

Full Length Research Paper

Influence of harvesting and postharvest processing methods on the quality of Arabica coffee (*Coffea arabica* L.) in Eastern Ethiopia

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Eastern Ethiopia is among the regions naturally known for producing the best quality Hararghe specialty coffee. However, due to poor pre-and post-harvest handling practices, the quality of its coffee is below level of its inherent quality characteristics. Therefore, this study was conducted to evaluate different harvesting and postharvest handling methods on the inherent quality of Hararghe coffee. The experiment was designed as a factorial combination of two harvesting (selective and strip harvesting) and six postharvest processing methods (dry processed dried on bare, cemented and plastic sheet ground floor; and dry, wet and semi-washed processed dried on raised mesh wire) methods in a CRD with three replications. The samples were prepared from one Hararghe coffee genotype (H-622/98) planted at Mechara Agriculture Research Center. A team of certified panelists did its raw and organoleptic quality evaluation. The results indicated that the main effect of harvesting and postharvest processing methods were highly significantly influenced all coffee quality parameters evaluated. Selective harvesting was produced highest overall coffee quality (above 80%) that can be categorized under specialty coffee grade. Dry processing method coupled with drying coffee on raised mesh wire was best in producing coffee beans with high raw quality. In contrast, dry processing using bare ground produced inferior coffee for all quality attributes. The highest raw quality score (32.33%) was observed from the dry processed coffee on mesh wire while wet processing produced the highest cup quality (44.88%). The highest overall coffee quality (75.21%) was recorded for wet processed followed by dry processed coffee on mesh wire. Thus, it can be concluded that like wet processing, dry processing of selective harvesting and drying on raised mesh wire and/or plastic sheet floor can produce superior specialty coffee under Hararghe conditions.

Key words: Hararghe coffee, specialty coffee, raw quality, organoleptic quality.

INTRODUCTION

Coffee is the world's favorite beverage and the second most traded commodity after oil on international trade

exchanges both in terms of volume and value (Alemseged and Yeabsira, 2014) representing

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a significant source of income to several developing countries in Africa, Asia and Latin America. Ethiopia, besides being coffee's birthplace, it is the single largest African producer of high quality Arabica coffee with about half of its production going for export. Furthermore, about 15% of its total population is deriving their livelihoods from coffee (Abu, 2015). In addition, coffee is the defining feature of the national culture and identity (Mayne et al., 2002) with 50% of the production consumed domestically (ICO, 2014). Among the Ethiopian coffee types that are distinguished for very fine quality acclaimed for its aroma and flavor characteristics recently, Hararghe (former Harar), Sidama and Yirgachefe are registered for trademark (Emebet et al., 2013) and sold at a premium price both at domestic and international coffee markets (ITC, 2002; Fekede and Gosa, 2015). In Ethiopia 29% of coffee is processed by wet (washed) method to produce green parchment coffee and 71% by dry (natural sundried) method to obtain cherry coffee. Musebe et al. (2007) reported that coffee quality is determined by 40% in the field, 40% at postharvest primary processing and 20% at secondary processing and handling practices.

Hararghe coffee is a *Coffea arabica* species growing in the highland and midland areas of eastern Ethiopia. It is well recognized specialty and exemplified category coffee which is grown mostly without shade, and intercropping system with different crops like sorghum, maize, haricot bean and rarely with *Khat edulis* (Dessie, 2008; Fekede and Gosa, 2015). The coffee is entirely produced by natural sun-dried processing method. It is characterized by medium sized beans with greenish yellow color, medium acidity and full body and a distinctive mocha flavor. In Hararghe, coffee was observed to grow as early as 850 A.D (Brownbridge and Eyassu, 1968). In the area, coffee is grown in homesteads under intensive management systems. Farmers of the area use indigenous knowledge to grow about seven coffee landraces having their own characteristics including Shumbure, Abadir, Kubaniya, Buna Guracha, Cherchero, Buna Kella and Goma (Anteneh et al., 2010; Berhanu, 2014). Shumbure coffee landrace is widely grown in West Hararghe due to its resistant to coffee berry disease (Fekede and Gosa, 2015), high yielder at early age and tolerant to drought whereas abadir is the second preferred coffee landrace by farmers in the areas due to its yielding potential and bigger bean size (Berhanu, 2014). However, merely having such potential will not bring significant contribution to country's income unless and otherwise the products meet the demand of customers in terms quality.

Most farmers (55%) in the area harvest coffee by stripping method which allows more cherries to mature, immature, some to dry, some fallen on the ground and some unripe cherries remain intact on the mother tree (Mohammedsani, 2014). Besides, in Hararghe only natural sundried method is used to process coffee by

farmers in which coffee cherries are harvested once from the tree and dried on plastic sheets or bare ground. This indicates the deterioration of Hararghe coffee quality due to improper postharvest management practices which calls for the improvement of agronomic practices such as harvesting, processing and handling practices. Coffee price in the international market has always been fluctuating affected mainly by overproduction. There is also a persistent demand for quality coffee in the world. As a result, coffee quality is the most important factor that determines the desirability and market value of coffee. In this situation, improvement of coffee quality could provide the coffee chain with a new impetus (Wassu, 2011). Similarly, there is a strong interest in producing and marketing coffee of higher quality to alleviate financial problems encountered by coffee farmers in Hararghe (Behailu et al., 2008). Therefore, interventions in the coffee sector in this regard remain of critical importance for both producers and the government to keep a special place of Hararghe coffees in the world coffee market (Scanagri, 2005). Hence, the first priority in research is on coffee quality paying much attention to the regions. Therefore, this study was conducted with the objective of determining the effects of harvesting and postharvest processing methods on the quality of Hararghe coffee.

MATERIALS AND METHODS

Description of the study area

The experiment was conducted at Mechara Agriculture Research Center (McARC) in 2013 cropping season on young established coffee genotype (H-622/98). The characteristic of the selected genotype was presented in Table 1. The site is located in Daro Labu district of West Hararghe Zone at 8°36'38" North and 40°19'29" East. It is 410 km east of Addis Ababa and 110 km southeast of Chiro town, the zonal capital and geographically, it is located at an altitude of 1760 m.a.s.l with average maximum and minimum temperature of 14 and 26°C, respectively and an annual average rainfall of 1143 mm (McARC, 2015).

Treatments and experimental design

The treatments consisted of the combination two harvesting methods viz., strip harvesting and selective harvesting; and six post-harvest processing methods viz., dry processing drying on bare ground, dry processing drying on cemented ground, dry processing drying on plastic sheet, dry processing drying on mesh wire, semi-washed processing drying on mesh wire and wet processing drying on mesh wire. The experiment was laid out in a completely randomized design (CRD) in factorial arrangement with three replications.

Experimental procedures

Harvesting method

Sample cherries were harvested following both harvesting methods. Accordingly, under strip harvesting, cherries were

Table 1. The characteristics of Hararghe coffee genotype (H-622/98) on research field.

Origin	West Hararghe, Daro Labu district
Yield	17.2 Qt/ha of clean green bean
Raw quality	Good
Cup Quality	Good
Screen size	89 %
Flavor note	Slightly mocha
Tolerance to stress	Moderate
Growth habit	Good
Number of branch	Sufficient
Tolerance to major disease	Moderate

harvested once at a time when 75% of the cherries were reached at full ripe stage whereas selective picking the cherries was harvested as they attained full red ripe stage in different time.

Dry processing method

The harvested cherries using both harvesting methods were spread out to dry in the sun using four drying methods (bare ground, cemented, plastic sheet and mesh wire). They were stirred regularly to promote even drying, prevent fermentation and the development of mold in each treatment. Then each sample cherries were dried up to when their outer shell skin became dark brown and brittle. Then after, the sample cherries were hulled with mortar and cleaned.

Wet processing method

Fresh cherries were pulped using single disc hand pulper separately as per its harvesting method. The pulped cherries were collected inside the large size plastic buckets where pulps and floater parchments bean were removed. Subsequently, the wet parchment beans were transferred into other bucket and fresh water was added on it until parchment beans were totally submerged inside the water for fermentation. The parchment beans were fermented for 40 h during which the water was changed three times. When the mucilage was totally degraded, parchment coffee beans were washed intensively for the total removal of mucilage. The resulting parchment beans were allowed to dry under full sun condition on mesh wire and the dried parchment bean were smoothly hulled to produce green bean.

Semi washed processing

Similar to wet processing, the harvested cherries were pulped with single disc hand pulper and collected in large size plastic buckets, however, as opposed to wet processing, parchment beans were immediately washed manually after pulping and rubbed with canvas cloth by hand until the mucilage was totally removed from the parchment beans. During sample drying the moisture content of the bean was measured using Electronic Rapid Moisture Tester (HE 50, Germany) in order to know and maintain the uniform standard recommended moisture level of all sample. The parchment beans were dried on mesh wire until appropriate moisture content of 11 to 12% was attained. Finally, sample parchment green beans were slowly hulled to remove their parchment.

Quality analyses

Clean coffee bean sample of 500 g was taken from each treatment combination based on sampling procedure set by Ethiopian standard (ESBN 8.001), which is on the basis of drawing 3 kg per 10 tons. Representative samples were assigned an arbitrary code in order to secure an unbiased judgment and brought to coffee quality laboratory of the Jimma Agricultural Research Center where the green coffee beans and sensory qualities were evaluated. Then quality evaluation for both physical and cup were carried out by a team (four cuppers) of experienced and internationally certified Q-Grader professional panelists evaluated three times as replications taking 100 g coffee beans from sample coffee of each treatment in each coffee test.

Data collection

Data for the physical and organoleptic quality were taken from representative green bean coffee sample with optimum moisture content of 11.5%. Accordingly, total raw quality which accounts out of 40% was obtained from the sum total of raw quality parameters including 15% by counting primary defects, 15% by weighing secondary defects and 10% odor of each sample; total cup quality which accounts out of 60% was calculated from the sum total of sensory evaluation parameters (15% cup cleanness, 15% acidity, 15% body and 15% flavor) of each sample; overall coffee quality was calculated from the summation of total raw quality value (40%) and cup quality value (60%) of each sample; and finally in order to evaluate the final quality performance of each sample, coffee grading was determined based on its overall coffee quality value following coffee grading standard set by ECX (2010) as Grade 1=91-100%; Grade 2=81-90%; Grade 3=71-80%; Grade 4=63-70%; Grade 5=58-62%; Grade 6=50-57%; Grade 7=40-49%; Grade 8=31-39%; Grade 9=20-30%; and under grade (UG)=15-19%.

Data analysis

Data were subjected to analysis of variance (ANOVA) using general linear model (GLM) procedure using SAS statistical software program (version 9.2). Whenever ANOVA showed significant variation, LSD at 5% probability level was used for treatment mean separation.

RESULTS AND DISCUSSION

Total raw quality

The main treatment effects highly significantly affected

Table 2. Total raw quality of green coffee bean due to the effect of coffee harvesting and postharvest processing methods.

Treatments	Total raw quality (%)
Harvesting methods	
Strip harvesting	20.24 ^b
Selective harvesting	35.94 ^a
LSD (5%)	2.15
Postharvest processing methods	
Dry processed dried on bare ground	21.42 ^c
Dry processed dried on cemented ground	26.67 ^b
Dry processed dried on plastic sheet ground	28.08 ^b
Dry processed dried on mesh wire	32.33 ^a
Semi-washed processed dried on mesh wire	29.72 ^{ab}
Wet processed dried on mesh wire	30.33 ^{ab}
LSD (5%)	3.73
C.V (%)	11.10
Mean	28.09

Mean values followed by the same letter within columns are not significantly different at $P \leq 0.05$ level of significance.

total raw quality of coffee but the two interactions did not significantly affect total raw quality. Among harvesting treatment, selective harvesting registered the higher mean value of total raw quality 36% whereas strip harvested coffee had lower (20%), indicating reduction by about 50% lower of point given as per current standard (ECX, 2010) (Table 2). It showed that even though this coffee will get 60 out of 60% in its total cup quality value, it could never meet specialty coffee standard. The minimum total quality required for specialty coffee is 80% and above and hence, require raw quality improvement by sorting and clearing (ECX, 2010). This perhaps attributed to the collection of mature, immature, over mature, dried, insect and fungus damaged cherries and defected cherries by striping. As result, primary and secondary defects increased to affect raw quality values for such parameters such as odor, shape and make and color of beans. This corroborated with Anteneh (2011) who reported reduced quality attributes due to poor harvesting practices, such as stripping and collecting dropped fruits by promoting uneven moisture levels, inducing fungus and ferment, and introducing foreign matter.

On the other hand, selective picking of only ripe red cherries and sorting defects before drying and processing significantly improved total raw quality of beans. Wintgens (2004) point out that whether to achieve coffee quality by harvesting ripe cherries or harvesting a mixed product and complementing with proper postharvest treatment is a cost benefit decision that coffee growers face. If only ripe cherries are picked, the volume of quality is higher, but harvesting cost is higher. If a mixed product is picked, the volumes of quality coffee are smaller, but harvesting costs low. The

decision facing the grower is whether the saving in harvesting cost offset the loss of income from less quality coffee. If they do, the grower should move away from selective hand picking and in to stripping and modern mechanical harvesting systems to maximize his profits. However, by paying premium price for high quality coffee produced by appropriate harvesting methods followed by good postharvest practice would provide economic incentives for farmers to maintain their coffee quality as well as increase their productivity.

Similarly, coffee total raw quality was highly affected by postharvest processing methods. Accordingly, significantly high value was determined for semi-washed (29.72%), wet (30.33%) and unwashed (32.33%) coffee in that order. In contrast, the least value (21.12%) was recorded for dry processed coffee dried on bare ground followed by those dried on cemented ground (Table 2). This is in agreement with the finding of Berhanu et al. (2014) who reported the highest raw quality from sundried coffee dried on mesh wire, while coffees dried on bricks scored the lowest raw quality values.

The lowest total raw quality for coffees dried on bare ground demonstrated the bad practice that can expose coffee to soil and foreign matter contamination with high secondary defects. Similarly, Anteneh (2011) reported that improper postharvest processing and handling practices (drying on bare ground) can induce fungus and foreign matters and deteriorate quality of coffee. This may result in re-wetting by absorbing soil moisture and favor development of fungus on coffee beans. Berhanu et al. (2014) also explained that similar decline in total raw quality from coffee dried perhaps due to less air movement that can favor mold development and black (foxy) bean formation. This can influence both

Table 3. Total cup quality of Hararghe coffee as influenced by the main effect of harvesting and postharvest processing methods.

Treatments	Total cup quality (%)
Harvesting methods	
Strip harvesting	39.11 ^b
Selective harvesting	44.92 ^a
LSD (5%)	1.85
Postharvest processing methods	
Dry processed dried on bare ground	38.40 ^c
Dry processed dried on cemented ground	40.92 ^b
Dry processed dried on plastic sheet ground	43.36 ^{ab}
Dry processed dried on mesh wire	41.38 ^b
Semi-washed processed dried on mesh wire	43.13 ^{ab}
Wet processed dried on mesh wire	44.88 ^a
LSD (5%)	3.21
C.V (%)	6.40
Mean	42.01

Mean values followed by the same letter within columns are not significantly different at $P \leq 0.05$ level of significance.

color and odor of the beans and increase the degree of defects count. Similarly, the highest result from drying coffees on plastic sheet and raised mesh wire clearly indicate the need for maximum care to maintain the inherent raw quality of coffee genotype. This supported by Selmar et al. (2006) who underlined the importance of covering sundried Arabica coffee drying tables in mesh or plastic sheet to simplify protection of the crop from re-wetting and improve quality coffee owing to the free vertical movement of air through the tables creating conducive environment for moisture loss. Therefore, it is possible to produce beans with the best total raw quality from dry processing and dried on mesh wire than both washed and semi-washed coffees dried on mesh wire. Elsa (2014) also found that sundried coffees prepared by better management of postharvest processing practice have better quality.

Total cup quality

The main effect of harvesting and postharvest processing methods significantly ($P \leq 0.01$) influenced total cup quality but the treatment interaction did not. Selectively harvested coffee cherries exhibited maximum total cup quality value of about 45%. This indicated that selective harvesting of red ripe, healthy and fruits free from any defects with better cleanness, acidity, body and flavor of brew, and thus superior total cup quality. The reverse was true from strip harvested coffee with reduced mean value of 39% (Table 3). This could be explained in terms of human induced practices to either maintain or deteriorate coffee quality that resulted to a number of defect cups. Bertrand et al.

(2006) described that decreased quality of green beans and final quality of brew is due to poor harvesting. Endale *et al.* (2008) found out that harvesting immature stage (unripe) and over-ripe coffee resulted in low caffeine content of brew. Again, Anwar (2010) mentioned that careless harvesting of ripe and unripe green berries collectively might contribute to the deterioration of coffee cup quality.

Among the processing methods, the highest mean value (44.88%) of total cup quality was recorded for wet processed coffee dried on mesh wire (Table 3). This could depict the importance of wet processing method in improving cup quality of coffee. This was in line with finding of Anwar (2010), who described that wet processing method was the best approach to obtain fine and typical flavor in the cup. Similarly, washed coffees have known to present better quality, less body, higher acidity and more aroma than the unwashed coffees (Mazzafera and Padilha-Purcino, 2004). Additionally, the wet or washed coffee method produces a superior acidity in the brewed coffee, fewer defects and a cleaner finish (FAO, 2010).

The lowest mean value (38.4%) was noticed for dry processed and dried on bare floor (Table 3), indicating the worst scenario to deteriorate quality. This could come due to several factors such as shortage of air movement, cherry contaminated with soil and other factors that have an effect on final cup quality. However, coffee dried on appropriate materials were not easily affected as noticed from drying on concrete, plastic sheet and mesh wire as compared to those dried on bare ground. This supported by Musebe et al. (2007), who stated that sun-drying could be an effective method in producing high quality coffee under good ambient

Table 4. Effect of coffee harvesting and postharvest processing methods on the overall coffee quality under Hararghe condition.

Treatments	Overall coffee quality (%)
Harvesting methods	
Strip harvesting	59.35 ^b
Selective harvesting	80.86 ^a
LSD (5%)	3.05
Postharvest processing methods	
Dry processed dried on bare ground	59.82 ^c
Dry processed dried on cemented ground	67.59 ^b
Dry processed dried on plastic sheet ground	71.44 ^{ab}
Dry processed dried on mesh wire	73.71 ^a
Semi-washed processed dried on mesh wire	72.84 ^{ab}
Wet processed dried on mesh wire	75.21 ^a
LSD (5%)	5.28
C.V (%)	6.30
Mean	70.10

Mean values followed by the same letter within columns are not significantly different at $P \leq 0.05$ level of significance.

conditions. In addition, Berhanu et al. (2014) found that, raised bed typically using bamboo mat having better aeration and drainage, maintained the natural quality attributes of coffee. Similarly, Anwar (2010) reported that coffee drying using raised bed with mesh wire, wooden and bamboo plastic sheets have better quality.

Therefore, it can be concluded that selective harvesting and use of drying materials including concrete, plastic sheet mat and raised mesh wire bed can be encouraged in maintaining and improving inherent quality of coffee. Specially drying on raised mesh wire bed was found to be the best option in Hararghe areas. This was in agreement with the finding of Berhanu et al. (2014), who emphasized that improved sun-drying wherein coffee can be dried on raised drying beds is advocated for improved quality and better economic benefits.

Overall coffee quality

Analysis of variance revealed that both the main effects of harvesting and postharvest processing techniques showed highly significant variation, but the interaction did not significantly influenced overall coffee quality. Selective harvesting methods had higher mean value of 80.86% for overall coffee quality. In contrast, strip harvested cherries gave low (59.35%) mean value (Table 4), which is categorized under lowest quality commercial coffee (ECX, 2010). This revealed that only due to poor harvesting practice inherent quality of coffee loses by more than 40%. Similarly, FAO (2010) reported that selective harvested coffee is foremost important in producing superior quality as the cherries were allowed to ripen on the tree to full maturity before harvesting.

Boot (2006) suggested the uniformity of selectively harvested beans is a key feature that provides several advantages for processing and producing high quality coffee. This indicated the greater number of defects in strip harvested coffee samples than from the recommended selective harvesting method. Therefore, although Hararghe coffee has high inherent flavor mocha quality, coffee had poor quality and low price in world market largely due to practicing strip harvesting. Wintgens (2004) pointed out that strip harvesting could reduce the overall coffee quality.

Similarly, postharvest processing methods showed significant effect on overall quality of coffee. Although statistically similar the highest overall coffee quality value was recorded for coffee prepared by wet processed and dry processed that were dried on mesh wire with mean values of 75.21 and 73.71%, respectively (Table 4). This showed that dry processing and drying on appropriate place resulted in good quality similar with wet processed coffee and dried on mesh wire. This is in line with result reported by Anwar (2010), who suggested that, wet processing method resulted in high mean values for good coffee quality. Similarly, FAO (2010) showed that sun-drying can be an economical and effective method in producing high quality coffee if coffee drying under good ambient conditions. Therefore, for a Hararghe coffee genotype both processing methods have positive effect on quality maintaining and improving. Even as far as considering economic preparation of green bean coffee it can be sound full to suggest the already known, natural sundried method with appropriate drying conditions. This might be due to variation in environmental and genetic factors in southwest and Eastern Ethiopia. This has been elaborated by Getu (2009) who pointed out that naturally

Table 5. Effect of coffee harvesting and postharvest processing methods on the coffee grade.

Treatments	Coffee grades
Harvesting methods	
Strip harvesting	5.11 ^b
Selective harvesting	2.44 ^a
LSD (5%)	0.44
Postharvest processing methods	
Dry processed dried on bare ground	5.17 ^a
Dry processed dried on cemented ground	4.33 ^a
Dry processed dried on plastic sheet ground	3.50 ^c
Dry processed dried on mesh wire	3.33 ^c
Semi-washed processed dried on mesh wire	3.33 ^c
Wet processed dried on mesh wire	3.00 ^c
LSD (5%)	0.77
C.V (%)	17.10
Mean	3.78

Mean values followed by the same letter within columns are not significantly different at $P \leq 0.05$ level of significance.

sundried Hararghe coffee have an excellent balanced flavor with good acidity and medium body. Therefore, proper harvesting and dry processing a Hararghe coffee genotype maintained its superior quality similar to wet processed of other coffee producing regions of Ethiopia, indicating the practical implications of dry processing Hararghe coffees. To this end, Appropedia (2010) indicated high coffee quality through the application of appropriate and scientifically approved harvesting and dry processing practices. The present study also showed that although statistically not different, relatively low values for semi-washed coffee than that of full fermented wet processed coffee and dry processed dried on mesh wire (Table 4). Similarly, Mekonen (2009) reported that most coffee varieties under semi-washed showed lower results than those under wet processed for total coffee quality. Moreover, similarly processed coffees showed variation in their overall quality value. In this case, sundried coffee dried on bare ground had the lowest (59.82%) mean value of overall coffee quality, followed by coffee dried on cemented ground (Table 4). This indicates that, due to bad drying technique the quality of coffee was reduced by more than 35%. In line with this, FAO (2010) pointed out that in poor drying conditions it is impossible to produce good quality of sundried coffee. However, coffees dried on plastic sheet and mesh wire gave medium to highest mean value of overall coffee quality. Similar results were found for coffee variety dried on raised bed covered with bamboo mat and mesh wire produced the highest overall coffee quality point (Mekonen, 2009; Anwar, 2010; Berhanu et al., 2014). High quality finished coffee product could only be obtained through the application of appropriate drying and proper management practices (FAO, 2010).

Coffee grading

Analysis of variance showed significant ($P \leq 0.01$) influence of the main effect of coffee harvesting and postharvest processing methods on grading but not their interaction effects. Accordingly, selectively harvested coffee had superior quality (grade 2) that can be categorized under specialty coffee (Table 5). In contrast, coffee produced by strip harvesting had inferior quality (grade 5) which can be categorized under low-grade commercial coffee (ECX, 2010). Therefore, it is possible to produce high quality specialty coffee that can fetch premium price in the world market by selective handpicking of fully ripe red cherries and by using appropriate postharvest processing management. In this regard, Boot (2006) underscored the critical role of harvesting ripe cherries to produce top grade specialty coffee. In agreement with this, Berhanu et al. (2014) reported that, selective harvesting coffee and drying on raised bed covered with appropriate materials (bamboo mat or mesh wire) using the recommended layer thickness loads of 20 kg/m^2 has the highest total quality points of excellent specialty coffee (grade 1). Similarly, the natural processing coffee if consistent quality control is applied to dry processing, the resulting coffee is highly preferred by the specialty coffee industry (Antonym and Surip, 2010).

The lowest coffee grade (grade 5) was recorded for dry processing and dried on bare ground with mean value 5.17, followed by dry processed dried on cemented ground (grade 4) with mean value of 4.33 (Table 5). This might be due to the possibility of high defects and rewetting of coffee cherries dried on the ground, which can favor mold development that resulted in quality

deterioration. In addition, the result showed that, sundried coffee dried on recommended place (plastic sheet ground or mesh wire) was recorded under superior grade similar with washed coffee. Mekonen (2009) and Beza (2011) also reported that, sun dried coffee variety dried on raised mesh wire had a good physical and over all cup quality of superior grade. Beza (2011) has additionally, indicated the extent loss in coffee quality grade and monetary value for different processing methods and drying materials.

Coffee processed by wet processing methods and dried on raised mesh wire possessed superior commercial coffee (grade 3) with mean value of 3.00 (Table 5). Similarly, coffee variety dried on bamboo mat was found to have the highest grading scores (Berhanu et al., 2014). Elsa (2014) also showed that quality performance differences among seven early released coffee varieties due to processing methods and inherent character of varieties. According to Berhanu et al. (2014), this could be associated to the combined effect of processing technologies, inherent quality of the variety and the levels of drying layer thicknesses. Hence, the structure of drying facilities has a great influence in producing good coffee quality.

Conclusion

In spite of the presence distinct inherent quality coffee in Hararghe, problems of pre-and postharvest practices of coffee in the region did not allow to produce consistent and traceable high quality Hararghe coffee as expected from its inherent quality characteristics. Taking these problems into account, this study was conducted to evaluate the effect of harvesting and postharvest processing methods on raw and organoleptic quality of a Hararghe coffee. The finding indicated that, unlike interaction effect, the two main treatments were highly significantly affected total raw quality, total cup quality, overall coffee quality and coffee grade. Selective harvesting produced higher total raw quality and cup quality with higher overall coffee quality that can be categorized under specialty coffee. Dry processed beans dried on mesh wire scored the highest total raw quality mean value, followed by wet processed coffee dried on mesh wire while, wet processed beans dried on mesh wire had the highest total cup quality, followed by dry processed beans dried on plastic sheet ground. Nonetheless, the lowest mean value in both total raw and cup quality values was recorded for dry processed beans dried on bare ground floor. Whereas, dry processing methods, drying cherries on raised mesh wire and plastic sheet ground floor produced better raw and cup quality as compared to bare and cemented ground. The best overall coffee quality was recorded for wet processed coffee and dry processed coffee dried on mesh wire than all the other treatment. Therefore, it can be suggested to be processed using wet and dry processing methods as

far as cherries are drying on mesh wire but, as far as economic coffee bean preparation point of view under this study areas dry method followed by appropriate drying techniques might be most sound full to produce superior overall coffee quality.

In general, the overall findings of the present study indicated that quality of coffee in Hararghe was highly affected by harvesting and drying methods. On the contrary, strip harvesting as practiced by many Hararghe coffee producers has a determinant effect on coffee quality. This showed that if producers avoid stripping cherries and practiced selective picking of red cherries only, the quality of coffee could be improved first by increasing percentage of bean retain above screen, decreasing number of primary and secondary defects thereby improving shape and make, odor and color of the bean and as a result enhancing overall quality of brew. Moreover, drying coffee on bare ground highly reduced raw and cup quality of coffee by producing off-flavor, abnormal color and unpleasant odor and finally cup cleanness, acidity and body. Therefore, proper harvesting and drying practices were found to be crucial in maintaining the typical inherent quality characteristics of Hararghe coffee beans.

CONFLICT OF INTERESTS

The author has not declared any conflict of interests.

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