoolbox.org/wheat)

GWAS Results

marker name = Excalibur_c20133_87

marker	phenotype	chrom	pos	z-score	q-value	p-value	phenotype trial	genotype trial	plot
Excalibur_c20133_87	leaf rust severity	1A	1A 34986377	2.741	0.720	0.01225	AMPANEL_LR_2012_StPaul	TCAP90K_LeafRustPanel	Manhattan Q-Q
Excalibur_c20133_87	leaf rust response	1A	1A 34986377	3.065	0.383	0.00435	AMPANEL_LR_2012_StPaul	TCAP90K_LeafRustPanel	Manhattan Q-Q
Excalibur_c20133_87	flag leaf chlorophyll content	1A	1A 34986377	2.496	0.984	0.02513	SW-AMPANEL_2014_Davis_Dry	TCAP90K_SpringAM_panel	Manhattan Q-Q
Excalibur_c20133_87	days to flag leaf senescence	1A	1A 34986377	2.404	0.846	0.03243	SW-AMPANEL_2012_Bozeman	TCAP90K_SpringAM_panel	Manhattan Q-Q
Excalibur_c20133_87	seeds per head	1A	1A 34986377	2.618	0.954	0.01769	SW-AMPANEL_2013_Huntley	TCAP90K_SpringAM_panel	Manhattan Q-Q
Excalibur_c20133_87	seeds per head	1A	1A 34986377	2.379	0.943	0.03469	SW-AMPANEL_2014_Imperial_Irr	TCAP90K_SpringAM_panel	Manhattan Q-Q



>chr1A chr1A:298037397..298037397 G

Line Name	GRIN Accession	Leaf Rust Severity (%)	Leaf Rust Response (0-1)	Check
THATCHER	PI 168659	70.0	1.0	1
RL6003	GSTR 401	70.0	1.0	0
RL6016	GSTR 403	50.0	1.0	0

Match URG1 Assembly July 2013

In the works ... 'BLAST-able' JBrowse

GrainGenes
A Database for Triticeae and Avena

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BLAST Search for Wheat Collections

Choose program to use and database to search:

Program **blastn** Database **T. aestivum cv. Chinese Spring (ABD release 1, 2018)**

Enter sequence below in FASTA

```
>EU052065.2 Triticum aestivum
enzyme mRNA, complete cds
AGCGGGGACACCATCCACCC
AAAAAAGGACAAAGACTCGA
CCGAATCCTGCGCTACGCATC
CGTTCGCCAGACTGCCGAG
```

Or load it from disk

Set subsequence: From

The query sequence is filtered by Masking

Filter Low complexity Masking

Expect **10** Matrix **BLOSUM62** Perform ungapped alignment

Query Genetic Codes (blastx only) **Standard (1)**

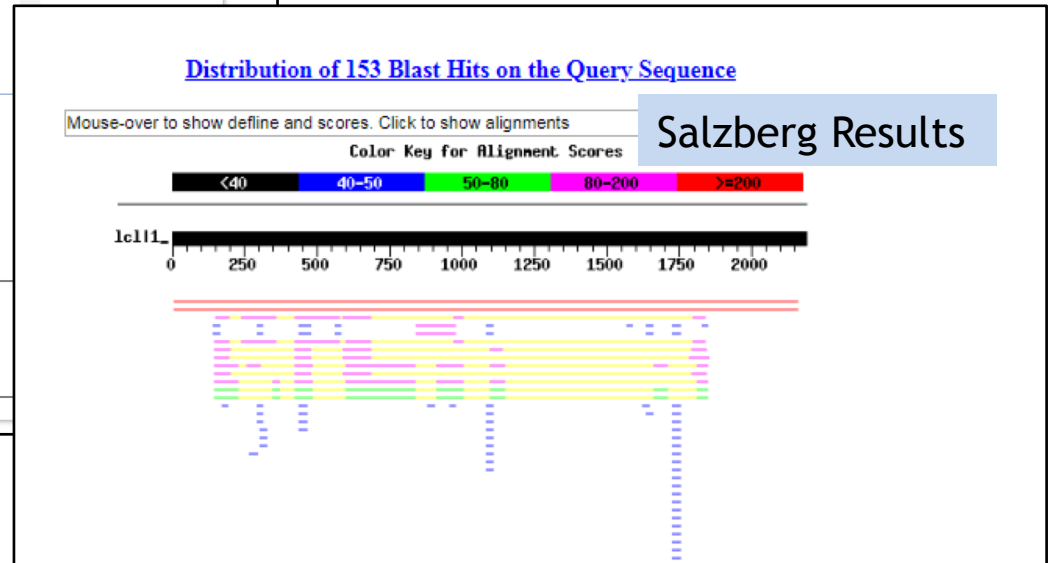
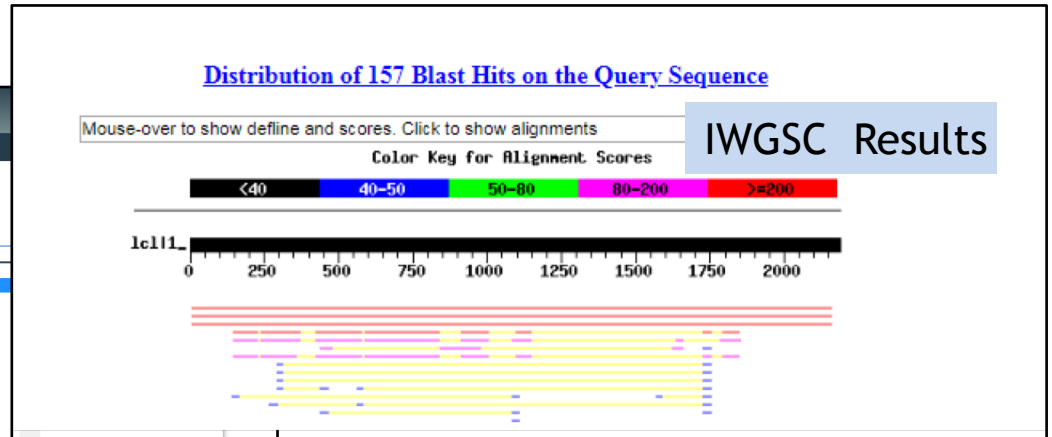
Database Genetic Codes (tblast[nx] only) **Standard (1)**

Frame shift penalty for blastx: **No OOF**

Other advanced options:

Graphical Overview Alignment view **Pairwise**

Descriptions **100** Alignments **50** Color schema **No color schema**



In the works ... curated tracks

Available Tracks

Reference sequence 1

Barley Morex IBSC 2017

IBSC Official Annotations 5

High-Confidence Annotations

Low-Confidence Annotations

All Annotations

CDS

mRNA

Functional Annotations 1

iTAK Predictions (Kinases = Blue, Transcription Factors/Regulators = Purple)

The Triticeae Toolbox (T3) Tracks 3

Barley T3 Markers

Barley T3 HapMap Markers

Barley T3 QTLs

Barley Morex IBSC 2018 Share

Genome Track View Help

0 100,000,000 200,000,000 300,000,000 400,000,000 500,000,000

chr1H chr1H:316672001..317491000 (819 Kb) Go

316,750,000 317,000,000 317,250,000 317,500,000

iTAK Predictions (Kinases = Blue, Transcription Factors/Regulators = Purple) HORVU1Hr1G043660.3
Cys(2)-His(2) zinc finger

Barley T3 Markers

mbGBS13860	mbGBS12163	mbGBS144	owbGBS8213	owbGBS26042	owbGBS36903
S1H_316691679	mbGBS12164		owbGBS8214	owbGBS26043	mbGBS22251
mbGBS1880	mbGBS18616		S1H_317087870		11_20698
S1H_316711781	S1H_316863686		S1H_317087902		12_30043
mbGBS7307	owbGBS855		S1H_317098184		S1H_317382400
owbGBS11603					S1H_317382413
					S1H_317382416

❖ Reference Tracks

❖ Lab-specific Contributions

❖ Links to WheatIS, etc.

phenolic compound cor

CRR Severity

heading date

heading date

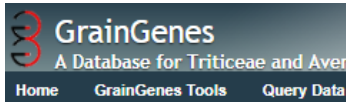
alpha-tocopherol

CRR Severity

kernel weight

scald reaction type (0-5)

In the works ... annotations in the SQL database



GrainGenes Class Browser

Query (optional)

Results: 3522189 Records in 29 Classes

Class	Records
Allele	9063
Assembly	5
Author	24501
Colleague	2638
Collection	291
Gene	5837
Gene Class	554
Gene Product	6270
Germplasm	39754
Image	2387
Journal	1224
Keyword	22378
Library	93
Locus	318131
Map	3063
Map Data	257
Marker	142729
Pathology	454
Polymorphism	3099
Probe	234542
Protein	32636
QTL	2234
Rearrangement	838
Reference	15029
Sequence	2645748
Species	1987
Trait	285
Trait Study	5563
Two Point Data	599

PAG 2018

We've been busy!

in 2018, GrainGenes added **698,271** new records.

Results: 4220460 Records in 29 Classes

Class	Records
Allele	9063
Assembly	5
Author	25039
Colleague	2662
Collection	299
Gene	5954
Gene Class	561
Gene Product	6278
Germplasm	45521
Image	2387
Journal	1200
Keyword	22385
Library	93
Locus	885672
Map	3734
Map Data	293
Marker	142669
Pathology	454
Polymorphism	3099
Probe	318663
Protein	32636
QTL	2277
Rearrangement	838
Reference	15293
Sequence	2684910
Species	1994
Trait	287
Trait Study	5595
Two Point Data	599

PAG 2019

117 new gene records in 7 gene classes

5,767 germplasm records in 8 new collections

567,541 locus records on 671 new maps

84,121 new probe records

39,162 new sequence records

WheatIS Partnership

WheatIS



Filters

[Clear](#)

Database

- GRAINGENES (16755)
- WHEAT GENE CATALOG AT KOMUGI (3119)
- OPENMINTED (3)

Type

- GERMLASM (16106)
- GENE (3119)
- QTL (548)
- GENETIC MAP (91)
- PHYSICAL MAP (10)
- BIBLIOGRAPHY (3)

Species

- TRITICUM AESTIVUM (13135)
- TRITICUM TURGIDUM SSP. DURUM (2888)
- TRITICUM AESTIVUM SSP. AESTIVUM (1974)
- TRITICUM TURGIDUM SSP. DICOCOCCUM (336)
- TRITICUM TIMOPHEEVII SSP. ARMENIACUM (303)
- TRITICUM TURGIDUM (164)
- TRITICUM TURGIDUM SSP. DICOCOCCOIDES (126)
- TRITICUM URARTU (106)
- AEGILOPS TAUSCHII (96)
- TRITICUM TURGIDUM SSP. TURANICUM (74)

Search

How To Join

About

GrainGenes 1-10 of 19,877 10 results per page

Link to source	Source	Type	Taxon	Description
10_1093/nar/gkg058	OpenMinTeD	Bibliography	Triticum	Triticum, Bibliography, OpenMinTeD, 10.1093/nar/gkg058, GrainGenes, the genome database for small-grain crops GrainGenes, http://www.graingenes.org , is the international database for the [...]
10_1007/BF01248416	OpenMinTeD	Bibliography	Triticum	Triticum, Bibliography, OpenMinTeD, 10.1007/BF01248416, A CONSENSUS LINKAGE MAP OF BARLEY A consensus linkage map of the barley genome was constructed. The map is based on six doub[...]
10_3835/plantgenome2008.01.005	OpenMinTeD	Bibliography	Triticum	Triticum, Bibliography, OpenMinTeD, 10.3835/plantgenome2008.01.005, An Integrated Resource for Barley Linkage Map and Malting Quality QTL Alignment Bl...
02.13	GrainGenes	Germplasm	Triticum aestivum	Triticum aestivum, Germplasm, GrainGenes, 02.13, Cultivar. FRA
02.14	GrainGenes	Germplasm	Triticum aestivum	Triticum aestivum, Germplasm, GrainGenes, 02.14, Cultivar. FRA
02.3	GrainGenes	Germplasm	Triticum aestivum	Triticum aestivum, Germplasm, GrainGenes, 02.3, Cultivar. FRA
02.8	GrainGenes	Germplasm	Triticum aestivum	Triticum aestivum, Germplasm, GrainGenes, 02.8, Cultivar. FRA
02.9	GrainGenes	Germplasm	Triticum aestivum	Triticum aestivum, Germplasm, GrainGenes, 02.9, Cultivar. FRA
4.14	GrainGenes	Germplasm	Triticum aestivum	Triticum aestivum, Germplasm, GrainGenes, 4.14, Cultivar.
4.22	GrainGenes	Germplasm	Triticum aestivum	Triticum aestivum, Germplasm, GrainGenes, 4.22, Cultivar.

GrainGenes contributes curated data for wheat maps, QTL, germplasm and links to the Wheat Gene Catalog (Komugi).
urgi.versailles.inra.fr/wheatis/

WheatIS Partnership

Link to source	Source	Type	Taxon	Description
vrn1	Wheat Gene Catalog at Komugi	Gene	Triticum aestivum	Triticum aestivum, Gene, Wheat Gene Catalog at Komugi, vrn1, [GrainGenes Summary] Response to Vernalization; Symbol Comment: Winter type
Vrn1	Wheat Gene Catalog at Komugi	Gene	Triticum aestivum	Triticum aestivum, Gene, Wheat Gene Catalog at Komugi, Vrn1, [GrainGenes Summary] Response to Vernalization; Symbol Comment: Spring type
Vrn-A1a	Wheat Gene Catalog at Komugi	Gene	Triticum aestivum	Triticum aestivum, Gene, Wheat Gene Catalog at Komugi, Vrn-A1a, [GrainGenes Summary] Response to Vernalization; Comment: Cultivars possessing Vrn-A1a are insensitive to vernalization. Vrn-A1a is epistatic to other gen[...]

https://shigen.nig.ac.jp/wheat/komugi/genes/symbolDetailAction.do?symbolName=Vrn1

National BioResource Project
KOMUGI - Wheat Genetic Resources Database -
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Genome / Development

Catalogue of Gene Symbols

Database
 Gene Symbols
 Class list
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 Search

2013
 Gene Catalogue 2013

2012
 MacGene

2011
 MacGene

2010
 MacGene

2008

Catalogue of Gene Symbols

Gene Symbol detail

Gene Symbol	
Level 1	Response to V
Level 2	
Level 3	
Level 4	
Symbol	Wild Type Vrn1 Allele
Symbol comment	Spring type
Germplasms	v:G2528{10014}

Related Reference

10014 : Yan L, Loukoianov A, Tranquilli G, Helguera M, Fahima T & Dubcovsky J 2003

✦ We hope to have all WGC genes curated in GrainGenes by PAG2020

WheatIS nodes:

transPlant-MIPS (UP):

- CrowsNest: 13324

transPlant-IPK (UP):

- CR-EST: 199220
- GEBIS: 51814
- MetaCrop: 355

UWA (UP):

- Wheat Pangenome: 167167

GrainGenes (UP):

- GrainGenes: 16755
- Wheat Gene Catalog at Komugi: 3119

Gramene-WheatIS (UP):

- Gramene: 229851

transplant-IPGPAS (UP):

- PlantPhenoDB: 3

T3 (UP):

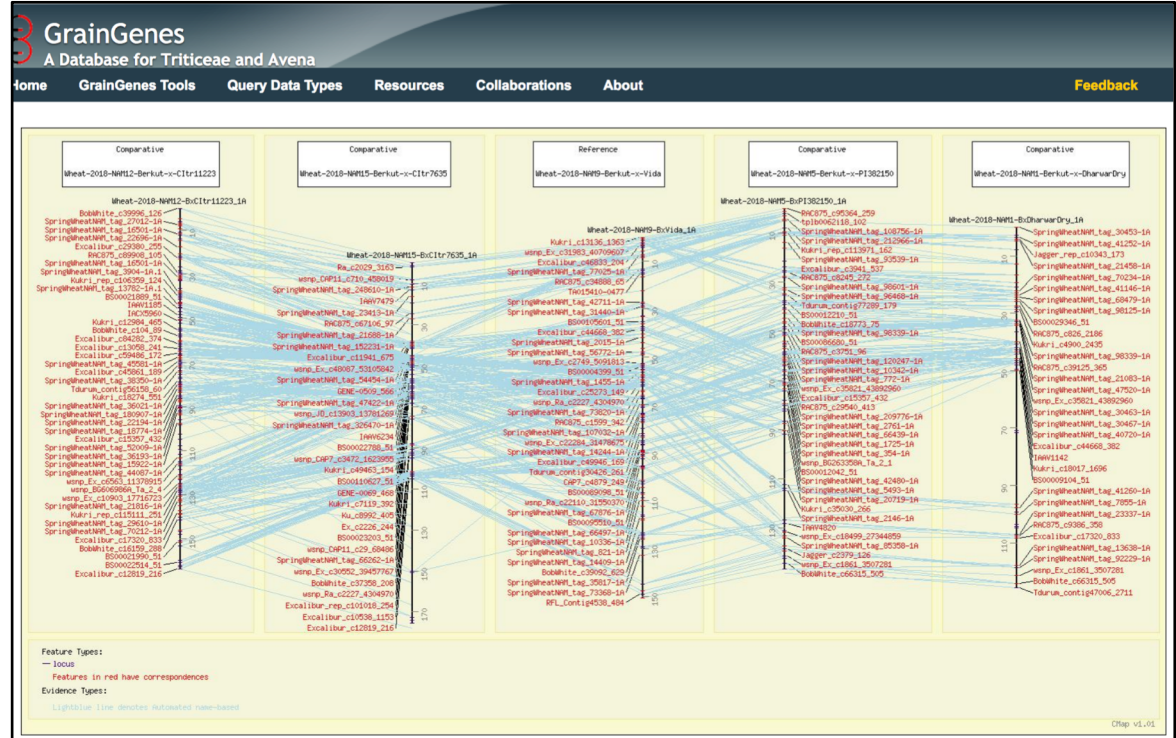
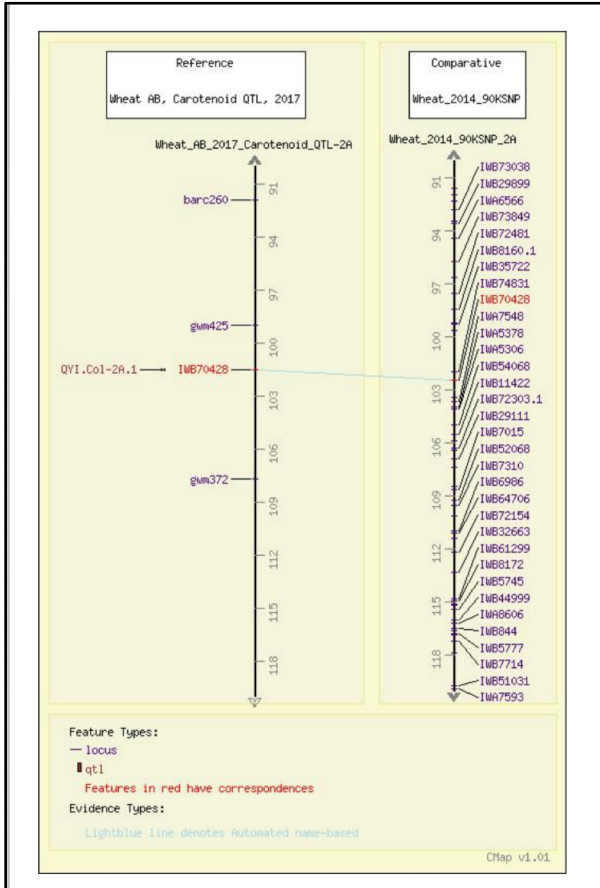
WheatIS File Repository:

- WheatIS File Repository: 6
- KNetMiner: 110775
- OpenMinTeD: 3398
- WheatIS File Repository: 6

EBI (UP):

- Ensembl Plants: 2391552

Visualizing genetic relationships with CMap



Aligned maps from a spring wheat nested-association mapping (NAM) population with drought-tolerant Berikut as the common parent (Jordan et al. 2018)

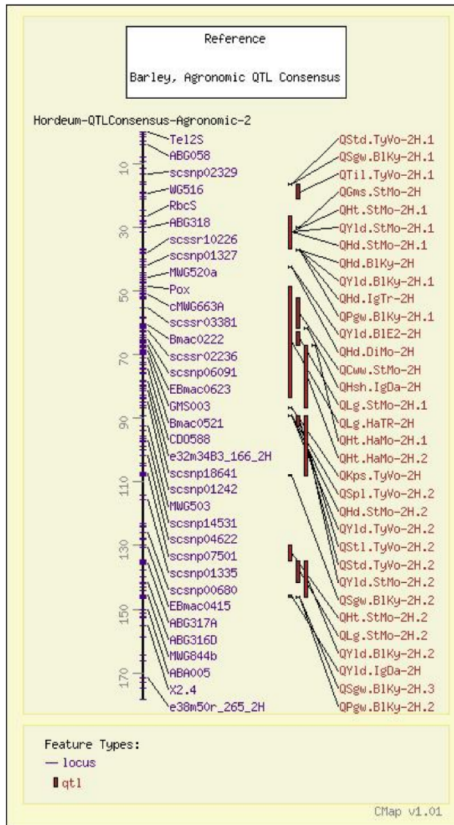
Using a densely mapped set to enrich markers around QYI.col-2A.1, a 'Grain Yellow Index' QTL mapped in durum Colasuanno *et al.* (2017)

In the works ... wheat QTL data

- 2,099 durum QTL aligned to the upcoming genome release.
 - curated as both new and original published QTL name.

Name=QTL0429_ARL__TRL-Maccaferri_et_al__2016	chr1A	QArI.uboGWAS-1A
Name=QTL1511_1B-Maccaferri_et_al__2016	chr1B	QTrI.ubo-1B.1

- Basemaps for Wheat QTL mapped on recent consensus maps

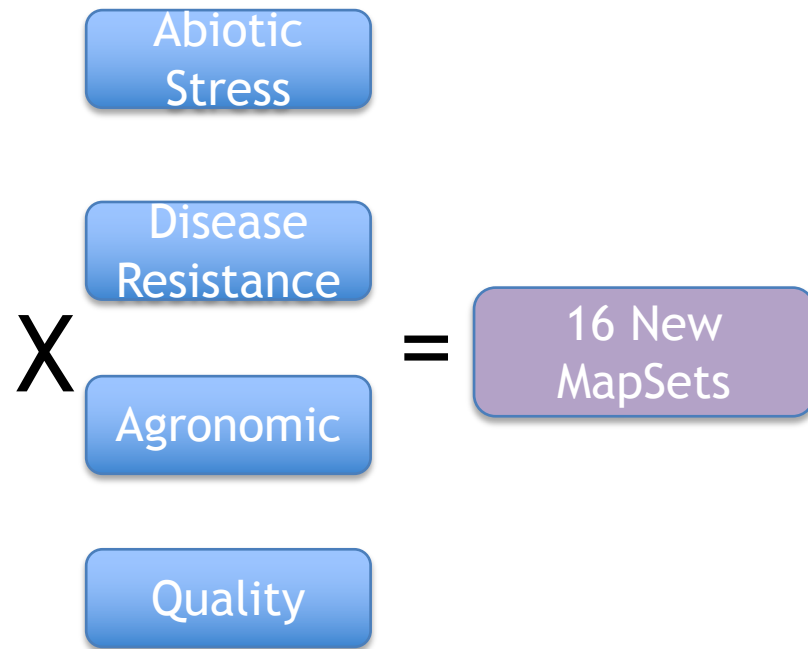


2015 *T.aestivum* Consensus.
‘Wheat, Yr genes and QTL’
Maccaferri *et al.*

2015 *T.durum* Consensus.
‘Wheat_AB_2015_Consensus’
Maccaferri *et al.*

2014 *T.aestivum* Consensus.
‘Wheat_2014_90KSNP’
Wang *et al.*

2013 *T.aestivum* Consensus.
‘Wheat, 2013, 9K Consensus’
Cavanagh *et al.*



GrainGenes is still providing data and tools

The GrainGenes home page - January 14, 2019.