

PROGRESS REPORT TO THE SOUTH CAROLINA SOYBEAN BOARD

April 2018

TITLE:

Evaluating and Improving Drought Tolerance in Soybean Across the Carolinas
Award# 2011966

PRINCIPAL INVESTAGATORS:

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OBJECTIVES:

- 1) Evaluate current, elite public and private soybean lines for drought tolerance. Approximately 200 lines will be screened.
- 2) Use elite breeding material with improved drought tolerance to develop new breeding populations.
- 3) Continue to screen, advance and select early generation populations developed for drought tolerance.

PROGRESS REPORT:

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Overall, 2017 was a very good year for soybean production in the Pee Dee region. May was a little dry, but most of the rainfall came later in the season, which was good because planting does not get into full swing until after May 15th. August was the only month when drought like conditions were experienced at the Pee Dee REC. Right around the middle of August we experienced a good period of hot, dry weather and some of the plots just started to exhibit symptoms of drought. We were able to record wilting scores on all plots on August 22. Wilting scores were based on the amount of visual stress exhibited by the plant compared to other known fast wilting varieties.

Similar conditions were seen in NC, where only short periods of hot, dry weather were observed. Yields were lower in NC compared to SC. Test averages were ~10Bu/A lower in NC, primarily due to a couple of well-timed showers in SC and different soil types in NC. Yield data was presented in the January report, so I have only included a few highlights and comments from the results in 2017.

Tables 1 and 2 depict the results from testing MG V-VIII commercial and public soybean varieties that were in the South Carolina Official Variety Test in 2017. The lines in red are fast wilting checks and the lines in purple are slow wilting checks. This year the growing conditions were favorable, with very little drought like conditions. However, there was still a large difference between the top yielding lines and the bottom yielding lines, suggesting even short periods of hot, dry weather can have a negative impact on yield. Also, it is important to note the top yielding line in the MG 7&8 test is a line from

Dr. Tommy Carter's program. It is not only slow wilting, but it has 37.5% exotic pedigree. So, the lines being developed are not only adapted for the targeted environment, but they perform well under various growing conditions as well. The last thing to mention is in 2017 we began measuring test weight, which is presented in Tables 1 and 2. We first want to evaluate current lines being tested for variation in test weight and determine if any correlations may be present. This is just the first year of data, from one location. So, it's hard to make any conclusions, but is on our radar and we have begun evaluating lines for this trait.

Table 1. MGV Commercial Stress Test grown in Florence, SC in 2017

MG 5e			MG 5L		
LINE	TSWT	YIELD	LINE	TSWT	YIELD
PI 471938	59.90	50.22	USG 75B75R	59.50	49.17
TN13-5745RR1	58.90	47.42	TN11-5140	59.00	48.50
TN12-5523R2	57.80	43.90	75B75R	58.10	45.82
TN13-5746RR1	58.00	42.73	PI 471938	60.20	45.48
SH 5215 LL	55.30	40.37	TN12-5712R2	54.50	44.36
P55T81R	58.00	39.75	S58-Z4	57.40	43.22
CZ 5147 LL	60.90	37.68	CZ 5947 LL	57.50	42.93
CZ 5375 RY	55.70	36.33	S58RY78	56.10	41.60
S52RS86	58.10	36.14	MS 5607 RXT	55.10	41.43
537LL	55.60	35.25	R10-2436	55.10	40.97
CZ 5150 LL	57.50	34.84	S56XT98	55.30	38.72
P55A49X	54.90	33.58	Osage	57.60	38.67
UA 5414RR	54.00	33.31	Osage	56.40	36.95
CZ 5515 LL	54.70	33.27	UA 5715GT	57.50	36.36
Osage	53.50	31.07	TN13-5508R2	56.20	35.67
UA 5814HP	53.30	28.35	SH 5915 LL	53.40	34.97
CZ 5242 LL	54.30	28.29	P 5752RY	55.30	34.90
UA 5014C	54.20	26.96	S56RY84	53.70	34.24
AG5959	53.40	23.11	R10-2710	56.20	33.89
UA 5115C	54.60	20.99	CZ 5727 LL	54.50	31.95
SX17651XS	54.50	18.52	R11-8346	56.10	26.50
			R11-7999	54.10	25.07
			AG5959	54.50	23.61

Table 2. MG6, 7&8 Commercial Stress Test, Florence, SC, 2017

MG 6			MG 7&8		
LINE	TSWT	YIELD	LINE	TSWT	YIELD
7698XT	59.20	52.19	N09-13890	60.30	45.66
S65-T4X	58.90	49.81	756LL	60.20	44.96
S67-B7	60.10	48.51	SC07-1518RR	54.10	44.03
SH 6815 LL	56.80	47.21	P72A21X	59.50	43.92
S64XT18	56.30	46.90	S72RS36	56.60	43.92
CZ 6316 LL	60.30	45.80	G13LL-7	54.20	43.43
7686XT	60.20	45.07	SS 7516 NX	59.20	42.25
7648XT	60.50	44.60	77J25RS	57.20	42.16
N10-7277	60.80	44.58	S75XT26	58.50	42.05
SH 6515 LL	59.00	43.26	SC07-1490RR	60.30	40.68
MS 6937 RXT	54.60	43.19	SC10-455RR	56.20	40.63
S69XT57	58.40	42.82	S77RY85	60.20	40.52
644R2X	59.00	42.62	G10PR-56444R2	54.30	40.22
76S73R	60.60	41.78	AG74X8	60.60	40.10
SC02-011RR	57.80	41.14	N8002	54.30	39.99
S65-J5	55.40	40.99	MS 7057 RXT	53.40	38.92
677LL	60.00	40.83	Paul	54.70	38.47
Musen	60.10	39.95	SC07-108RR	54.60	37.68
AG69X6	60.70	39.84	P76T54R2	58.50	37.59
CZ 6060 RY	59.60	39.69	7757XT	56.20	37.57
S67RY25	57.50	39.47	SC06-306RR	54.50	37.02
NC-ROY	60.40	39.38	807RSC	59.20	36.93
S64LS95	54.90	39.13	Santee	56.40	36.89
SS 6816 NX	54.00	38.63	SH 7116 LL	55.40	36.33
AG64X8	54.70	37.48	757RSC	56.90	36.09
CZ 6515 LL	58.40	36.98	738 RR	56.00	35.32
CZ 6109 LL	54.00	36.40	G13LL-44	53.70	34.68
SH 6215 LL	53.90	36.25	700R2X	57.90	34.18
7697XT	53.30	36.14	NC-ROY	54.40	33.23
7607XT	59.40	34.04	SC10-261RR	55.10	33.16
MS 6027 RXT	54.10	33.67	S74-M3	53.90	32.50
N07-8138	58.20	31.06	CZ 7007 LL	59.20	31.66
SC03-9151RR	53.10	28.66	NTCPR94-5157	56.30	31.62
SC06-051RR	54.90	27.85	828 RR	54.50	30.23
P60T95X	53.90	25.44	Agustina	58.20	30.10
			AG72X7	54.70	28.11
			Cheraw	54.40	28.05
			CZ 7132 LL	54.90	19.43

The results from the first year, preliminary yield trials for testing newly developed breeding lines for drought tolerance are presented in Table 3. These are lines developed from Tommy Carter's line, N8002. The first soybean release specifically for drought tolerance. These varieties were developed with funding in part by the SCSB Evaluating SC Soybean Breeding Lines 2014-2016. So, the funding received previously was greatly appreciated and utilized. As well as continued funding, which allows this material to be tested and further selections to be made, with the ultimate goal of releasing a variety. In 2018, we hope to continue testing these experimental breeding lines and other newly developed lines. Also, as more germplasm is developed and becomes available through the efforts made by this project, that material will also be utilized to begin making new populations, for continued varietal development.

Table 3. Preliminary Drought Breeding Trials, Florence SC, 2017

LINE	HT	YIELD	LINE	HT	YIELD
SC17-DRC27	42.00	29.16	SC17-DRR08	33.33	26.75
SC17-DRC23	30.33	27.47	SC17-DRR15	29.00	26.51
SC17-DRC29	47.67	27.47	SC17-DRR10	28.00	26.03
SC17-DRC28	28.67	25.06	SC17-DRR13	34.33	25.28
SC17-DRC22	26.67	24.10	SC17-DRR17	38.00	23.62
SC17-DRC24	29.67	23.38	SC17-DRR01	29.00	21.21
SC17-DRC21	31.00	23.14	N8002	24.33	20.97
N8002	28.33	22.90	SC17-DRR12	29.33	20.00
SC17-DRC19	27.33	22.41	NC-ROY	25.67	19.76
SC17-DRC20	28.00	22.41	SC17-DRR07	24.67	19.52
SC17-DRC26	28.33	19.76	SC17-DRR14	28.00	18.56
SC17-DRC25	28.67	19.28	SC17-DRR11	26.67	18.08
NTCPR94-5157	29.67	17.83	SC17-DRR09	25.00	17.59
SC17-DRC18	30.00	16.63	SC17-DRR16	28.67	17.35
SC17-DRC30	31.33	16.39	SC17-DRR05	26.00	16.39
NC-ROY	19.67	16.39	SC17-DRR03	27.33	15.18
			SC17-DRR06	23.00	12.29
			SC17-DRR04	25.00	12.16
			SC17-DRR02	22.00	11.59

Presentation of Research

Ben Fallen. "Breeding for Drought Tolerate Varieties." South Carolina Crop Improvement Association Board Meeting. Columbia, SC. 02/22/18

Ben Fallen. "Evaluating and Improving Drought Tolerance Across the Carolinas." South Carolina Young Farmer and Agribusiness Association, South Carolina Promotion Board and the South Soybean Board Meeting. Charleston, SC. 01/20/18.