

Southeastern UNiversity GRAIN Collaborative Small Grain Breeding Program

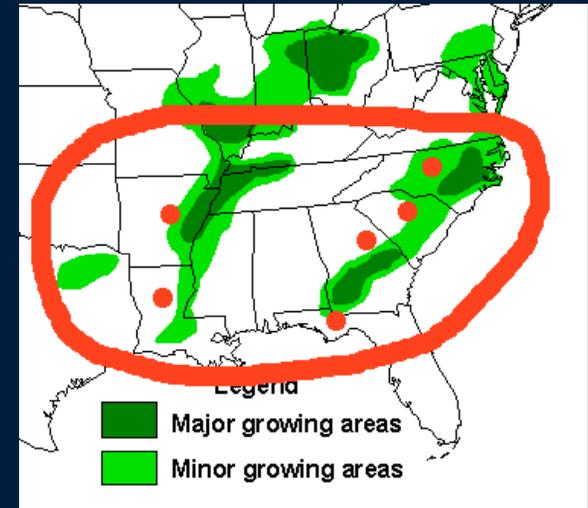
- University of Florida
- University of Georgia
- Clemson University
- North Carolina State University
- Louisiana State University



Cooperating Programs:

- University of Arkansas
- Texas A&M
- Virginia Tech





- is unique in structure
- is unprecedented in degree of cooperation
- is necessary for the survival of public plant breeding
- should be an example of cooperation for other areas, particularly given the current economic climate

History of Small Grain Breeding:

Coker's Pedigreed Seed (Hartsville, SC)

McNair's (Laurensburg, NC)

Pioneer (South Carolina) – 1980's – 1990's

Syngenta (Coker's)(AR) – 1980's – 2005

AgriPro Wheat (AR) – 1980's – 2005

AgriPro-Coker – 2005 – present. Bay, AR

*Relatively limited private breeding effort compared to other crops.
Public breeding programs are very important.*

*Public plant breeding programs account for most of the wheat acreage in the
Southeastern US.*

History of Small Grain Breeding:

Many companies with no breeding program but licensing varieties:

Terral Seed – LA

AgSouth Genetics – GA

Hornbeck – AR

Delta King / Armor – AR

Stratton Seed – AR

G&H Seed – LA

Progeny Ag – AR

Wannamaker – SC

Mixon Seed - SC

UniSouth Genetics - TN

Crop Production Services– OH/AR

Delta Grow - AR

FFR – IN

Cullum Seed (Armor) – AR

Southern States

Ragan & Massey – LA

History of Small Grain Breeding:

Active Southern University Breeding Programs:

FL	Ron Barnett / Ann Blount	oats, forages
GA	Jerry Johnson	soft wheat
SC	Ben Edge	soft wheat , some oats
NC	Paul Murphy	soft wheat, oats
AR	Robert Bacon*	soft wheat
LA	Steve Harrison	soft wheat , oats
VA	Carl Griffey	soft wheat, barley
TX	Amir Ibrahim	hard wheat , oats

* Department Head – position scheduled to be filled

Rationale for SUNGRAINS:

- Critical Mass of scientists
- Cost of programs and program efficiency
- Facilities and resources
 - regional testing and variety development
 - shared releases, royalties, and registrations
 - shared germplasm
 - shared strategic planning
 - shared \$\$ & special resources
- Grants and Funding opportunities
- Service to clientele

SUNGRAINS is widely recognized by seedsmen. The regional data and breeding activities have excellent credibility

Objectives of Sungrains:

- *Provide **superior varieties** of wheat, oats, rye, barley, and triticale for end users including growers, seedsmen, processors, consumers and commodity groups.*
- *Foster exchange of germplasm and **efficient use** of testing environments and other resources.*
- *To **enhance** graduate student **training**, applied and basic **research**, and international programs and cooperation.*
- *To increase opportunities for **program funding** through royalties from intellectual properties, enhanced extramural funding from various sources including federal agencies, and to stabilize funding levels over years.*

Expected Outcomes:

- five universities with a unified breeding and genetics program that serves the 10-state southern region.
- shared intellectual property
- greater exchange of germplasm and enhanced variety development
- sustained service to university clientele
 - growers
 - seedsmen
- stabilized research funding through royalty sharing and cooperative grants
- leveraging of resources to support ancillary projects
 - off-season nurseries
 - marker development
- efficiency through sharing of equipment and facilities
- efficient utilization of expensive new technologies

SUNGRAINS

~50 Wheat Varieties Released:

- AGS/ 2000, 2010, 2031, 2060
- AGS/ 2026, 2020, 2485
- Coker 5E35
- Crawford
- LA95135
- Neuse
- Oglethorpe
- SS 524, 36803, 8641
- Terral/ LA841, LA482, LA821
- USG/ 3295, 3592



22 Oat Varieties Released:

Benefits to States without a SUNGRAINS Breeder:

- **Increased collaborative research in pathology, entomology, and agronomy.**
- **Supply of locally adapted varieties for clientele, including rye, oats, triticale, and other crops with no commercial breeding.**
- **Varieties to utilize foundation seed resources.**
- **Varieties that state seedsmen can license and market.**
- **Forage and specialty crops for growers.**
- **Quick startup of future programs.**

Fusarium Headblight
23 4 2003

Benefactors from SUNGRAINS

- Growers
- Foundation Seed Programs
- Breeders
- SAES
- Seed Companies
- Coops
- End Users

Operating Procedures - Breeding

Cooperative Nurseries

GAWN: Gulf-Atlantic Wheat Nursery (SUNGRAINS + Virginia Tech)

SUNPRE: Southern University Prelim

GAWS: Gulf-Atlantic Wheat Screening

SUNOAT: Southern University Oat

Uniform Southern Fusarium Headblight Nursery

Idaho Summer Oat Nursery

Offseason Wheat Nurseries

2009 GAWN: Gulf-Atlantic Wheat Nursery

- the Most Advanced SUNGRAINS Yield Trial
- Coordinated by Jerry Johnson (Georgia)
- excellent germplasm exchange, can advance others lines
- 8 Regional Yield Test Locations, 2 reps,
 - Quincy, Florida
 - Florence, SC
 - Winnsboro, LA
 - ??, Texas
 - Plains, Georgia
 - Kinston, , NC
 - Stuttgart, AR
 - Warsaw, VA
- Extensive Disease and Insect Screening Trials
 - Buck/Youmans – rust
 - Goates/USDA – Kenya SR
 - Cowger/USDA – Septoria
 - Marshall/USDA – foliar
 - Sungrains/ - Fusarium nurseries
 - CDL/Long – rust
 - G.Brown/USDA – markers
 - Cambron/USDA – Hessian Fly
 - Yue Jin/USDA – stripe rust
- 74 entries (NC, LA, VA, GA, AR, SC, FL)
- Data is posted on the Sungrains website

2009 SUNPRE – Sungrains Preliminary Wheat Trial

- Precedes the GAWN
- Coordinated by Ben Edge (Clemson)
- 7 Regional Yield Test Locations, non-replicated – augmented design
 - Quincy, Florida
 - Florence, SC
 - Winnsboro, LA
 - Texas
 - Plains, Georgia
 - Kinston, , NC
 - Stuttgart, AR
- Disease and Insect Screening Trials
 - Buck/Youmans – foliar
 - Marshall/USDA – foliar
 - Sungrains/ - Fusarium nurseries
 - Goates/USDA – Kenya Stem Rust
 - Yue Jin/USDA – stripe rust
- 200 entries (NC, LA, GA, AR, SC, FL)
- Data is posted on the Sungrains website for breeders only (non-public)

2009 SUNOAT: Southern University Oat Nursery

- **SUNGRAINS Oat Yield Trial**
- **Coordinated by Steve Harrison (LSU AgCenter)**
- **excellent germplasm exchange, can advance others lines**
- **5 Regional Yield Test Locations, 2 reps,**
 - Quincy, Florida**
 - Kinston, , NC**
 - ??, Texas**
 - Florence, SC**
 - BatonRouge, LA**
- **45 entries (NC, LA, FL, TX)**
- **Data is posted on the Sungrains website**

Operating Procedures - Data

SUNGRAINS Website

Public Section & Protected Section

- pedigree information
- performance data
- trait, gene, and marker data
- useful links
- release announcements

Operating Procedures - Royalties

Lead Institution - the university that had the greatest part in development and makes the actual release decision.

Developer Institution(s) - played a significant role in development of the variety. Receive 75% of all collected royalties funneled through normal channels.

- may be shared by 2 or more participants.

Collaborating Institutions - all five participating universities receive 5% of total royalties from any variety release.

Royalties is defined as all money collected – no off the top fees.

Operating Procedures - Releases

Every breeder and member institution is listed on release documents and publications.

- vested interest in working for each other
- motivation to share knowledge and germplasm

Operating Procedures – “Membership”

SUNGRAINS is intended to be a collaborative effort among southern university small grain breeders. Success of this endeavor is dependent on significant contribution and collaboration by breeders of the institutions initially forming SUNGRAINS. This agreement became effective in January 2006. Releases made after April 2005 are in accordance with the SUNGRAINS agreement.

Operating Procedures – “Membership”

A participating institution may withdraw from SUNGRAINS at any time by informing the other institutions in writing of its intent to withdraw. Withdrawal from SUNGRAINS is effective at the time the request signed by the appropriate institutional representative is mailed. Withdrawal does not affect varieties released prior to withdrawal.

Operating Procedures – “Membership”

When a breeder is no longer employed by an institution due to retirement or other cause, the remaining institutions shall determine whether or not that institution has an active breeding program and if it should remain a SUNGRAINS member institution. A majority vote by representatives of participating institutions at the spring or fall meeting is required to remove an institution from participation in SUNGRAINS.

Operating Procedures – “Membership”

The SUNGRAINS group is not restricted to the initial cooperating institutions. Other Southern Agricultural Experiment Stations may petition to formally join the group when they initiate a small grain breeding program. A majority vote by participating breeders at the spring or fall meeting is required to add an institution to full participation SUNGRAINS. Upon such action by the breeders, the appropriate administration will be asked to ‘sign off’ on the proposed changes.

Affiliate members? And cooperators

Operating Procedures – “Membership”

It is the intent of SUNGRAINS to serve all Southern Agricultural Experiment Stations and their constituencies as described in the white paper. This will be done by developing varieties adapted to the entire region. Institutions without breeding programs may also benefit from SUNGRAINS by having the opportunity to utilize Foundation Seed Programs to increase and release varieties developed by SUNGRAINS.



Sungrains and Wheat Quality

How would you rank quality traits in your overall objectives?

- Has to be acceptable but still - about number 8
- Fourth
- Pretty low on the list after other items like yield, disease and insect resistance, and agronomic traits. But crosses are made with quality in mind, such that good quality should be recoverable in each cross.
- It is always considered important, but poor yield, test weight and disease resistance will knock out a line before end use quality traits will.

What traits are more important than quality?

- Yield, test wt, stripe rust resistance, leaf rust resistance, lodging resistance, height, maturity
- Yield, test weight, disease and insect resistance: however, we are working hard to cross good quality by good quality when possible
- Yield, test weight, leaf and stripe rust, Hessian Fly, agronomic

How many samples do you submit to the SWQL every year, not counting the SUNPRE, GAWN, USS, and UES?

- 40 samples just our elite material to obtain information for crossing and release.
- About 100
- About 100
- Varies from 0 to 200, depending on the quality of the samples I can send.
- 0 to 100. Need to send more but it takes time and planning

What specific quality traits are you working on?

- Flour yield, gluten strength
- Mainly looking for an overall acceptable quality – combined milling and baking score
- All of the ones in micro test. But have a ‘special’ line of strong gluten
- Milling qual, Baking Qual(break flour yield), TW, Protein%, and SRC, but primarily the first three
- Gluten strength, purple color/anthocyanins

What specific quality traits do you consider to be important?

- Presently, more of the milling traits and in the future some of the baking traits
- Milling yield is the most important in my mind
- I rate milling yield and ‘baking quality’ highly
- MQ, BQ, and TW – I find protein not too limiting, and I consider SRC, but put more emphasis on the others.
- Milling yield

What can Sungrians do to better address quality?

- It is already a priority with breeders. I think the millers and bakers can best answer that by giving us guidelines for specific needs.
- Identify and highlight all exc. and good quality lines for crossing, the testing of the GAWN is very helpful.
- I think we're doing just fine
- Continue what we are doing.
- Database, shared germplasm for special traits

What is the biggest impediment to developing high quality wheat?

- No premium for excellent quality
- Lack of incentive relative to economically important traits
- A user-friendly way to evaluate large numbers of lines. Funding
- If we have to choose between yield and quality – yield wins out, as long as quality is “acceptable”. I figure as long as one fair/poor quality variety doesn’t dominate the market, a range of quality lines probably does a better job of insuring adequate supply and quality than concentrating only on “superior” quality lines. When we talk of "superior" quality, the question must be asked, "superior for whom?"

How can we get growers and seedsmen to grow enhanced quality wheat varieties?

- License good quality varieties; also take into consideration the recommended N rates and timing for good soft wheat quality (low protein)
- Pay 'em for that quality
- Pay them
- Pay more for quality, or penalize poor quality. I much prefer the first option, but it is hard to separate the two in practice.
- Premiums, marketing channels, contracts

List varieties you have released that have good / excellent quality.

- AGS2000, AGS2020
- All of them
- AGS2060
- 26R46, 26R31, 26R38
- NC-Neuse

Do you use molecular markers for quality traits in selecting parents, planning crosses, and selecting progeny.

- Markers for strong gluten now, need to identify markers for specific traits that would enhance the value-added of soft red winter wheat
- Plan to use for selecting progeny, use for selecting parents and planning crosses as markers or data are available.
- That might be one of the considerations but would not be a driving factor
- Yes
- Markers for strong gluten

2008 Uniform Southern Soft Red Winter Wheat.

	Yield	Test Wt	Quality			
Line / Variety	bu/a	lbs/bu	MILL		BAKE	
GA991371-6E13	79.9	56.5	79.2	B	82.2	A
USG 3555	80.2	56.9	64.0	C	44.1	E
GA991209-6E33	81.8	58.7	79.8	B	62.2	C
GA991336-6E9	75.4	57.7	83.3	A	52.0	D
Coker 9553	76.9	59.3	63.1	C	48.0	E
AGS 2000	75.2	57.6	85.9	A	69.9	C
LA99005UC-31-3-C	74.1	56.2	77.9	B	75.4	B
LA01140D-70	72.3	57.9	78.0	B	59.6	D
LA01138D-52	70.8	55.8	77.7	B	74.4	B
LA98214D-14-1-2-B	68.2	57.3	71.5	B	68.2	C
Pioneer Brand 26R61	72.4	58.5	72.4	B	46.5	E
MEAN (42)	72.6	57.5	69.1		57.1	

2008 Uniform Southern Soft Red Winter Wheat.

	Quality					
Line / Variety	MILL	BAKE	SOFT	FLOUR	LAR	COOKIE
AGS 2000	85.9	69.9	62.9	73.1	102.7	18.8
GA991336-6E9	83.3	52.0	51.4	72.6	113.1	18.2
GA991209-6E33	79.8	62.2	56.9	71.9	102.4	18.5
GA991371-6E13	79.2	82.2	59.1	71.8	114.8	19.1
LA01140D-70	78.0	59.6	62.5	71.6	115.2	18.5
LA99005UC-31-3-C	77.9	75.4	67.3	71.5	107.8	18.9
LA01138D-52	77.7	74.4	64.1	71.5	105.7	18.9
LA98214D-14-1-2-B	71.5	68.2	55.3	70.3	115.4	18.7
Coker 9553	63.1	48.0	62.7	68.6	107.6	18.1
MEAN (42)	69.1	57.1	57.4	69.8	111.1	18.4

2007 Uniform Southern Soft Red Winter Wheat.

Line / Variety	Quality					
	MILL	BAKE	SOFT	FLOUR	LAR	COOKIE
AGS 2000	83.9	72.2	72.8	72.0	105.1	17.8
LA99005	81.4	71.9	78.3	71.5	89.1	17.9
GA981621	80.4	57.2	83.9	71.3	108.0	17.4
GA981622	79.4	64.5	75.8	71.1	108.7	17.6
LA98214	77.5	74.5	70.2	70.8	94.8	17.9
USG 3209	66.9	49.5	62.1	68.6	98.8	17.2
LA978	62.6	45.9	76.2	67.8	101.8	17.1
GA98401	54.7	49.2	78.2	66.2	117.5	17.2

DISCUSSION

