Discrimination of Ruiru 11 Hybrid Sibs based on Raw Coffee Quality

Gichimu B.M.*, Gichuru E.K., Mamati G.E. & Nyende A.B.

*Coffee Research Foundation
P.O. Box 4–00232, Ruiru, Kenya

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Email: *wacikubm@gmail.com, gichimubm@crf.co.ke*

INTRODUCTION

- Ruiru 11, a composite cultivar comprising of about 60 F1 hybrid sibs was developed at CRS & released in 1985.
- Each sib is derived from a cross between a specific female and male population.
- The cultivar is high yielding, resistant to CBD and Leaf Rust and its quality is generally acceptable.
- Success of a coffee variety depends to a great extent on its raw bean quality.
- Bean size is an important factor since it determines the price. Bigger beans attract premium prices.
- The size and shape of the beans differ depending upon the variety, environmental conditions and management practices.

Objectives

This study aimed at selecting individual Ruiru 11 sibs with good raw bean quality.

The study also targeted to measure the extent to which raw bean quality of Ruiru 11 is affected by the environment.

Materials and Methods

Description of Study Sites

SITE	GPS	ALTITUDE	SOILS	SOIL pH	YEAR PLANTED
Mariene (Meru)	0^0N, 37^0 35'E	1524M	ando-humic acrisols, friable clays	strongly acidic	April 1991
Koru	0^0 07'S, 35^0 16'E	1554M	eutric nitosols, friable clays	weakly acidic to neutral	April 1990
Kisii	0^0 41'S, 34^0 47'E	1700M	molic nitosols, friable clays	acidic	April 1990

Other agronomic practices were carried out uniformly in all sites.

Materials and Methods Cont'

Test Materials: 34 Ruiru 11 sibs evaluated alongside 2 entries of SL28 (checks). One entry of SL28 was sprayed with fungicides to control CBD and CLR while the other one was not sprayed at all.

The pedigree of Ruiru 11 sibs							
	Catimor Lines						
Male Parent	**86**	**88**	**90**	**124**	**127**	**128**	**134**
SL28 x [(SL28 x RS) (B x HT)]	1,11,41	22,42	3,23	5	6	7	50
SL28 x [(K7 x RS) (SL34 x HT)]		52					
SL28 x [(N39 x HT) (SL4 x RS)]	71	72					80
SL28 x [(SL34 x RS) HT]	91,111, 121,131	112,142	93,103, 123,143	105,115, 125	106	107,117	100
SL34 x [(SL34 x RS) HT]				135		137	

Key: RS = Rume sudan, HT = Hibrido de Timor

Experimental Design: RCBD with three reps

Data Collection and Analysis

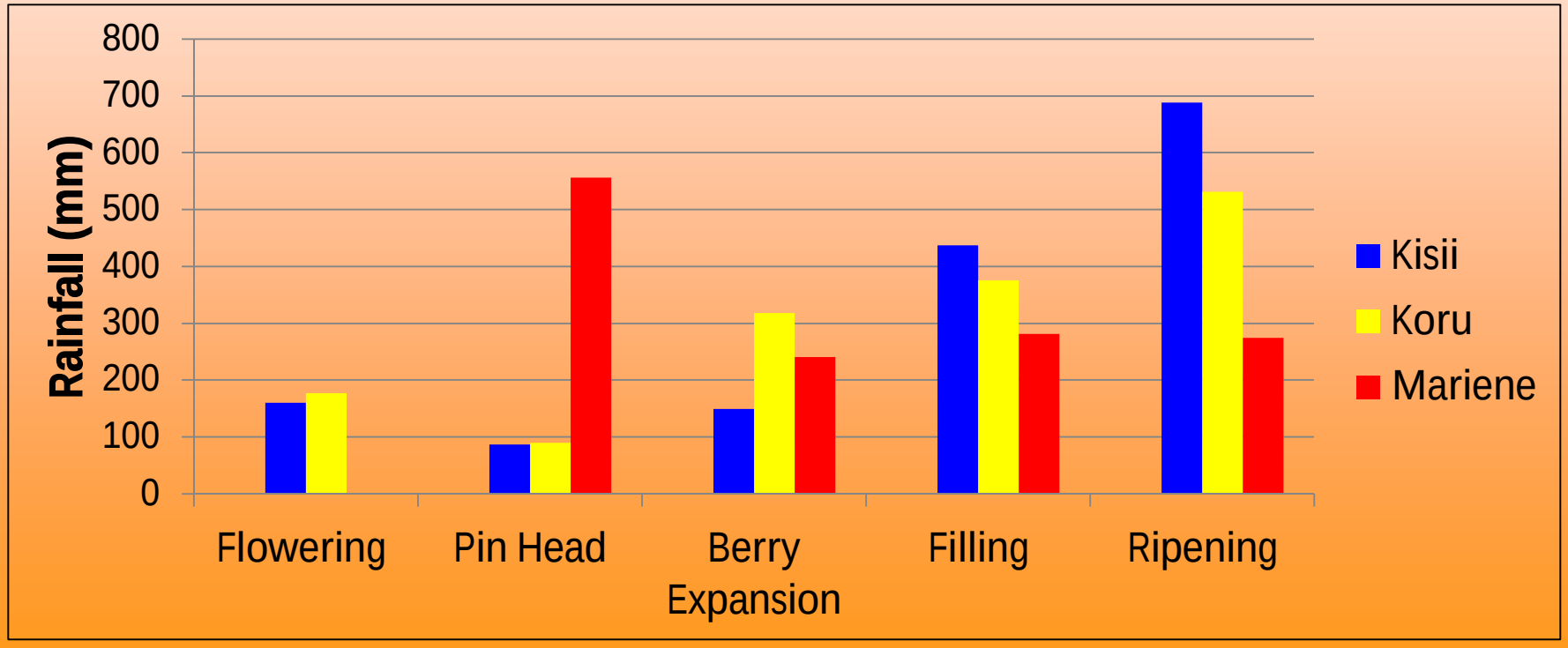
Data Collection: Cherry samples picked from May – July 2010. Cherry weighed, bulked, wet processed, parchment dried to MC of 10.5 to 11%, hulled and graded to seven grades based on size, shape and density as follows:

1. AA – Heavy beans retained by 7.15 mm screen
2. AB – Heavy beans retained by 5.95 mm screen
3. TT – Light beans separated from AA and AB
4. PB – Beans retained by a piano wire screen with 4.43 mm spaces
5. C – Beans retained by a piano wire screen with 2.90 mm spaces
6. T – Very small beans and broken bits
7. E – Elephant beans – a genetic effect

Data Analysis: ANOVA using COSTAT Software and mean separation using SNK method at p=0.05. Correlations, cluster and Discriminant Funtion analysis were done using XLSTAT version 2010 Software.

Rainfall received during the coffee production

	Berry Development Stages										
	Flowering	Pinhead	Berry Expansion				Filling		Ripening and Harvesting		
Month	Sept 2009	Oct 2009	Nov 2009	Dec 2009	Jan 2010	Feb 2010	Mar 2010	Apr 2010	May 2010	June 2010	July 2010
Kisii	160.3	86.2	151.7	305.5	49.8	99.6	203.4	233.7	406.8	202.4	79.6
Koru	176.6	89.1	106.2	343	102.8	215.5	211.8	163.4	258.9	140.6	132
Mariene	0	556.4	330.1	194.7	76.8	163.9	112.5	168.6	129.1	84.7	60.3



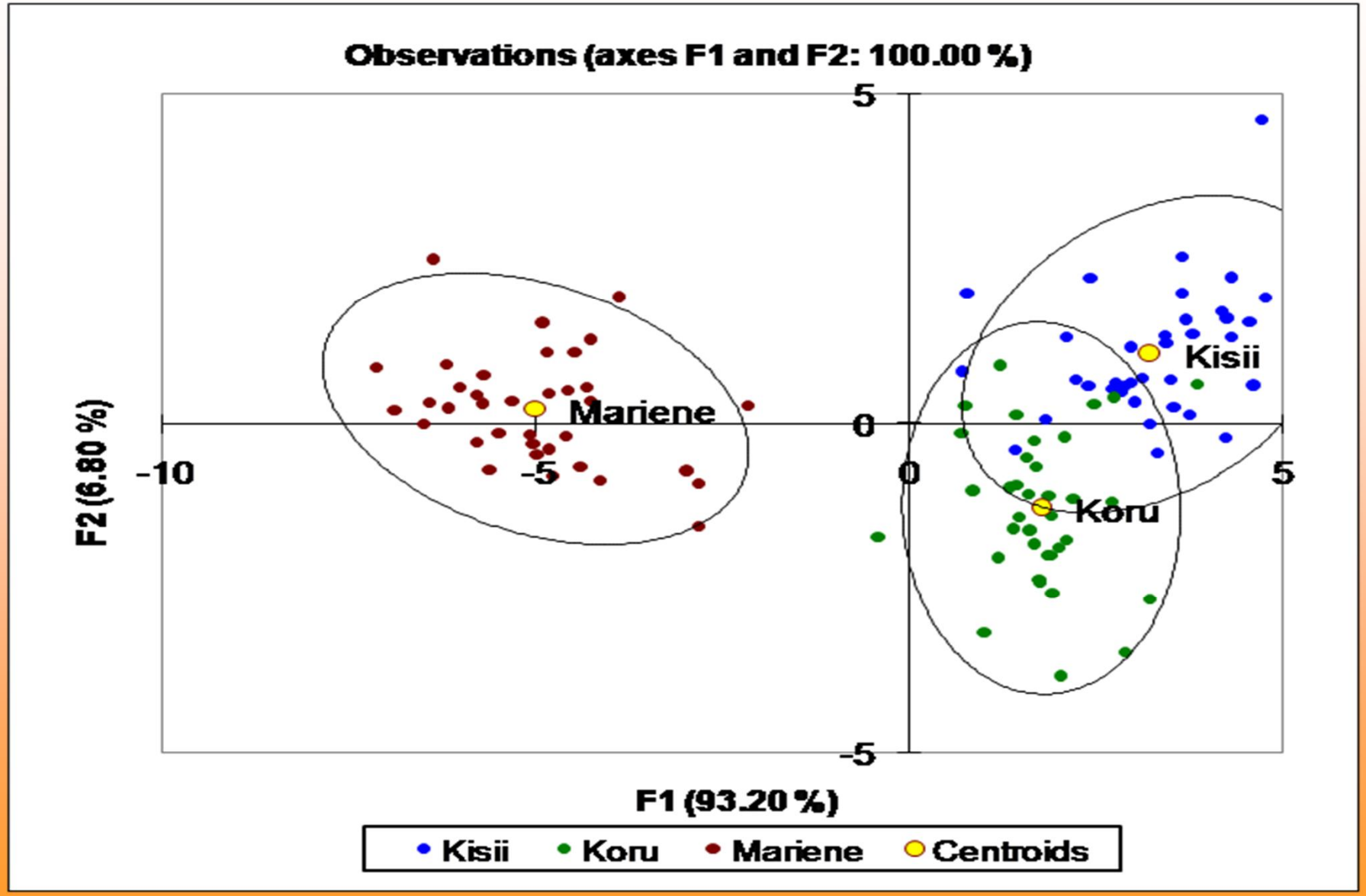
Results

Multi-site ANOVA for cherry and raw bean grades

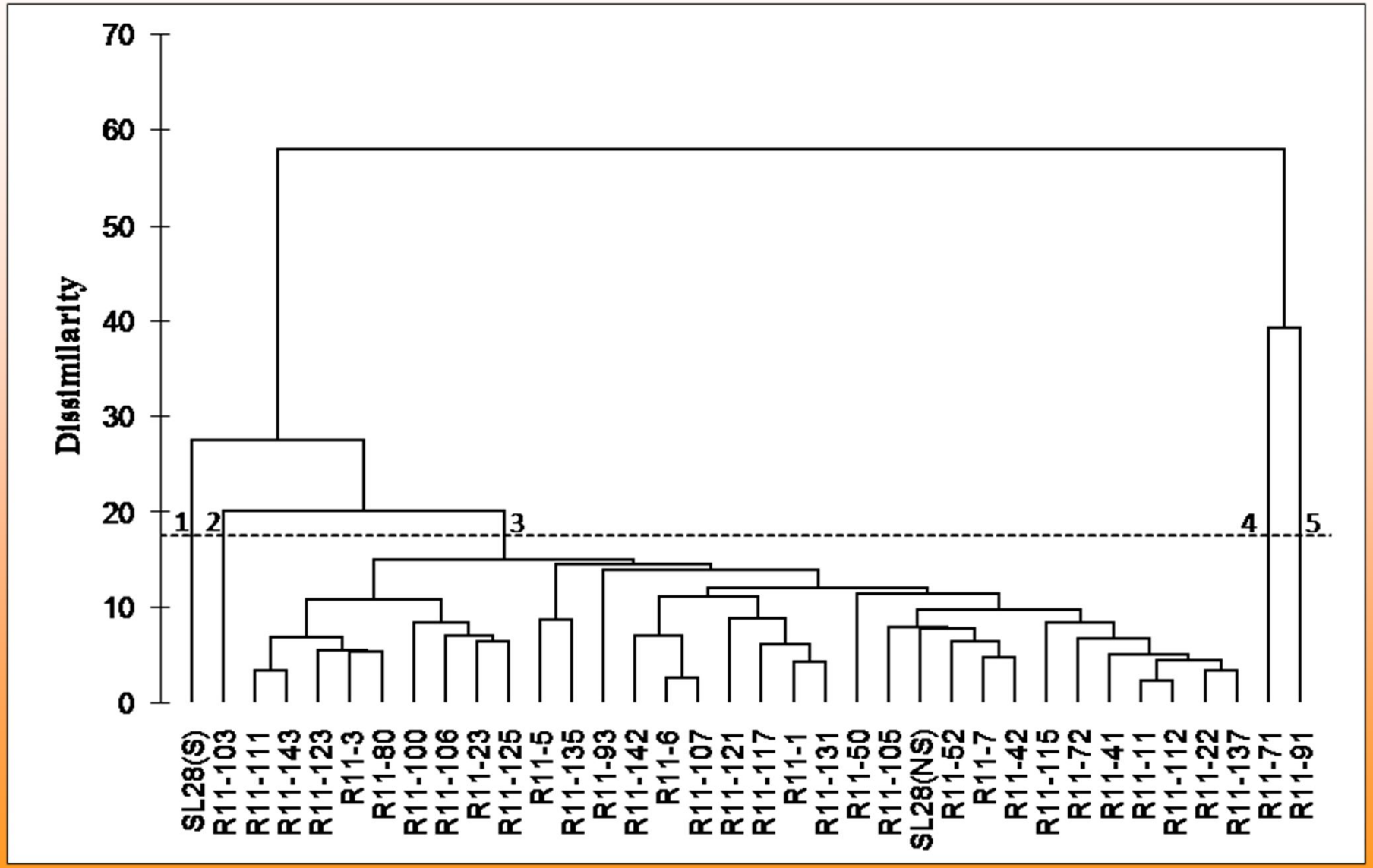
Traits	Sib Variations				Site Variation	Site x Sib Interaction
	Mariene	Kisii	Koru	Combined		
100 Berry Weight	0.2717ns	0.5149ns	0.5542ns	0.3873ns	0.0001***	0.4459ns
%Pulp	0.4530ns	0.300*	0.2944ns	0.1491ns	0.0000***	0.3816ns
%Outturn	0.0372*	0.0184*	0.1541ns	0.0525ns	0.0000***	0.0114*
%TT	0.0412*	0.6217ns	0.1861ns	0.0608ns	0.0000***	0.1291ns
%PB	0.2242ns	0.2509ns	0.0113*	0.0011**	0.0000***	0.1912ns
%E	0.3974ns	0.5870ns	0.5712ns	0.5079	0.0000***	0.6960ns
%AA	0.0004***	0.0000***	0.0024**	0.0000***	0.0000***	0.0027**
%AB	0.2448ns	0.2276ns	0.2016ns	0.0594ns	0.0000***	0.0594ns
%C	0.0000***	0.0002***	0.1068ns	0.0000***	0.0000***	0.0018**
%T	0.0024**	0.0002***	0.0305*	0.0000***	0.0000***	0.0061**
100 Bean Weight	0.7611ns	0.3853ns	0.0916ns	0.0092**	0.0000***	0.6335ns
Degrees of Freedom	35	35	35	35	2	70

Significance: * at 5%, ** at 1%, *** at 0.1%, ns = not significant

DFA plot depicting location differences



Diversity among genotypes based on raw coffee grades



COFFEE GRADES vs PRICES

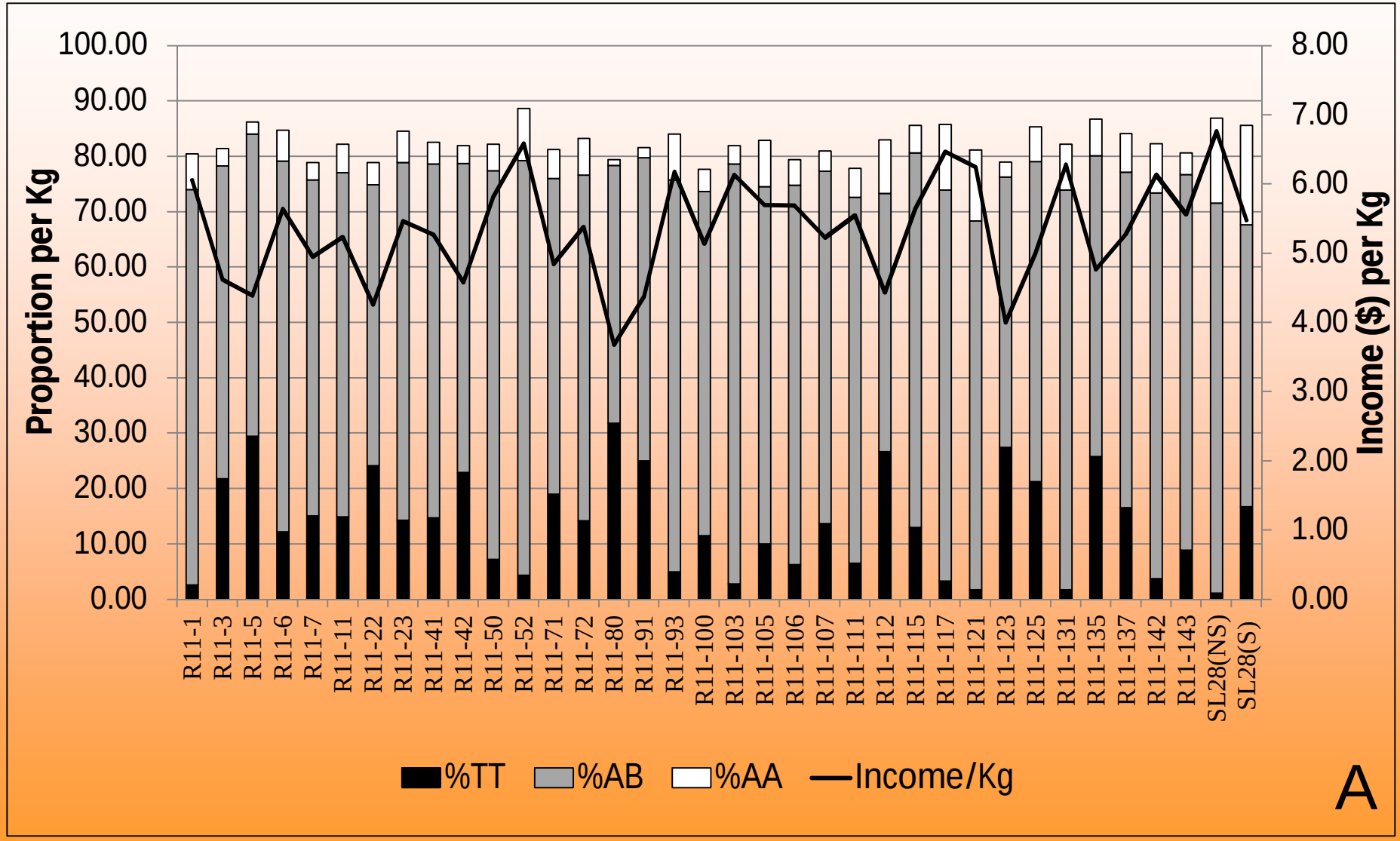
The most important and highly valued grades of coffee are AA and AB.

2010/11 Av. Coffee Prices (Reuters, 2011):

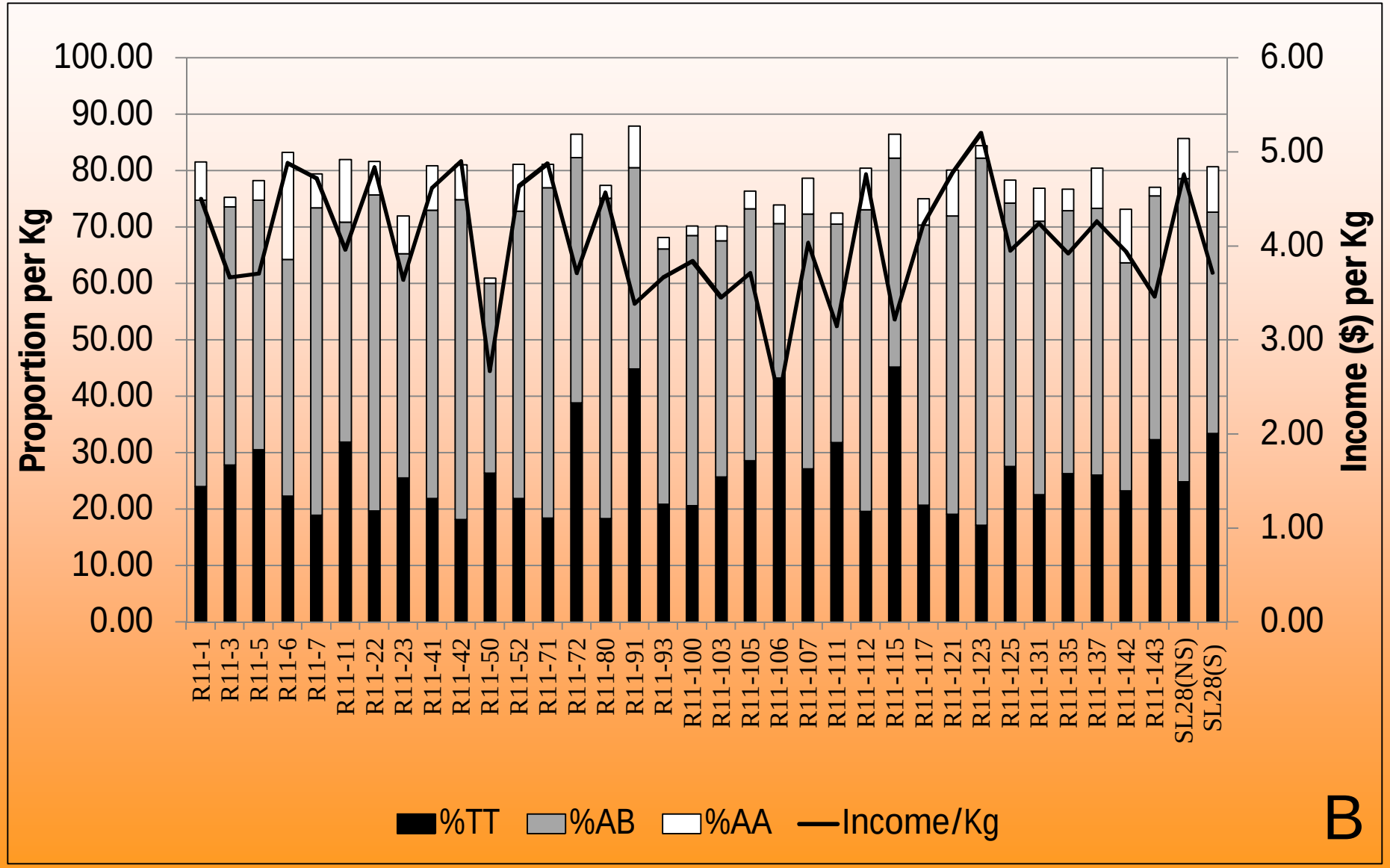
- Grade AA: $8.66 per Kg
- Grade AB: $7.71 per Kg (12% lower)

TT – Light beans separated from AA and AB using Pneumatic separator attracts low prices

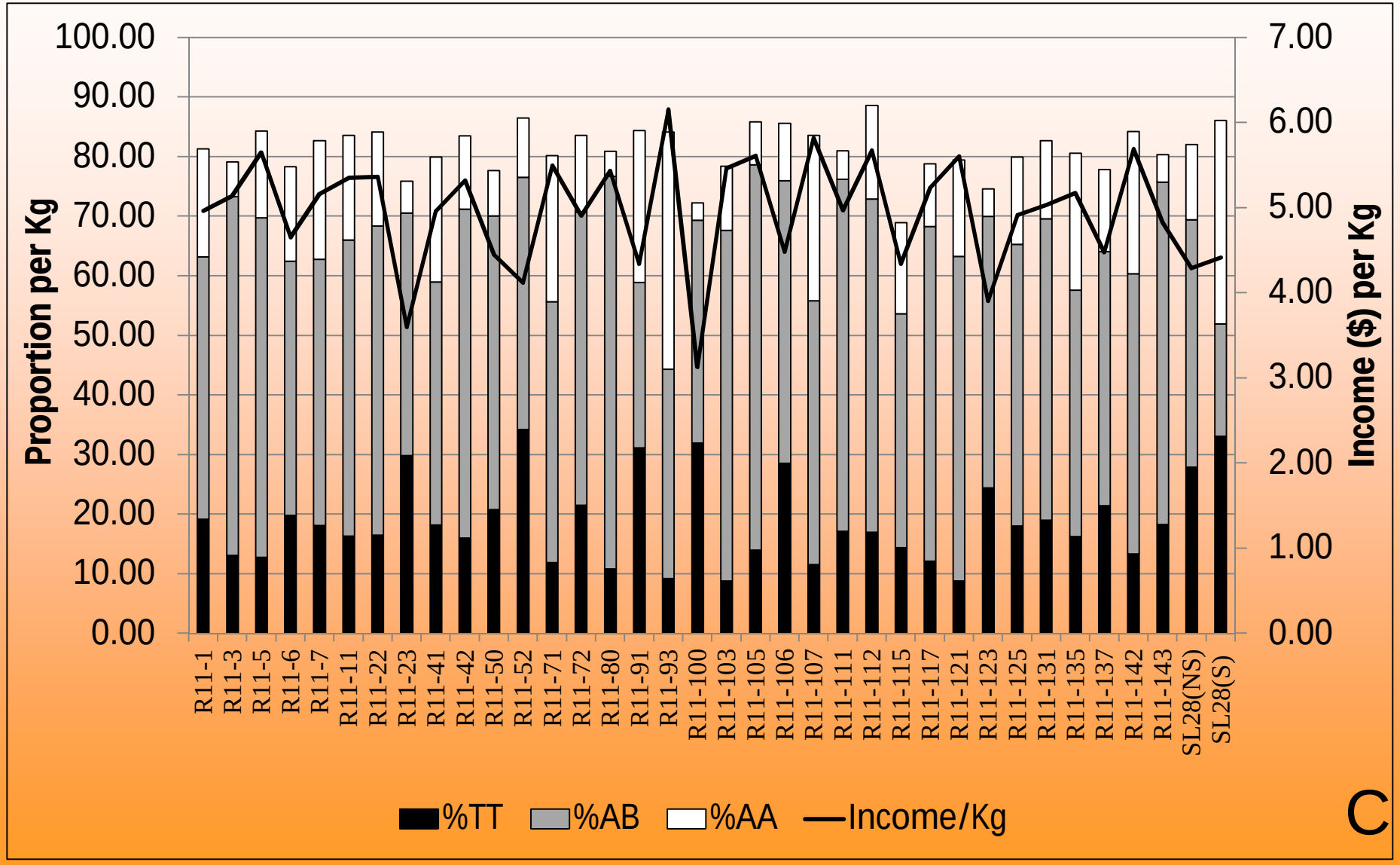
Proportion of the most important grades (AA and AB) and light beans (TT) separated from them - Mariene



Proportion of the most important grades (AA and AB) and light beans (TT) separated from them - Kisii



Proportion of the most important grades (AA and AB) and light beans (TT) separated from them - Koru



SOME PROMISING LINES

Koru	R11-93	R11-107	R11-142	R11-112	R11-5	R11-105	R11-121	R11-71	R11-103	R11-80
$	6.16	5.82	5.69	5.67	5.65	5.61	5.60	5.50	5.46	5.43
Mariene	R11-52	R11-117	R11-131	R11-121	R11-93	R11-142	R11-103	R11-1	R11-50	R11-105
$	6.59	6.47	6.28	6.25	6.17	6.13	6.13	6.06	5.82	5.70
Kisii	R11-123	R11-42	R11-6	R11-71	R11-22	R11-121	R11-112	R11-7	R11-52	R11-41
$	5.20	4.90	4.88	4.88	4.84	4.78	4.76	4.72	4.64	4.62

Relationship between grades

Site	Variables	100 BerryWt	%Pulp	%Outturn	%TT	%PB	%E	%AA	%AB	%C	%T
Kisii	%Pulp	**0.293**									
Koru	%Pulp	-0.077									
Mariene	%Pulp	**-0.310**	%Pulp								
Kisii	%Outturn	-0.042	**-0.511**								
Koru	%Outturn	-0.014	-0.169								
Mariene	%Outturn	0.000	**0.483**	%Outturn							
Kisii	%TT	-0.076	-0.032	-0.113							
Koru	%TT	0.007	-0.012	-0.063							
Mariene	%TT	0.082	-0.094	-0.080	%TT						
Kisii	%PB	0.034	-0.144	0.131	-0.076						
Koru	%PB	0.132	-0.126	**0.436**	-0.037						
Mariene	%PB	0.119	0.133	0.153	-0.099	%PB					
Kisii	%E	-0.049	-0.090	-0.044	-0.053	0.069					
Koru	%E	-0.059	-0.041	-0.140	0.042	-0.122					
Mariene	%E	-0.017	0.093	0.061	0.188	-0.001	%E				
Kisii	%AA	-0.003	**-0.220**	0.094	**-0.194**	0.119	0.091				
Koru	%AA	0.167	-0.089	0.140	**-0.239**	0.101	**0.293**				
Mariene	%AA	0.046	0.185	-0.037	**-0.259**	**0.422**	-0.001	%AA			
Kisii	%AB	0.079	0.070	0.155	**-0.837**	-0.179	0.084	-0.030			
Koru	%AB	-0.062	0.036	-0.081	**-0.597**	-0.185	**-0.276**	**-0.517**			
Mariene	%AB	-0.089	0.008	0.038	**-0.925**	-0.174	-0.167	-0.038	%AB		
Kisii	%C	-0.030	0.175	**-0.211**	**-0.213**	**-0.301**	-0.166	**-0.376**	-0.057		
Koru	%C	**-0.260**	0.181	**-0.196**	0.007	**-0.291**	-0.131	**-0.430**	-0.005		
Mariene	%C	-0.156	-0.048	0.081	0.091	**-0.446**	-0.117	**-0.639**	-0.009	%C	
Kisii	%T	0.038	**0.243**	**-0.229**	-0.069	**-0.283**	**-0.198**	**-0.283**	-0.135	**0.699**	
Koru	%T	-0.097	0.152	**-0.207**	0.074	**-0.224**	-0.034	**-0.276**	0.001	**0.408**	
Mariene	%T	-0.056	-0.021	-0.006	-0.015	**-0.412**	0.012	-0.171	0.073	**0.341**	%T
Kisii	100BnWt	0.032	-0.145	0.089	-0.091	-0.015	-0.065	0.058	0.122	-0.063	-0.126
Koru	100BnWt	0.081	0.022	0.043	-0.105	**0.229**	0.052	**0.251**	-0.133	-0.139	-0.112
Mariene	100BnWt	0.016	-0.158	-0.167	0.071	-0.072	-0.109	0.086	-0.097	0.043	0.072

Conclusion and Recommendations

1. The study demonstrated a high potential of intra-selection within the hybrid cultivar, Ruiru 11. However, selection should continue for at least 3 years.
2. All the three sites used in this study provided favorable conditions for coffee production thus not exposing the genotypes to harsh conditions which would provide better grounds for selection. Future studies should therefore include more variable locations.
3. Rainfall intensity and distribution is critical during berry expansion and bean filling stages. The highest bean yields of desirable grades were obtained in the site where moderate moisture supply was received during the two stages.
4. The study also exhibited significant G x E interactions in four raw bean traits (outturn, AA, C and T) indicating that the best improvement strategy should be a multi-site selection.

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