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Methods of Dry Processing Affecting the Cup Quality of Coffee Arabica

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Abstract: Coffee is the most important crop in the national economy of Ethiopia and the leading export commodity. Cup quality is a complex characteristic which depends on a series of factors such as the species or variety (genetic factors). Ethiopia had been the origin of coffee since coffee plant was initially found and cultivated in the Kaffa province (Bonga, Makira) of Ethiopia. However, due to poor pre-and post-harvest handling practices, the quality of its coffee is below level of its inherent quality characteristics. 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. Coffee quality was evaluated based on the physical and cup quality attributes. Cup quality was assessed by experienced and professional coffee tasters (3–5 numbers). The cup quality was evaluated based on Hedonic scale with rating from 1 to 6 (6, good; 5, above average; 4, average; 3, below average; 2, falling off; 1, poor). Quality can be a section of coffee comes from a combination of the botanical variety, topographical conditions, weather conditions and the management given during growing spell, harvesting, storage, preparation for export and transport. The top medium pointed to pointed acidity was recorded under wet processing method with a mean value of 12.51. The medium acidity was recorded under sun dried processing method with a mean value of 10.46.All cherries harvested using both harvesting methods were immediately spread out to dry in the sun using four drying methods (bare, cemented and plastic sheet ground and raised mesh wire table). They were stirred regularly to promote even drying, prevent fermentation and the development of mold in each treatment.

Key words: Coffee · Quality · Arabica · Processing

INTRODUCTION

Coffee is the most important crop in the national economy of Ethiopia and the leading export commodity. Ethiopia is well known not only for being the home of Arabica coffee, but also for it is very fine quality coffee acclaimed for its aroma and flavor characteristics. Most popular beverages worldwide and become the most important traded commodity after petroleum. It's significant impact on the world economy and people welfare has been well-recognized. World Coffee Outlook reported that exporting and re-exporting activities have been growing consistently in the last five decades. Considerable growth has been observed after the year 2000 [1] and an important crop that assures a sustainable economy to farmers in tropical regions.

A dramatic concern for coffee production is currently represented by climate change, which threatens the survival of Coffee Arabica cultivation worldwide and imposes medications of the agronomic practices to prevent this risk. The quality of coffee beans depends on optimized protocols of cultivation, ripe berries collection and removal of the outer fruit layers by dry or wet processes and moisture reduction. Storage and shipment represent two steps where bean quality needs to be preserved by preventing fungal contamination that may

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impact the final product and form mycotoxins, mainly [2]. Coffee quality is critical importance to the coffee industry and could be affected by several factors from farm to cup including the post-harvest processing methods [3].

Cup quality is a complex characteristic which depends on a series of factors such as the species or variety (genetic factors), environmental conditions (ecological factors), agronomical practices (cultivation factors), processing systems (postharvest factors), storage conditions, industrial processing, preparation of the beverage and taste of the consumer [4]. Demand on high quality coffee for consumption is continually increasing not only in the consuming countries (importers) but also in the producing countries (exporters). Different post-harvest processing methods to produce green coffee beans (natural/dry, semi-washed and fully-washed processing) under sun drying. Physical quality evaluation was based on The Indonesian National Standard (SNI 01-29072008) drying was proven to yield a higher quality green coffee beans and minimize losses [3]. In terms of organoleptic cup-quality, physical appearances and inherent chemical constituents such as sugars, caffeine, volatile and nonvolatile phenolic contents of a green bean produced. Coffee quality is considerably affected by many factors. Inter alias, inappropriate post-harvest practices are major problems of Ethiopian coffee, since numerous factors are affecting coffee quality. Improper coffee roasting temperature and duration may be factor for quality difference even if similar post-harvest practices applied for the same coffee variety. Thus post-harvest processing techniques largely contribute to the decline in coffee quality processing method and roasting duration on cup quality of selected Arabica coffee varieties. Primary and secondary coffee processing determines 60% of coffee quality [5] and mechanical harvest, produce the best quality green coffee by decreasing the percentage of faults in coffee batches depending on the magnitude of attention during pre-harvesting and post harvesting processes have strong consequences on coffee quality. To achieve coffee quality by harvesting ripe cherries or harvesting a mixed product and equilibrating with proper post-harvest treatment is a cost benefit decision that coffee growers will have to face [6]. Postharvest practices for sun drying of coffee to come up with technical recommendations to ensure premium coffee quality [7].

Literature Review

Coffee Production in Ethiopia: Ethiopia had been the origin of coffee since coffee plant was initially found and cultivated in the Kaffa province (Bonga, Makira) of Ethiopia [8]. Ethiopia is the primary center of origin and center of genetic diversity of Coffee Arabica L. and the existence of such genetic diversity provides immense opportunity for coffee improvement. Ethiopia is the home and cradle of biodiversity of Arabica coffee seeds and also it is the center for origin, diversification and dissemination of the coffee plant [9].

According to Central statistical Agency Agricultural sample survey [10] the estimated area of land covered by coffee in Ethiopia is about 700474.69 ha, whereas the estimated annual national production of clean coffee is about 469091.12 tons with average productivity of 669.6 kg ha^{-1}. Ethiopia has about 25 % of the total populations of the country are dependent on production, processing, distribution and export of coffee. It accounts for more than 25 % of the GNP, 40% of the total export earnings, absorbing 25 % of the employment opportunity for both rural and urban dwellers and 10 % of the total government revenue [11]. According to Berhanu Tsegaye *et al.* [12] the total area covered by coffee in Ethiopia is about 600, 000 hectares, with a total of annual coffee production ranges from 300, 000-350, 000 tones, which is about 600 kg ha^{-1}. Out of this, more than 90 % of the coffee is produced by small-scale subsistent farmers, while the remaining comes from private and government owned large-scale farmers.

In southern regions, about 50 districts are producing coffee and 235, 000 ha of land is devoted to coffee production with the annual production of 120000-140000 tons, of which 70, 000 to 100, 000 tons are supplied to the central market. The washed and sun dried coffees account for 46 % and 54 % making the share of washed coffee to 70 % of the country's export [13] and also Eastern Ethiopia is naturally known for producing best quality of coffee [14]. 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 [15]. 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 [16] and sold at a premium price both at domestic and international coffee markets. 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 [17]. However, due to poor pre-and post-harvest handling practices, the quality of its coffee is below level of its inherent quality characteristics [14].

Coffee Processing and Quality: 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. Dry processing un-pulped cherries are dried whole in the sun under natural conditions after harvesting. In the washed method the cherries are pulped immediately after picking followed by fermentation and washing to remove mucilage cover. Post-harvest primary coffee processing was sun-drying. This was followed by washed coffee processing using hand pulpers and coffee washing stations 71% of the coffee produced by smallholder farmers undergoes sun-drying and the remainder is washed [18].

Coffee quality was evaluated based on the physical and cup quality attributes. Cup quality was assessed by experienced and professional coffee tasters (3-5 numbers). The cup quality was evaluated based on Hedonic scale with rating from 1 to 6 (6, good; 5, above average; 4, average; 3, below average; 2, falling off; 1, poor). These ratings are a measure of cup quality such as acidity, body and aroma or flavor. The rating presented in the current study is based on the coffee quality evaluation generally employed for marketing purposes [19]. [18] 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 Coffee 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 Khatedulis [20].

Quality can be a section of coffee comes from a combination of the botanical variety, topographical conditions, weather conditions and the management given during growing spell, harvesting, storage, preparation for export and transport. They comprise intervention by human beings, whose motivation is the main factor in the determination of the final quality of a part of green coffee. Several factors contribute to the quality of the coffee that producers and environment widely handle them ITC [21]. According to Leroy *et al.* [22], the current context of overproduction and low prices of the coffee market, improvement and valorization of coffee quality could provide the coffee chain with a new impetus At the farmer level, coffee quality is a combination of production level, price and easiness of culture; at the exporter or importer level, coffee quality is linked to bean size, lack of defects and regularity of provision, tonnage available, physical characteristics and price; at the roaster level, coffee quality depends on moisture content, stability of the characteristics, origin, price, biochemical compounds and organoleptic quality.

There are different views of expressing quality. ITC [23], defines that the quality of a parcel of coffee comes from combination of the botanical variety, topographical conditions, weather conditions and the care taken during growing, harvesting, storage, export preparation and transport. On the other hand, for coffee, the definition of quality and the attributes considered have probably evolved through the centuries. Now days, according to Leroy *et al.* [22], this definition varies along the production to consumer chain: At the farmer level: coffee quality is combination of production level, price and easiness of culture; At the exporter or importer level: coffee quality is linked to bean size, lack of defects, regularity of provisioning, tonnage available, physical characteristics and price; At the roaster level: coffee qualities depend on moisture content, stability of the characteristics, origin, price, biochemical compounds and organoleptic quality. It should be noted that each consumer market or country may define its own organoleptic qualities. At the consumer level: coffee quality deal with price, taste and flavor, effect on health and alertness, geographical origin, environmental and sociological aspects (organic coffee, fair trade, etc).

The top medium pointed to pointed acidity was recorded under wet processing method with a mean value of 12.51. The medium acidity was recorded under sun dried processing method with a mean value of 10.46. There for coffee subjected to sun dried had the highest medium to full body (12.42) and coffee sample subjected to washing treatment showed the lowest medium body of 10.27 this Significant difference were detected in total quality due to processing treatment [24].

Coffee Quality: Quality is a determining factor in the price of coffee beans [25] is a critical importance to the coffee industry. Quality coffee is a product that has desirable characteristics such as clean raw and roasted appearance, attractive aroma and good cup taste [26] and traditionally focused on varietal and environment [27]. Moreover, coffee quality comes from a combination of the botanical variety, topographical and weather conditions and the care taken during growing, harvesting, processing, storage, export preparation and transport [28]. Coffee quality is associated to a set of factors that involve physio-chemical and sensory aspects which in turn, depend on postharvest handling and processing [29]. Drying causes stress metabolism that can also play a role in the chemical compounds present [30].

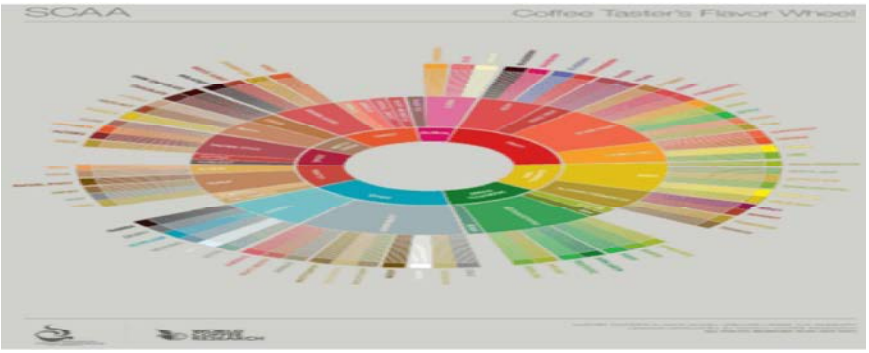

Fig. 1: The Coffee Taster's Flavour Wheel by the Specialty Coffee Association of America (SCAA) and World Coffee Research (WCR) (©2016) licensed under a Creative Commons Attribution-Non Commercial-No Derivatives 4.0 International License, as courtesy by E. Sage of SCAA source [33]

The Specialty Coffee Association of America (SCAA) continues to define specialty in this context. In this respect, Golden Mountain coffee growers in Thailand, must be mentioned as an example, since they put a premium on taking extra care, both before and after processing, to inspect beans and ensure the export of only the finest choice of high-quality products. Both electronic light sensors and individuals pick out imperfections, ensuring that when the beans reach roasters and customers they reflect all the hard work involved in growing and processing them [31].

Drying is also considered an important step in quality coffee production, since moisture levels higher than 12% can promote microbial growth and mycotoxin formation [32] and cup of coffee is then graded according to the classification of Specialty Grade, or Below Specialty Grade. The Technical Standards Committee (TSC) of the SCAA recommended certain standards for cupping coffee, such as sample preparation to evaluation the quality.i.e., sensory testing, flavour description, scoring. A sensory lexicon has been established, for the tasting and cupping experience, applying sensory science to name coffee's primary sensory attributes and pave the way for a replicable measuring of those qualities. The Coffee Quality Institute (CQI) protocols introduced a Cupping Form, with sensory descriptive analysis, to show the quantifiable difference in sensory characteristics of two quality coffees. Based on the protocol, it was evaluated that a good Castillo is fruity but not citric, with notes of dark chocolate and roasted nuts, while a good Caturra is floral with cocoa and caramel note. The Coffee Taster's Flavour Wheel (©2016), by SCAA and World Coffee Research (WCR), licensed under a Creative Commons Attribution-Non Commercial-No Derivatives 4.0 International License(CCBY-NC ND 4.0), is reproduced, by courtesy of Emma Sage of SCAA [33]. The work is based on the World Coffee Research Sensory Lexicon, with the collaboration of professional sensory panelists, scientists, coffee buyers and roasting companies collaborating via WCR and SCAA [31].

The SCAA Cupping Form provides a means of recording important flavour attributes for coffee: fragrance/aroma, flavour, aftertaste, acidity, body, balance, uniformity, clean cup, sweetness, defects and"overall"attributes. The over all score is based on the flavour experience of the individual"cupper" as a personal appraisal. The specific flavour attributes are positive scores of quality reflecting a judgment rating by the cupper [31]. In blind cupping tests, wet-processed coffee generally scores higher than dry processed coffee had been assumed that this was because wet-processed coffee had a higher percentage of ripe fruit harvested, while dry-processed had a wider range of ripeness, including unripe and overripe fruits [34]. The two main processing methods have a measurably different affection the sugars and flavor precursors present, which in turn play a role in complex metabolic processes that the bean undergoes during processing and drying. Metabolic processes are related to germination, which starts to occur even when the period between harvest and final drying is short [35]. Water content of the roasted coffee was calculated by weighing of ground roasted coffee before and after a stay of 16 h ±15 mn in an oven less than 103±2°C. The organoleptic quality of coffee was evaluated through the triangular test [36], using the following judgment specifications: 1) The unique sample, different from the others, 2) The high bitterness sample(s), 3) The high acidity sample(s), 4) The high aroma sample(s) and 5) The high preference sample(s). Drying of coffee cherries lead to the obtention of more defective beans than drying of fermented and pulped coffee.

Table 1: Effect of the Types of Demucilagination Yield in Green Coffee (Gc) Insect Damage Beans Content in Green Bean (Wcg) Weight Coffee (Wlr) Swelling Index in Roster and Water Content in Rosted Coffee

Type of demucila-gination	gc (% wt)	db (% wt)	iab (% wt)	wcg (% wt)	wlr (% wt)	swr (% vol)	wcr (% wt)
DP[x1]	51,10[a(1)]	39,00[a(2)]	31,00	13,70[a]	23,50[a]	70,30[a]	05,50[a]
CF-H_2O	85,10[b]	49,60[ab]	07,00[b]	10,20[c]	15,10[c]	84,10[b]	02,72[b]
CF+H_2O	85,50[b]	57,30[bc]	09,20[b]	12,20[b]	12,50[ab]	84,80[b]	03,12[b]
EF+H_2O	85,60[b]	52,00[cd]	10,00[b]	12,30[b]	18,90[b]	84,40[ab]	02,65[b]
NF-H_2O	85,80[b]	59,80[d]	10,30[a]	12,10[b]	15,50[c]	74,80[a]	02,69[b]
NF+H_2O	86,00[b]	70,40[de]	08,90[b]	12,80[b]	16,20[b]	77,50[a]	02,95[b]
EF-H_2O	86,20[b]	82,20[e]	09,90[b]	10,50[c]	16,10[bc]	77,40[a]	02,74[b]

Source journal multidisciplinary Engineering science [37]

Fig. 2: Wet-processed (depulped& washed; left) and dry-processed (dried in fruit; right; source [38]

The use of the commercial enzyme for mucilage removal has reduced more defective coffee as compared to that obtained with sodium hydroxide. Besides, enzymatic is faster and more efficient than natural fermentation. Among the types of mucilage disintegrating methods, water dipping yielded no significant change. The coffee borers constitute the major cause of insect-attacked beans. Coffee borers damaged coffee was significantly higher when coffee was processed by the dry method [35].

Water content of roasted coffee is not influenced by the type of fermentation; instead, any fermentation form brought a significant reduction in humidity content of roasted coffee, in comparison with the dry method. During roasting, water content increased in coffee as temperatures increased. The dry method and the use of sodium hydroxide, followed by dipping in water brought a significant increase in weight loss in roasted coffee [35].

Processing System and Cup Quality of Arabica Coffee: Arabica coffee is processed in one of two ways: dry processing and wet processing. Dry processing is simpler; more often used in East Africa and involves simply allowing the harvested fruits to dry in the sun intact. When they are dry, the beans are removed by a machine. Wet processing is more common in Latin America and involves more steps. The beans are removed from the fruit, allowed to ferment to remove a slippery mucilage layer, washed and dried [38].

Postharvest Processing Systems: Coffee processing begins just after the harvesting of coffee cherries. Coffee cherry processing consists primarily of drying (natural, wet, or semi-wet), fermentation, roasting, storage, grinding and brewing. For the sake of better understanding the nature, significance and sequence of processing events, initial and immediate processing of cherries involving green bean production is here grouped into secondary processing, while processing after green bean production is grouped into the primary processing of coffee [39].

All cherries harvested using both harvesting methods were immediately spread out to dry in the sun using four drying methods (bare, cemented and plastic sheet ground and raised mesh wire table). They were stirred regularly to promote even drying, prevent fermentation and the development of mold in each treatment [40] harvesting and postharvest processing methods 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%. 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 [41] described that decreased quality of green beans and final quality of brew is due to poor harvesting [42].

In order to enhance quality and market value of Ethiopian coffee, improved primary processing by farmers at the village level is a prerequisite. An improvement in coffee quality and therefore income, has a direct impact on the livelihoods of a large number of resource-poor people in the rural populations. Farmers dry their coffee using different approaches. About 48.0% spread their coffee on the ground, 49.5% dry on raised drying beds and 2.5% dry on cemented floors. The preferred method for coffee drying is on raised drying beds as reported by 67.3% of the farmers. However, most of the coffee is dried on the ground due to the farmers' inability to construct drying beds. Methods for ensuring farmer accessibility to raised drying beds need to be sought. This may involve initial supply of materials/equipment for drying coffee; such as black net shed, jute strip and plastic sheets. Indeed 81% of the farmers indicated that they were interested in owning raised drying beds [43].

Effect of Processing on Coffee Quality: Post processing handling practices creates a major change on physical properties of roasted coffee beans due to roasting of different quality beans together evolves high water elimination, formation of gases and water vapors and thereby promotes the bean expansion [44] According to Mohammeds and Amin Ameyu [45] reported that the interaction effects of harvesting and postharvest processing methods were highly significant variation on roast volume change. The highest roast volume increment (93%) was observed from strip harvesting, dry processed and dried on bare ground, while the lowest (69%) was recorded for beans harvested in strip, semi-washed processed and dried on mesh wire. In contrary, selective harvesting produced the lowest volume change that ranges from 65% for dry processed beans and dried on cemented ground and 55% for dry processed bean dried on mesh wire. This perhaps is due to chemical and physical changes in the coffee bean caused by heat energy.

Table 2: Effect of harvesting and postharvest processing methods on roast volume change of coffee beans

Processing method	Roast volume change (%)
Harvesting Methods	
Strip harvesting	81.05
Selective harvesting	61.16
LSD (5%)	2.81
Postharvest Processing Methods	
Dry processed dried on bare ground	76.79
Dry processed dried on cemented ground	74.32
Dry processed dried on plastic sheet ground	71.08
Dry processed dried on mesh wire	70.06
Semi-washed processed dried on mesh wire	66.39
Wet processed dried on mesh wire	67.97
LSD (5%)	4.87
C.V (%)	5.7
Mean	71.10

Source [45]

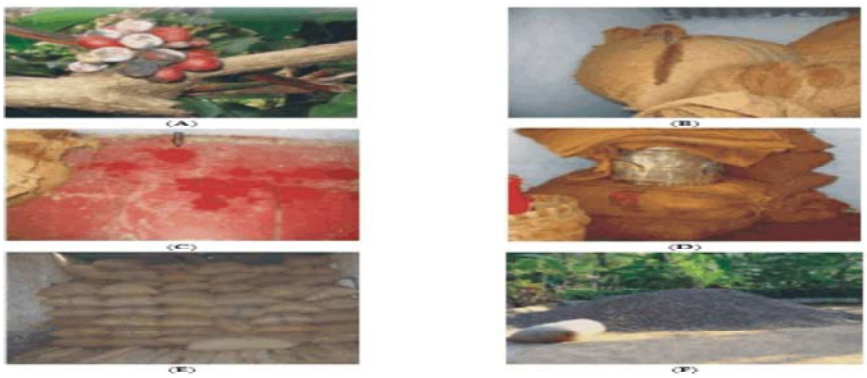

Fig. 3: Various stages of coffee processing supporting the development of ochratoxigenic fungi source [31]

Table 3: Postharvest treatment of coffee Effect on quality

Operations	Expression	Reasons
Pulping	Green cherries Fermented cherries Nipped, bruised beans	Early harvesting Delay before pulping Unadjusted pulping machine
Fermentation	Pungent taste Bitter, fermented taste Stinker beans	Dirty water Inadequate removal of mucilage Unhygienic, dry fermentation
Washing	Stinker Fermented Earthy beans	Inappropriate equipment Dirty water Earth contact when drying
Drying	Green cherries discolored green beans Burnt, soft beans	Early harvesting Drying on the ground Over drying
Hulling	Broken beans Quakers	Poor adjustment of machine Improper sorting and grading

Source: [52]

(A) Presence of Aspergilli on ripe coffee fruits; (B) rewetting of dried coffee stored in juta packages; (C) dampness of the storage floor due to moisture inflltration; (D) improper storage of packages on a farm without isolation from the adjacent walls. Infiltration of moisture from rooftops that wet the stored packaged coffee; (E) too heavily packed storage rooms at estate level; (F) poor drying surface on compacted soil [31].

Post Harvesting Factor: Inappropriate post-harvest practices are major problems of Ethiopian coffee, since numerous factors are affecting coffee quality. Improper coffee roasting temperature and duration may be factor for quality difference even if similar post-harvest practices applied for the same coffee variety. Thus post-harvest processing techniques largely contribute to the decline in coffee quality [46]. Depending on the post-harvest processes, significant effects on coffee quality can be observed [47]. Processing is a very important activity in coffee production and plays a crucial role in quality determination [48].

Coffee is either processed by the wet or dry methods, which vary in complexity and expected quality of the coffee [49]. 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 [50]. During post-harvest processing and handling practices period the chemical structure of green coffee and consequently the final coffee quality adequately determined using postharvest treatment of the wet and dry processing. As recently shown, there are distinct differences in the chemical composition of various processed coffee beans [51]. Impacts of different postharvest operation on coffee quality as presented. On postharvest processing in relation to coffee quality strongly supports the views and opinions.

Pre Harvesting Factors: Yigzaw Dessalegn [53], reported that in South America, coffee grown with heavy application of nitrogen fertilizer had poorer, lighter and thinner quality than that from unfertilized fields. An excess of nitrogen increase the caffeine content, resulting in a more bitter taste of the brew. The caffeine and chlorgenic acid contents of the beans are not affected by the levels of phosphorus, calcium, potassium and magnesium in the soil. A lack of zinc will lead to the production of small light grey-colored beans, which will produce poor liquor. The relationship between crop management and total coffee quality, however, has not yet been investigated in detail Pests and diseases attacks can affect the cherries directly or cause them to deteriorate by debilitating the plants, which will then produce immature or damaged fruits. Disease and insect attack (such as leaf miner and mites) may also result in lower quality beans For instance, as reported by the coffee berry borer *Hypothenemushampii* feeds and reproduces inside the coffee beans and causes their quality to deteriorate. The antestia sting bug as a vector of micro-organisms damages the bean and causes a bitter flavor. Similarly, the fly *Ceratitiscapitata* feeds on the mucilage [54] and the cherry becomes infected with micro-organisms; the secondary bacterial infection causes a distinct potato flavor. OTA (Ochratoxin A) is a form of mycotoxin, produced as a metabolic product of *Aspergillusochraceus*, Eshetu Derso and Girma Adugna [55].

Storage Condition: The viability and quality of living coffee beans with their own active physiological system are highly influenced by storage conditions. Temperature, relative humidity (RH), moisture and gas/air composition are the main driving forces of storage conditions Temperature is a mostcrucial factor influencing both the viability and quality of coffee beans. Coffee beans need to be stored at a low temperature to slow down metabolism [56] because Coffee is susceptible to attacks by pests' and fungi. The damage caused to coffee by these two parasites can be extremely serious both from the financial point of view and with regard to the incidence on consumers' health. This does not only involve the pesticide residue level in the bean, but also the level of toxins, which may affect human beings.

As a result, many companies engaged in coffee processing, storage and transportation have set up process control programs. Similar control systems should be set up to guarantee quality through traceability, good storage practice, identification of critical control points and quality monitoring systems [57].

Coffee storage is a crucial step, since the dried coffee can easily absorb bad flavors or moisture that degrades the quality from the storage area. Farmers or traders should put into a cool dry area away from the potential contaminants, such as cow dung, soils, chickens and smoke sources. The moisture levels were checked frequently to ensure that the levels had equilibrated and stabilized at the target moisture levels. Besides this, due to the underlying imbalance between supply and demand in the coffee market, it is sometimes necessary to store coffee for long period of time in which the length of storage affects the quality of coffee [58] storing coffee for long periods of time affected their qualities and aged coffee may suffer a loss of their acidity, which is needed for a coffee to have a specialty coffee grade [54] On the other hand, length and condition of bean storage also affect cup quality [59].

In the storage coffee affected by different Pests and fungi, insects are one of the most important problems in coffee storage. Damage caused by insects can be lethal to the point that it may destroy the total value of a stored lot 71 % of the coffee damage appeared in imports. Some of the insects that affect coffee during storage are coffee berry borer, an important pest in coffee in its storage because its biological cycle enables it to continue feeding on the beans for months, it can even cause total loss of the infested beans, which leads to the drop of their commercial value. And coffee bean weevil, one of the most harmful as it even attacks dry coffee cherries. Its larvae develop in environments with a high RH, 80% and temperature of 25°C or more, conditions which generally prevail in tropical and sub-tropical areas [60].

And also Fungi, which chiefly attack coffee are *Aspergillus* spp. and *Penicilliumverucosum*. The development of these fungi is favored when the moisture content of the bean is higher than 15 % and the RH above 75 %. Therefore, the level of moisture content should be maintained below 15 % and RH should be less than 70 %. In addition to their impact on the appearance, the aroma and flavor of coffee, fungi also produce toxic substances, which can be harmful when consumed. The most important of these are mycotoxins and ochratoxins, for which maximum tolerance levels have been ascertained [61].

Industrial Processing: Industry is the present and future challenges affecting the coffee production, challenges faced by the coffee industry to guarantee quality from production to roasting and brewing. recently established specialty coffee section and the technological approaches that coffee producers can put into practice in order to assure a high quality product and specialty grade coffees every year, including improvements in moisture avoidance, optimization of storage conditions and packaging [62]. Beyond harvesting high quality coffee cherries, the coffee industry and local producers rely on procedures for coffee bean processing, that may involve controlled fermentation, to obtain the desired characteristics, in terms of ?avours, proteolysis and lipolysis, synthesis of volatiles such as aldehydes and chetones, free fatty acids and acidity (sour/citric) in the product. Control on these processes is required to avoid spoilage by bacteria and undesired fungi, such as ochratoxin producing [63].

Climatic Factor: Coffee has proven to be highly sensitive to climate change. Because coffee plantations have a lifespan of about thirty years, the likely affects of future climates are already a concern [64]. The environment has also a strong influence on coffee quality [52] specially Arabica coffee quality is strongly affected by temperature increases since, for optimum growth and taste, a temperature of about 18-21°C is required, while the exposure to temperatures of 23°C or higher can in most cases accelerate ripening of fruits and negatively affect the quality of the product [65]. Another threat linked to the increased temperatures and rainfall is the rise of the coffee leaf rust that has become prevalent at higher altitudes than before and has attacked Arabica coffee [67].

Climate, altitude and shade can play an important role through regulating temperature, availability of light and water during the ripening period. The distributions of rainfall and sunshine hour have a strong influence on flowering, bean expansion and ripening. For instance, chlorogenic acids and fat content have been found to increase with elevation in C. Arabica. The role of soil types has been well studied and it is generally admitted that the most acidic coffee are grown on rich volcanic soils [52]. The slowed-down ripening process of coffee berries at higher elevations (lower air temperatures), or under shading, allows more time for complete bean filling. Yielding beans that are denser and far more intense in flavor than their neighbors grown at lower altitudes (or under full sunlight). The slower maturation process should therefore play a central role in determining

high cup quality, possibly by guaranteeing the full manifestation of all biochemical steps required for the development of the beverage quality [68].

Genetic Factors: As harvesting method, post-harvest procedures and the physiology of the plant itself affect coffee quality, its genetic origin (species and genotype) also greatly influence coffee quality [22]. The Coffee genus includes more than one hundred different species between which a large variation in terms of chemical composition is observed [69] and genetic correlation with preference, was easy to determine organoleptically and had relatively high sensitivity in discriminating different coffee genotypes. According to Yigzaw Dessalegn [53] reports revealed that coffee quality depends on genetic make-up and genes control the production of chemical compounds that behave as aroma agents either directly or as aroma precursors expressed during the roasting process. Hence while selecting a cultivar to be planted; cup quality must be the first priority to be considered.

Farther more improved the cup quality of different coffee genotypes with the assistance of professional coffee tasters. Characteristics of the cultivars, indicating that any one panel could be relied on selection for cup quality [70]. The main quality traits that could be improved for Robusta coffee are the following: bean size and extractable soluble solids regarding technological qualities, sugars, caffeine, trigonelline, lipids, chlorogenic acids for biochemical traits and beverage quality [22].

Genetics, pests, Fungus and etc another factors that affecting coffee quality in local community the place where he used for drying. In different region post-harvest process is different for examples most of are used bare ground and plastic sheet ground due to these process quality of coffee decrease in time to time.

Future Line: In order to ensure quality processed coffees in the future in the face of climate change, declining producer populations and more, we as roasters and importers must continue to express interest in well- and/or inventively-processed coffees. Further, we must help foster and expand a knowledge support system for farmers to access the information they need to learn new or improve their existing processing methods. This may take the form of new certifications or classes for processing. For more improving quality of coffee advice farmers to using natural fertilizers better than chemicals and gives training during pre-harvesting and post harvesting because most coffee quality decreasing after and before harvesting better than genetic. Similarly in terms of genetic diversity all researchers give attention for distributing better survive according to condition of the area un less the Economy of our country under question in terms of exporting coffee. Generally to improve the quality of coffee is not only issue of one sectors all sectors and all people are includes to creating awareness for suppliers otherwise the economy of the country decrease with quality of coffee.

CONCLUSIONS

Coffee is a crops nationally use to improving Economy of the country Ethiopians has the home of coffee Arabica and well known exporting quality coffee to foreign country. Coffee quality is critical importance to the coffee industry and could be affected by several factors from farm to cup including the post-harvest processing methods. There are different coffee processing methods under this; Ethiopians has used 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. Quality of coffee can evaluates by two methods physical and cup quality attributes. Coffee cup quality evaluated depends on the Hedonic scale with rating from 1 to 6 (6, good; 5, above average; 4, average; 3, below average; 2, falling off; 1, poor). Inappropriate post-harvest practices are major problems of Ethiopian coffee, since numerous factors are affecting coffee quality such as storage, climates,

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