

# Pre-Extension Demonstration And Evaluation Of Improved Small Scale Pulper For Wet Coffee

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**Abstract**—The study was conducted in Jimma and Buno Bedele Zones of Oromia Regional State, Ethiopia. The objective of the study was to evaluate the pulper performance, to demonstrate the technology and enhance awareness to the farmers of the study area. Three pulping sites (Sedi, Suse, and Hawa Yember) were selected and used as hosting centers for popularization of technology in three districts (Goma, Gera and Chora) selected for the study. Participants were organized in three FREG groups having 45 members. The evaluation result showed that the machine has pulping capacity of 173.06 kg/hour, 95.5% cleaning efficiency with relatively less grain breakage (9%) for the pulped wet coffee. Perception response showed that the machine has good cleaning capacity by 75.6% respondents and

*24.4% ranked it to the medium performance. Yet no respondent responded for its poor level of pulping capacity. More number (82.3%) of the respondents perceived that it has good efficiency and the rest 17.7% and no respondents perceived as medium and poor performance, respectively. The machine is also preferred for its minimum seed breakage, easy to operate and simple to transport. Generally the feedback data showed that the farmers have positively perceived the machine simply by observing its pulping efficiency (%), breakage percentage (%) and pulping capacity (kg/hr) of 95.5, 0.09 and 173.06 values, respectively as it has good performance compared to the local pulping method.*

**Keywords**—Pre-extension, Demonstration, Pulper, Capacity, Efficiency, Grain Breakage

## INTRODUCTION

Coffee (*Coffea arabica* L.) is a non-alcoholic stimulant beverage crop that belongs to the family Rubiaceae and genus *Coffea*. Among 100 *Coffea* species in the genus *Coffea*; *C. arabica* is the only species naturally occurring in Ethiopia [1]. Ethiopia is the only center of origin and diversity of Arabica coffee (*C. arabica*) [2]. Coffee is the major source of foreign currency for Ethiopia and contributes more than 35% of the total export earnings [3]. Thus, it is a cornerstone in the export economy of the country and

it supports directly or indirectly the livelihood of some 15 million people [4]. In Ethiopia, coffee is produced in four production systems, namely: forest, semi-forest, garden and plantation coffee in the Western, Southern, and Southwestern parts of the country [5].

Jimma Zone is one of coffee growing zones in the Oromia Regional State, which has a total area of 1,093,268 hectares of land [6]. Currently, the total area of land covered by coffee in the zone is about 105,140 hectares, which includes small-scale farmers' holdings as well as state and private owned plantations. Out of the 40–55 thousand tons of coffee annually produced in the Zone and about 28-35 thousand tons is sent to the central market, while the remaining is locally consumed [7].

Coffee is the major cash crop of the Zone, which is produced in the eight districts namely, Gomma, Manna, Gera, Limmu Kossa, Limmu Seka, Seka Chokorsa, Kersa and Dedo, which serves as a major means of cash income for the livelihood of coffee farming families.

Despite the favorable climatic conditions, variety of local coffee types for quality improvement and long history of its production in Jimma Zone, coffee quality is declining from time to time due to several improper pre-and post-harvest management practices.

This is still practiced by the majority of coffee farmers/traders, from which the larger portion of the produce is obtained. Improper post-harvest processing and handling practices such as drying on bare ground, improper storage and transportation are some of the causes associated with coffee quality problems among many others. In addition to this, natural impediment such as prolonged rainy weather, particularly during harvesting and drying season can also contribute to reduced coffee quality.

For instance [8], it was reported that out of Jimma coffee sent to the coffee quality inspection center laboratory from 2003 to 2007, more than 60% of dry processed coffee classified into grade as compared to 80% of wet processed into grade 2 and grade 3. The author indicated the problem of post-harvest processing and handling in the area resulted in poor quality as the main contributing factor. The poor quality and the subsequent drop in earnings had severely affected coffee farmers in woredas like

Gomma, Limmu Kossa, and Manna, where coffee provides a larger portion of their annual income. But Jimma Zone is known for some quality coffee types such as Limmu Enaria (Limmu) coffee, which is known for its best quality in the world market.

Processing is a very important activity in coffee production and plays a crucial role in quality determination [9]. Coffee is either processed by the wet or dry methods, which vary in complexity and expected quality of the coffee [10]. Both sun-drying as well as wet-processing methods are operated in Ethiopia, which accounts for 70% and 30% of coffee produced in the country, respectively.

Despite the favorable climatic conditions, variety of local coffee types for quality improvement and long history of its productions, still there are gaps like lack of improved small scale wet coffee pulper to enhance wet coffee process that can minimize coffee quality problems in Jimma zone and lack of adequate information on the effects of post-harvest processing and handling techniques on coffee quality. Hence, the small scale wet coffee pulper is evaluated and introduced to promote the coffee production by minimizing the above mentioned problems of coffee growers and processors for quality coffee produce in the study areas.

#### Objective of the study

- To evaluate wet coffee's performance under farmers management
- To introduce small scale wet coffee pulper for better post-harvest and coffee quality.
- To enhance coffee produce farmers' awareness in coffee quality maintaining

#### Materials and methods

##### Materials

Manufacturing material such as steel shaft, galvanizes sheet metal, flat iron etc was used for Wet coffee pulper machine production. Wet coffee pulpers were used to conduct research.

##### Methodology

##### Study area

The study was conducted in Gera, Gomma, districts of Jimma, and Chora district of Illuababor zone.

The five hand operated coffee pulper was manufactured in Jimma Agricultural Engineering Research Center. One Kebele was selected from Gera, Goma, and Chora district of Jimma, and Buno-Bedelle zone.

Accordingly, three participatory FREGs which consist of fifteen (15) members were formed at the three sites of the identified Kebeles. Training on general coffee processing technology was given at the hosting farmers' site. Then technology production, evaluation, training & demonstration were carried out

by distributing sample prototypes to each farmer extension research groups. Finally the technical evaluation and the feedback data were collected on user farmers' perception on the technology.

#### Training Farmers SMS and DAs on Mini-disc wet Coffee Pulper

Both practical and theoretical trainings were given for the participant farmers and other stakeholders. The training participants were the Subject Matter Specialists (SMS) from selected districts working on crop production and Development Agents (DAs) that exist at the Kebele level that were trained on machine operation and maintenance before actual demonstration was done to create awareness.

#### On farm Performance Evaluation

Pulping involves removal of outer red skin, white fleshy pulp, separation of the pulp and wet parchment coffee. The pulping activity was carried out by squeezing the cherries between a pulper chopper knife and disc. The gap between them can be adjusted as per the coffee variety. This disc pulper is specially designed to pulp Arabica and Robusta coffee varieties.

The performance of the disc pulper was calculated as follows:

$$\text{pulping efficiency} = \frac{\text{input} - \text{unpulp coffee}}{\text{input}}$$

$$\text{breakage persent} = \left(1 - \frac{\text{input} - \text{broken}}{\text{input}}\right)100$$

$$\text{pulping capacity} = \frac{\text{input} - \text{unpulp}}{\text{time}}$$

#### Demonstration

Farmer to farmer learning was used to promote the technology simply by arranging pulping program at the host farmer's farm site. In this study, the farmers' feedback after the demonstration of mini disc wet coffee pulper technology were collected based on evaluation criteria jointly set by researchers and farmers. These includes, values for visible grain damage, optimum pulper output capacity, pulping and cleaning efficiency considered for them and farmers' perception in respective of these criteria.

#### Average price for pulped and un-pulped coffee

Simple calculation was done to determine the price difference by considering coffee price before using pulper and after using the pulper. Using the pulper there were the variation on selling price by enabling the farmers to store the crop for long time to overcome the effect of low price during harvesting time.

### Farmers' perception on the technology attributes

Data on technical operation and social perception aspects were collected and analyzed as well. Feedback was taken during and after demonstration to analyze farmers' perception about the pulper. Some of the pulper attributes used in the analysis were pulping efficiency (%), breakage percentage (%) and pulping capacity (kg/hr).

#### Data collection and analysis methods

The quantitative and qualitative data were collected about the technical performance and perception through interview, observation and group discussion and analyzed by using descriptive statistics.

### RESULT AND DISCUSSION

#### Training of Farmers, SMS and DAs on Mini-disc wet Coffee Pulper

Both practical and theoretical trainings were given for the 45 participant farmers, the 6 Subject Matter Specialists (SMS) and 12 Development Agents (DAs) on machine operation and maintenance.

**Table 1: Training Provided on Mini Disc Wet Coffee Pulper Technology**

No	Training Site		Farmers				DAs	SM		Total	
			Adult		Youth			S	I		
			M	F	M	F		M	F		M
1	Goma	Loya Sedi	7	2	5	1	3	1	1	0	20
2	Goma	Cedero Suse	9	3	2	1	3	2	2	0	22
3	Chora	Hawa Yember	8	2	3	2	2	1	2	1	21
<b>Total</b>			<b>24</b>	<b>7</b>	<b>10</b>	<b>4</b>	<b>8</b>	<b>4</b>	<b>5</b>	<b>1</b>	<b>63</b>

#### On-farm Performance Evaluation

**Table 2: Average performance of Pulper (Efficiency, Breakage and capacity)**

No.	Rep.	Pulping efficiency (%)	Breakage percentage (%)	Pulping capacity (kg/hr)
1	A1	95.1	0.05	246.64
	A2	100	0	189.1
	A3	96.65	0.02	165.8
	<b>Av.</b>	<b>97.25</b>	<b>0.02</b>	<b>200.5</b>
2	B1	93.6	0.06	148.1
	B2	97.6	0.1	156.4
	B3	94.5	0.3	168.2
	<b>Av.</b>	<b>95.23</b>	<b>0.15</b>	<b>157.57</b>
3	C1	93.65	0.06	167.49
	C2	95.68	0.04	151.34
	C3	92.84	0.2	164.53
	<b>Av.</b>	<b>94.06</b>	<b>0.1</b>	<b>161.12</b>
<b>Grand total</b>		<b>95.5</b>	<b>0.09</b>	<b>173.06</b>

The letters A, B & C indicate the pulper evaluated at three different sites.

On farm evaluation of the technology was made in teamwork with participant farmers, SMS and DAs. Evaluation of Mini Disc Wet Coffee Pulper was based on the attributes recognized as important pulping efficiency (%), Breakage percentage (%) and pulping capacity (kg/hr) of 95.5, 0.09 and 173.06 values, respectively as it has good performance compared to the local pulping method.

Accordingly, the above table indicates that this mini-disc coffee pulper have good pulping efficiency and capacity with minimum breakage due to adjustable clearance between disc and knife.

#### Demonstration

The demonstration was done through organizing mini field day. The farmers' feedback after the demonstration of Mini Disc Wet Coffee Pulper technology were collected based on evaluation criteria. These includes, values for visible grain damage, optimum pulper output capacity, pulping and cleaning efficiency considered for them and farmers' perception in respective of these criteria.

#### Mini-Field days conducted

**Table 3: Participants on mini field days**

No	Location		Participants of field days											
			Farmers				SMS		DA		Stakeholder		Total	
			Adult	Youth	M	F	M	F	M	F	M	F		
1	Goma	Loya Sedi	20	10	8	1	1	3	2	1	1	33	22	
2	Goma	Cedero Suse	17	11	13	5	1	3	1	1	1	35	27	
3	Chora	Hawa Yember	15	8	15	3	1	3	1	1	1	134	24	
<b>Total</b>			<b>52</b>	<b>29</b>	<b>36</b>	<b>8</b>	<b>2</b>	<b>9</b>	<b>4</b>	<b>3</b>	<b>1</b>	<b>107</b>	<b>73</b>	

Mini-field days were organized at different sites (Loya Sedi, Cedero Suse and Hawa Yember) which was attended by different stake holders. In view of that, 155 farmers (67 Female, 88Male), 3 SMS, 13 DAs, and 4 Administrators (Kebele Level) have attended the mini field days.

#### Average price for pulped and un-pulped coffee

The average price difference was observed through manipulating pulped and un-pulped coffee price mainly before using pulper and after using the

pulper. The price variation on selling was resulted by enabling the farmers to store the crop for long time to overcome the effect of low price during harvesting time.

**Table 4: Price difference**

No	Wet Coffee crop	Quantity (kg)	Average Price during harvest	Average Price after 3 months	Remark
1	Before pulped	4	4 kg x 7 Birr =28	-	Short period
2	After Pulped	1	1 kg x 65 Birr =65	1x90=90	Can be stored
3	Price difference (Birr)		65 – 28 = 37 Birr	90-28=62	62-37=25

As described in table 4 above, 4 kg of un-pulped wet coffee became 1 kg of pulped coffee bean in average. In the same way, the price of 1kg of un-pulped wet coffee was 7 Birr which is 28 Birr for 4kg. While 1kg pulped coffee with price of 65 Birr accordingly. Thus, the difference of selling price between un-pulped wet coffee and pulped coffee bean was 37 Birr that was happened due to the machine introduction.

**Farmers’ perception on the technology attributes**

Data on technical operation and social perception aspects were collected and analyzed as well. Perception feedback during and after demonstration to analyze farmers’ opinion about the pulper on some of the pulper attributes pulping efficiency (%), Breakage percentage (%) and pulping capacity (kg/hr) obtained were described in table below.

**Table 5: Perception of FREG Members**

Attribute acceptance degree by farmers	Scale measurement	Participant Respondents		
		Frequency	Percentage	Remarks
Criteria		(Fr)	(%)	
Pulping capacity (kg/hr).	Poor	-	-	
	Medium	11	24.4	
	Good	34	75.6	
Pulping efficiency (%),	Poor	-	-	Require adjustment precision
	Medium	8	17.7	
	Good	37	82.3	
Breakage percentage (%)	Poor	-	-	Require adjustment precision
	Medium	6	13	
	Good	39	87	

Among the total respondents, 75.6% replied that the wet coffee pulper had good pulping capacity and the rest 24.4% ranked it to the medium performance. Yet no respondent responded for its poor level of

pulping capacity. This shows that most of the farmers have positively perceived to this machine towards its capacity.

Moreover, the respondent farmers were also perceived the machine for good pulping efficiency. More number (82.3%) of the respondents perceived that it has good efficiency and the rest 17.7% and no respondents perceived as medium and poor performance, respectively. The machine is also preferred for its own strength and drawbacks at the farmers’ field. Farmers just liked it in its minimum seed breakage, easy to operate and simple to transport.

Generally the feedback data showed that the farmers have positively perceived the machine simply by observing its pulping efficiency (%), Breakage percentage (%) and pulping capacity (kg/hr) of 95.5, 0.09 and 173.06 values, respectively as it has good performance compared to the local pulping method.

**CONCLUSION AND RECOMMENDATION**

**Conclusion**

- The evaluation of min-disc small scale wet coffee pulper showed that it has good performance with average pulping efficiency, breakage and pulping capacity of 95.5%, 0.09% and 173.06kg/hr respectively.
- The coffee producer farmers had appreciated the pulper suitable for their coffee production activities recognizing that it has good performance compared to the local manual tiresome method of pulping.
- They acquired skill on wet coffee pulper through training for using the improved technology for pulping as it enable them prepare pulped coffee for better market price and get coffee seed to prepare coffee seedlings use and supply for sale to other farmers in their localities.
- The introduction of the technology has motivated more coffee producer farmers where some have already raised demand for the technology supply in advance though the centre failed to respond instantly as it requires budget and time to produce.

**Recommendation**

- All stakeholders and concerning bodies should strongly work in supplying the technology by creating linkage among coffee producers and technology manufacturers in order to strengthen coffee production and marketing in a sustainable manner in the areas.
- Micro enterprise and coffee development offices in the respective districts and kebeles should maintain sustainable partnership system in order to strength the linkage among producers and technology manufacturers.
- The min-disc small scale wet coffee pulper is single disc type usually manually operated that used

by farmers of small farm and in appropriate for farmers of medium and large coffee producers. So, further modifications are needed by researchers making it motorized and two or more disk application.

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