Determining the Adaptability of Medium Staple *Gossypium Hirsutum L.* Genotypes to the Agro-ecological Conditions of the Lowveld of Zimbabwe

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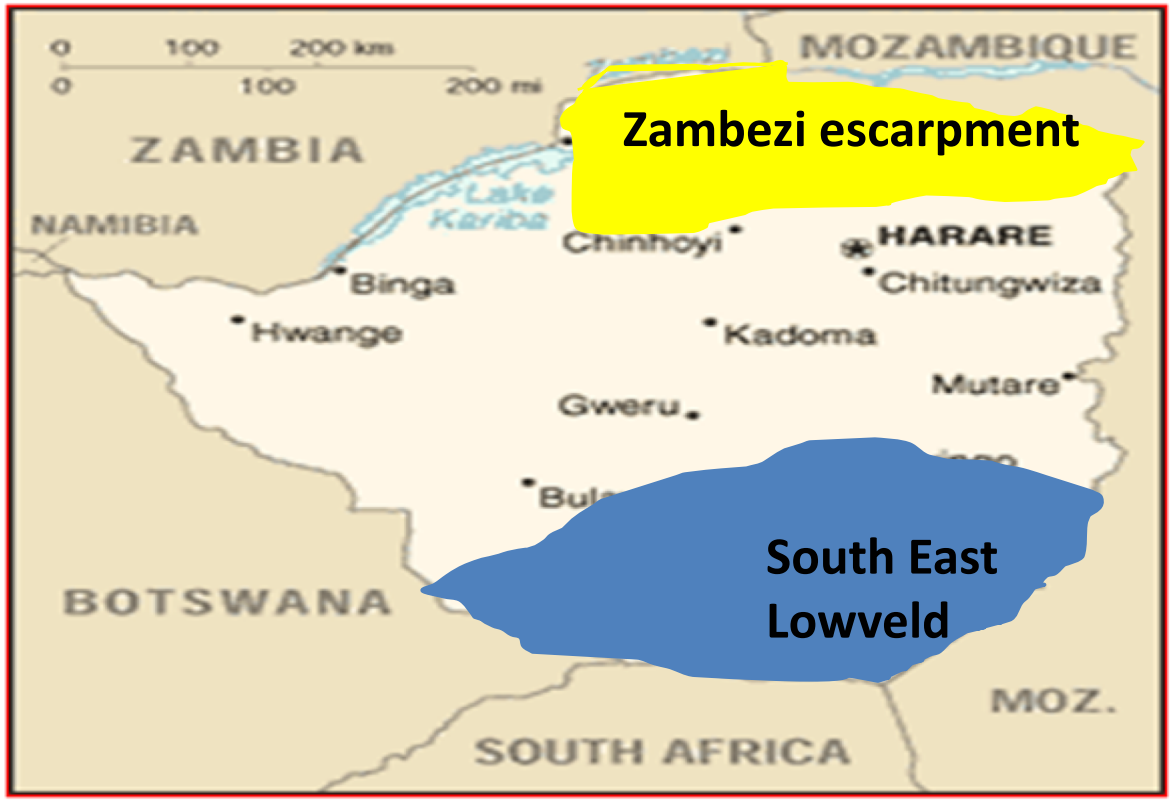
Introduction

✓The Lowveld – 200 to 600 m.a.s.l



✓Cotton production in this mega environment contributes close to 15% of annual cotton production

Introduction

- ✓ The MSL program provides cotton varieties for this important mega environment
- ✓ Current varieties suitable for this region: CRI-MS-2
- ✓ There is need to add to this basket of varieties

Objectives

- ✓ To identify superior genotypes for the Lowveld conditions.
- ✓ To identify ideal environments for testing Lowveld cotton genotypes

Methodology

MSL genotype evaluation trial was implemented for 4 seasons (2013/14- 2016/17) across 9 sites (see table 1).

MSLV3: had a total of 11 genotypes with 8 experimental lines and 3 commercial varieties.

Table 3: Treatments.

Treatment No	MSLV 3 Trial
1	812-01-3
2	820-01-1
3	83-01-4
4	830-01-3
5	830-01-7
6	831-01-3
7	85-01-1
8	89-01-2
9	CRI-MS-1
10	CRI-MS-2
11	SZ9314

Table 1: Site characterisation

	Environment								
Characteristic	***Chitekete***	***Kadoma***	***Tokwane***	***Chisumbanje***	***Masakadza***	***Dande***	***Umguza***	***Chizvirizvi***	***Muzarabani***
Latitude	17º 25' south	18º 19' south	25º 47' south	20º 48' south	17º25' south	16º33' south	20º20' south	21º00' south	17º 48' south
Longitude	16º 28' east	29º 53' east	31º 15' east	32º 14' east	16º28' east	30º58 'east	28º71' east	32º01' east	31º 05' east
Altitude (m)	914	1156	400	300	914	600	1200	400	600
Ave annual rainfall (mm)	650-800	750-1000	350-650	450-500	450-650	600-800	550-575	300 - 600	600-800
Max temp ºC	45	38	37	40	45	36	38	38	42
Soil properties	Black vertisols	MG/SCL	Black soils	Black vertisols	Black vertisols	Rhizoidal soils	Red clay soils	Black alluvial vertisols	Clay alluvial
Natural farming region (Zimbabwe)	4	2b	4	5	4	4	4	5	4

Table 2: Design and crop management.

Experimental Design	RCBD with 3 replications
Plot size and seed rate	5 rows x 6m x 1m x 0.30m at a seed rate of 20kg/ha. And later thinned to 1 plant/station at 3 weeks
Fertiliser used	Compound L fertiliser at 250 kg per hectare and Ammonium nitrate (34.5% N) at 150 kg per hectare at the ninth week after crop emergence
Weeding	Done three times at all sites to remove weeds as necessary
Data Collection	**Field** - Total seed cotton yield (TSC), Gin out turn (GOT %), Earliness Index (EI%), boll weights, Lint yield, seed size **Fibre** - staple length, mean length, micronaire, length uniformity (LUI%), strength and elongation
Pest control	Pest control was done following the recommended scouting technique.

Data analysis

- ✓ Genstat 18th edition, was used for analysis of variance (ANOVA) and further partitioning of variance of components.
- ✓ Fisher's Protected LSD was used for mean separation at 5% level.

- ✓ GGE biplots:
  - to explain relations between the genotypes and environments
  - Identify mega, representative and ideal environments.

- ✓ PREMIER ART 2 High Volume Instrument (HVI) was used for fibre testing.

Results and discussions

Medium staple Lowveld variety 3 trial (MSLV3)

Table 4. Field performance of MSLV3 genotypes

Genotype	Boll weight (g)	TSC (kg ha^{-1})	EI (%)	GOT (%)	LY (kg ha^{-1})	100 swt (g)
812-01-3	5.94d	1774bc	74.34	43.40	658.3bc	11.19g
820-01-1	5.78bc	1751b	74.94	42.37	631.4ab	10.96def
83-01-4	5.88cd	1896d	75.20	42.17	690.5c	10.90cde
830-01-3	5.77bc	1824bcd	76.22	43.12	680.8c	11.06efg
830-01-7	5.68ab	1856bcd	75.91	42.16	668.7bc	10.76bc
831-01-3	5.57a	1807bcd	76.63	43.01	678.7bc	10.54a
85-01-1	5.85cd	1865cd	75.91	41.89	666.9bc	11.12fg
89-01-2	5.76bc	1888d	75.63	43.20	694.5c	10.86cd
CRI-MS-1	5.81bcd	2158e	76.90	43.02	763.0d	11.04defg
CRI-MS-2	5.70ab	1882d	75.56	42.82	689.3c	10.61ab
SZ9314	5.70abc	1334a	70.68	43.58	582.6a	10.57ab
LSD	0.14	67.93	1.39	1.253	48.31	0.1941
F-probability	<.001	0.010	0.218	0.126	0.050	<.001
CV %	7.71	18.43	9.11	8.29	22.90	5.05

Table 5. Fibre performance of MSLV3 genotypes

Genotype	Staple (mm)	Mean Length (mm)	Micronaire (ug/inch)	UL (%)	Strength (g/tex)	Elongation (%)
830-01-3	28.5	24.1	4.6	81.7	32.1	6.5
89-01-2	28.6	24.1	4.6	84.2	32.2	6.6
85-01-1	27.7	23.1	4.4	81.6	31.0	6.4
831-01-3	27.4	23.0	4.5	81.7	31.3	6.5
820-01-1	28.3	23.9	4.3	82.1	31.6	6.5
812-01-3	27.4	23.2	4.2	79.7	31.1	6.3
830-01-7	28.6	24.1	4.6	84.4	32.1	6.5
83-01-4	27.8	23.5	4.4	81.9	30.9	6.2
SZ9314	28.0	23.7	4.5	82.8	31.2	6.4
CRI-MS-1	27.5	23.1	4.3	79.6	31.0	6.3
CRI-MS-2	28.0	23.6	4.7	83.7	31.1	6.5
F prob	0.906	0.849	0.219	0.716	0.904	0.835
LSD	1.05	1.61	0.214	5.22	2.11	0.43
CV	14.2	14.8	18.2	1.7	13.7	14.3

Table 6. Variance components and their percentage (in brackets) contribution to the total variance for cotton fibre yield and related traits for MSLV 3 varieties

Source of variation	Seed cotton yield	Boll weight	Earliness Index	Gin out turn	Lint Yield	100 seed weight
Season	1372666 (16.0)	0.37 (1.49)	91.17 (3.05)	0.00 (0.0)	292471 (24.5)	0.25 (4.68)
Site	221340 (2.58)	0.25 (1.00)	75.08 (2.5)	1.51 (1.54)	35335 (2.95)	0.31 (5.69)
Genotype	1318 (0.02)	0.01 (0.03)	0.23 (0.01)	0.10 (0.10)	155 (0.01)	0.03 (0.51)
Season x Site	6873760 (80.0)	2.65 (10.7)	2774.90 (92.7)	83.17 (84.5)	844490 (70.6)	4.49 (83.1)
Season x Genotype	935 (0.01)	0.0003 (0.001)	0.10 (0.003)	0.09 (0.09)	332 (0.03)	0.02 (0.34)
Site x Genotype	10 (0.0001)	0.005 (0.02)	0.72 (0.02)	0.15 (0.15)	138 (0.01)	0.001 (0.02)
Season x Genotype x Site	4265 (0.05)	21.38 (86.0)	3.21 (0.11)	0.70 (0.71)	231 (0.02)	0.01 (0.13)
Residual	115114 (1.34)	0.20 (0.8)	48.45 (1.62)	12.55 (12.8)	22700 (1.90)	0.30 (5.57)
Environments	8467765 (98.6)	3.26 (13.1)	2941.14 (98.2)	84.69 (86.2)	1172296 (98.0)	5.05 (93.4)
Genotype x Environment (GE)	5209 (0.06)	21.38 (86.0)	4.03 (0.13)	0.94 (0.95)	701.68 (0.06)	0.03 (0.49)
GE/G	3.95	3341.88	17.42	9.65	4.54	0.97

Figure 1. Mega environments suitable for medium staple Lowveld 3 (MSLV 3) cotton varieties

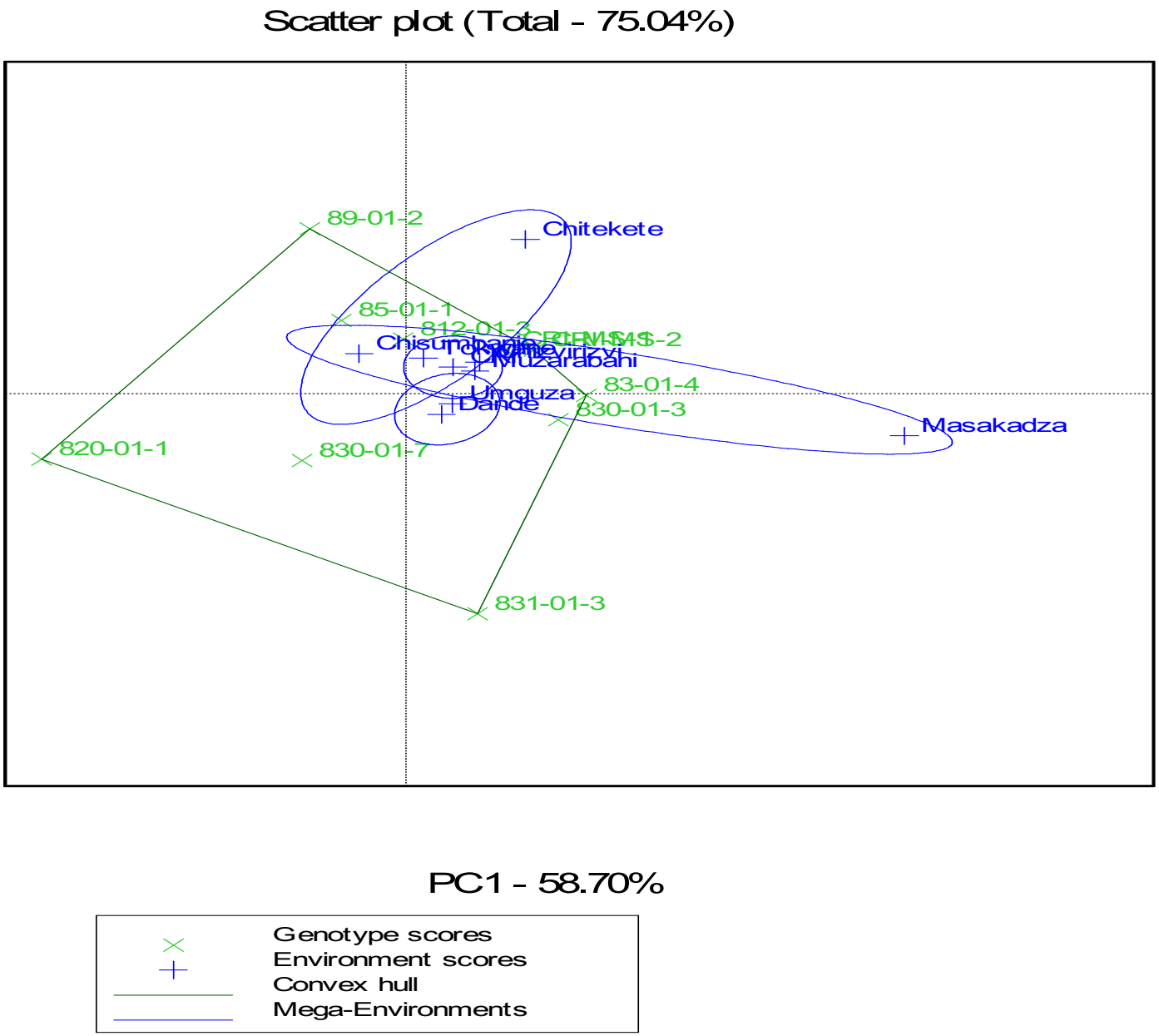


Figure 2. Which-won-where medium staple Lowveld 3 cotton varieties

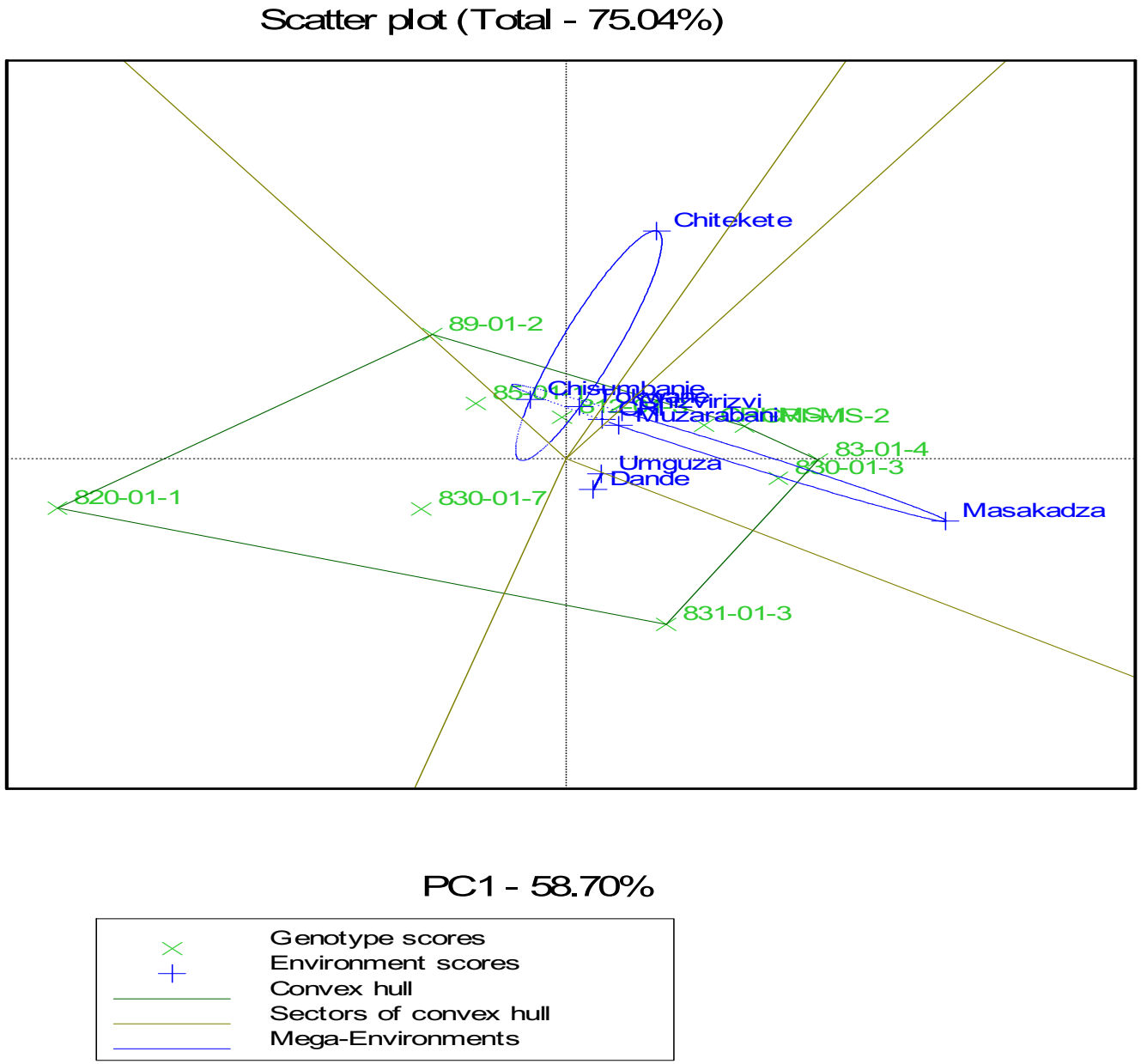


Figure 3. Ideal genotype for the Lowveld conditions cotton

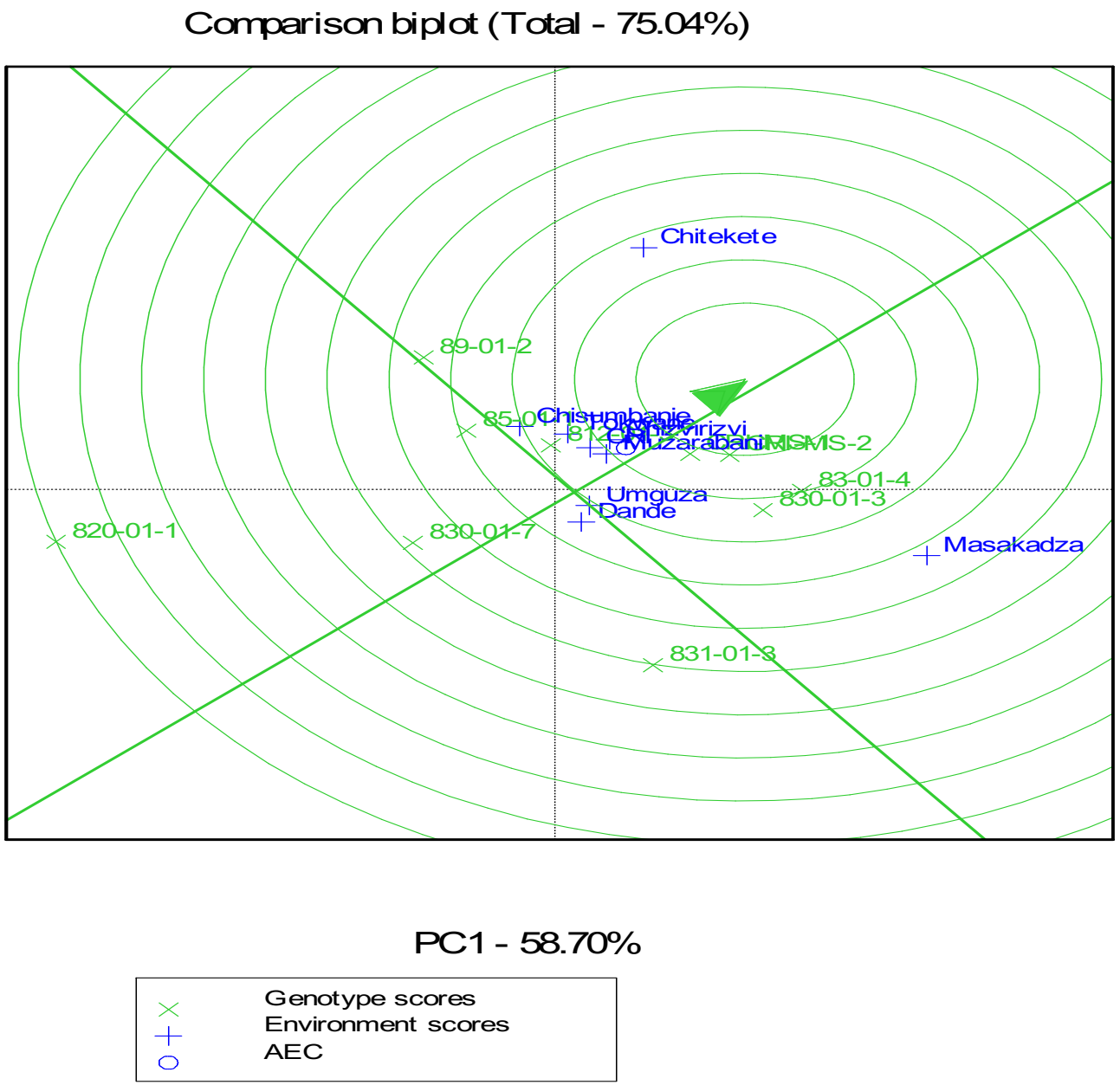


Figure 4. Ideal test locations for the medium staple Lowveld 2 cotton varieties

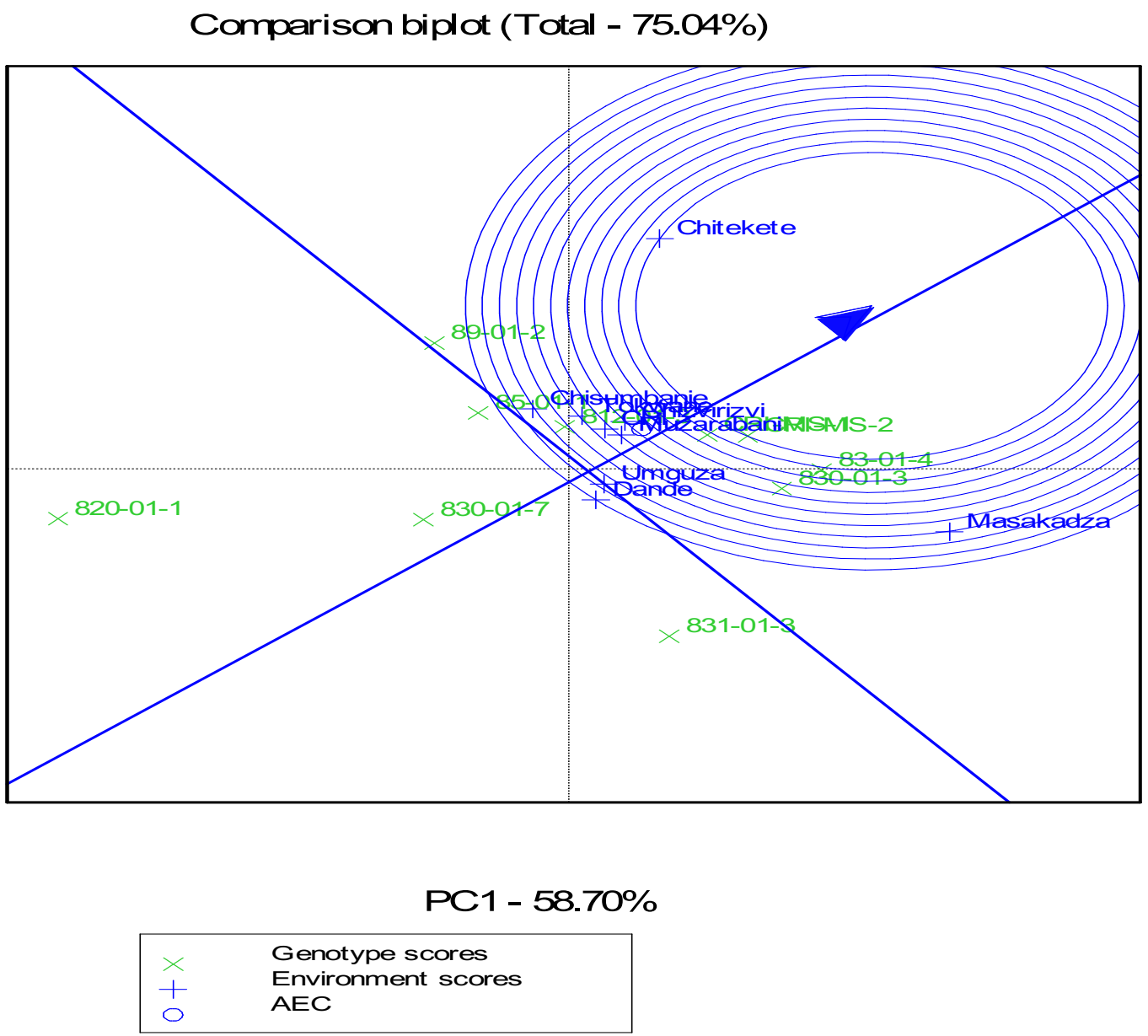
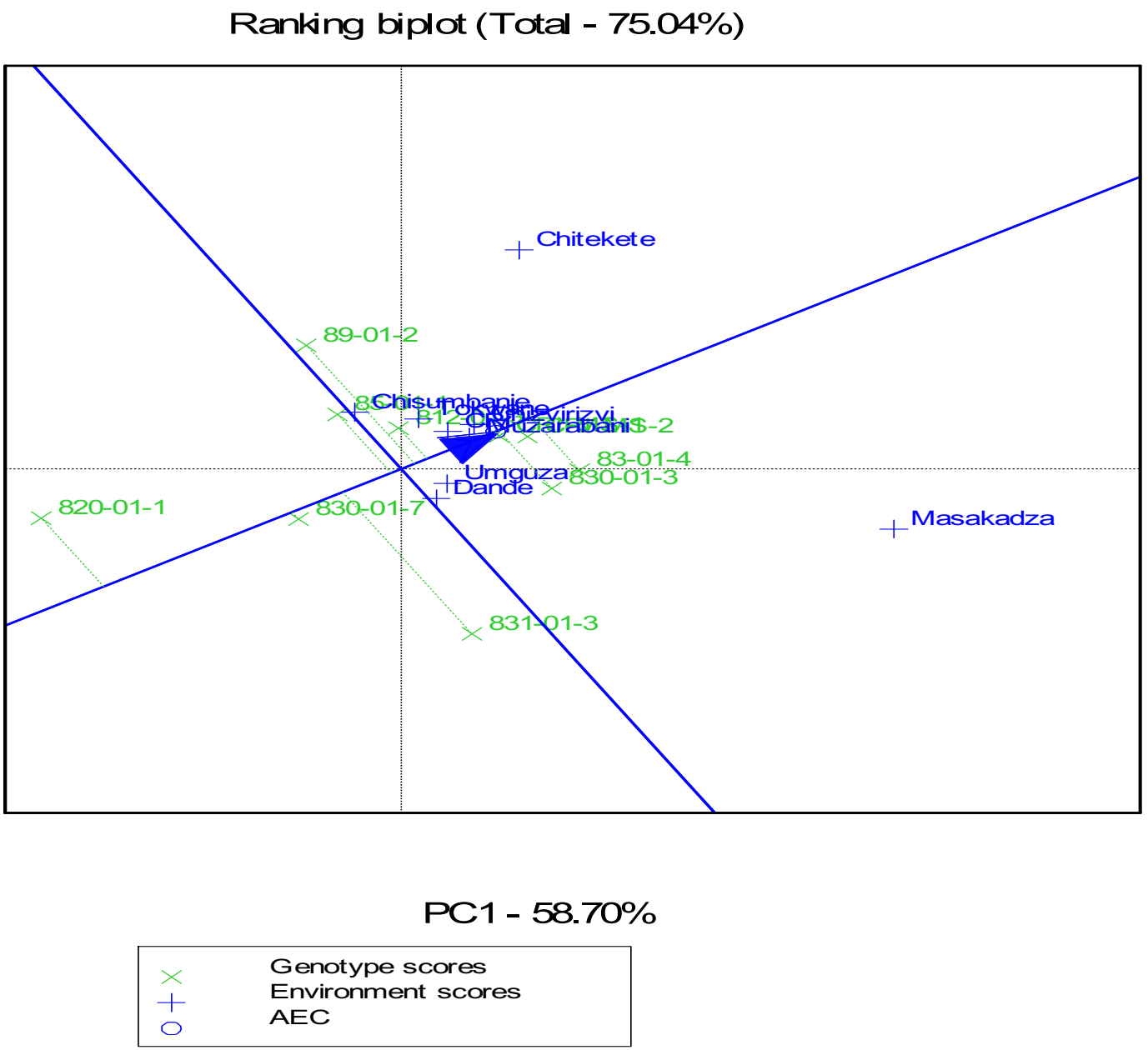


Figure 5. Genotype ranking for the medium staple Lowveld 3 cotton varieties



Conclusions

Field Qualities:

- 83-01-4 showed good performance (Seed cotton yield and stability)

- 89-01-2 performed well (Seed cotton yield, stability and GOT%)

Conclusions

Fibre properties:

830-01-3, and 89-01-2 performed well (Staple length, strength and elongation) and were comparable to the check variety CRI-MS2

Recommendations

- ✓ Genotypes 83-01-4, 830-01-3 and 89-01-2 could be tested for distinctiveness, uniformity and stability (DUS) in preparation for release based on their performance (field performance and fiber qualities).

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THANK YOU