

## Research Article

# Evaluation of Raya Azebo Coffee Landraces for Cup Quality Traits

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## Abstract

In Ethiopia there are different known coffee types and place of origin of coffee having their own quality and flavor. Assessment of coffee quality is a key step in price setting and determines its export potential in coffee producing countries and to many coffee roasters and distributors. The study was conducted to evaluate Raya Azebo coffee landrace for bean quality traits. A total of ten (10) Raya Azebo coffee landrace along with two Hararghe coffee varieties were evaluated for bean physical and organoleptic coffee quality traits using Completely Randomized Design with three replications. The analysis of variance results showed significant difference among Raya Azebo coffee landrace for raw, cup and overall coffee quality. Most of the Raya Azebo coffee landraces possess mocha to slightly mocha flavor which represents the characteristics of typical quality profile of Hararghe coffee flavor. The coffee landraces had medium bean size as compared to other region coffee genotype. The bean size ranged from 88% to 97% with the overall mean of 94.33%. The coffee landraces had good and acceptable cup quality for aromatic quality, acidity, body, flavor and overall standards. The total cup and overall quality of Raya Azebo coffee landrace was in the range between 43.83% to 48.17% and 79.17% to 84%, respectively. Thus, the research results suggested the higher chance of selection of landraces to be developed as varieties for high and acceptable coffee quality.

## Keywords

Cup Quality, Raw Quality, Raya Azebo, Landrace

## 1. Introduction

Ethiopia is the primary center of origin and diversity for arabica coffee, which is the country's most important crop in terms of its economic contribution. As the county of origin for this crop, Ethiopia produces premium quality coffee. It is the leading producer in Africa, and the 5<sup>th</sup> in the world, following Brazil, Vietnam, Colombia and Indonesia [6]. Arabica coffee is the most widely consumed, dominating over 70% in volume

of production and over 90% of traded value globally. More than 80 developing countries mainly earn their foreign currency from coffee [9]. It ranks second after oil in international trade and has created several million jobs in the producer and consumer countries where more than nine million tons of green beans are produced annually [6].

The country exports its coffee based on their areas of origin

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(type), which are known for their own distinct quality and agronomic characters [7]. The development of local landraces for each locality largely based on their yield performance and resistance to major diseases like coffee berry disease (CBD) and quality would help to reduce quality adulteration of the inherent quality of known coffees in the country. Besides genetic and environmental factors, the range of cares taken from field to cupping can affect coffee quality. Assessment of coffee quality is a key step in price setting and determines its export potential in coffee producing countries and to many coffee roasters and distributors [8]. The genetic diversity for quality among 21 arabica coffee genotypes, collected in six regions of southwestern Ethiopia, verified significant divergence both between and within regions of geographical origin, suggesting the possibility of quality gains with the selection of promising parents [10]. Coffee quality is the most important factor that determines the desirability and market value of coffee and improvement of coffee quality could provide the coffee chain with a new impetus [12]. Therefore, the objective of this study was designed to evaluate Raya Azebo coffee landrace for quality traits.

## 2. Materials and Methods

### 2.1. Description of the Study Area

The experiment was conducted at Mechara Agricultural Research Center (McARC) on station for seven consecutive years starting from 2016/17 to 2022/23. Mechara is located 434 km to the east of Addis Ababa in Daro Labu district of West Hararghe Zone in Oromia Regional State. It is 110 km from Ciyo (Zonal Capital) to the south on a gravel road that connects to Arsi and Bale Zones. The center is geographically located at altitude of 1760 m.a.s.l and receives an average annual rainfall of about 900 mm with monthly mean maximum and minimum temperatures of 26 °C and 14 °C, respectively. The major soil type of the center is sandy clay loam which is reddish in color.

### 2.2. Experimental Materials and Design

A total of 10 coffee accessions of Raya Azebo local coffee landraces were field planted along with two released varieties in Completely Randomized Block Design (RCBD) at Mechara in 2016/17. A spacing of 2 m between plants and 3 m between blocks were maintained. All field management practices were applied to all plots uniformly as recommended for coffee. The laboratory experiment was conducted in completely randomized design (CRD) with three replications. About three kg of fresh cherry was collected from each accession and dried using sun-dry processing method. Then 300 g clean coffee beans per accession were prepared for laboratory test.

**Table 1.** Lists of Raya Azebo coffee landraces.

Sr/no.	Accn.no.
1	RA-11/04
2	RA-09/04
3	RA-04/04
4	RA-07/04
5	RA-10/04
6	RA-08/04
7	RA-01/04
8	RA-05/04
9	RA-02/04
10	RA-12/04
Checks	Mocha
	Mechara-1

### 2.3. Sample Preparation

**Harvesting coffee cherries:** Selective hand picking method was applied to collect only red ripe cherries from trees selectively leaving behind unripe green beans to be harvested later. Accordingly, more than three harvests were conducted to collect cherries to prepare the required amount of beans for the experiment. The harvested red ripe cherries during each harvesting time were measured and dried, mixed as sample.

**Coffee drying:** The collected red ripe cherries sample was placed on raised bed mesh wire under sun for drying. Drying was done for about two to three weeks depending on the unpredictable climate. During drying, the moisture content of the bean was measured using Electronic Rapid Moisture Tester (HOH-Express, HE 50 Germany) to maintain the moisture level between 11% and - or to 11% for all samples uniformly.

**Hulling:** Fully dried sample cherries were hulled with mortar. The dried pulp, the parchment skin part of the husk was removed.

**Roasting the samples:** The roaster machine with six cylinders (PROBAT BRZ6, WELKE, VON GIMBORN GMBHAN CO. KJ. Germany) was used for sample roasting. About 100 g of dried green coffee beans from each collection was weighted and roasted for an average of six minutes to medium roast under roasting temperature of 200 °C. The medium roast coffee were tipped out into a cooling tray and allowed to cool down for an average of four minutes. The roasted and cooled beans were blown to remove the loose silver skins and weighed.

**Grinding the samples:** Medium roasting of each sample was done using roasted coffee electrical grinder (MahlKonig, Germany) with middle adjustment.

**Brewing preparation:** Soon after grinding, eight gram

coffee powder were put into a clean standard porcelain cup with 180 ml capacity (Schonwald, Germany). Then boiled water was poured into the ground coffee up to about half of the 180 ml capacity cup. Soon after, volatile aromatic quality and intensity parameters were recorded by sniffing. Then, the contents of the cup were stirred to ensure an infusion of all coffee grounds. The cup was then filled to the brim with boiled water. The brew was left for four minutes (60 °C drinkable temperature); then the foam was skimmed off with spoon and the brew was made ready for panelists.

## 2.4. Data Collection

Raw coffee bean quality attributes: A total of 300 g of green beans sample were prepared per each accession for raw beans and cup quality attributes analysis. The green bean evaluated for raw beans quality according to the standard established for washed coffee raw quality [5]. Accordingly, raw coffee bean quality was determined by bean size, shape and make, color and odor traits. Bean size: distribution of coffee bean was determined by conventional screen analysis using perforated plate screens of diameter sizes 14 (5.55 mm).

**Table 2.** Standard parameters and their values used for coffee raw quality (40%).

Shape and make (15%)		Color (15%)		Odor (10%)	
Quality	Points	Quality	points	Quality	Points
Very good	15	Bluish	15	Clean	10
Good	12	Grayish	12	Fair clean	8
Fair good	10	Greenish	10	Trace	6
Average	8	Coated	8	Light	4
Mixed	6	Faded	6	Moderate	2
Small	4	White	4	Strong	0

## 2.5. Cup Quality Attribute

Three cups per sample in three replications were prepared for each accession and tasting session. The accessions replicated for each accession was arranged at random. The sensory evaluation of each accessions and the cup quality were carried

out by three trained and certified professional panelists of Jimma Agricultural Research Center (JARC). The cupping form provides a systematic means of recording eight important quality attributes. These include aromatic intensity, aromatic quality, acidity, astringency, bitterness, body, flavor, and overall standard.

**Table 3.** Standard parameters and their values used for liquor quality.

Parameters	Scale	Description of each scale					
		0	1	2	3	4	5
Aromatic intensity	0-5	Nil	V. light	Light	Medium	Strong	V. strong
Aromatic quality	0-5	Nil	V. light	Light	Medium	Strong	V. strong
Bitterness	0-5	Nil	V. light	Light	Medium	Strong	V. strong
Astringency	0-5	Nil	V. light	Light	Medium	Strong	V. strong
Parameters	Scale	Description of each scale					
		0	2	4	6	8	10
Acidity	0-10	Nil	Lacking	Light	Medium	M. pointed	pointed
Body	0-10	Nil	V. light	Light	Medium	M. full	Full

Parameters	Scale	Description of each scale					
		0	1	2	3	4	5
Flavor	0-10	Nil	Bad	Fair	Medium	Good	V. good
Overall standard	0-10	Nil	Bad	Regular	Good	V. good	Excellent

## 2.6. Data Analysis

Data was subjected to the Analysis of Variance (ANOVA) by using R-software. The mean comparison will be done using least significant difference test (LSD) at 5% level of significance.

## 3. Results and Discussion

The results of analysis of variance (ANOVA) showed the presence of significant differences among the Raya Azebo coffee landraces for the raw and cup quality traits (Table 4). The presence of significant difference among Raya Azebo coffee landraces for coffee quality traits is a good indicator for the presence of exploitable genetic variability for the improvement of Raya Azebo coffee quality through selection of landraces.

**Table 4.** Mean of Quality traits of Raya Azebo local coffee landraces.

Accn.no.	Bean size	Raw (40%)	Cup (60%)	Total	Typicity
RA-01/04	91	35.83	48.17	84	Mocha
RA-02/04	90	34.17	47.67	81.83	Mocha
RA-04/04	88	35.33	43.83	79.17	
RA-05/04	96	35.5	48.17	83.67	Spicy
RA-07/04	97	35.33	44.5	79.83	S. Mocha
RA-08/04	97	35.67	43.83	79.5	
RA-09/04	96	35.67	45.67	81.33	Mocha
RA-10/04	94	34.5	45	79.5	Mocha
RA-11/04	95	35.67	47.33	83	S. spicy
RA-12/04	97	35	47.33	82.33	S. Mocha
Mechara	96	36	47.5	83.5	Mocha
Mocha	95	35.67	47.33	83	Mocha
Mean	94.33	35.36	46.36	81.72	
LSD (5%)	0.76	0.89	3.65	3.5	
CV (%)	2.06	2.06	2.06	2.06	

## 3.1. Raw Quality Traits

The bean size of the Raya Azebo coffee landraces fell in the range from 88% to 97% with the overall mean of 94.33% for bean size which had medium to larger bean size. Almost all of the landraces and Hararghe coffee varieties were grouped under grayish color category (12 to 13.5). The total raw quality ranged from 34.17% to 36% with the overall mean of 35.36%. Most of the landraces had significantly higher mean values above overall mean value for total raw quality. The present study results indicated that Raya Azebo coffee landraces had medium bean size as compared to other region coffee genotype. The observed difference between bean size of Raya Azebo coffee landraces and other region coffee genotype could be due to genetic and growth environment difference. Raw bean quality which is evaluated by total value of bean size, shape and make, color and odor is one of the criteria for conducting coffee business within the international market [2].

The significant difference observed among coffee genotypes of different regions for bean size, shape and make, bean color and total bean raw quality have been reported by some authors. Abrar *et al.* reported 94.43% to 99.13% of bean size for Sidamo hybrid coffee [1]. The authors reported 49% to 99% for bean size, 11 to 14 for bean color, and 27.67% to 38% for total raw quality. Total raw bean quality ranging between 21.12% and 40% were reported by Anwar [3], Wassu [12], Berhanu *et al.*, [4]. Yigzaw stated that bean size has a particular importance to roasters since it would uniformly, and is influenced by botanical variety [11].

## 3.2. Cup Quality Traits

The coffee landraces had significantly higher and acceptable cup quality for aromatic intensity, aromatic quality, acidity, body, flavor and overall standards. Total cup quality had ranged between 43.83% to 48.17.5% with overall mean of 46.36%. Two landraces RA-01/04 and RA-5/04 had significantly the highest mean on total cup quality. Four Raya Azebo coffee landraces; RA-01/04, RA-2/04, RA-09/04 and RA-10/04 possess mocha flavor which maintain the characteristics of Hararghe coffee flavor typicity. And also, two coffee landraces; RA-07/04 and RA-12/04 were characterized by slightly Mocha type of flavor. Almost all the landrace have acceptable range of overall quality.

### 3.3. Overall Quality

The overall Raya Azebo coffee quality ranged from 79.17% to 84% with mean of 81.73%. (Table 4). The highest mean of overall quality was recorded from coffee landrace RA-01/04 (84%) followed by RA-05/04 (83.67%). These landraces had higher mean values as compared to the two standard check Mocha and Mechara-1 varieties. Therefore, the observed variation among Raya Azebo coffee landraces for raw and cup quality and all its components indicates the higher chance of improving this quality traits through selection.

According to ECX, coffee samples that scored > 85% overall quality were grouped under grade one while samples with score of 75-84% and 63-74% grouped under grade two and three, respectively [5]. Accordingly, all Raya Azebo coffee landraces and Hararghe coffee varieties were grouped under commercial coffee grade two.

## 4. Conclusion and Recommendation

The results of the study showed that Raya Azebo coffee landraces have good and acceptable raw and cup quality test. Most of the landraces have possess Harar coffee flavor which can promise good price in international market. Generally, the Raya Azebo coffee landraces were characterized by medium bean size, Harar coffee flavor type (Mocha) and have acceptable overall coffee quality. Therefore, the research results suggested the higher chance of selection of landraces to be developed as varieties for high and acceptable coffee quality.

## Abbreviations

ANOVA	Analysis of Variance
ECX	Ethiopian Commodity Exchanges
LSD	Least Significant Difference Test
McARC	Mechara Agricultural Research Center
RCBD	Completely Randomized Block Design
RCBD	Completely Randomized Design

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## Conflicts of Interest

The authors declare no conflicts of interest.

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