Breeding Efforts to Expand Genetic Diversity for Yield

Compiled by

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Randy Nelson	USDA-ARS, Urbana, Univ. of Illinois
Rouf Mian	USDA-ARS, Wooster, OH
Tommy Carter	USDA-ARS, Raleigh, NCSU
Rusty Smith	USDA-ARS, Stoneville, MS

How are you choosing exotic material for parents?

- Selection for yield
- Sources
  - Soybean Asian Variety Evaluation (SAVE)
  - Soybean Asian Germplasm Evaluation (SAGE)
  - Other Japanese and Chinese varieties
  - European varieties
  - Selections based on USDA germplasm evaluation data
  - Local germplasm tests
  - Lines and populations from exotic germplasm
- Selection for yield is not duplicating existing alleles

What sources of exotic germplasm are currently active in your breeding program?

- 165 PIs are being actively used by respondents
- 22 *G. soja:* T. Carter, R. Boerma, and R. Nelson
- 1 *G. tomentella:* R. Nelson

How are you handling populations with exotic germplasm?

6 of 14 programs do not alter methods

- **Use of foreign cultivars**
- **Domestically improved exotic germplasm**

How are you handling populations with exotic germplasm?

Roger Boerma, Univ. of Georgia

- **F_2 populations up to 6,000 plants**
- **Selection against shattering and pustule**
- **Selection on a single plant basis until F_5**
- **Goal: Yield test 150 to 200 lines per population**

How are you handling populations with exotic germplasm?

Tommy Carter, USDA-ARS, NCSU

- **Bulk breeding in the F_2**
- **Visual selection in the F_3**
- **SSD for 1 or 2 generations removed from PIs**

How are you handling populations with exotic germplasm?

Randy Nelson, USDA-ARS, Univ. of Illinois

- Early generation testing
- ~1000 F_2 plants
- One-row tests in F_3 and F_6
- Selection for yield and by pedigree

How are you handling populations with exotic germplasm?

- **Larger populations**
  - **Jim Orf, Univ. of Minn.**
  - **Pengyin Chen, Univ. of Ark.**
  - **Grover Shannon, Univ. of Missouri**

How are you handling populations with exotic germplasm?

Lower selection intensity

Pengyin Chen, Univ. of Arkansas

Jim Orf, Univ. of Minn.

Vaino Poysa, Agriculture Canada

How are you handling populations with exotic germplasm?

Early generation mass selection

Pengyin Chen, Univ. of Arkansas

What are your biggest challenges to success?

- Selecting lines competitive with cultivars
- Disease resistance
- Lack of resources
- Proper maturity
- Maintaining large populations

Who do you view as the consumer of your improved lines?

- **Breeders in private industry**
- **Breeders at public institutions**
- **Soybean growers**

What additional collaborations would be helpful for you?

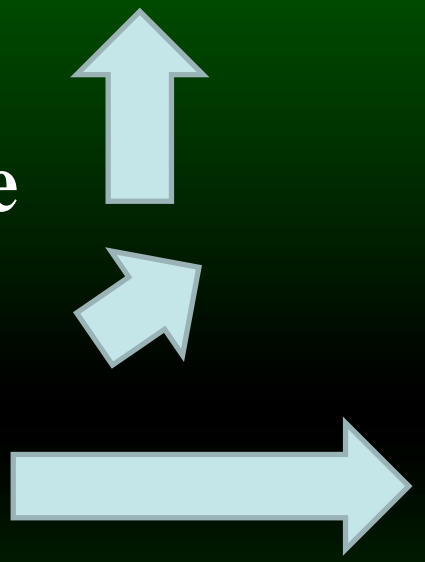
- Specific testing environments
- Test partnering with private industry and other public institutions
- Working with industry to educate students
- Exchanging experimental lines

What is the future of this research for you?

Four programs will increase

Two may increase slightly

Eight will remain the same



What are the successful outcomes from your program?

Roger Boerma, Univ. of Georgia

Yield of AGS Woodruff (MG VII)

Line	2004-2009 45 locs	2008-2009 12 locs
AGS Woodruff	3807 a	4464 a
AGS Benning	3331 b	
G04-2215RR		4069 b

AGS Woodruff = N7001 x Boggs

N7001 = N77-114 x PI 416937

Roger Boerma, Univ. of Georgia

G07-6012 and G07-6029 from N7103 x PI 366122

PI 366122, IV *G. soja* from Fukushima, Japan

Both lines yield within 85% of N7103

Pengyin Chen, Univ. of Arkansas

R99-1613F NKRA452 x PI 290126B
R01-2731F Caviness × PI 592947

PI 592947 is Jin yi No. 9 from China

PI 594208 is Kosuzu from Japan

Yield between 97% and 101% of checks

Lines with Caviness as parent yield more (~3 bu/a) than Caviness

Prelim III Test – 2010
11 locations

Entry	Pedigree	Mat	Ldg	Hgt	Yield
LG07-2309	F4 IA3023 x LG01-7728	3.8	1.9	102	4144
IA3023	Check	0.0	1.5	90	4145
IA4004	Check	2.3	1.9	98	4113
LSD (0.05)		1.5	0.3	3	287

LG01-7728 is Williams 82 (2) x PI 479767 (*G. soja*)
MG 0 from Heilongjiang, China

Uniform IV Test – 2010
15 locations

Entry	Pedigree		Kg/ha	Mat
LG06-5798	LG00-3372 x LD00-3309	50%	3837 a	5.3
LD00-3309	Check		3601 b	0
IA4004	Check		3595 b	-1.2
LSD (0.05)			183	1.5

LG00-3272 from PI 561319A x PI 574477
Hui nan zi hua he jia (PI 561319A) x Fen dou 31 (PI 574477)

USB Diversity 6 Test
6 environments

Entry	Pedigree	R8	Ldg	Hgt	bu/a
N06-10059	**Young x N6202**	**-1**	**1.9**	**36**	**43.2**
N6202	Check	-1	2.0	37	40.7
Young	Check	0	2.3	40	39.4
NC-Roy	Check	2	2.3	38	42.4

N6202 is 25 % Nakasennari and Fukuyataka

USB Diversity 7 Test
5 environments

Entry	Pedigree	R8	Ldg	Hgt	bu/a
N06-14753	Young x N94-7350	-1	1.9	36	43.2
Young	Check	0	2.3	40	39.4
NC-Roy	Check	1	2.3	38	42.4

N94-7350 is 25% Suzuyataka

USB Diversity 6 Test
6 environments

Entry	Pedigree	R8	bu/a	g/100
NMS-75-709	N7103 x PI 366122	-2	35.3	10.0
N7103	Check	0	34.6	7.3
Benning	Check	-1	37.0	14.1
Woodruff	Check	3	39.2	13.9

PI 366122 is G. soja MG IV from Fukushima, Japan

Jim Orf, Univ. of Minnesota
Released germplasm

M01-242025 **MN0302 x PI 495831**

Competitive yield
Rps-1k
Good iron chlorosis tolerance
> average protein and oil concentration

Grover Shannon

Yield Means of S07-3666 in SEMO 2008-10 and Uniform tests 2009-10

Variety	Loam	Clay	Sand	U Prel IVSE	U. Grp IVS
S07-3666*	63.3	62.9	48.8	58.3	42.1
AG 4703	67.1	62.6	40.7	55.8	43.2
# Loc	6	6	2	9	17

*50% PI427099, 445830

Performance of Late Group IV at nine locations in Southeast Missouri, 2009-10

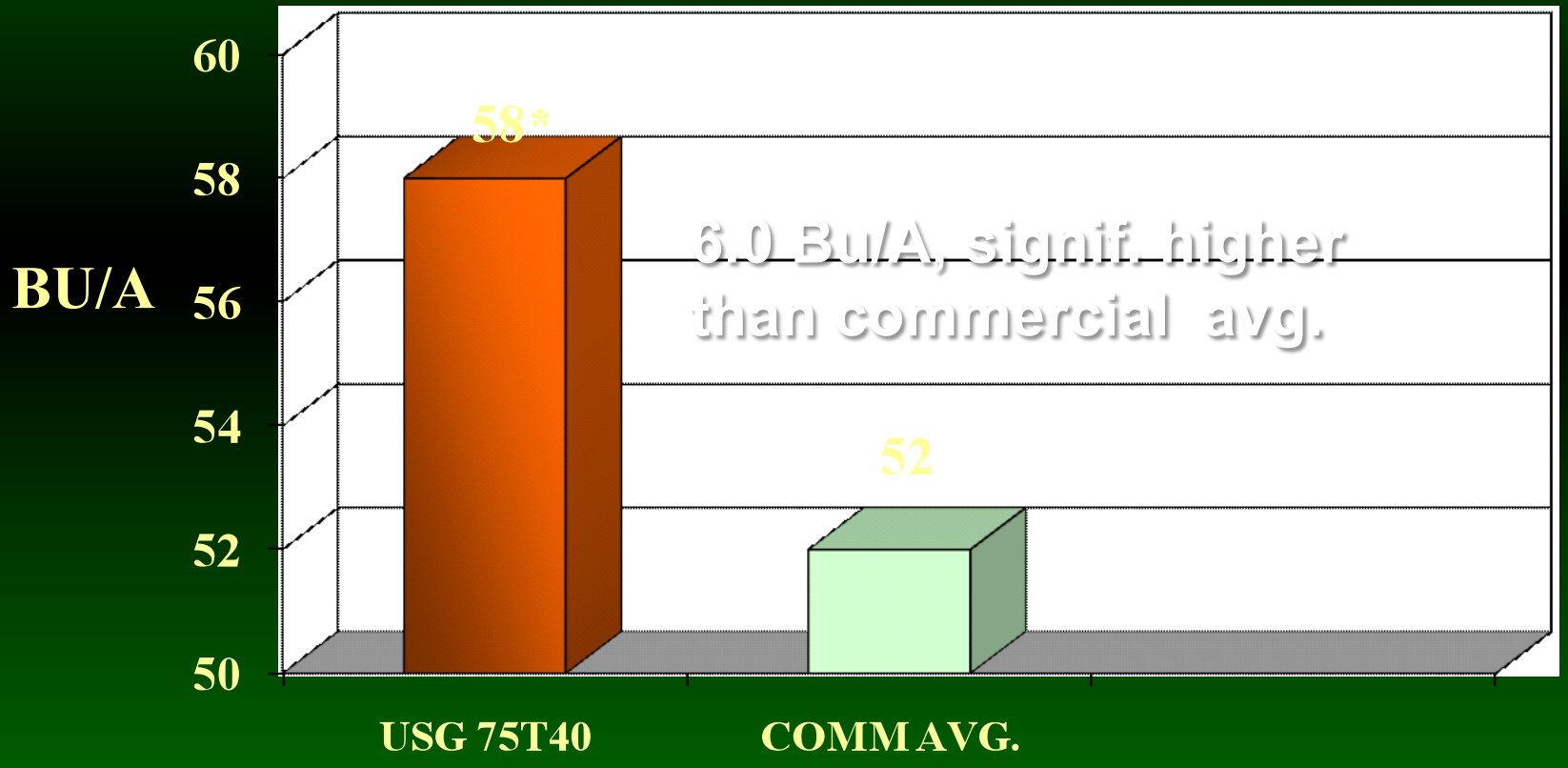
Line	Bu/A	%PI	PIs in Pedigree
S08-17361	69.3	25	437851A, 391594, 253665D, 233331
S08-17357	63.6	25	437851A, 391594, 253665D, 233331
AG 4903 CK	56.3	0	

2010 TAES released cultivar 'USG 75T40'

Pedigree utilized LG98-1445

(containing exotic PI 227333 and PI 91730-1

2 yr: 2008-09 Tennessee State Variety Test 5e



Vince Pantalone

2010 group IVE test in Tennessee

Top 4 lines were reselections from LG01-3733
($F_{3:5}$ Rend x LG97-9301)
38% exotic pedigree from
PI 253665D, PI 283331, PI 391594

Four lines averaged 44.4 bu/a
The best check LD00-2817P was 36.2 bu/a

Vaino Poysa

Cultivar releases with Japanese parentage:

- **Tourco from Honiku-65**
- **Nature from Raiden and Enrei**
- **OX-101 from Toyomusume and Enrei**

Rusty Smith, USDA-ARS, Stoneville, MS

Will release LG01-5087-5

(LN93-11632 x LG96-1713)

LG96-1713 has 75% exotic pedigree

from PI 427099, PI 438151, and PI 445830

In tests at Stoneville, MS from 2006 to 2010:

LG01-5087-5	68.7 bu/a
94B73	68.2 bu/a

Thanks!

USDA ARS