



Seventh framework programme
Food, Agriculture and Fisheries, and Biotechnology

Specific International Co-operation Actions
Small or medium scale focused research project



Sweet Sorghum an alternative energy Crop

Grant Agreement n° 227422

WP3

Deliverable 3.9:

Three to six pair of sweet sorghum
female lines (A and B-lines) developed



Composition of the consortium

CIRAD
ICRISAT
EMBRAPA
KWS
IFEU
UniBO
UCSC
ARC-GCI
UANL
WIP

Two groups of six pair of male-sterile (Line-A) and maintainer (Line-B) lines were derived from the cross of maintainer juicy (non-sweet) line CMSXS157B and juicy sweet restorer line (Line-R) CMSXS505. All lines were selected for short stature, juicy stem, fertility non-restoration in the B-line and desirable agronomic characteristics. Experimental hybrids are currently being developed with these 12 A-lines for evaluation in the 2013/2014 agricultural year (November – April). Group I (Table 1) is in the F8 generation in normal cytoplasm (line-B) with backcross four (BC4) in sterile cytoplasm (line-A). These 12 pair of A and B lines were derived from seven F2 plants selected for juiciness and short stature. Note that juice extraction was at post seed maturity resulting in overall lower values for both juice extraction and juice soluble solids (Brix). Previous Brix analysis of individual plants of F6 and F7 progeny ranged from 10 to 18. Short stature (1.1 to 1.7m) sweet sorghum A and B lines are essential for mechanical harvest of the seed parent in hybrid seed production.

Table 1: Group I – Fast track development

Entry	Cytoplasm Type	Pedigree	Cycle	Juice Extraction %	Brix
2013 (L) 02 017	A	CMSXS157B * {CMSXS157B x BR505}-43-2-1-3-1-2	BC4	69,8	12,4
2013 (L) 02 018	B	{CMSXS157B x BR505}-43-2-1-3-1-2	F8	80,1	11,5
2014 (L) 02 017	A	(CMSXS157A{CMSXS157B x BR505}-43-2-1-3-1-3	BC4	70,2	10,6
2014 (L) 02 018	B	{CMSXS157B x BR505}-43-2-1-3-1-3	F8	81,1	9,7
2013 (L) 02 083	A	(CMSXS157A* {CMSXS157B x BR505}-99-2-1-1-2-1	BC4	67,5	11,5
2013 (L) 02 084	B	{CMSXS157B x BR505}-99-2-1-1-2-1	F8	70,7	12,7
2013 (L) 02 085	A	(CMSXS157A{CMSXS157B x BR505}-99-2-1-1-3-1	BC4	68,6	12,6
2013 (L) 02 086	B	{CMSXS157B x BR505}-99-2-1-1-3-1	F8	65,3	13,1
2012 (L) 02 093	A	(CMSXS157A * {CMSXS157B x BR505}-115-1-1-2-3-1	BC4	73,0	13,0
2012 (L) 02 094	B	{CMSXS157B x BR505}-115-1-1-2-3-1	F8	71,4	12,6
2013 (L) 02 093	A	(CMSXS157A*{CMSXS157B x BR505}-115-1-1-2-3-2	BC4	69,9	12,2
2013 (L) 02 094	B	{CMSXS157B x BR505}-115-1-1-2-3-2	F8	68,3	11,8

*Juice extraction determined with hydraulic press

Table 4: Group II - Normal development.

Entry	Cytoplasm Type	Pedigree	Cycle	Juice Extraction %	Brix
201240(B)031	A	(CMSXS157A*{CMSXS157B x BR505}-6-2-1-1-1)-2	BC3	65	10.2
201240(B)032	B	{CMSXS157B x BR505}-6-2-1-1-1-2	F7	67	13.7
201240(B)067	A	(CMSXS157A*{CMSXS157B x BR505}-37-1-1-1)-2	BC3	72	10.6
201240(B)068	B	{CMSXS157B x BR505}-37-1-1-1-2	F7	67	12.6
201240(B)139	A	(CMSXS157A*{CMSXS157B x BR505}-78-2-1-1)-1	BC3	69	10.8
201240(B)140	B	{CMSXS157B x BR505}-78-2-1-1-1	F7	69	13.7
201240(B)151	A	(CMSXS157A*{CMSXS157B x BR505}-103-1-1-3)-1	BC3	64	11.8
201240(B)152	B	{CMSXS157B x BR505}-103-1-1-3-1	F7	64	13.3
201240(B)155	A	(CMSXS157A*{CMSXS157B x BR505}-115-1-1-1)-1	BC3	65	14.6
201240(B)156	B	{CMSXS157B x BR505}-115-1-1-1-1	F7	66	15.8
201240(B)157	A	(CMSXS157A*{CMSXS157B x BR505}-115-1-1-3)-1	BC3	66	13.6
201240(B)158	B	{CMSXS157B x BR505}-115-1-1-3-1	F7	67	15.6

*Juice extraction determined with hydraulic press

During the past several months Embrapa has identified 11 historical sweet sorghum varieties that are nonrestorer or B-lines. These lines have been characterized and are summarized in table 3. These lines are tall with the exception of CMSXS5012 and most probably cannot be used to produce sweet sorghum hybrids with mechanical harvesting of the seed parent (A-line). Isogenic A-lines of all 11 B-line entries have been developed. The juice quality in this evaluation is relative low but equivalent to the best R-line control, CMSXS616R (BR505R). CMSXS5010 and CMSXS5011 are superior to BR505R with desirable high sucrose content. CMSXS5010, CMSXS5011 and CMSXS5017 are being used as the recurrent parent in B x B crosses to develop short statured AI tolerant sweet sorghum A and B lines without interference of segregating fertility restorer genes.

Table 3: Historic sweet sorghum maintainer B-lines.

Entry	Fertility		Plant	Biomass	Juice	POL		Purity (%)
	Restoration (A1 cyto)	Flowering (days)	Height (m)	Production (t ha ⁻¹)	Extraction (%)	Brix °	(Sucrose) (% juice)	
CMSXS5008	B	77	3,1	66,0	69,2	12,7	5,63	48,0
CMSXS5009	B	73	2,9	48,3	62,7	14,4	8,47	61,4
CMSXS5010	B	73	3,07	53,1	65,5	14,1	8,99	61,5
CMSXS5011	B	74	3,15	50,0	66,3	14,0	9,74	67,3
CMSXS5012	B	67	2,16	37,7	64,8	14,6	7,72	56,9
CMSXS5013	B	72	2,84	49,1	68,1	14,1	6,85	58,9
CMSXS5014	B	74	2,98	59,4	68,7	13,2	5,35	49,4
CMSXS5015	B	67	2,5	29,1	68,7	12,1	5,21	50,4
CMSXS5016	B	72	2,96	59,7	68,2	12,6	6,94	56,6
CMSXS5017	B	65	3,52	62,9	68,8	12,5	7,38	60,3
CMSXS5018	B	77	3,5	58,0	69,3	12,1	6,75	55,8
CMSXS516 R*	R	79	3,2	52,0	71,8	13,7	8,97	65,3

* BR505 R reference control, ** Total Sugar Recovery.

Table 3: Historic sweet sorghum maintainer B-lines (cont).

Entry	Reduced Sugars (% juice)	Fiber (%)	TRS (% juice)	ATR** (kg t ⁻¹)	Alcohol L t ⁻¹	Alcohol (L ha ⁻¹)
CMSXS5008	1,99	10,1	7,9	63,1	43,6	2878,6
CMSXS5009	1,53	11,3	10,4	81,0	57,5	2776,5
CMSXS5010	1,53	10,1	11,0	86,9	60,5	3215,0
CMSXS5011	1,33	10,7	11,6	90,9	63,8	3188,3
CMSXS5012	1,69	11,0	9,8	76,6	54,0	2037,3
CMSXS5013	1,62	11,8	8,8	68,0	48,6	2386,4
CMSXS5014	1,95	11,1	7,6	59,1	41,7	2477,0
CMSXS5015	1,91	12,1	7,4	56,8	40,7	1185,2
CMSXS5016	1,70	10,9	9,0	70,5	49,5	2958,1
CMSXS5017	1,57	12,1	9,3	71,4	51,4	3234,7
CMSXS5018	1,73	10,7	8,8	69,3	48,6	2819,3
CMSXS516 R*	1,40	9,8	10,8	86,2	59,7	3102,9

* BR505 R reference control, ** Total Reduced Sugar, ***Total Sugar Recovery.