Table 1. Description of clones used for the drought G x E analysis.

ID Number	Name	IIAM code	CIP code	CT[§]	CO[§§]	Storage root			Plant type[‡‡]
						Skin color[†]	Flesh color[††]	From[‡]	
1	Tacna	MZC0001	187019.1	BL	PE	BO	DY	RE	SE
2	Chissicuana-2	MZC0002	-	FV	MZ	BO	LY	RE	S
3	Nhacutse-5	MZC0003	-	FV	MZ	BO	DY	LE	S
4	Nwaracu	MZC0004	-	FV	MZ	DR	DY	E	S
5	Nwazambane	MZC0005	-	FV	MZ	C	LY	E	S
6	NASPOT5	MZC0006	-	MV	UG	BO	IO	RE	S
7	Malawe	MZC0007	-	FV	MZ	R	LO	O	S
8	Nhacoongo-1	MZC0008	-	FV	MZ	C	W	LE	S
9	Mamphenane	MZC0009	-	MV	ZA	BO	LO	OBL	S
10	Maphuta	MZC0010	-	MV	ZA	P	DY	E	E
11	Nwamanhiça	MZC0011	-	FV	MZ	C	Y	E	S
12	199062.1	MZC0012	199062.1	BL	PE	BO	IO	RE	S
13	Nhacutse-3	MZC0013	-	FV	MZ	C	C	RE	S
14	ADMARC	MZC0014	-	FV	MZ	P	C	E	S
15	Diliva	MZC0015	-	FV	MZ	P	Y	RE	SE
16	ST87-030	MZC0016	189001.2	BL	CIP	Y	Y	RE	SE
17	440203	MZC0017	440203	MV	CIP	BO	W	OBV	S
18	Thuang-Thuang	MZC0018	-	FV	MZ	BO	W	RE	S
19	Atacana	MZC0019	187020.1	MV	PE	DR	Y	RE	S
20	1998-12-3	MZC0020	-	BL	PE	LB	DO	E	S
21	Chissicuana-3	MZC0021	-	FV	MZ	C	W	RE	S
22	Nhacutse-1	MZC0022	-	FV	MZ	C	Y	LO	S
23	Canassumana	MZC0023	-	FV	MZ	R	Y	E	S
24	UNK-Malawe	MZC0024	-	FV	MZ	R	Y	O	S
25	Nhacutse-2	MZC0025	-	FV	MZ	C	W	RE	S
26	Chitandzana	MZC0026	-	FV	MZ	R	LY	LE	S
27	Jogó	MZC0027	-	FV	MZ	P	LY	R	S
28	Xiadlaxakau	MZC0028	-	FV	MZ	R	Y	R	S
29	Xitsekele	MZC0029	-	FV	MZ	P	Y	E	S
30	Chissicuana-1	MZC0030	-	FV	MZ	DR	DY	RE	S
31	Nhacutse-4	MZC0031	-	FV	MZ	BO	W	E	SE
32	Jogó-2	MZC0032	-	FV	MZ	BO	W	E	S
33	Manhissane	MZC0033	-	FV	MZ	C	W	E	S
34	Nwamazambe	MZC0034	-	FV	MZ	BO	Y	E	S
35	Mafambane	MZC0035	-	FV	MZ	C	W	OBV	S
36	Nwamonguane	MZC0036	-	FV	MZ	C	C	E	S
37	Chulamete	MZC0037	-	FV	MZ	C	Y	RE	S
38	Cincominutos	MZC0038	-	FV	MZ	C	Y	RE	S

Table 1. Continued.

	Name	IIAM code	CIP code	CT[§]	CO[§§]	Storage root			Plant type[‡‡]
						Skin color[†]	Flesh color[††]	From[‡]	
39	Xiphone	MZC0039	-	FV	MZ	C	W	RE	S
40	Nwaxitsimbwane	MZC0040	-	FV	MZ	R	W	RE	SE
41	Cacilda	MZC0041	-	FV	MZ	C	W	OBV	S
42	Nwanaqtsjo	MZC0042	-	FV	MZ	C	C	E	S
43	Ligodo	MZC0043	-	FV	MZ	C	C	RE	SE
44	Xihetamakote	MZC0044	-	FV	MZ	C	DY	O	S
45	TIS9265	MZC0045	440075	BL	NG	LB	W	OBV	S
46	Ximitakwatse	MZC0046	-	FV	MZ	C	Y	O	S
47	Resisto	MZC0047	440001	MV	US	R	DO	RE	SE
48	Jonathan	MZC0048	420014	MV	PE	BO	IO	O	E
49	Japon	MZC0049	420009	MV	JP	BO	IO	O	E
50	CN-448-49	MZC0050	440181	MV	TW	BO	IO	O	E
51	Tainung-64	MZC0051	440189	MV	TW	BO	DO	RE	S
52	Cordner	MZC0052	-	MV	US	BO	DO	RE	SE
53	Tanzania	MZC0053	-		TZ	C	Y	O	SE
54	TIS-2534	MZC0054	44006	BL	NG	R	W	O	S
55	MgCl01	MZC0055	-	FV	MZ	C	DO	RE	S
56	Moz-White	MZC0056	-	FV	ZW	R	W	E	S
57	Lo-323	MZC0057	440185	BL	US	BO	DO	O	E
58	SPK004	MZC0058	???	FV	KE	C	IO	RE	SE

[§] CT, cultivar type; FV, farmer variety; BL, breeding line; MV, modern variety.

[§§] CO, country of origin; JP, Japan; KE, Kenya; MZ, Mozambique; NG, Nigeria; PE, Peru; TZ, Tanzania; TW, Taiwan; US, United States of America; ZA, South Africa; ZW, Zimbabwe.

[†] C, cream; LB, light brown; BO, brown orange; R, red; DR, dark red; P, pink.

[††] W, white; L, light yellow; IY, intermediate yellow; DY, dark yellow; C, cream; LO, light yellow; IO, intermediate orange; DO, dark orange.

[‡] RE, round eliptic; E, eliptic; LE, long eliptic; OBV, obovate; OBL, oblong.

[‡‡] E, erect; SE, semi-erect; S, spreading.

Table 2. Average rainfall and temperature at Umbeluzi by year and month from 2001 to 2010 (in bold rainfall and temperature during growing period of experiments).

Year	MP §	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
2001	R	112.6	204.2	23.2	31.8	9.4	0	14.5	6.6	1.6	19.6	316.4	157.9	∑=733.6
	T	25.7	26.2	26.4	24.6	21.3	19.6	19.2	23.5	22.4	23.6	25.5	25.7	$\bar{x}$=23.64
2002	R	65.5	19.6	17.0	2.5	0	0	15.4	9.2	4.3	45.3	14.1	47.6	∑=240.5
	T	27.4	26.4	26.7	24.9	21.7	18.8	18.2	22.1	21.0	24.3	24.0	25.5	$\bar{x}$=23.42
2003	R	5.8	74.2	28.6	2	9.1	57.6	5.2	0	110.7	6.6	17.9	20.2	∑=337.9
	T	27.8	28.2	27.1	25.5	22.0	19.5	18.6	20.1	22.3	24.9	25.9	27.8	$\bar{x}$=24.14
2004	R	189.7	75.0	89.0	36.0	8.9	2.9	76.0	18.0	28.8	42.2	108.7	56.6	∑=731.8
	T	27.8	27.1	25.8	24.1	20.8	18.8	17.7	20.9	21.2	23.5	29.3	27.5	$\bar{x}$=23.71
2005	R	30.4	48.9	111.2	35.8	9.2	1.1	1.2	7.2	1.7	8.6	34.1	16.9	∑=306.3
	T	27.9	27.6	26.0	24.2	22.3	21.3	18.8	22.5	23.7	24.4	26.0	25.9	$\bar{x}$=24.22
2006	R	98.3	97.5	**163.7**	**22.7**	**1.5**	**3.6**	**8.3**	**18.8**	23.1	43	104.4	118.7	∑=703.6
	T	27.4	27.9	**24.9**	**23.3**	**20.5**	**19.2**	**19.7**	**20.4**	21.8	24.2	24.9	27.3	$\bar{x}$=23.46
2007	R	24.2	64.8	43.0	118	0	5.1	7.9	0	11.6	39.7	51.7	210.3	∑=576.3
	T	27.5	28.0	27.1	24.0	20.8	19.3	18.7	20.6	23.1	23.3	25.5	25.3	$\bar{x}$=23.60
2008	R	77.0	31.0	85.2	48.7	15.2	**14.2**	**0**	**0**	**13.3**	**0.5**	**128.7**	121.5	∑=535.3
	T	26.2	26.9	25.7	23.1	21.7	**19.6**	**20**	**21.6**	**22.9**	**24.2**	**25.7**	26.4	$\bar{x}$=23.67
2009	R	130	72.4	76.3	**5.4**	**1.7**	**13.0**	**5.5**	**61.9**	**0**	0	89.8	22.7	∑=478.7
	T	27.5	26.5	25.3	**23.6**	**22.0**	**20.5**	**18.5**	**20.1**	**22.5**	23.1	24.7	27.4	$\bar{x}$=23.48
2010	R	39.9	33.0	125.0	86.7	3.6	9.5	3.3	0	1.2	40.6	99.7	267.9	∑=710.4
	T	28.0	27.9	27.2	24.9	23.0	18.7	20.0	19.5	23.2	23.3	26.1	26.6	$\bar{x}$=24.0
$\bar{x}$	R	77.3	72.1	76.2	39.0	5.9	10.7	14.1	12.2	19.6	24.6	96.6	104.0	$\bar{x}$=535.4
	T	27.32	27.27	26.22	24.2	21.61	19.53	18.94	21.17	22.41	23.88	25.76	26.54	$\bar{x}$=
min	R	6	20	17	2	0	0	0	0	0	0	14	17	
	T	25.7	26.2	24.9	23.1	20.5	18.7	17.7	19.5	21.0	23.1	24.0	25.3	
max	R	190	204	164	118	15	58	76	62	111	45	316	268	
	T	28.0	28.2	27.2	25.5	23.0	21.3	20.0	23.5	23.1	24.5	29.3	27.8	

§ MP, metrological parameter; R, rainfall in mm; T, temperature average in ^{o}C.

Table 3. Experimental means ($\bar{x}$) and coefficient of variation (CV) for observed traits at six environments (seasons and irrigation treatments).

		Season 2006		Season 2008		Season 2009		$\bar{\bar{x}}$ Across environments
Trait		Irrigated	Not irrigated	Irrigated	Not irrigated	Irrigated	Not irrigated	
Storage root yield, Mg ha^{-1}	$\bar{x}$	5.19	4.91	7.11	2.26	8.99	8.64	6.18
	CV, %	55.47	68.42	30.78	71.5	61.04	60.76	59.84
Vine yield, Mg ha^{-1}	$\bar{x}$	26.53	21.17	23.89	10.94	17.80	11.59	18.653 (19.11SAS)
	CV, %	35.95	44.68	35.34	61.46	57.63	48.07	45.37
Biomass, Mg ha^{-1}	$\bar{x}$	31.74	26.03	31.00	13.20	26.37	20.11	24.74 (25.3SAS)
	CV, %	32.76	40.66	28.40	54.96	46.09	40.88	39.11
Harvest index, %	$\bar{x}$	18.16	22.16	26.25	20.11	33.62	41.79	27.01 (26.6SAS)
	CV, %	57.19	54.58	33.76	57.97	50.06	38.12	47.62
Dry matter content of storage roots, % FM[†]	$\bar{x}$	32.14	33.28	31.66	31.26	31.38	32.47	32.02 (32.11SAS)
	CV, %	7.17	6.86	3.18	5.38	8.01	9.07	6.7

[†] FM = fresh matter.

Table 4. Clone means for observed traits for each irrigation treatment across seasons (I = irrigates and NI = not irrigated; check clones: Tanzania, Resisto, and Jonathan in bold).

	Farmer varieties									
	Storage root yield, Mg ha^{-1}		Vine yield, Mg ha^{-1}		Biomass, Mg ha^{-1}		Harvest index, %		Root dry matter, %	
Name	I	NI	I	NI	I	NI	I	NI	I	NI
Chissicuana-2	13.18	9.26	38.99	30.24	52.16	39.50	30.91	24.14	32.31	33.01
Nhacutse-5	7.13	5.54	36.92	19.64	44.05	25.17	17.92	25.73	32.64	31.02
Nwaracu	4.13	2.70	21.52	14.07	25.54	16.82	12.94	19.56	31.88	32.22
Nwazambane	6.09	7.43	14.91	16.05	21.00	23.48	31.31	30.31	31.78	32.70
Malawe	6.47	3.49	15.45	13.50	21.92	16.91	28.91	22.74	28.64	33.16
Nhacoongo-1	4.94	1.80	37.60	24.54	42.54	26.34	11.21	7.39	36.39	35.24
Nwamanhiça	2.24	2.96	22.80	15.96	26.74	18.92	12.26	15.19	33.48	34.88
Nhacutse-3	4.75	3.13	23.95	23.01	28.70	26.14	16.61	12.25	32.13	34.95
ADMARC	13.48	10.48	28.94	17.66	43.08	28.14	34.57	42.13	32.42	34.96
Diliva	2.89	1.96	40.56	33.97	43.00	35.06	7.42	4.72	36.84	36.20
Thuang-Thuang	10.71	3.78	29.41	8.61	39.99	13.91	26.58	32.04	33.10	30.89
Chissicuana-3	6.78	4.45	27.19	19.81	34.16	24.25	18.67	18.27	32.98	33.44
Nhacutse-1	3.29	3.13	45.69	29.40	49.02	32.53	7.24	10.43	32.59	32.24
Canassumana	7.00	6.33	19.64	16.17	26.64	22.49	29.65	30.49	34.13	33.51
UNK-Malawe	6.07	8.36	22.53	18.16	27.51	26.52	22.73	30.24	32.74	33.93
Nhacutse-2	8.66	2.13	28.99	12.77	36.96	14.95	22.90	12.57	35.06	33.05
Chitandzana	4.26	3.89	17.43	16.31	21.34	20.16	20.06	18.22	32.44	31.45
Jogó	3.52	2.34	29.21	21.33	32.48	23.67	10.28	10.82	33.33	34.66
Xiadlaxakau	15.11	10.10	21.45	20.12	36.56	30.26	40.87	33.63	31.91	32.17
Xitsekele	4.89	8.81	35.98	21.24	40.87	30.04	10.77	20.06	33.73	32.76
Chissicuana-1	3.83	1.88	14.83	10.77	18.52	12.68	20.03	14.39	32.27	31.06
Nhacutse-4	4.54	5.87	20.29	15.20	24.87	21.02	21.39	32.41	29.14	30.96
Jogó-2	4.89	5.59	41.72	28.07	46.58	33.66	12.63	18.39	33.78	32.67
Manhissane	6.13	5.84	15.91	14.75	22.04	18.73	24.82	27.48	31.70	32.97
Nwamazambe	8.50	6.92	28.95	9.62	37.45	14.55	19.83	38.38	31.94	31.47
Mafambane	2.72	2.34	20.55	13.19	23.27	15.54	12.27	20.92	30.01	33.79
Nwamonguane	7.60	1.52	17.66	4.02	25.12	5.55	29.42	22.45	34.40	32.28
Chulamete	5.35	8.74	27.62	17.79	32.97	26.53	17.18	30.04	32.93	32.46
Cincominutos	5.90	7.39	37.22	16.96	43.12	24.34	15.91	29.52	33.52	32.73
Xiphone	7.22	3.63	13.87	12.93	21.09	16.55	39.23	27.75	30.75	32.57
Nwaxitsimbwane	2.77	5.06	26.34	20.16	28.98	25.15	17.09	27.52	32.21	34.21
Cacilda	8.98	4.78	25.71	9.18	34.58	13.96	26.60	28.95	34.77	34.43
Nwanaqtsjo	7.79	7.13	24.71	27.31	32.54	33.16	23.86	21.28	31.26	32.73
Ligodo	17.38	6.43	19.79	12.52	37.17	18.95	45.55	36.46	32.91	32.60
Xihetamakote	4.03	4.15	22.23	26.10	28.36	30.26	23.32	16.51	32.36	34.77
Ximitakwatse	11.96	3.12	43.31	25.30	53.58	28.42	27.16	12.14	33.55	36.93
Tanzania	**7.32**	**8.17**	**28.01**	**18.37**	**33.70**	**26.55**	**23.49**	**31.94**	**33.88**	**34.78**

Table 4. Continued.

	Storage root yield, Mg ha^{-1}		Vine yield, Mg ha^{-1}		Biomass, Mg ha^{-1}		Harvest index, %		Root dry matter, %	
Name	I	NI	I	NI	I	NI	I	NI	I	NI
MgCl01	3.41	1.63	13.47	10.68	16.96	12.30	23.54	20.28	32.60	33.69
Moz-White	3.96	4.68	13.87	5.33	17.45	10.06	27.49	34.32	33.62	33.25
SPK004	2.82	1.40	10.63	6.61	14.12	7.92	15.83	22.07	32.93	33.86
$\bar{x}$ Farmer varieties	6.57	4.96	25.65	17.44	32.17	22.28	22.01	23.35	32.78	33.27
	Breeding Lines and Modern Varieties									
Tacna	16.40	14.72	23.56	12.92	39.96	27.64	43.25	44.88	29.17	32.44
NASPOT5	4.07	4.95	43.85	19.96	47.92	24.92	12.62	20.52	36.82	34.74
Mamphenane	8.25	6.30	9.35	3.54	17.56	9.53	51.90	53.52	27.10	31.84
Maphuta	3.75	5.55	9.94	10.76	13.12	16.31	21.94	30.58	33.15	33.81
199062.1	15.31	7.78	22.69	8.67	38.00	16.45	41.95	52.65	28.18	27.06
ST87-030	12.66	5.57	18.36	7.03	31.02	13.46	43.36	44.96	35.76	36.08
440203	3.85	2.29	27.23	9.44	31.08	11.73	15.72	28.76	33.53	35.26
Atacana	10.07	7.15	20.40	16.87	27.62	24.02	45.89	32.35	32.39	31.95
1998-12-3	14.51	8.10	12.50	7.52	27.22	15.57	47.07	34.97	28.03	28.45
TIS9265	3.30	1.67	10.97	4.32	14.32	5.95	25.24	24.21	28.30	30.13
Resisto	**8.13**	**4.18**	**13.75**	**5.87**	**21.88**	**10.98**	**38.18**	**42.90**	**28.62**	**30.32**
Jonathan	**7.38**	**6.22**	**8.80**	**5.15**	**17.06**	**11.37**	**41.35**	**39.15**	**25.77**	**29.78**
Japon	6.09	5.86	10.97	5.70	17.60	11.56	34.42	38.06	24.80	26.88
CN-448-49	3.29	3.87	10.67	5.21	11.71	9.07	24.41	34.10	27.84	25.86
Tainung-64	7.40	5.79	10.00	6.04	15.60	11.83	39.52	42.86	26.03	27.21
Cordner	6.56	3.57	11.12	7.17	17.69	10.74	38.32	31.54	29.25	30.22
TIS-2534	10.24	8.72	16.23	5.85	26.46	14.57	30.39	51.21	28.95	27.70
Lo-323	7.67	5.24	12.62	5.38	20.30	10.62	32.47	43.89	26.20	25.29
$\bar{x}$ Breeding Lines & Modern Varieties	8.27	5.97	16.28	8.19	24.23	14.24	34.89	38.40	29.44	30.28
LSD (0.05)	3.34 (7.1)	3.32 (6.7)	8.86 (13.0)	7.11 (12.8)	9.94 (15.7)	8.36 (15.9)	10.92 (20.7)	11.89 (22.5)	1.79 (3.3)	2.15 (3.5)
Heritab	56.51	23.40	78.86	64.38	73.01	52.21	57.68	50.95	83.44	76.24

Table 4a. Clone means for observed traits for each irrigation treatment in season 2008 (I = irrigates and NI = not irrigated; check clones: Tanzania, Resisto, and Jonathan in bold).

	Farmer varieties									
	Storage root yield, Mg ha^{-1}		Vine yield, Mg ha^{-1}		Biomass, Mg ha^{-1}		Harvest index, %		Root dry matter, %	
Name	I	NI	I	NI	I	NI	I	NI	I	NI
Chissicuana-2	9.25	6.11	52.21	20.25	61.46	26.36	15.05	23.67	31.41	28.16
Nhacutse-5	6.94	4.11	44.91	13.55	51.85	17.66	13.45	23.03	32.33	30.40
Nwaracu	7.02	2.00	25.59	5.39	32.61	7.39	21.63	24.27	33.25	32.30
Nwazambane	5.60	2.87	14.74	11.58	20.34	14.45	28.65	21.55	32.30	31.76
Malawe	6.03	0.53	11.23	16.92	17.26	17.45	37.22	3.72	27.17	31.39
Nhacoongo-1	6.88	0.82	40.65	15.81	47.54	16.63	14.55	5.14	34.84	35.22
Nwamanhiça	3.21	0.69	9.08	8.69	12.29	9.38	24.36	10.01	32.89	30.98
Nhacutse-3	6.47	0.67	28.86	14.25	35.33	14.92	18.43	4.49	32.34	35.14
ADMARC	14.02	4.00	39.12	4.91	53.14	8.91	26.45	48.94	29.91	33.68
Diliva	4.21	0.63	36.85	30.91	41.06	31.55	10.47	2.10	33.55	31.62
Thuang-Thuang	7.57	0.92	36.71	5.14	44.28	6.06	16.93	13.65	33.48	29.35
Chissicuana-3	6.25	0.68	31.04	6.69	37.57	7.37	16.99	10.14	33.04	33.91
Nhacutse-1	3.65	0.67	43.09	12.70	46.74	13.36	7.87	6.07	32.05	32.49
Canassumana	7.92	3.50	24.93	14.70	32.85	18.20	26.86	14.74	33.50	32.30
UNK-Malawe	4.49	1.46	25.86	6.34	30.36	7.80	16.78	21.35	31.66	32.71
Nhacutse-2	10.03	0.80	32.34	6.69	42.37	7.49	25.91	11.72	36.23	28.92
Chitandzana	3.85	3.43	9.43	16.15	12.66	19.58	26.38	15.82	32.90	32.53
Jogó	4.60	1.32	23.17	13.58	27.77	14.90	15.77	11.23	31.01	32.97
Xiadlaxakau	12.14	4.21	21.37	21.58	33.50	25.79	37.04	15.66	31.65	29.40
Xitsekele	7.30	3.50	40.04	22.03	47.34	25.53	14.31	13.59	34.10	28.69
Chissicuana-1	4.06	0.86	11.62	11.14	15.68	12.00	25.83	8.00	34.00	31.36
Nhacutse-4	4.62	3.01	11.06	9.36	15.68	12.37	29.45	21.06	32.08	30.08
Jogó-2	6.08	0.87	45.58	20.70	51.66	21.56	12.46	8.47	33.22	29.96
Manhissane	5.58	2.97	16.09	14.91	21.67	17.88	26.01	18.45	32.06	32.32
Nwamazambe	4.91	3.14	26.32	5.10	31.23	8.24	15.48	38.25	31.36	30.52
Mafambane	3.99	1.37	24.30	8.25	28.28	9.62	14.41	26.96	28.36	33.58
Nwamonguane	10.84	0.40	21.57	1.20	32.42	1.60	34.92	22.61	35.62	28.54
Chulamete	4.16	1.99	29.65	10.47	33.82	12.46	13.34	16.54	33.37	29.82
Cincominutos	3.57	2.97	39.02	9.58	42.59	12.55	8.00	29.46	32.48	31.74
Xiphone	7.71	0.84	17.56	4.15	25.28	4.99	34.39	30.58	33.70	32.23
Nwaxitsimbwane	2.88	2.52	35.37	6.47	38.25	9.00	10.68	36.12	32.40	31.31
Cacilda	6.56	1.36	30.49	5.58	37.05	6.95	17.53	15.75	33.65	31.69
Nwanaqtsjo	7.38	9.19	28.94	34.82	36.32	43.70	19.27	20.27	32.11	31.57
Ligodo	11.63	2.66	13.78	7.58	25.41	10.24	45.55	19.72	32.33	30.61
Xihetamakote	3.45	1.15	3.89	25.23	7.35	26.37	49.29	5.30	31.34	33.85
Ximitakwatse	11.82	0.72	50.67	20.25	62.49	20.97	20.10	4.31	34.86	35.83
Tanzania	**4.92**	**4.74**	**32.71**	**20.25**	**37.63**	**24.99**	**13.26**	**22.22**	**30.95**	**33.08**

Table 4a. Continued.

	Storage root yield, Mg ha^{-1}		Vine yield, Mg ha^{-1}		Biomass, Mg ha^{-1}		Harvest index, %		Root dry matter, %	
Name	I	NI	I	NI	I	NI	I	NI	I	NI
MgCl01	5.97	1.21	13.72	6.03	19.69	7.24	30.03	16.52	31.91	35.03
Moz-White	7.59	3.72	7.85	6.92	15.44	10.64	49.23	31.56	32.83	30.80
SPK004	1.01	1.72	11.59	16.69	12.6	18.42	8.39	10.10	31.99	34.77
$\bar{x}$ Farmer varieties	6.40	2.26	26.58	12.81	32.97	15.06	22.32	17.58	32.51	31.82
	Breeding Lines and Modern Varieties									
Tacna	13.48	3.18	31.79	11.80	45.27	14.98	30.11	19.19	30.46	32.79
NASPOT5	2.98	3.89	56.46	17.14	59.44	21.03	5.44	19.09	35.67	34.21
Mamphenane	10.88	0.53	12.18	7.25	23.06	7.78	47.13	6.43	27.30	31.07
Maphuta	2.19	0.92	9.19	10.53	11.38	11.44	19.20	7.63	31.93	29.37
199062.1	20.16	6.02	25.82	3.81	45.98	9.83	45.95	58.55	29.83	26.48
ST87-030	10.98	1.96	20.51	4.38	31.49	6.34	38.72	29.45	35.95	33.79
440203	4.38	1.06	33.16	5.58	37.54	6.64	11.68	16.90	33.52	33.21
Atacana	14.45	3.28	19.79	5.80	34.23	9.08	44.71	33.97	31.94	30.65
1998-12-3	19.37	1.23	16.58	6.92	35.95	8.15	53.92	14.97	28.90	29.28
IS9265	4.89	0.70	6.68	1.95	11.57	2.65	43.59	27.04	26.83	31.60
Resisto	**12.04**	**3.28**	**12.31**	**6.70**	**24.35**	**10.68**	**49.35**	**32.43**	**29.08**	**31.04**
Jonathan	**10.94**	**1.23**	**9.83**	**6.69**	**20.76**	**7.93**	**52.82**	**12.48**	**27.48**	**31.93**
Japon	7.19	2.39	9.14	5.58	16.33	7.97	44.39	25.24	26.50	25.12
CN-448-49	1.94	1.14	10.72	2.96	12.66	4.11	15.22	26.40	27.76	24.39
Tainung-64	3.47	1.28	10.06	11.01	13.53	12.29	30.04	13.01	28.91	34.07
Cordner	6.53	0.90	8.86	7.70	15.39	8.60	43.70	10.47	29.62	28.67
TIS-2534	3.43	5.11	17.42	2.98	20.85	8.10	15.93	66.46	27.79	28.22
Lo-323	5.80	2.45	11.52	3.02	17.34	5.47	34.57	44.37	28.44	24.68
$\bar{x}$ Breeding Lines & Modern Varieties	8.62	2.25	17.89	6.77	26.51	9.06	34.80	25.78	29.88	30.03
LSD (0.05)	3.09		12.24		12.93		16.70		2.27	
Heritab										

Table 5. Variance components and operational broad-sense heritabilities of observed traits[†].

Trait	σ_G^2	σ_S^2	σ_T^2	σ_{SxT}^2	σ_{GxS}^2	σ_{GxT}^2	σ_{GxSxT}^2	σ_ε^2	h^2
TYLD	3.358*	3.351	0.497	2.790*	9.428**	1.644*	4.293**	12.915	38.35
	(1)	(0.997)	(0.148)	(0.831)	(2.808)	(0.490)	(1.278)	(3.846)	
VYLD	52.01**	17.355	30.399+	3.884	23.260**	6.78*	15.06**	75.14	74.48
	(1)	(0.337)	(0.584)	(0.075)	(0.447)	(0.133)	(0.290)	(1.445)	
BIOM	51.44**	0.910	41.337	15.91+	38.993**	8.586*	23.622**	97.98	65.85
	(1)	(0.017)	(0.804)	(0.309)	(0.758)	(0.167)	(0.459)	(1.905)	
HI	76.11**	73.360	-6.910	23.264**	63.864**	-5.579	63.839**	151.704	66.95
	(1)	(0.963)	(-0.091)	(0.306)	(0.839)	(-0.073)	(0.839)	(1.993)	
DM	5.10**	0.202	0.049	0.29*	1.73**	0.42+	1.74**	4.65	79.29
	(1)	(0.040)	(0.010)	(0.057)	(0.339)	(0.082)	(0.341)	(0.93)	

\+ significant at the 0.10 level.
* significant at the 0.05 level.
** significant at the 0.01 level.
[†] Variance components: σ_G^2 = genotypes, σ_S^2 = seasons, σ_T^2= irrigation treatments, σ_{SxT}^2=year-irrigation treatment, σ_{GxS}^2= genotype-season, σ_{GxT}^2= genotype-irrigation treatment, σ_{GxSxT}^2= genotype-year-irrigation treatment interactions, σ_ε^2= error; h^2=.operational broad-sense heritability.

Table 5b. Variance components and operational broad-sense heritabilities of observed traits[†].

Trait	σ_G^2	σ_E^2	σ_{GxE}^2	σ_ε^2	h^2
TYLD	5.901**	5.769**	12.822**	12.915	67.4
	(1)	(0.978)	(2.173)	(2.189)	
VYLD	59.375**	36.007**	37.732**	75.144	85.0
	(1)	(0.606)	(0.635)	(1.266)	
BIOM	62.668**	41.440**	59.969**	97.98	80.2
	(1)	(0.661)	(0.957)	(1.563)	
HI	86.655**	77.806	111.584**	151.704**	76.2
	(1)	(0.898)	(1.288)	(1.751)	
DM	5.874**	0.481**	3.234**	4.647	88.1
	(1)	(0.082)	(0.551)	(0.791)	

\+ significant at the 0.10 level.
* significant at the 0.05 level.
** significant at the 0.01 level.
[†] Variance components: σ_G^2 = genotypes, σ_E^2= environment, σ_{GxE}^2= genotype-environment, interactions, σ_ε^2= error; h^2=.operational broad-sense heritability.

Table 6. An ANOVA for genotype (G) by environment (E) interaction (GxE) with subdivision (SUB) of GxE interactions using regression analysis for storage root yield, biomass, and harvest index (Het.R. = heterogeneity due to regression, Dev. R. deviations from regression lines).

Trait	Effect	df	MS	σ^2	Rel. σ^2
Storage root Yield	E	5	1142.26	5.77**	97.8
	G	57	157.60	5.90**	100
	G x E	285	51.38	12.82**	217.3
	SUB Het. R.G	57	71.54	1.40*	**10.9**†
	Dev. R.G	228	46.34	11.14**	86.9†
	SUB Het. R.E	5	240.18	1.10**	**8.6**†
	Dev. R.E	280	48.01	11.70**	91.2†
	Error	596	12.92	12.91	223.9
Biomass	E	5	8600.35	41.44**	66.1
	G	57	1405.90	62.67**	100
	G x E	285	277.89	59.97**	95.7
	SUB Het. R.G	57	423.29	10.10**	**16.8**†
	Dev. R.G	228	241.54	47.85**	79.8†
	SUB Het. R.E	5	3686.79	19.94**	**33.3**†
	Dev. R.E	280	217.012	39.68**	66.2†
	Error	606	97.98	97.98	156.4
Harvest Index	E	5	14345.31	77.81**	89.8
	G	57	2046.25	86.66**	100
	G x E	285	486.46	111.58**	128.8
	SUB Het. R.G	57	922.86	30.31**	**27.2**†
	Dev. R.G	228	377.36	75.22**	67.4†
	SUB Het. R.E	5	1179.84	4.056**	**3.6**†
	Dev. R.E	280	474.08	107.46**	96.3†
	Error	588	151.70	151.70	175.1

* Significant at the 0.05 level.
** Significant at the 0.01 level.
† Relative to σ^2_{GxE}.

Was dropped because of low ratio of σ^2_{GxE} / σ^2_G

Vine Yield	E	5	7162.892	36.007**	60.64
	G	57	1257.096	59.375**	100
	G x E	285	188.341	37.732**	63.55
	SUB Het. R.G	57	422.264	16.245**	**43.05**†
	Dev. R.G	228	129.860	18.239**	48.34†
	SUB Het. R.E	5	3086.723	16.955**	**44.94**†
	Dev. R.E	280	136.584	20.480**	54.28†
	Error	621	75.144	75.144	126.55

Table 7. Estimates obtained using the dynamic concept of genotype x environment interaction and for storage root yield, biomass, and harvest index.

	TYLD			BIOM			HI		
Environments	$\bar{x}_i$	b_i	MS	$\bar{x}_i$	b_i	MS	$\bar{x}_i$	b_i	MS
With IRR 2006	5.2	1.14	10.77	31.7	1.51	48.8	18.2	0.95	123.4
Without IRR 2006	4.9	1.07	15.23	26.0	1.57	82.6	22.2	1.12	119.7
With IRR 2008	7.1	0.95	8.48	31.0	1.33	62.1	26.2	0.85	106.1
Without IRR 2008	2.3	0.30	2.28	13.2	0.52	41.6	20.1	0.61	132.4
With IRR 2009	9.0	1.53	23.87	26.4	0.63	82.6	33.6	1.17	146.4
Without IRR 2009	8.6	1.01	19.38	20.1	0.44	44.0	41.8	1.29	163.2
LSD (0.05)		0.48			0.35			0.39	
B test			**			*			Ns
Genotypes									
1 Tacna	15.6	3.21	12.66	33.8	1.25	61.4	44.1	2.12	143.7
2 Chissicuana-2	11.2	1.53	27.74	45.8	2.04	137.4	27.5	1.21	324.3
3 Nwaracu	6.3	0.97	2.10	34.6	1.85	25.4	21.8	1.40	58.7
4	3.4	-0.27	8.08	21.2	1.49	78.7	16.3	-0.17	76.1
5	6.8	1.58	13.46	22.2	0.15	33.3	30.8	1.86	38.3
6	4.5	1.03	10.73	36.4	2.00	156.6	16.6	1.49	80.1
7	5.0	1.34	6.34	19.4	-0.09	89.3	25.8	0.76	226.2
8	3.4	0.21	6.88	34.4	1.86	30.1	9.3	0.18	15.7
9z. Mamphenane	7.3	1.26	11.41	13.5	0.55	56.3	52.7	1.75	558.7
10	4.6	0.64	11.85	14.7	0.00	18.5	26.3	0.90	208.7
11	2.6	0.58	3.07	22.8	1.08	134.7	13.7	0.83	73.3
12 199062.1	11.5	0.23	51.70	27.2	2.03	50.6	47.3	0.79	218.2
13	3.9	0.74	4.85	27.4	0.99	63.6	14.4	0.88	34.2
14 ADMARC	12.0	0.04	42.28	35.6	2.60	199.1	38.3	0.41	92.1
15	2.4	0.42	1.93	39.0	1.19	110.3	6.1	0.29	10.4
16 ST87-030	9.1	2.10	8.26	22.2	1.01	125.0	44.2	0.63	62.7
17	3.1	0.54	0.51	21.4	1.75	29.5	22.2	1.60	44.1
18 Thuang-Thuang	7.2	2.11	17.21	26.9	1.93	56.3	29.3	2.62	45.7
19. Atacana	8.6	0.20	24.11	25.8	0.55	135.2	39.1	-1.90	344.7
20 1998-12-3	11.3	-0.61	121.9	21.4	1.55	64.4	41.0	-1.48	527.3
21	5.6	1.07	0.97	29.2	1.68	52.8	18.5	0.82	4.06
22	3.2	0.58	1.14	40.8	1.93	74.1	8.8	0.52	15.3
23	6.7	0.33	2.89	24.6	0.93	77.3	30.1	1.40	19.5
24z UNK-Malawe	7.2	0.93	21.15	27.0	1.29	154.6	26.5	1.13	37.4
25	5.4	0.60	17.45	26.0	1.88	60.8	17.7	0.06	49.0
26	4.1	0.50	1.32	20.7	0.03	29.0	19.1	0.66	23.4
27	2.9	0.15	1.30	28.1	0.87	33.9	10.6	-0.12	13.8
28 Xiadlaxakau	12.6	2.21	5.91	33.4	0.45	38.2	37.3	1.21	71.8
29 Xitsekele	6.8	-1.07	67.49	35.5	1.69	203.6	15.4	-0.58	147.8
30	2.8	0.61	0.79	15.6	0.26	16.3	17.2	0.50	33.1
31	5.2	0.46	3.24	22.9	0.83	112.3	26.9	1.60	57.1
32	5.2	1.61	10.0	40.1	1.56	11.9	15.5	1.58	18.4
33	6.0	1.38	6.63	20.4	0.01	30.6	26.2	1.32	25.8

34 Nwamazambe	7.7	2.18	17.39	26.0	1.21	205.1	29.1	1.29	149.6
35	2.5	0.29	0.66	19.4	0.91	8.20	16.6	0.35	60.0
36	4.6	0.65	17.94	15.3	1.54	51.8	25.9	0.61	73.1
37z Chulamete	7.0	1.11	17.58	29.7	1.13	25.4	23.6	1.23	68.3
38	6.6	1.14	7.83	33.7	1.60	31.1	22.7	0.93	95.2
39	5.4	0.24	11.24	18.8	1.29	97.8	33.5	0.41	89.8
40	3.9	0.72	8.10	27.1	1.63	192.56	22.3	1.24	198.9
41	6.9	1.83	5.21	24.3	1.54	35.7	27.8	1.97	38.3
42z Nwanaqtsjo	7.4	0.12	4.18	32.9	-0.15	85.5	22.6	0.72	31.2
43 Ligodo	11.9	2.01	59.32	28.1	1.53	133.4	41.0	1.33	72.2
44	4.1	0.80	2.10	29.3	0.12	219.1	19.9	1.01	282.5
45	2.5	0.44	1.3	10.1	0.66	9.0	24.7	0.19	144.2
46z Ximitakwatse	7.5	1.51	19.12	41.0	2.61	121.3	19.6	1.25	179.2
47 Resisto	6.2	0.52	10.11	16.4	0.63	29.8	40.5	0.64	67.5
48 Jonathan	6.8	2.23	16.23	14.2	0.17	88.6	40.3	2.02	149.3
49	6.0	1.64	10.41	14.6	0.12	86.8	36.2	1.59	54.4
50	3.6	1.23	6.80	10.4	0.16	32.7	29.3	2.08	83.2
51	6.6	2.58	24.47	13.7	-0.34	151.5	41.2	2.37	117.2
52	5.1	0.87	1.45	14.2	0.52	3.5	34.9	1.58	88.7
53 Tanzania	7.7	1.90	19.99	30.1	0.72	17.9	27.7	2.44	93.6
54 TIS-2534	9.5	3.05	59.80	20.5	0.55	131.2	40.8	2.40	727.2
55	2.5	0.57	3.54	14.6	0.44	12.3	21.9	0.40	112.2
56	4.3	0.79	15.02	13.8	0.07	75.4	30.9	1.25	318.2
57	6.5	1.91	9.90	15.5	0.34	128.3	38.2	1.14	106.5
58	2.1	0.48	3.48	11.0	-0.17	64.2	19.0	1.33	67.7
LSD (0.05)		1.89			1.48			1.52	**
B-test			**			+			

Table 8. Estimates obtained using the static concept of genotype x environment interaction for harvest index and storage root dry matter content.

Name	TYLD		BIOM		HI		RDM	
	mean	σ_i^2	mean	σ_i^2	mean	σ_i^2	mean	σ_i^2
Tacna	15.6	77.80	33.8	125.82	44.1	485.99	30.8	4.29
Chissicuana-2	11.2	37.65	45.8	315.39	27.5	379.96	32.7	7.99
Nhacutse-5	6.3	7.87	34.6	189.76	21.8	209.00	31.8	1.08
Nwaracu	3.4	6.95	21.2	172.24	16.3	63.36	32.1	2.28
Nwazambane	6.8	27.17	22.2	27.72	30.8	316.81	32.2	1.16
NASPOT5	4.5	15.55	36.4	322.57	16.6	245.84	35.8	2.97
Malawe	5.0	16.91	19.4	71.81	25.8	228.85	30.9	10.72
Nhacoongo-1	3.4	5.79	34.4	193.93	9.3	15.30	35.8	3.27
Mamphenane	7.3	19.61	13.5	60.12	52.7	699.19	29.5	8.66
Maphuta	4.6	12.17	14.7	14.79	26.3	233.57	33.5	8.43
Nwamanhiça	2.6	4.66	22.8	165.42	13.7	115.08	34.2	7.76
199062.1	11.5	41.70	27.2	243.52	47.3	226.58	27.6	4.28
Nhacutse-3	3.9	7.43	27.4	99.43	14.4	91.41	33.5	3.28
ADMARC +++	**12.0**	**33.83**	**35.6**	**494.14**	**38.3**	**87.44**	**33.7**	**9.58**
15. Diliva	2.4	2.72	39.0	158.74	6.1	15.40	36.5	11.23
ST87-030	9.1	35.61	22.2	150.81	44.2	82.68	35.9	2.93
440203	3.1	2.33	21.4	175.57	22.2	246.45	34.4	2.20
Thuang-Thuang	7.2	43.00	26.9	228.91	29.3	604.20	32.0	3.75
Atacana	8.6	19.55	25.8	123.09	39.1	574.46	32.2	0.73
1998-12-3	11.3	99.91	21.4	169.47	41.0	603.56	28.2	0.82
Chissicuana-3	5.6	8.22	29.2	180.95	18.5	58.17	33.2	0.15
Nhacutse-1	3.2	3.09	40.8	243.25	8.8	34.11	32.4	2.63
Canassumana	6.7	3.02	24.6	104.81	30.1	177.07	33.8	0.89
UNK-Malawe	7.2	22.55	27.0	206.48	26.5	134.94	33.3	2.05
25.Nhacutse-2	5.4	16.33	26.0	224.10	17.7	39.48	34.1	8.02
Chitandzana	4.1	2.72	20.7	23.26	19.1	54.78	31.9	6.43
Jogó	2.9	1.19	28.1	64.07	10.6	12.28	34.0	4.79
Xiadlaxakau	12.6	36.69	33.4	40.50	37.3	178.45	32.0	2.72
Xitsekele	6.8	61.50	35.5	304.48	15.4	145.60	33.2	5.54
Chissicuana-1	2.8	3.05	15.6	16.50	17.2	46.92	31.7	5.25
Nhacutse-4	5.2	3.97	22.9	124.24	26.9	256.10	30.1	14.15
32. Jogó-2	5.2	24.94	40.1	129.32	15.5	219.66	33.2	5.46
Manhissane	6.0	17.86	20.4	24.49	26.2	165.02	32.3	2.37
Nwamazambe	7.7	45.19	26.0	235.98	29.1	256.81	31.7	0.45
Mafambane	2.5	1.07	19.4	47.85	16.6	58.11	31.9	8.41
Nwamonguane	4.5	17.10	15.3	159.30	25.9	89.85	33.3	12.52
Chulamete	7.0	22.21	29.7	82.98	23.6	178.71	32.7	2.29
Cincominutos	6.6	14.71	33.7	149.44	22.7	146.63	33.1	3.27
Xiphone	5.4	9.36	18.8	160.73	33.5	85.49	31.7	7.76

Nwaxitsimbwane	3.9	9.86	27.1	285.26	22.3	285.92	33.2	3.91
Cacilda	6.9	26.09	24.3	146.44	27.8	349.62	34.6	2.85
Nwanaqtsjo	7.4	3.44	32.9	69.55	22.6	67.46	32.0	2.58
Ligodo	11.9	73.99	28.1	222.61	41.0	202.63	32.8	1.59
Xihetamakote	4.1	5.86	29.3	175.94	19.9	310.50	33.6	2.54
45. TIS9265	2.5	2.26	10.1	28.66	24.7	118.17	29.2	6.09
Ximitakwatse	7.5	30.23	41.0	434.66	19.6	271.81	35.2	8.32
Resisto	**6.2**	**9.86**	**16.4**	**43.48**	**40.5**	**87.23**	**32.0**	**2.01**
Jonathan	**6.8**	**45.56**	**14.2**	**72.30**	**40.3**	**455.86**	**27.8**	**12.14**
Japon	6.0	26.05	14.6	70.14	36.2	252.51	25.8	4.04
CN-448-49	3.6	15.43	10.4	27.38	29.3	423.42	25.7	11.97
Tainung-64	6.6	63.41	13.7	127.08	41.2	557.01	26.6	17.18
Cordner	5.1	6.18	14.2	16.38	34.9	277.01	29.7	5.94
Chingova = Tanzania	**7.7**	**39.73**	**30.1**	**39.85**	**27.7**	**565.10**	**34.3**	**4.48**
TIS-2534	9.5	108.8	20.5	120.0	40.8	1057.29	28.3	1.52
MgCl01	2.5	4.95	14.6	19.23	21.9	103.20	33.1	4.50
Moz-White	4.3	16.08	13.8	60.57	30.9	384.63	33.4	2.38
Lo-323	6.5	31.98	15.5	108.33	38.2	193.17	25.7	14.64
SPK004	2.1	4.26	11.0	52.75	19.0	199.61	33.4	4.27
LSD								
Lev								

Table 9. Pearson Correlation Coefficients, N = 58

Trait	YMean	HIMean	HIinter	Hientry	YPCA1
HIMean	0.698***				
HIinter	0.346**	0.423**			
Hientry	0.419**	0.572***	0.742***		
YPCA1	0.532***	0.437***	0.640***	0.501***	
YPCA2	0.370**	0.210	0.055	0.223+	-0.047

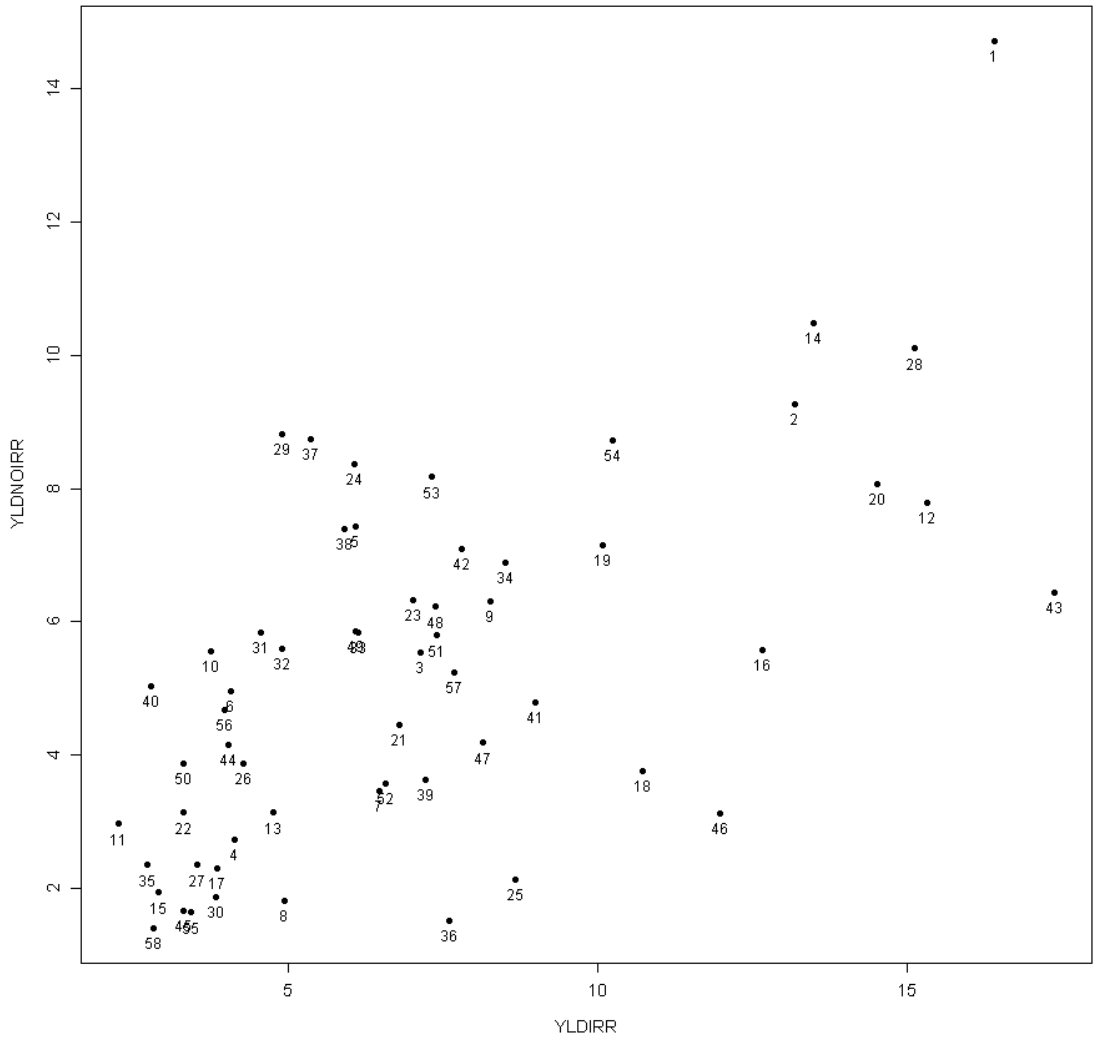
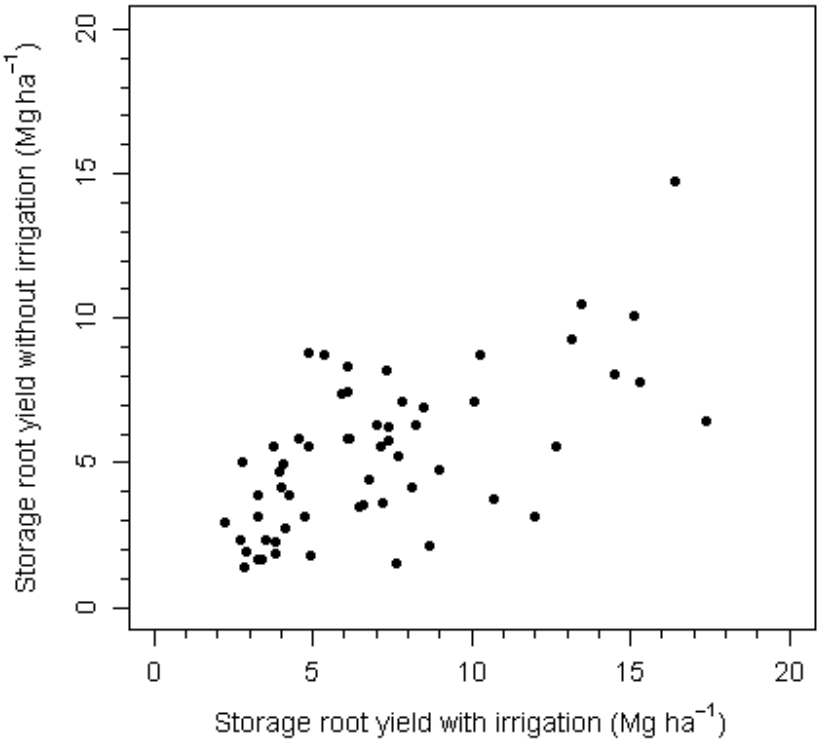


Figure 1. Biplot Root yield under irrigation and no irrigation.



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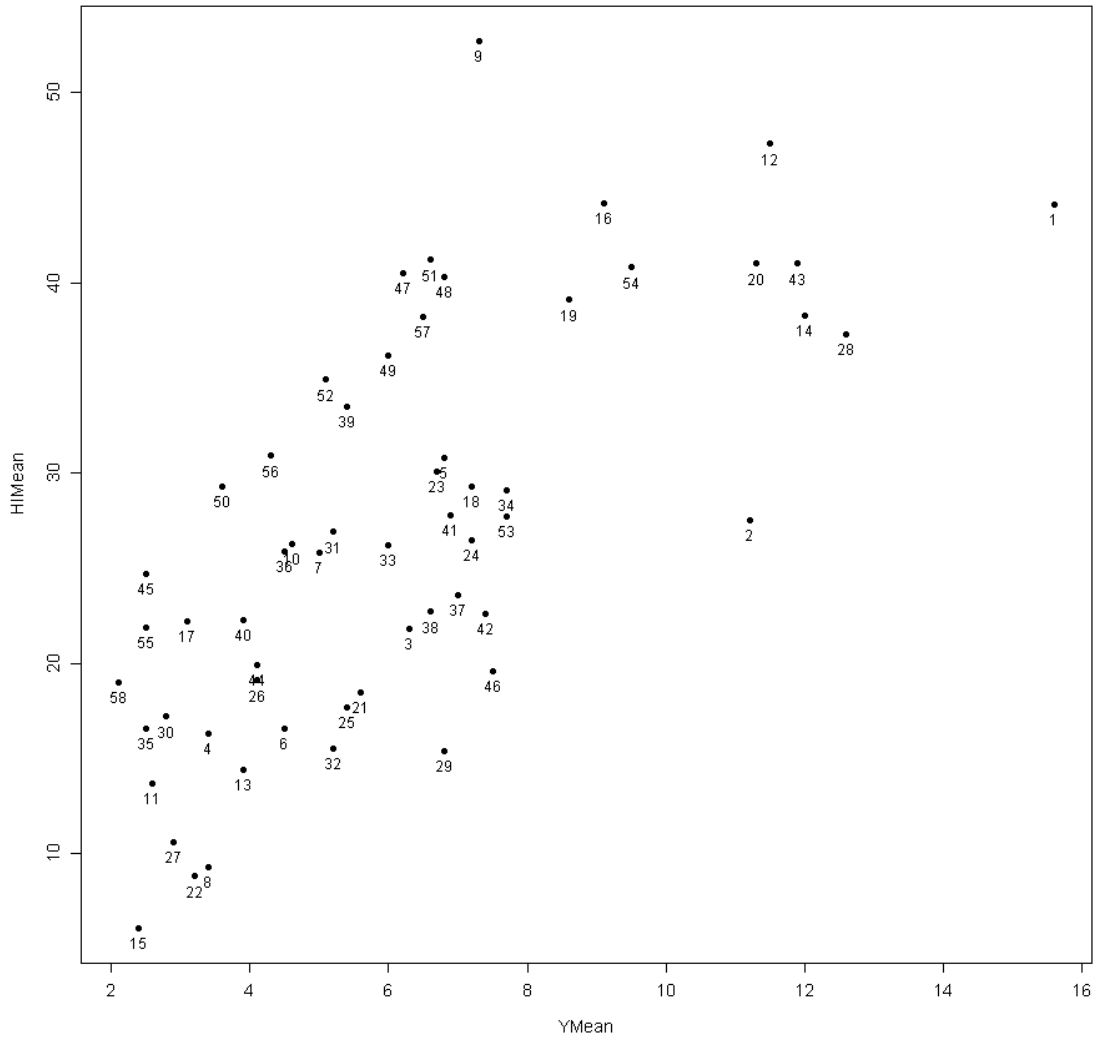


Figure 2. Bi_Plot for HI Mean and Root means

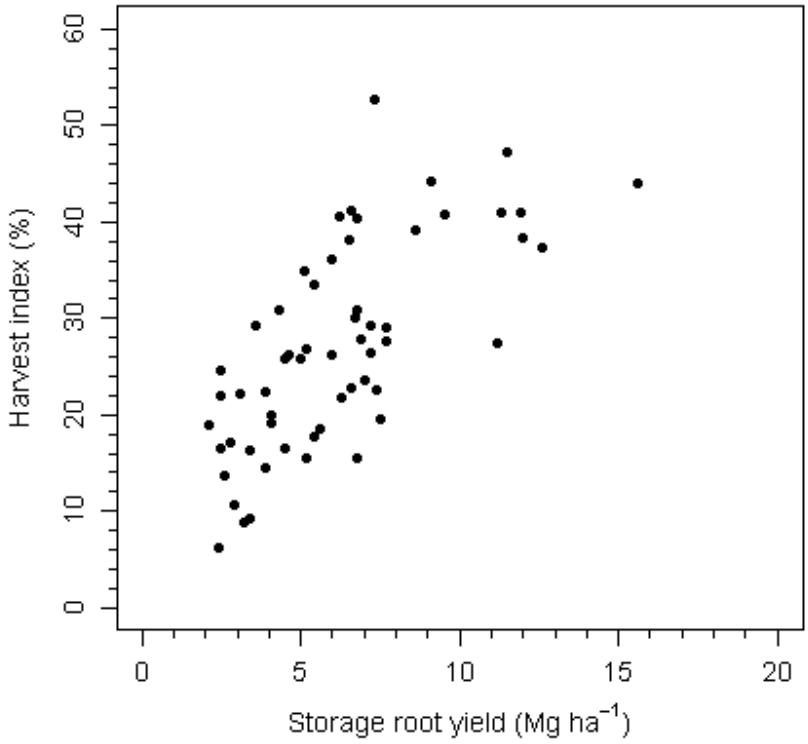
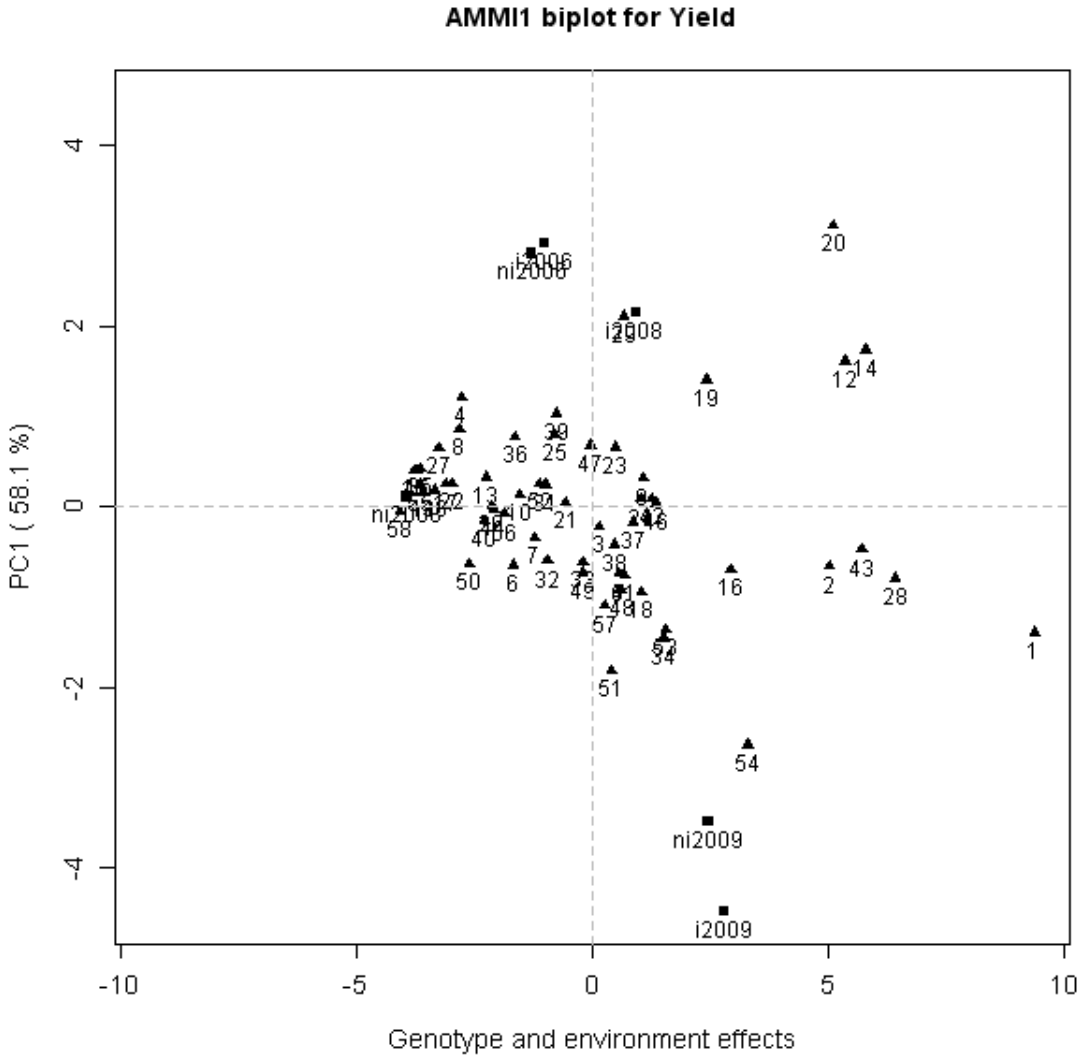


Figure 2$. Bi_Plot for HI Mean and Root means



Additive main effect for storage root yield (Mg ha^{-1}); general mean: 6.19 (Mg ha^{-1}).

Fig. 3. The AMMI biplot of 58 sweetpotato clones evaluated for storage root yield in 6 environments at Umbeluzi in Mozambique.

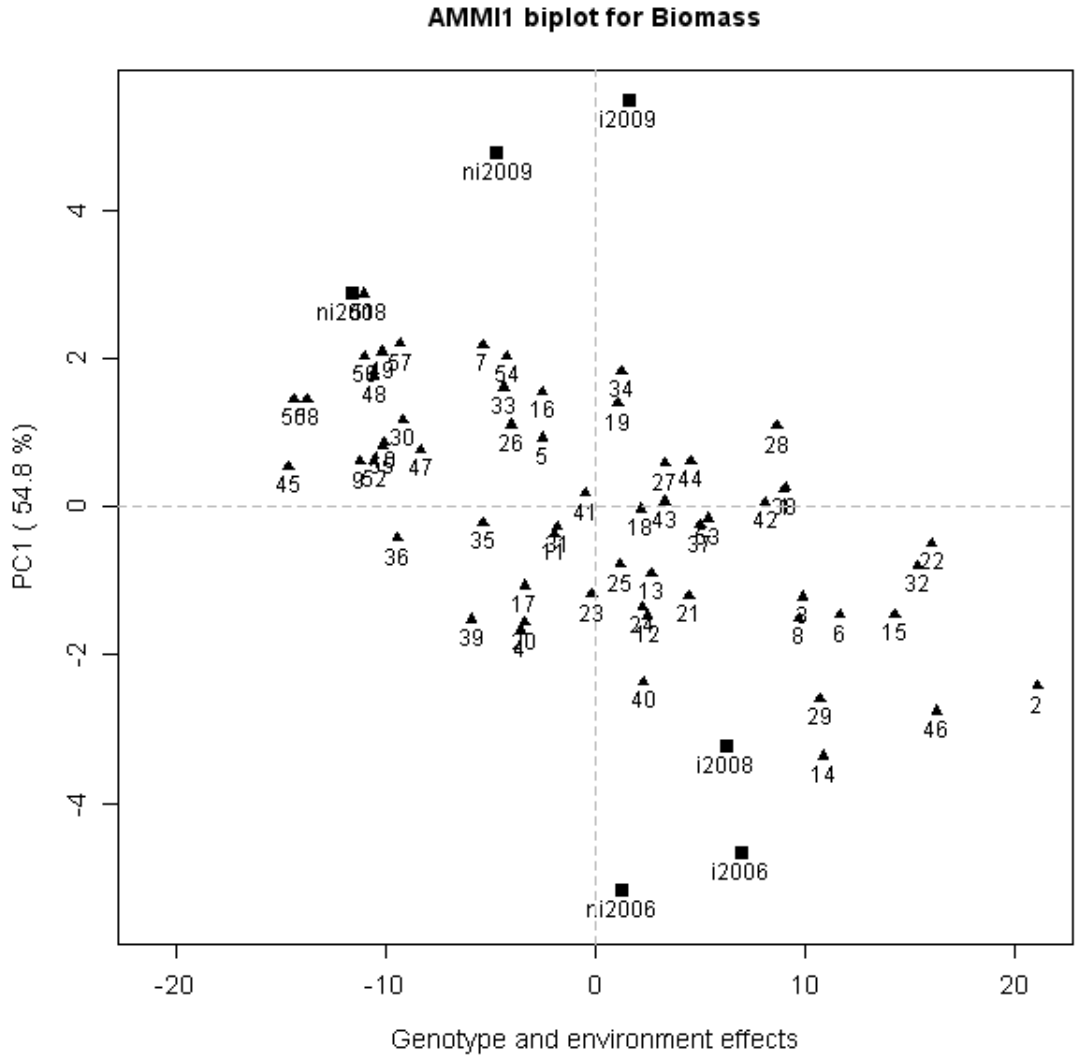


Fig. 4. The AMMI biplot of 58 sweetpotato clones evaluated for biomass production in 6 environments at Umbeluzi in Mozambique.

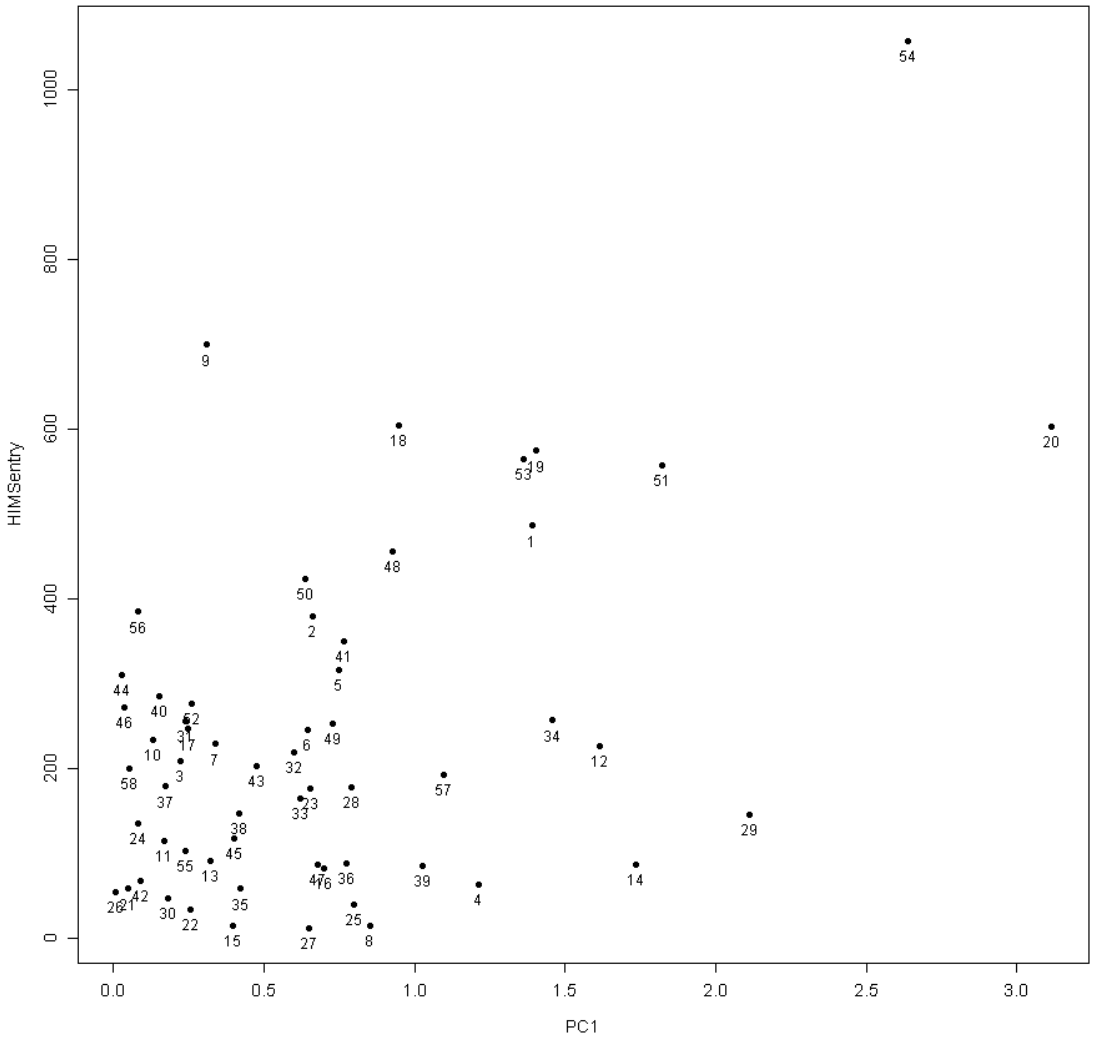
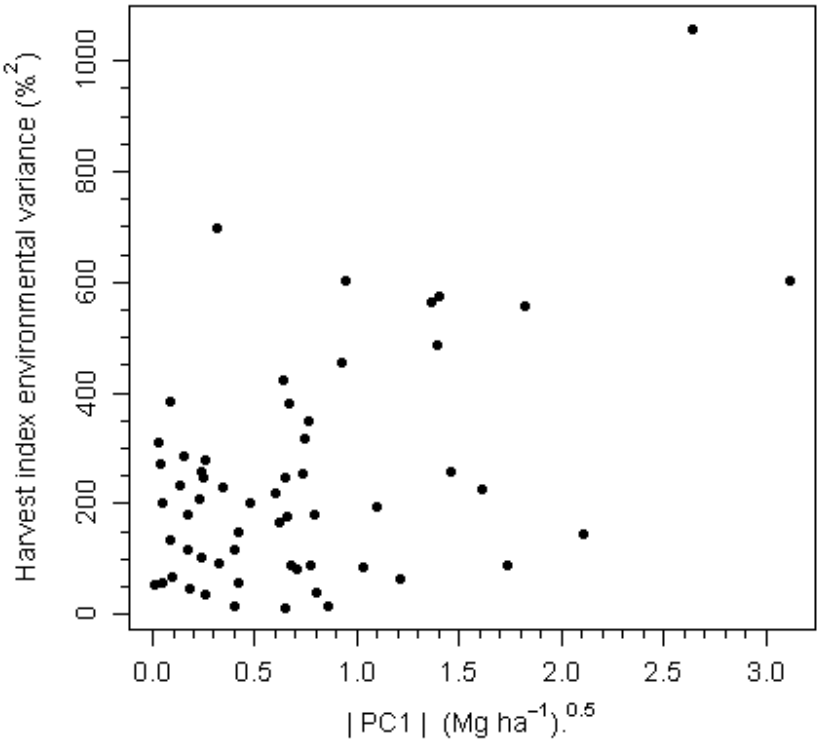


Figure 5. Bi_Plot ABS(PCA1) x HI environmatal sigma



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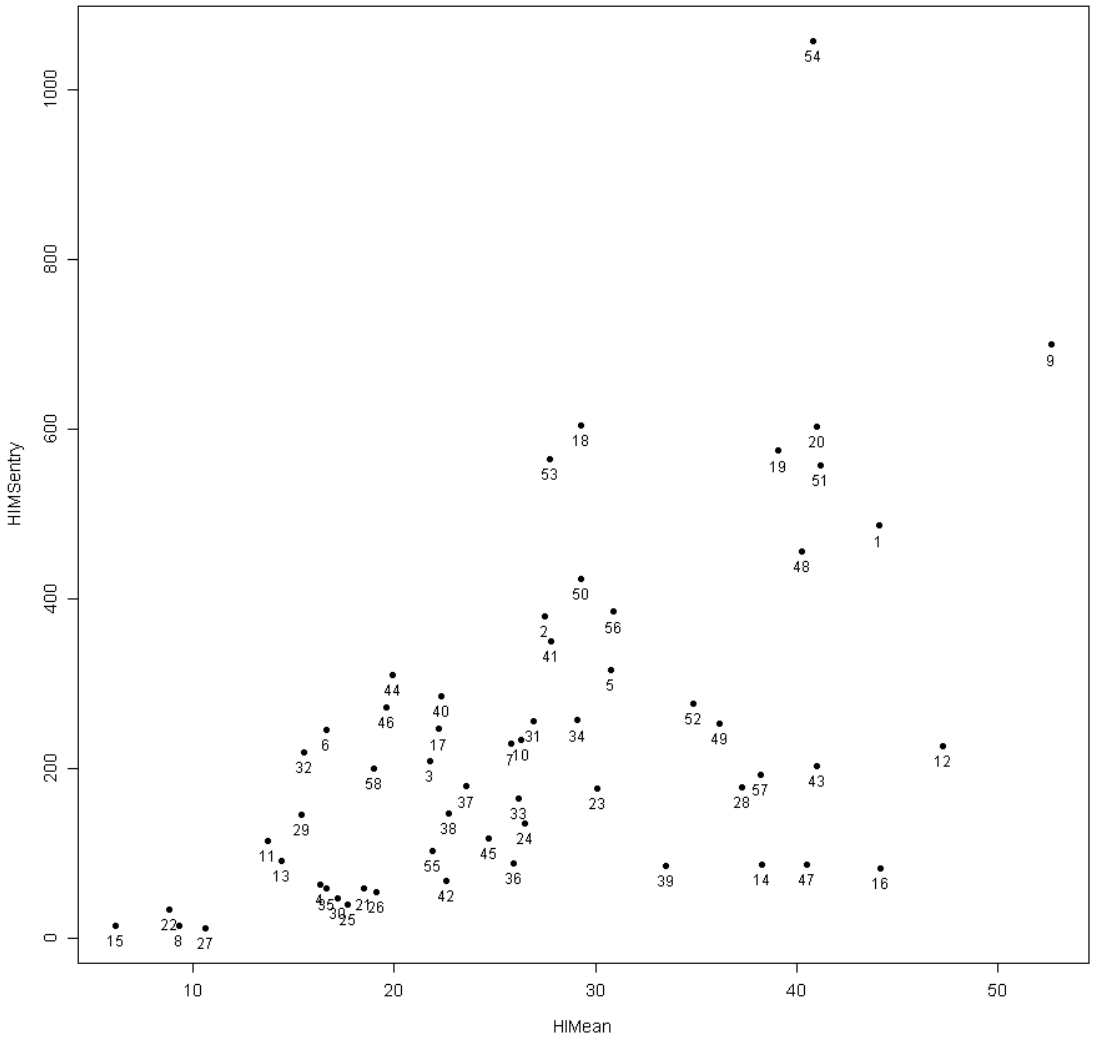

Figure 6. Bi_Plot HIMean x HI environmatal sigma

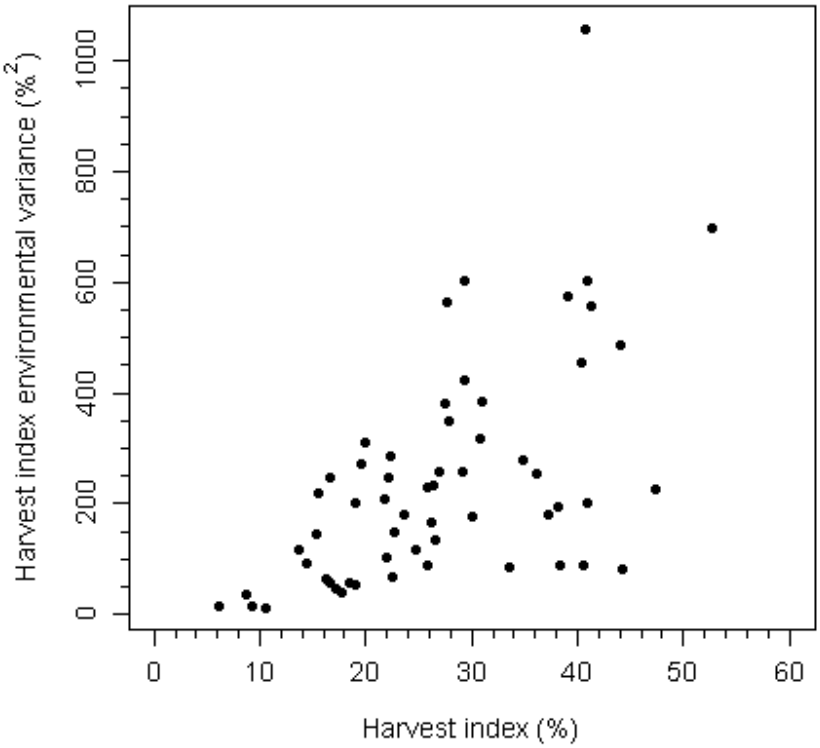

Figure 6$. Bi_Plot HIMean x HI environmatal sigma