



Sweet Sorghum an alternative energy Crop

Grant Agreement n° 227422

WP3

Deliverable 3.12:

*Three to six pairs of sweet sorghum
female lines (A and B) with Al
tolerance developed*

Composition of the consortium

CIRAD
ICRISAT
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UCSC
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This deliverable has been slightly modified (temporarily) in order to produce Al tolerant sweet sorghum hybrids in a shorter time span. Initially, no sweet sorghum female lines (A-lines) were available, and the development of sweet sorghum female lines is one of the goals of this project. The Al tolerant gene in sorghum, *Alt_{SB}*, identified, cloned and characterized at Embrapa has dominant or partially dominant expression depending upon the level of Al saturation in the soil or Al concentration in nutrient solution.

Consequently Al tolerant commercial sweet sorghum hybrids can be made with only one parent being tolerant. One parent of the cross to generate the 275 F8 member RIL population, BR501R (Brandes), was determined to be Al tolerant. Consequently 50% of these RILs are expected to be tolerant to Al toxicity and hybrids made with these Al tolerant RILs as the restorer (R-line) will also be tolerant to Al toxicity.

Pedigree (RILs)	Alcohol	Alcohol	Alcohol	Net root Growth (mm) in Nutrient Solution with 27 µM Al			CRRS	Al
	L ha ⁻¹	L ha ⁻¹	L ha ⁻¹	5-7 days	1-5 days	1-7 days	1-7 days	Tolerance
(BR505 * BR501)-90-1-1-1-1	4017,4	2532,6	3275,0	5,9	38,2	50	79,9	T
(BR505 * BR501)-132-1-1-1-1	1938,4	3270,6	2604,5	11,4	54,9	77,6	73,9	T
(BR505 * BR501)-74-1-1-1-1	1544,9	3622,0	2583,4	4,6	52,4	61,6	74,6	T
(BR505 * BR501)-276-1-1-1-1	2456,9	2583,5	2520,2	6,4	40,0	52,9	66,1	T
(BR505 * BR501)-253-1-1-1-1	2038,7	2988,3	2513,5	9,3	46,3	65	82,5	T
(BR505 * BR501)-281-1-1-1-1	1591,5	3167,3	2379,4	2,2	24,3	28,7	37,4	T
(BR505 * BR501)-178-1-1-1-1	1651,6	3079,8	2365,7	12,1	56,5	80,7	88,7	T
(BR505 * BR501)-85-1-1-1-1	1638,6	3078,7	2358,6	2,6	29,1	34,4	59,6	T
(BR505 * BR501)-126-1-1-1-1	1627,4	3089,6	2358,5	12,4	52,1	76,9	97,3	T
(BR505 * BR501)-249-1-1-1-1	1758,3	2958,0	2358,2	3,0	32,1	38,1	44,2	T
(BR505 * BR501)-102-1-1-1-1	1631,2	3034,0	2332,6	2,3	37,3	41,9	47,3	T
(BR505 * BR501)-30-1-1-1-1	2082,8	2568,0	2325,4	6,2	56,3	68,7	82,3	T
(BR505 * BR501)-103-1-1-1-1	1047,5	3590,5	2319,0	0,9	14,1	16,0	30,2	T/S
(BR505 * BR501)-268-1-1-1-1	1573,3	3042,6	2308,0	3,4	19,3	26,0	45,8	T
(BR505 * BR501)-271-1-1-1-1	1798,3	2807,6	2303,0	9,8	37,5	57,0	94,0	T
(BR505 * BR501)-22-1-1-1-1	1976,4	2612,0	2294,2	4,3	66,9	75,4	68,6	T
(BR505 * BR501)-245-1-1-1-1	1663,3	2914,6	2288,9	3,7	46,6	54	70,1	T
Average Best 17 of Top 20 Al Tolerant RILS	1884,5	2996,5	2440,5		41,4	53,2	67,2	
(BR505 * BR501)-83-1-1-1-1	2656,1	3006,2	2831,2	0,5	12,6	13,6	15,7	⊆
(BR505 * BR501)-24-1-1-1-1	3001,2	2301,8	2651,5	0,5	22,8	23,8	29,9	⊆
(BR505 * BR501)-225-1-1-1-1	1765,3	2878,7	2322,0	0,3	15,5	16,0	17,1	⊆
Average Best 3 of Top 20 Al Susceptible RILS	2474,2	2728,9	2601,6		17,0	17,8	20,9	
Trial Average of 223 RILs	2071,1	1839,0	1511,9		36,0	45,6	56,5	
BR505 (Wray)	1862,0	2972,2	2417,1	0,2	12,3	12,7	16,5	S
BR501 (Brandes)	564,4	1411,7	988,0	5,6	39,9	51,2	61,3	T

A summary of the results of 225 RILs are presented in the above table. Note that these trials were conducted in the second semester to distribute the work load and with expected lower productivity. The relative yield of these RILs compared to the RIL parents is important. Based on ethanol yield per hectare of two year's data, 17 of the top 20 lines were tolerant to Al toxicity when evaluated on a latosol soil with the pH of the top soil corrected and with an acid subsoil (pH not measured but most likely with toxic Al saturation). Experimental hybrids confected with the A-lines in deliverable 3.9 and the best 17 R-lines will be made in the first semester of 2014.

Crosses were initiated in 2013 between selected juicy stem short statured Al tolerant B-lines and CMSXS5010, CMSXS5011 and CMSXS5017 noted in deliverable 3.9. The F1's were self-pollinated to produce F2 seed. The F2 seedlings were selected for tolerance to Al toxicity in nutrient solution with 27 μ M Al. F3 seed from short statured F2 plants will be harvested in the second semester of 2013. Selection for juice quality will be made on the F3 plants. These selections will be crossed to appropriate A-lines and backcrossed to generate isogenic pairs of Al tolerant A and B-lines. These female lines will be available in 2015. In the next series of crosses to produce A and B sweet sorghum lines, we will also use genomic selection to recover the sweet sorghum attributes from the recurrent parent in the F3 generation.