Gene discovery in oat

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Current oat sequences

Transcriptome (ESTs)
540, 242 contigs

SNP markers

Consensus Map

Gene “fishing”

Traits of interest

Agronomic
- ❑Height
- ❑Lodging

Milling
- ❑Groat
- ❑Ease of dehulling
- ❑Color
- ❑Hairy

Disease
- ❑Crown rust
- ❑Stem rust
- ❑BYDV

Nutrition
- ❑Beta glucan
- ❑Xyloglucan
- ❑Alpha Tocopherol
- ❑Gamma Tocopherol
- ❑Alpha Tocotrienol
- ❑Gamma Tocotrienol
- ❑Total Tocopherol
- ❑Avenanthramide
- ❑ Linoleic Acid

Abiotic Stress
- ❑Drought
- ❑Aluminum toxicity

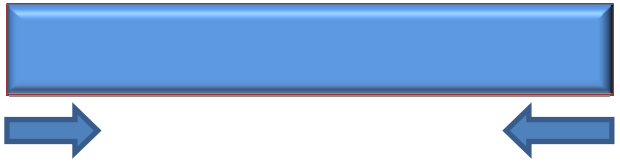
Crown Rust Partial Resistance

PAL (Phenylalanine ammonia-lyase)

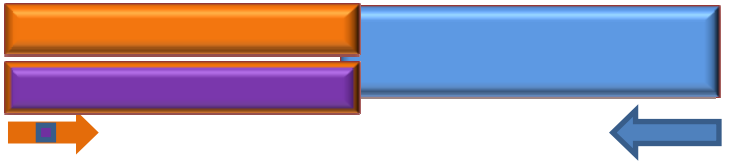
↓ Search NCBI

EST Sequence of related species PAL

↓ Search oat transcriptome



or



↓ Full length or partial EST Sequence of oat PAL

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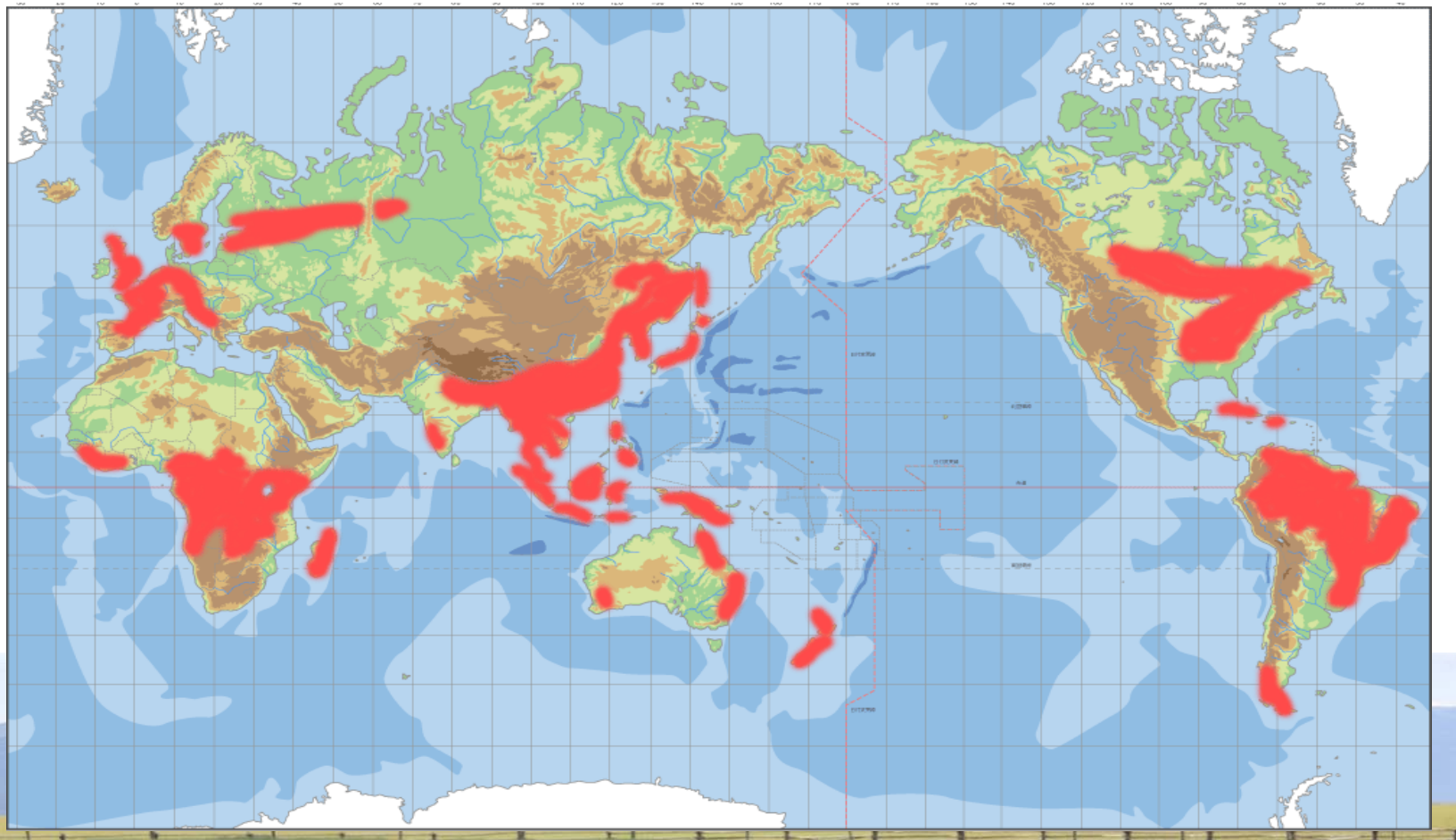
Aluminum toxicity



Aluminum tolerance pathway

Adriano Schneider

Aluminum tolerance genes

Gene	CDS Coverage	Function
Aluminum Malate Transporter (ALMT1)	100%	Malate transporter
Aluminum sensitive 1 (ALS1)	80%	ABC Transporter
Aluminum sensitive 3 (ALS3)	92%	ABC Transporter
ART1	40%	Transcription factor
Multi-drug and toxic compound extrusion (MATE1)	90%	Citrate transporter
Multi-drug and toxic compound extrusion (MATE2)	100%	Citrate transporter
STAR1	93%	ABC Transporter
STAR2	90%	ABC Transporter
STOP1	20%	Transcription factor

ALMT1 in NCBI

NCBI Resources How To

Nucleotide Nucleotide

Limits Advanced

Display Settings: GenBank

Triticum aestivum cultivar ET8 ALMT1 (ALMT1) gene, complete cds

GenBank: DQ072260.1

FASTA Graphics

Go to:

```
LOCUS       DQ072260                3968 bp    DNA     linear   PLN 30-NOV-2005
DEFINITION  Triticum aestivum cultivar ET8 ALMT1 (ALMT1) gene, complete cds.
ACCESSION   DQ072260
VERSION     DQ072260.1  GI:71067632
KEYWORDS    .
SOURCE      Triticum aestivum (bread wheat)
  ORGANISM  Triticum aestivum
            Eukaryota; Viridiplantae; Streptophyta; Embryophyta; Tracheophyta;
            Spermatophyta; Magnoliophyta; Liliopsida; Poales; Poaceae; BEP
            clade; Pooideae; Triticeae; Triticum
```

Taxonomic Groups [List]

- Poaceae *(204)*
  - Aegilops *(178)*
  - Triticum *(17)*
  - Secale *(8)*
  - Zea *(1)*

ALMT1 in CORE BLAST

Batch BLAST search

About BatchBLAST Help

Enter query sequences here in Fasta format

```
Enter query sequence here
```

Sample Query

Or upload sequence file in fasta format: Browse...

Choose a BLAST program:

blastn

Choose one or more databases **(shift+click or ctr+click)**:

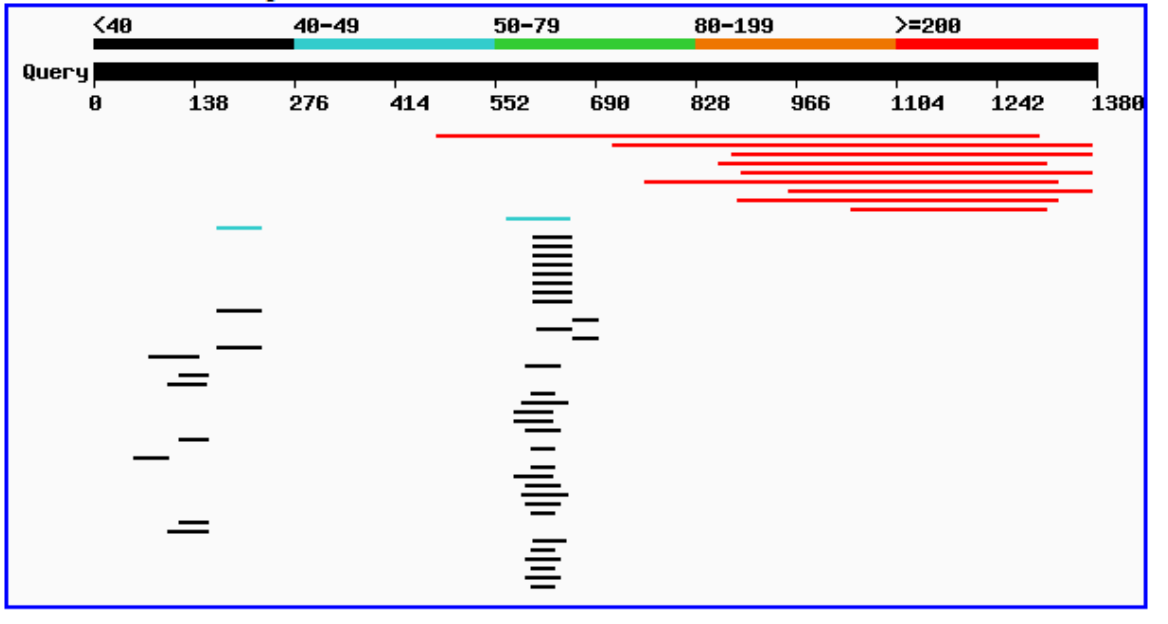
CORE Contigs
CORE short reads
OPA 6K Probes

And/or upload sequence fasta file Browse...

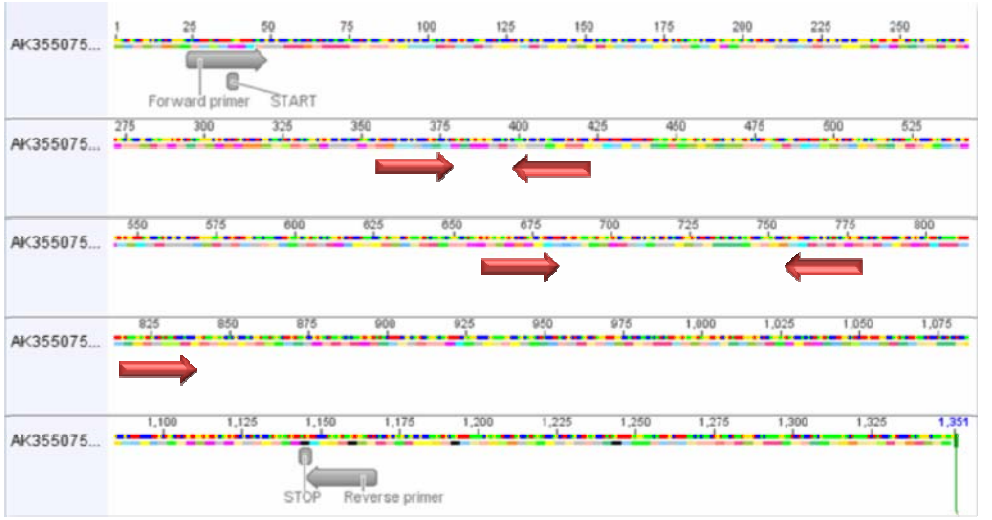
Basic search Reset

ALMT1 in CORE BLAST

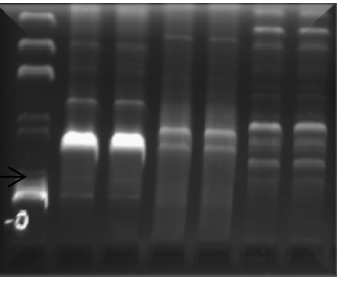
Mouseover to view sequence ID



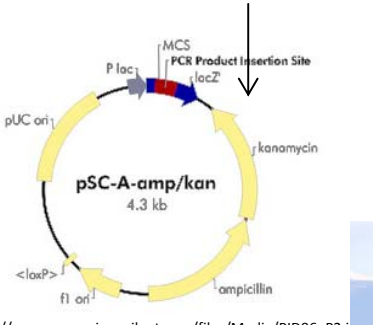
Cloning *ALMT1*



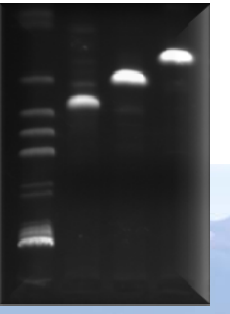
Design 'fishing primers' based on CDS



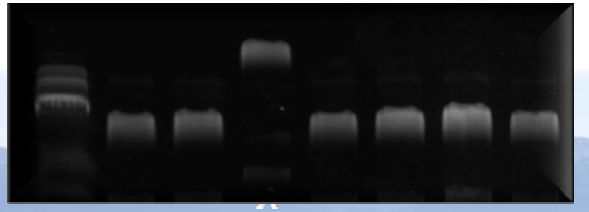
PCR-amplify full-length gene, purify from gel and clone



http://www.genomics.agilent.com/files/Media/PID96_P2.jpg

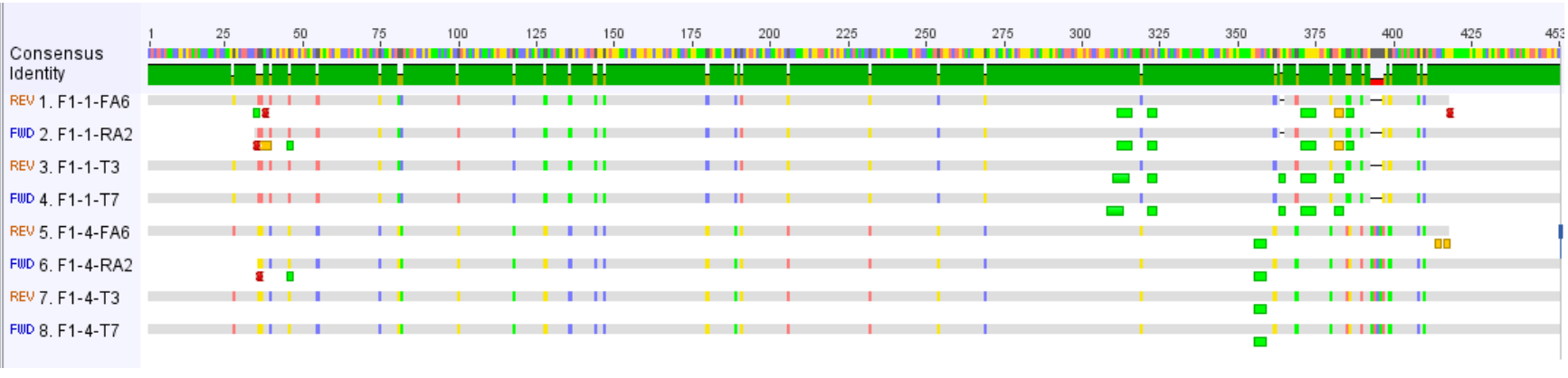


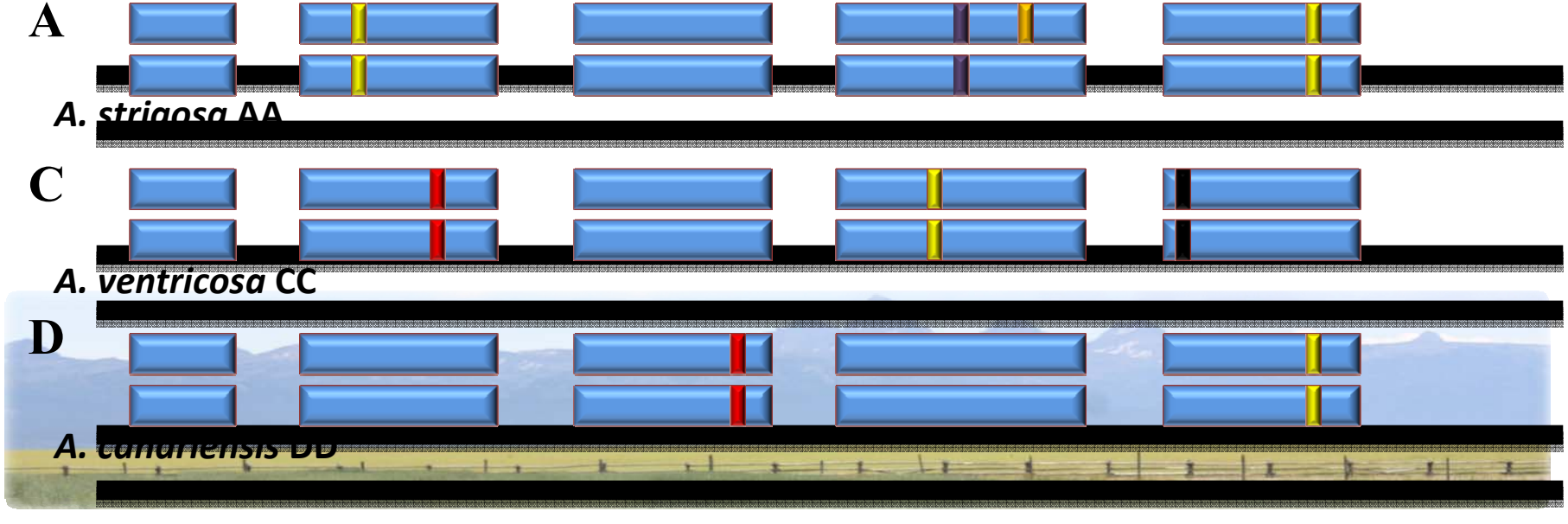
Internal primer check



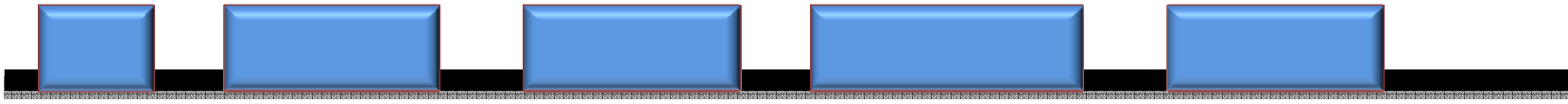
Plasmid check

Sequencing *ALMT1*

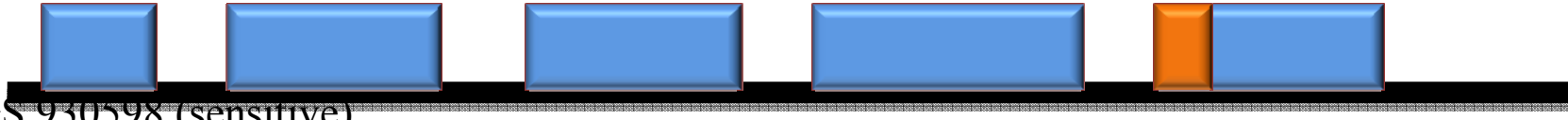




ALMT1 sequence comparison

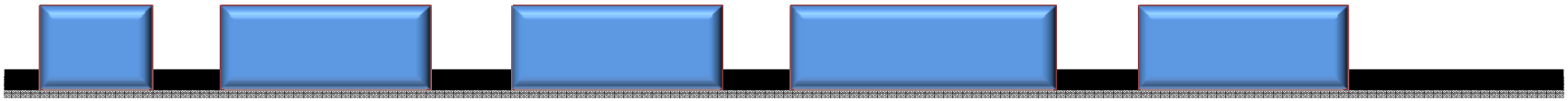


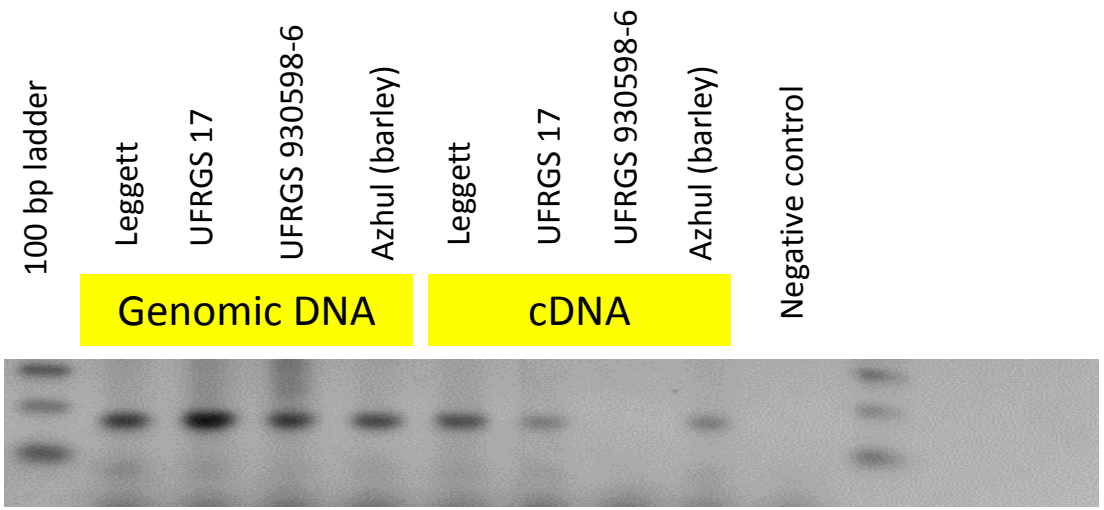
UFRGS 17 (tolerant)



UFRGS 930598 (sensitive)

Genomic PCR vs cDNA PCR





POSTER P36:
Quantitative Trait Loci in the UFRGS17/UFRGS930598 oat population controlling aluminum tolerance.

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- ❑Lodging

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Abiotic Stress
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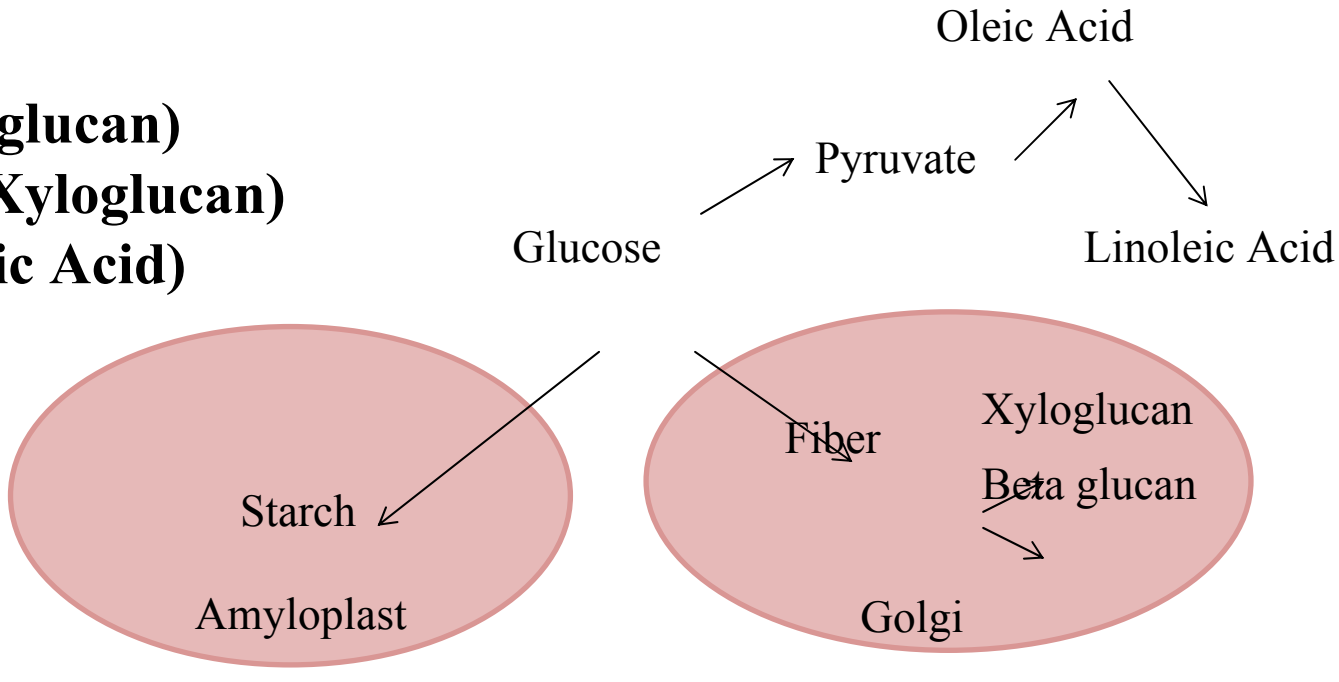
- ❑Aluminum toxicity

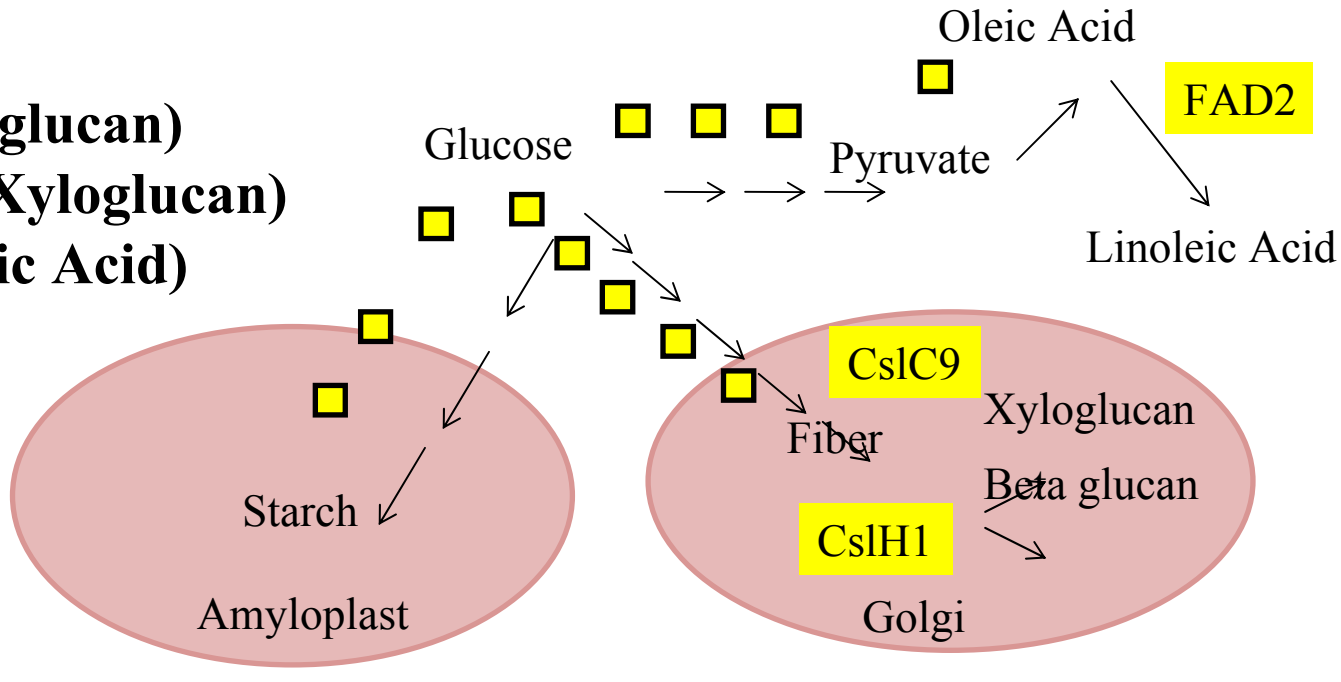
Molecular Pathways

Soluble Fiber (β -glucan)
In-soluble Fiber (Xyloglucan)
Fatty acid (Linoleic Acid)

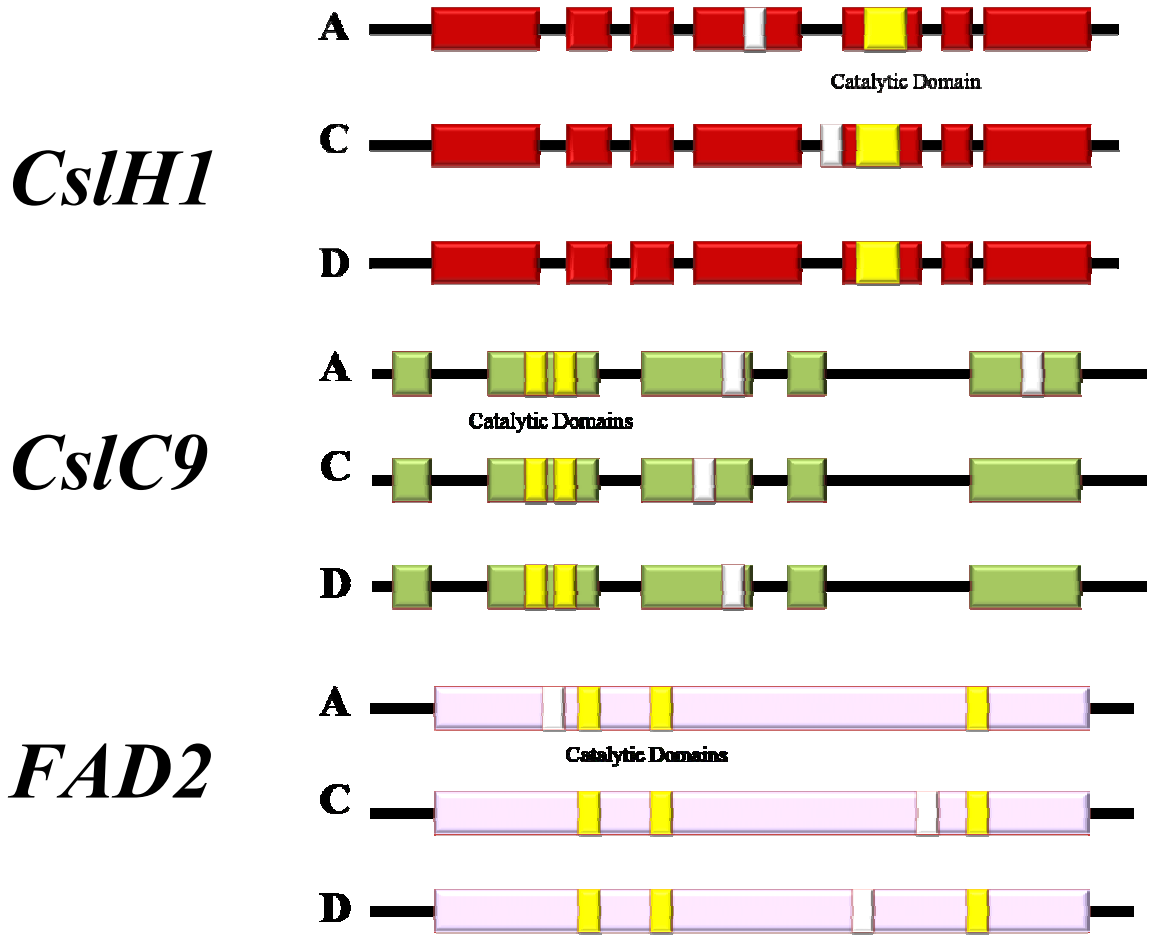


Gene discovery in oat

Soluble Fiber (β -glucan)
In-soluble Fiber (Xyloglucan)
Fatty acid (Linoleic Acid)

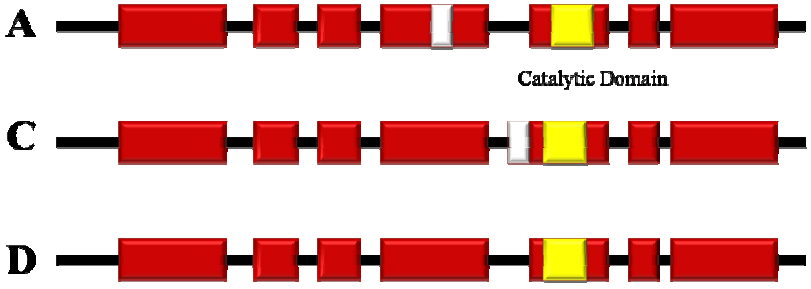


Gene discovery in oat



Gene discovery in oat

CslH1



Avena sativa cultivar Nudisativa cellulose synthase-like protein H1 (CSLH) gene, complete cds

GenBank: HQ128579.1

FASTA Graphics

Go to:

```
LOCUS       HQ128579                5312 bp    DNA     linear   PLN 20-OCT-2010
DEFINITION  Avena sativa cultivar Nudisativa cellulose synthase-like protein H1
            (CSLH) gene, complete cds.
ACCESSION   HQ128579
VERSION     HQ128579.1  GI:308737306
KEYWORDS    .
SOURCE      Avena sativa (oat)
  ORGANISM  Avena sativa
            Eukaryota; Viridiplantae; Streptophyta; Embryophyta; Tracheophyta;
            Spermatophyta; Magnoliophyta; Liliopsida; Poales; Poaceae; BEP
            clade; Pooideae; Poeae; Aveninae; Avena.
REFERENCE   1  (bases 1 to 5312)
  AUTHORS   Wu,B. and Zhang,Z.
  TITLE     Cloning and Analysis of CSLH Gene in Avena sativa
  JOURNAL   Unpublished
REFERENCE   2  (bases 1 to 5312)
  AUTHORS   Wu,B. and Zhang,Z.
  TITLE     Direct Submission
  JOURNAL   Submitted (12-AUG-2010) Institute of Crop Science, Chinese Academy
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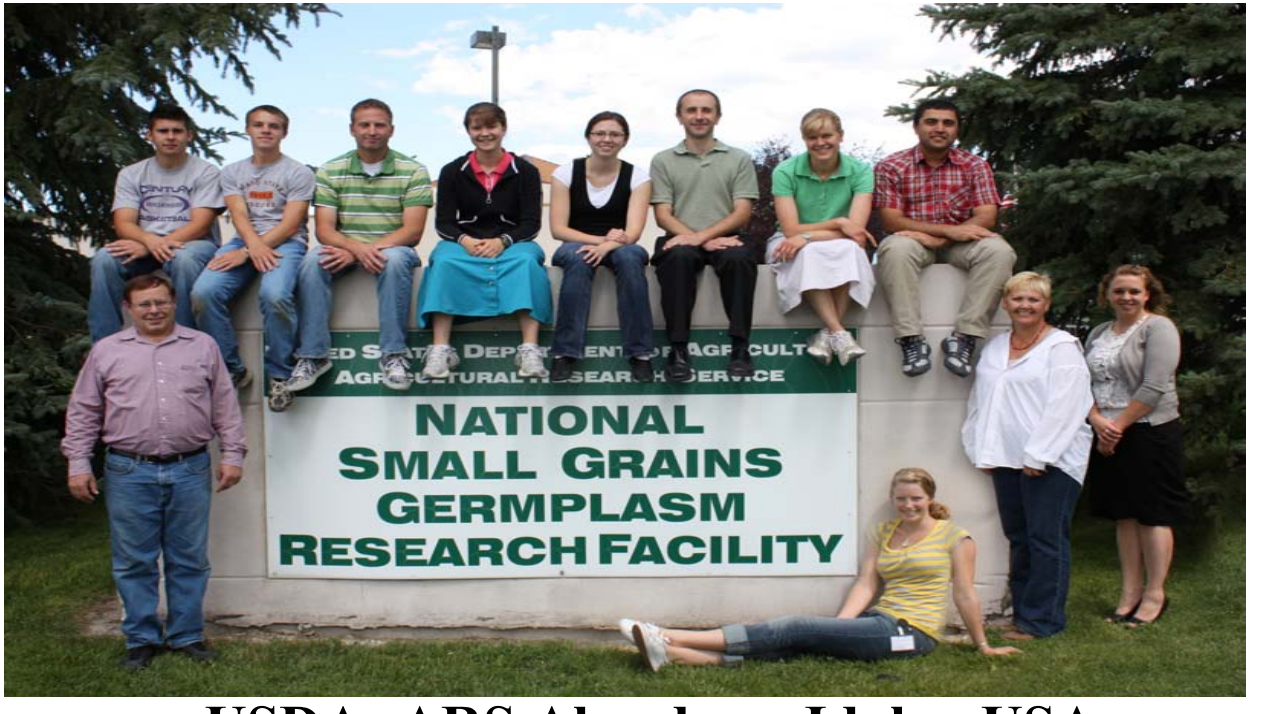
Acknowledgments



USDA -ARS Aberdeen, Idaho, USA

Acknowledgments

CORE Members:

Eric Jackson – Generall Mills, Inc.
Nick Tinker – AAFC Ottawa
Gerard Lazo – ARS Albany
Shiaoman Chao – ARS Fargo
Rick Jellen – BYU
Marty Carson – ARS CDL St. Paul
Fred Kolb – University of Illinois
Herb Ohm – Purdue University
Aaron Beattie – University of Saskatchewan
Rebekah Oliver – General Mills, Inc.

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