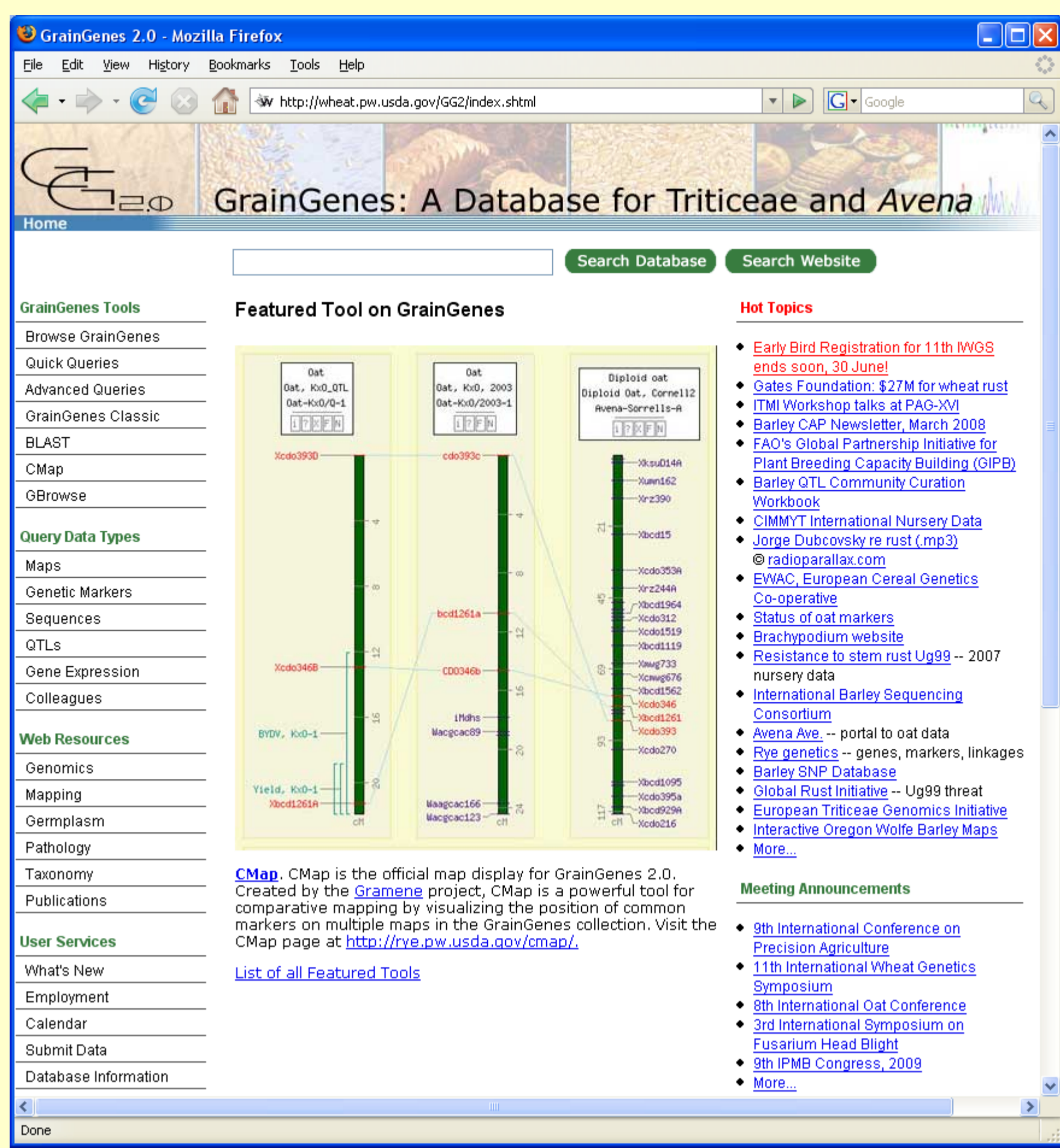


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GrainGenes 2.0 Homepage

www.graingenes.org

The GrainGenes resource (<http://www.graingenes.org>) is a web-portal and database that has been available to the public since 1992 to provide information on the small grain crops of the Triticeae tribe (wheat, barley, rye) and *Avena* species. A convenient web space for discovering oat information available via the GrainGenes resource as well as links to other information can be found on a recently created page called "Avena Avenue".

As linkage maps are made available, they can be made web-accessible using the CMap visual displays used by the GrainGenes database. Currently there are ten map studies creating over 250 linkage groups for oat. This interface allows the comparative tracking of common molecular markers found among different map studies. Comparative mapping between related species may prove valuable in refining map studies. There are over 1000 RFLP, AFLP, SNP, SSR types of mapped molecular marker records including ancillary information (i.e. primers, PCR conditions, etc...) available within the GrainGenes database. Information from recent DAR marker production is in the process of being integrated into the database. Use of the "Quick Queries" will aid accessing this information.

An effort has been launched to input phenotypic data from oat nursery plots. Some of these data are accessible from Avena Avenue. These data, coupled with high-throughput genotyping data will enable researchers to perform association analysis for gene and QTL discovery. A few QTL studies for oat have been entered into the GrainGenes database. Currently about seven different traits have been represented in 376 KxO QTLs distributed across oat maps. A funded project to enrich GrainGenes with barley QTLs have added about 600 new loci and consensus maps are in development for traits such as abiotic stress, quality, pathology, and other agronomic traits. It is hopeful that these will be valuable for comparative mapping studies between species. The database is able to provide the traits, range of phenotype scores among the sample population, and provides a map highlighting the area of the QTL.

GrainGenes also houses information about related grass species which allows the use of comparative maps to determine like-associations among related species. A model organism for the grass species, *Brachypodium distachyon*, is evolving as a research tool and information from this species may help build gaps in the comparative efforts between the related species. The *Brachypodium* species is part of the Pooideae subfamily, and thus can be quite valuable for comparative genomic studies between oat and other grasses, and closely related temperate cereals. We invite you to visit the GrainGenes resource and keep in contact with us. We welcome suggestions on ways to improve this resource for your research needs.

Other tools such as pre-formatted "Quick Queries", advanced SQL, and Batch Queries have been updated to add user access to the database.

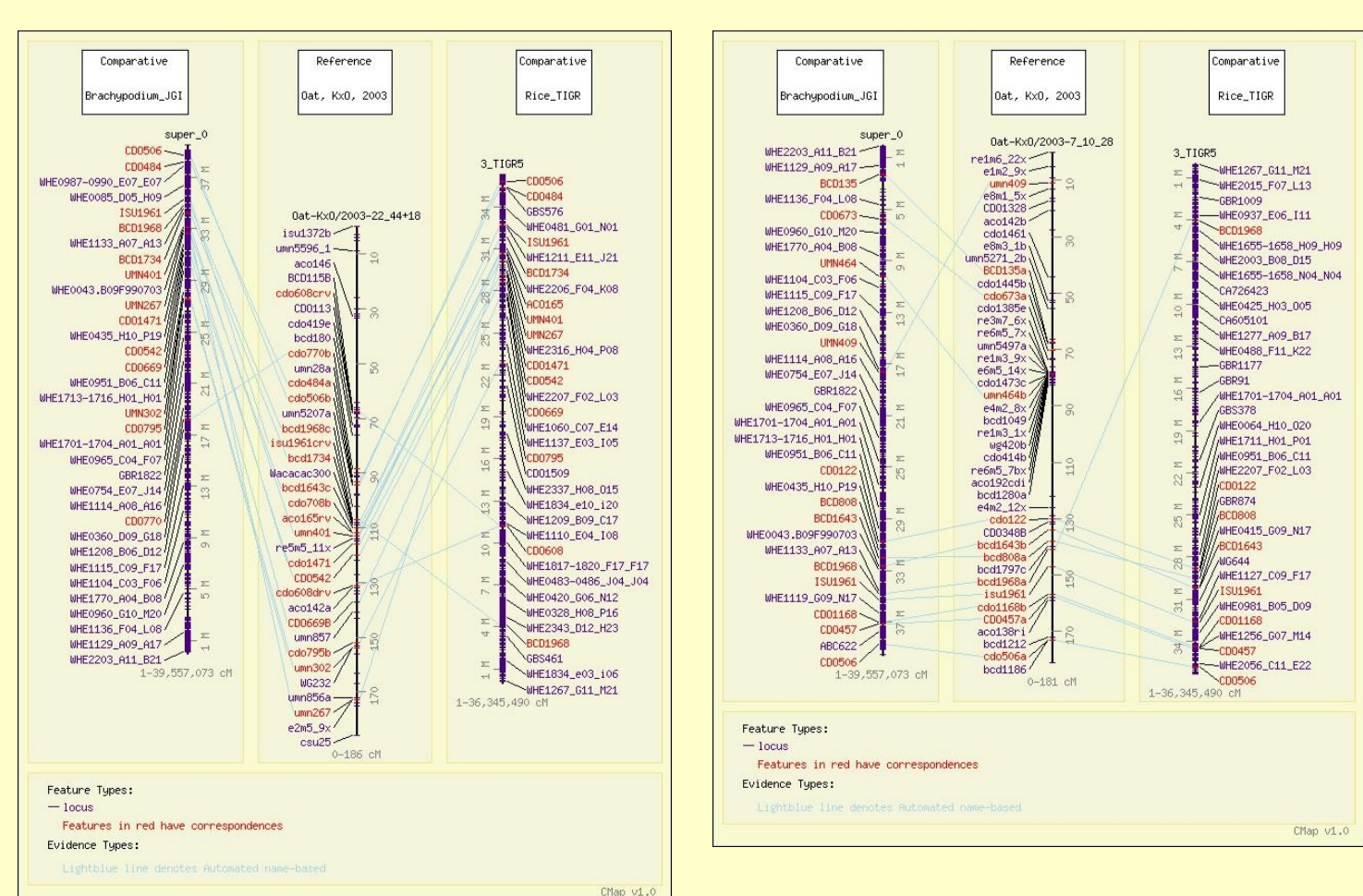
MAPS!

A new Table of Contents page has been created to help organize the 165 Map studies now in GrainGenes. The map display used in GrainGenes 2.0 is CMap, developed by the GMOD group (www.gmod.org). This tool provides an excellent interface both for viewing single maps and for comparing maps. Listed below are the current set of maps for oat.

Link	Oat Maps	Date	Parent	Parent	#	Type	Maps
Link	Diplod Oat, AFLP	2003	<i>Avena strigosa</i> Clw3015	<i>Avena westii</i> Clw1994	511	AFLP, RFLP	A - G
Link	Diplod Oat, Corne12	1995	<i>Avena sativa</i> M66/G	<i>Avena sativa</i>	347	RFLP	A - G
Link	Diplod Oat, Iowa St.	1994	<i>Avena strigosa</i> Clw3015	<i>Avena westii</i> Clw1994	202	RFLP	A - G
Link	Oat, D4B4 x Lang	1994	D4B4 P1501536	Lang Clw9257	2	Genes, RFLP	Linkage Group
Link	Oat, D526 x Lang	1994	D526 P1501540	Lang Clw9257	14	Genes, RFLP	Linkage Group
Link	Oat, C41	2000	Cleveland 64 Clw17639	IL86-5059	254	AFLP	1 - 30
Link	Oat, KxO	1995	Kanota Clw2265	Ogle Clw9401	571	Genes, RFLP	1 - 30
Link	Oat, KxO, 2003	2003	Kanota Clw2265	Ogle Clw9401	1173	AFLP, Genes, RFLP	1 - 45
Link	Oat, KxO, AFLP	2000	Kanota Clw2265	Ogle Clw9401	459	AFLP, Genes, RFLP	2 - 36
Link	Oat, KxO, QTL	1995	Kanota Clw2265	Ogle Clw9401	465	Genes, QTL, RFLP	1 - 37
Link	Oat, Mn1, genetic 2005	2005	MN81801-1	Notle-2	230	RFLP, AFLP	1 - 30
Link	Oat, Oat7	2001	Ogle Clw9401	TAM O-301 Clw9198	442	RFLP	1 - 34
Link	Oat, X454-II x C237-89	1994	X454-II Clw9170	C237-89 Clw8044	2	Genes, RFLP	Linkage Group
Link	Oat, X466-I x C237-89	1994	X466-I Clw9172	C237-89 Clw8044	6	Genes, RFLP	Linkage Group
Link	Oat, X445 x C237-89	1994	X445 Clw9286	C237-89 Clw8044	3	Genes, RFLP	Linkage Group

CMap Display

The CMap display is a powerful tool to make comparisons between map studies to determine if markers are shared between maps, or if different cultivars or species share the same results. Below are two sample linkage groups from the KxO, 2003 Map Study which compare common molecular markers shared (as shown by connecting map lines) between the two model grass species, *Brachypodium* (left) and Rice (right).



CMap Display: Comparison of two Oat linkage groups to model grasses.

QUERIES!

The Quick Queries page from GrainGenes Classic has been updated to use SQL queries. Many of the queries are frequently asked question suggested by GrainGenes users. Selecting a query will execute it and will also provide the SQL query code which may be edited to customize future queries. A few of the queries are shown. Also available are Batch Queries. Perform a raw SQL query on a list of up to 10,000 items. Powerful!

Microsatellites and STS's

- SSR primers and corresponding mapped loci. Improvements suggested by *Christie Williams and Simon Barry*.
 - BARC - SSR set (* for all)
 - Primer Search
- Map locations on chromosome 10 (* for all)
 - Mapping data: segregation scores for these SSRs in all populations for which we have the data.
- STS primers
 - "Sequence-Tagged Sites", primers designed to amplify specific sequences.

Markers and Mapped Genes

- Download a whole map (Map_Data)
 - Linkage groups, Loci and positions, and the corresponding Probes. Suggested by *GrainGenes*.
 - Wheat, Synthetic x Opata Map_Data_name Search List Map_Data names
- Nearby Loci
 - All Loci within a specified distance of a specified Locus on any map. Suggested by *Jim Anderson*, improved by *Vivuz Barbaros*.
 - C6364* Locus Search List All Loci
- Nearby Genes
 - A modification that shows only the Genes near the specified Locus. Suggested by *Algebra Karakoc and Victor Aguiar*.
 - C6364* Locus Search List All Loci
- Loci between two markers
 - All Loci that are between two specified Loci on any map. Suggested by *Molly Jahn and Gilly Sanchez*.
 - C6364* Locus Search List All Loci

Quick Queries

Expedited access to GrainGenes' most Frequently Asked Queries. If you have a GrainGenes question you want to ask, please let me know. Somebody else probably has the same question. - Dave, matthew@graingenes.org

- Categories:
 - Markers and STS's
 - Markers and Mapped Genes
 - Mapped Sequences
 - Sequences
 - QTLs
 - Genes
 - Polymorphisms
 - Address Book
 - GeneticMap

New Queries for Trait Study Data!

A series of sample queries have been created to survey oat nursery data. Shown below are a sample of UOPN and QUON datasets. These are linked from the *Avena Avenue* web area.

Quick Queries for the UOPN and QUON

Queries to extract datasets from the *Uniform Early and Midseason Oat Performance Nurseries*, 1994 - 2007, and the *Quaker Uniform Oat Nurseries*, 1997 - 2005. Data provided by *Howard W. Rines and Brian Rosenagel*.

A Trait Study represents a particular trait in a particular nursery, e.g., "Yield, 2001 UEOPN" An Environment is a location in a particular nursery, e.g., "Amea, IA in 1995 UOPN"

For assistance contact Dave, matthew@graingenes.org

Trait data

- Search by Trait Study for all Environments and entries
 - Trait Study: Beta glucan, 1994 UOPN List all Trait Studies
- Search by Trait Study and Germplasm, for all Environments
 - Trait Study: Beta glucan, "QUON" List all Trait Studies
 - Germplasm: CDC Dancer* AC Assiniboia* List all Germplasms
- Search by trait and location, for all years
 - Trait Study: Test weight, "OPN" List all Trait Studies
 - Location: Ames* Search

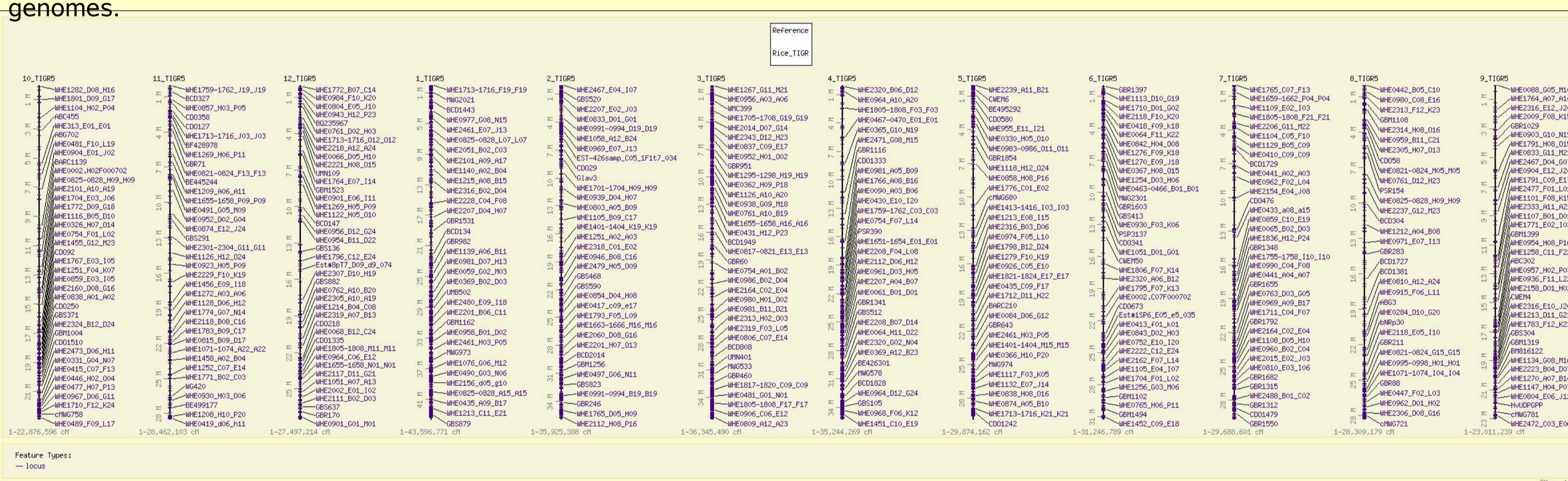
Traits evaluated are: Beta glucan, BYDV, Days to heading, Great yield, Great percentage, Great yield, Height, Lodging, Reaction to crown rust, Reaction to smut, Reaction to stem rust, Test weight, Yield

Germplasm

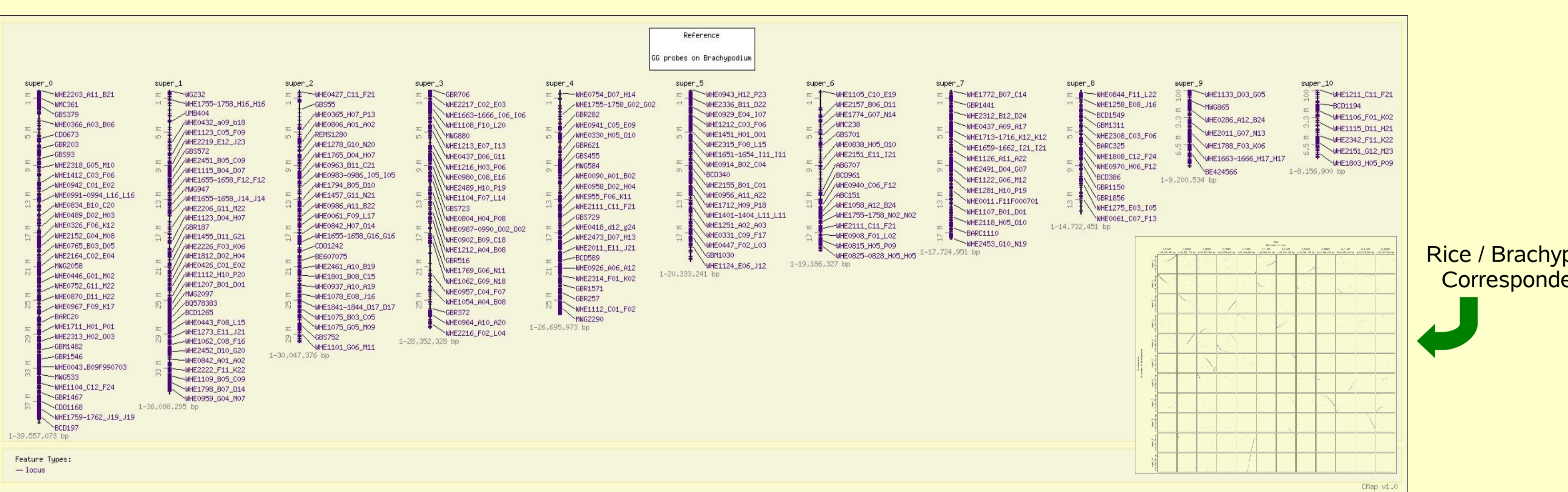
- Pedigree
 - Germplasm: Ogle* Search
 - Germplasm: Ogle* Search

PROBES!

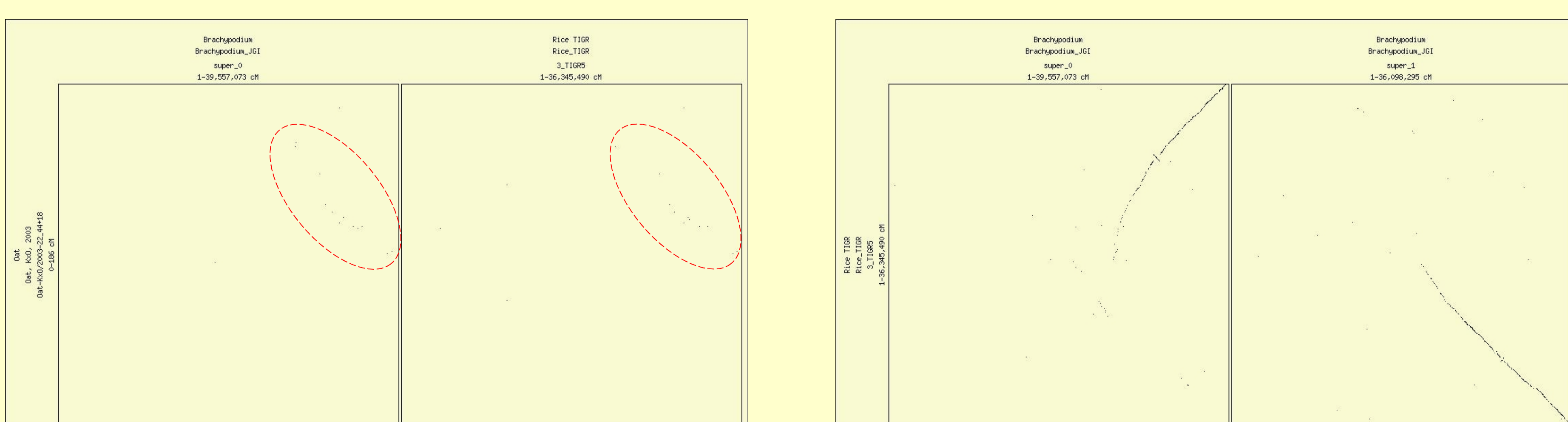
The GrainGenes database houses information on over 30,000 molecular markers, many for which sequence data is available. There are currently only 990 probes listed as being sourced from *Avena* and the rest are from the closely related wheat, barley, and rye species. The rice genome has been sequenced and the *Brachypodium distachyon* genome is underway. As a test of coverage, molecular probes listed in the GrainGenes resource were matched against the rice genome and the preliminary 4X coverage *Brachypodium* genome. Below is shown the saturation of the GrainGenes molecular markers against these genomes.



CMap Display: GrainGenes collection of probes compared to the twelve chromosomes of rice (TIGR release 5, 2007).



CMap Display: GrainGenes collection of probes compared to the twelve largest supercontigs of Brachypodium (JGI, brachypodium.org, 2008).



Dot Plot (CMap) of Map Display: Probes shared between Oat linkage group 22_44+18 and model grass species *Brachypodium* supercontig_0 (left) and Rice chromosome 3 (right). Region of co-linear matches with oat are circled in red.

Dot Plot (CMap) Map Correspondences: Probe matches shared between Rice chromosome 3 (Y-axis) and *Brachypodium* supercontig_0 (left) and supercontig_1 (right).

Avena Avenue!

A web area of the GrainGenes resources has been placed to provide quick links to vital oat information. Shown below a list of links now available, from searching a list of oat markers to signing up for the oat e-mail list.

Avena Ave.

A shortcut to oat data in GrainGenes and elsewhere

Quick Oat Queries in GrainGenes

- SSR markers from oat
- SSR markers mapped on oat
- STS markers from oat
- STS markers mapped on oat
- QTLs from Kanota x Ogle
- Trait: "heading" Search List all QTL, Trait
- Data from Uniform Oat Performance Nurseries

Other oat links

- Meetings and newsletters
 - 10th International Oat Conference
 - 23 June - 2 July, 2008, Minneapolis MN, USA
 - Deadline for titles of papers and posters: 30 March
 - Discussion of oat markers, PAG-IV, January 2007
 - 2006 American Oat Workers Conference, Fargo ND
 - Abstracts, from Doug Dohliet
 - Proceedings, from Jean-Luc Jannink
 - Photos of participants, by Steve Hansson
 - Program, including posters.
- Oat Newsletter
- Markers and maps
 - SSR polymorphism in *A. sativa*, from Yong-Bi Fu
 - Inventory of oat markers, from Howard Rines and Nick Timmer. PCR-based markers being tested for oat mapping.
 - Additional oat markers, from Howard Rines.
 - OatGenes Database, from Charlene Wright and Diane Bergeron. Integrated maps and QTLs from many mapping populations.
 - DELTA, from Diane Bergeron and Nick Timmer. Graphical views of marker allele sizes in oat lines.
 - CHL and KSNM EST-SSRs, from Ju-Kyung Yu et al. Tested on wheat, barley, rice, maize and sorghum.
- Germplasm and characterization
 - International Oat Workers' Code of Ethics For Oat Germplasm Exchange
 - POOL, Pedigree of Oat Lines, from Jitka Deyl and Nick Timmer. 18000 germplasm records.
 - Uniform Early and Midseason Oat Performance Nurseries, from UI Minnesota. Performance data from state agricultural experiment stations and USDA, 1996 - date.
 - Searchable data in the GrainGenes Database
 - Status of oat releases from the UE-MOPN nurseries
 - EOG, European Oat Database, BAZ Genbank, Braunschweig, DE. Passport, characterization and evaluation data, 32000 oat accessions.
- Other
 - oatmail mailing, operated by Nick Timmer and Charlene Wright. Current members of the oatmail group.
 - Background on oat, on Wikipedia