

Full Length Research Paper

# The role of avocado production in coffee based farming systems of South Western Ethiopia: The case of Jimma zone

Berhanu Megerssa

Department of Agricultural Economics, Rural Development and Value Chain Management, Jimma University College of Agriculture and Veterinary Medicine, P. O. Box 307, Jimma, Ethiopia.

Accepted 23 April, 2013

Empirical data collected from smallholder farmers (N = 99) residing in three Woredas of Jimma zone, was analyzed to investigate production issues pertaining to avocados, and the pros and cons of producing the crop was investigated. To address these tasks, field and desk research was accompanied by interviews and discussions with focus groups. Despite the crop's potential, data suggest that avocados have not yet been fully exploited in Jimma zone where the crop remains an elemental component of farming systems. Results highlighted a shortage of large commercial processors, weak financial institutions and monetary support, and a lack of enabling infrastructure, especially such as research, and extension to support farmers, and production and marketing chains. Despite large production volumes, the potential of avocado production is not being realized because of these identified shortcomings. Consequently, intervention points and socio-economic constraints are outlined in an attempt to improve avocado production capabilities in Jimma zone.

**Key words:** Avocado, Jimma, production, smallholder farmers.

## INTRODUCTION

Avocado (*Persea americana* Miller) is native to Mexico. Because of its high calorific value, the fruit is proclaimed as the Globe's healthiest fruit (Guinness Book of Records, 2010) and the crop brings considerable net return per acre when compared to staple crops (FAO, 2005). In addition to its high nutritive values, avocados can also be used as shade trees, windbreaks, posts, and ornamentals (Albertin and Nair, 2004). Large plantations may play an important role in carbon storage and sequestration that mitigates environmental pollution (Kirby and Potvin, 2007).

Avocado's global production has now reached more than 3.8 million metric tons (FAOSTAT, 2010). These days, the crop is produced in several countries where

Ethiopia stands the 10<sup>th</sup> leading producer and 6<sup>th</sup> most important consumer in the world (FAOSTAT, 2010).

Avocado was first introduced to Ethiopia in 1938 by private orchardists in Hirna and Wondo-genet and production gradually spread into the countryside where the crop was adapted to different agro-ecologies (Edossa, 1997; Woyessa and Berhanu, 2010; Zekarias, 2010). Avocados are second in total volume of production, next to banana, in Ethiopia (Joosten, 2007). Annual avocado production in Ethiopia is 80,000 tons. The crop is now produced by more than half a million farmers countrywide who collectively farm more than 7,000 ha of land (CSA, 2008; FAOSTAT, 2010; Joosten, 2007).

Jimma Agricultural Research Center (JARC) pioneered the introduction of avocados to South-western Ethiopia (Edossa, 1997; Farm Africa and SOS Sahel, 2004; Mohamed et al., 2009; Woyessa and Berhanu, 2010; Zekarias, 2010). According to these sources, the center established the first avocado varietal orchard in 1969 with materials initially sourced from Wondo-genet and Debrezeit. Jimma is the 4<sup>th</sup> largest avocado producing zone of Ethiopia, after Wolayata, Sidama and Haditya zones. In Jimma zone, many households have relied on avocados as a major source of income (CSA, 2008). Avocados are the principal cash crop in South-western Ethiopia and large numbers of farming households rely on avocados for their livelihood (CSA, 2008; MoARD, 2008).

Despite relatively early establishment, the avocado industry in Ethiopia is in its infancy and has not yet utilized the immense potential of this crop. According to World Bank Group (2006), lack of concerted public support, scanty information, and lack of systematically documented knowledge that is readily accessible are the main constraints hampering the development of this sector. If these hurdles are not overcome, it is obvious that Ethiopia's capacity to produce avocado will not improve. In consideration of these facts, this work sought to identify impediments associated with the value chain of avocados in Jimma zone, South-western Ethiopia.

## Objectives of the study

### General objectives

1) To evaluate the role of avocado production in the coffee based farming system of South-western Ethiopia, Jimma zone.

### Specific objectives

- 1) To characterize the avocado production system
- 2) To analyze determinants of market supply

## METHODOLOGY

### Description of the study area

Jimma zone is the most prominent avocado growing area in South-western Ethiopia, where coffee production prevails in Afromontaine forest remnants. The zone is located between 7° 13' and 8° 56' N latitude, and 35° 52' and 37° 37' E longitude. The zone is characterized by its humid tropical climate with heavy annual rainfall ranging from 1200 to 2000 mm with a temperature range of 25 to 30°C and a minimum temperature of 7°C. Largest part of the zone (62%) is mid-altitude (Jimma Zone Agriculture, 2010).

### Sampling technique

This study relied on three stage random sampling techniques. In

the first stage, three Woredas were selected randomly from the nine Woredas of the target zone. In the second stage, Kebeles were selected from these three Woredas based on population proportional to size (PPS) to have a total of eight sample Kebeles. In the third stage, similar approach was followed to select respondent households to have a total of 99 farmer respondents. Determination of sample size is resolved by means of Slovin's sampling formula with a 90% confidence level.

$$n = \frac{N}{1 + N(e)^2}$$

Where: n = Sample size for research use, N = total number of household head in eight avocado producing Kebeles, and e = margin of error at 10%.

### Focus group discussions (FGD) and key informants

Purposive sampling was employed to collect data from knowledgeable people (elders, youth, and women farmers and responsible persons of different institutions) on avocado production in the three selected Woredas in Jimma zone, and at the terminal market at the capital city, Addis Ababa. Discussions were held to access community level information, so pertinent data was collected to satisfy the assumptions of the underlying analytical techniques (Haggblade and Gamsler, 1991; Heisman, 1995). Thus, open FGD were held with three groups based on pre-determined checklists and a total of 27 key informants were interviewed from 12 different institutions. The data generated from discussions was combined with other relevant data collected for this project.

### Methods of data collection

The exploratory survey was conducted in February, 2010. During this period, informal discussion was held with farmers, frontline extension personnel, subject-matter specialists, governmental and non-governmental offices to obtain prior-informed consents and to identify villages to participate in surveys. Techniques recommended by Hellion and Meijer (2006) were used, and field surveys were conducted between September and December, 2010. Exploration for pertinent information was continued through key informant and FGD, case studies, and secondary information sources such as official and unofficial reports, statistics, research papers, press clippings, websites, and journals.

Interview schedules were administered by trained researchers from JARC and pre-testing was done to eliminate irrelevant questions and to refine questions to ensure the intended metric was measured. Preliminary data from informal surveys was used to support formal surveys to better understand current situations and to capture insights into the actions and subsequent outcomes generated by participants. Data on agronomic practices, demographic issues, production trends, prices, costs, yields, endowments, employment, remuneration, and direction of trade and physical flows of produce were collected through semi-structured interview schedules, case studies, key informants, and FGD to satisfy pre-determined objectives set at number one and two above.

### Method of data analysis

Raw data were coded before analysis in Statistical Package for Social Sciences (SPSS) Version 17 and Microsoft Excel 2010. The SPSS was run to generate tabulated reports, charts; plots of distributions and descriptive statistics. T-test; and Chi-square tests

**Table 1.** Demographic characteristics and access to services to the farming households.

Indicator	Mana (N = 36)		Goma (N = 35)		Seka-Chokorsa (N = 34)		Total		F-value
	Mean	STD	Mean	STD	Mean	STD	Mean	STD	
Household head age (years)	42.39	16.12	43.16	13.04	38.85	12.54	41.33	14.10	28.56***
Family size (No. of people)	6.22	2.66	6.6	1.5	6.85	2.53	6.54	2.36	27.09***
Experience (years)	11.42	5.22	8.08	2.74	11.21	5.267	10.46	4.89	20.87***
<b>Access to infrastructures</b>									<b><math>\chi^2</math> value</b>
Distance to road (km)	1.66	2.75	1.66	1.82	1.49	1.83	1.60	2.21	7.07***
Distance to DA office (km)	2.38	3.31	2.66	2.14	2.17	1.74	2.38	2.52	9.21***
Distance to market (km)	1.92	4.35	4.36	3.42	3.11	4.38	3.13	4.05	6.95***
Visit to demonstration (frequency in days)	19.17	24.11	15.32	16.60	1.19	2.87	17.25	20.36	20.74*

\*\*\*, Significant at 1%; \*\*, significant at 5%; \*, significant at 10%. Source: Survey result (October, 2010).

were analyzed to identify mean differences among continuous and discrete variables, respectively.

## RESULTS AND DISCUSSION

### Socio-demographic characteristics of producers

#### *Age of the household head*

The mean age of household head was 41.33 years. The results further indicated smallest proportions of the respondents (48% of avocado producers) and are within a range of 18 to 30 years of age. The statistical test for homogeneity, which was run to compare means of continuous variable among Woredas was highly significant ( $P < 0.01$ ) for age, family size and experience; depicting extreme variations among sample locations. Additionally, the distance to the nearest road and development agents' office, access to and use of land, and distance to market were significantly different between Woredas ( $P < 0.01$ ) (Table 5). This result suggested that household outcomes were strongly influenced by access to resources and this had a positive effect on the marketable supply of avocado fruit.

#### *Education*

With an adult literacy rate of 73%, the study identified a good level of education. This result is twice that of the national average (35.5% literacy rate) and it has important implications for augmenting the volume of production and sales of avocado in the study areas (Table 1).

Indirect transfer of information was channeled through the implementation of programs for primary school children (45%). Consequently, this endeavor influenced parents' awareness of important issues. Consequently,

67.5% of respondents were indirect beneficiaries because they had at least one child in primary school that was exposed to this information.

The result is similar to that of Bezabih and Hadera (2007) who explained that a child's education can influence parents' decisions and direct attitude changes. This approach has the potential to amplify momentum in horticultural production and marketing in Eastern Ethiopia.

#### *Family size*

Survey results showed that an increase in family size was directly proportional to allotted productive labor sources for avocado production (Table 5). As a result, lower dependency ratios and larger family sizes positively affected the supply of avocados promoting better participation in markets (Wolday 1994). Bezabih and Hadera (2007) documented that different labor sources are employed in horticulture in Eastern Ethiopia and family laborers account for the majority of labor allotments.

**Farming experience:** Farming experience of more than 7 years was reported by 85% of respondents, which likely increased the probability of HHH to be better able to participate in production and marketing of avocados in study areas. This 7 years period is more than the minimum time required for plantings to bear at least one crop of avocado fruit. Further, research results from JARC (1995), demonstrated that time to first bearing can be reduced to 3 years through grafting when compared to the production of non-clonal avocados grown from seeds.

#### **Dependency ratio**

A dependency ratio of 0.80 is reported as a way of life in

**Table 2.** Average household size and dependency ratio.

Woredas	Non-working members	Working members	Dependency ratio (Mean)
Mana	180	207	0.87
Goma	125	187	0.67
Seka-chokorsa	170	202	0.84
Total	475	596	0.80

Source: Own computation (October, 2010).

the study area, which is better off to national average that is, 0.97 (CSA, 2008). The result indicated that, out of 100 working persons, 80 are economically inactive in the study area (Table 2), but more are unable to support income generation in nationwide. Thus, family labor endowments have positively affected participation in the chain, given labor-intensive nature of avocado on harvesting.

### Access to all weather roads and distance to development agents

Availability and adequacy of roads was an important prerequisite to link producers with markets which also reduced transportation costs. The assessment on the continuum, measured in km, revealed 81 and 90% of respondents are within 3 and 2 km from all-weather roads and development agencies offices, respectively. Under these conditions, most households can access roads and offices within 30 min of walking. Paradoxically, most avocado farmers failed to use these access ways. Thus, weak and intermittent delivery of extension services was observed in study areas because of these under-utilized access ways.

### Accessibility to markets

Accessibility to reach markets was measured in km. This distance study revealed that the transportation infrastructure in Jimma zone is generally satisfactory and comparatively close to nearby fruit markets. Ease of accessibility assisted farmers by lessening transport costs and facilitated market supply. Access to good roadways was associated with avocado production in study areas.

This result supports a World Bank (2004) finding which found that better road densities in the study area, 77 km/1000 km<sup>2</sup> was significantly better than the national average of 30 km/1000 km<sup>2</sup>. Despite this finding, however, our data indicated road networks did not support the neighboring farming communities, since most farmers were accepting whatever lower prices offered them at the farm gate.

Conversely, some farmers explained that road access was conducive to selling a large proportion of avocado

fruit at distant markets, but 44% of sales were made at the farm gate, followed by vending at nearby village markets (22%). However, despite these seeming inconsistencies regarding the importance of road access for selling avocados, the overall research results highlighted that access to close markets have assisted farmers to plant avocados in large numbers as they do not have to rely on costly road transport to move their produce to distant markets where they invariably sell at loss.

### Access to extension services

Despite two institutionally assigned development agents to work-in production areas, extension services assisted little on avocado production and promotion of consumption. This agency failure was accompanied by a significant shortage of technical expertise by development agencies which ultimately resulted in an inability to access markets. The result further highlighted that a failure to extend knowledge failed to support households that participated in the avocado production chain. Thus, information exchange through informal routes has remained the most accessible channel for information (64%) followed by extension personnel (21%). But because of lack of facilities, instructional materials, and trained manpower, Farmer Training Centers (FTCs) remained dysfunctional to serve as knowledge promotion centers to study areas.

Belay (2003) and Sonko et al. (2005) had similar findings for extension efforts supporting cereal and fruit production. Lack of effective extension negatively affected fruit production and marketing because of weak linkages between stakeholders and affiliates.

### Types of extension services required

Low frequency of extension visits and unfamiliarity of development agents with avocado production was reported by 81 and 75.3% of the respondents, respectively. These are two central failings to building capacity which ultimately reduces dissemination of information. For this reason, development agents are compelled to rely on informal knowledge sources which may be of poor quality or erroneous (Table 3).

**Table 3.** Rank of extension service acquisition on various themes.

Extension information is needed for	Rank					Total	Mean
	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>		
Disease management	32.60	24.20	13.70	11.60	8.40	90.50	18.06 (1 <sup>st</sup> )
Planting material preparation	28.42	23.16	24.21	12.63	-	88.42	17.68 (2 <sup>nd</sup> )
Post-harvest handling	12.60	5.30	17.90	13.70	20.0	69.50	13.90 (3 <sup>rd</sup> )

Source: survey result (October, 2010).

**Table 4.** Major means of income for farming households.

Principal income sources	Best-bet income sources among tropical fruits	Rank
Coffee	Avocado	1
Fruit	Banana	2
Grain	Papaya	3
Other	Orange	4
Livestock	Pineapple	5

Source: survey result (October, 2010).

Similarly, 90% of respondents appreciated receiving extension services on disease management followed by planting material preparation (88.42%) and post-harvest handling (69.5%), respectively. But insects were not reported as important factor that needs intervention.

### Access to and use of land

Average land holdings in the study area was 1.94 ha, which is two-fold more than the national average (that is, 0.8 ha) (CSA, 2008). These large land holdings are primarily for coffee production which provides an opportunity for avocado production which supports crop diversification in South-western Ethiopia.

### Avocado fruit as a source of income

The annual revenue earned from avocados (81,000 Ethiopian Birr/ha) is better than that of coffee (18,000 Ethiopian Birr/ha) and many other crops. For instance, the average annual income of maize is (7,200 Ethiopian Birr/ha), whereas for sorghum revenues reach 5,400 ETB/ha. Avocado revenue is about 11 to 15 times larger than the latter crops, respectively. The high potential commercial returns revealed the significance of avocados in local farming systems which could lessen reliance on coffee as a cash crop through diversification with a high value fruit (Table 4).

This finding is supported by the FAO (2005) which confirmed that revenue from avocado in Ethiopia and

Kenya is rapidly increasing. Weinberger and Lumpkin (2005) stated avocado has brought higher net return hectare<sup>-1</sup> than other staples produced by farming households in Costa Rica, where it is an important overstorey providing shade for coffee production.

### Cultural practices

About 55% of respondents reported that they intercrop avocados with maize, taro, ginger, chat, cabbage, and bananas. Gillard and Godefroy (1995) stated that intercropping of avocados with short cycled crops was very common in sub-Saharan Africa and an excellent way to utilize the empty space as crops established.

### Role of livestock in avocado production

Donkeys and horses are used principally to transport avocado from the farm gate to accessible roads and markets. Manure produced by these animals is used as organic fertilizer study areas. However, their numbers are constrained by shortages of grazing areas and stored feed.

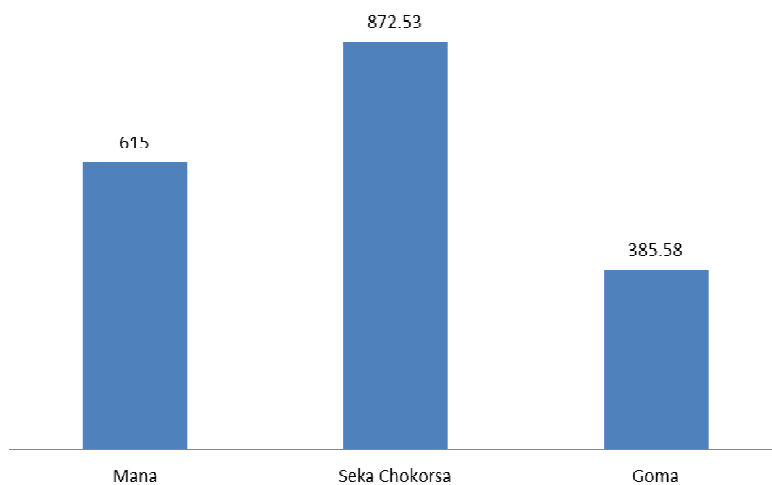
### Average number of avocado trees owned by households

The average number of total avocado plants and bearing trees owned by individual farmer was 34.03 and 13.01, respectively. With standard deviation of 41.6, the range

**Table 5.** Avocado trees owned by growers.

Indicator	Mana (N = 36)		Goma (N = 25)		Seka-Chokorsa (N = 34)		Total		$\chi^2$ /t-value
	Mean	STD	Mean	STD	Mean	STD	Mean	STD	
Bearing tree number	15.53	32.29	2.76	3.84	17.88	57.02	13.01	39.65	3.20***
Nonbearing tree	33.33	44.61	15.53	32.29	3.83	8.30	23.05	32.67	6.88***
Number of died trees	3.83	8.30	.44	0.96	2.88	3.59	2.60	5.68	4.46***
Total trees	52.44	55.48	10.60	8.944	31.76	28.67	34.03	41.63	7.97***
Production (ton/ tree )	0.31	0.14	0.29	0.77	0.33	0.15	0.31	0.13	2.35***

Source: Own survey (October, 2010).



**Figure 1.** Volume of avocado channeled to markets in tons. Source: Survey result (October, 2010).

indicates that many juvenile avocado trees are not in the stage of fruit bearing, which in turn is indicating the prospect of increased fruit production with increased start of bearing of juvenile avocado trees.

Wasilwa et al. (2004) reported that Kenyan farmers own a greater number of fruit bearing trees and fewer juveniles, although the same total number of trees per farm is similar to that of Ethiopia, trees tend to be more mature on average (Table 5).

### Production and productivity of avocados

Average productivity of 3.21 tons/ha is reported in the study area which is larger than the national average of 6.6 tons/ha (CSA, 2008). This productivity is within previously documented ranges of 1.56 to 7.80 ton/ha (Woyessa and Berhanu, 2010; Zekarias, 2010).

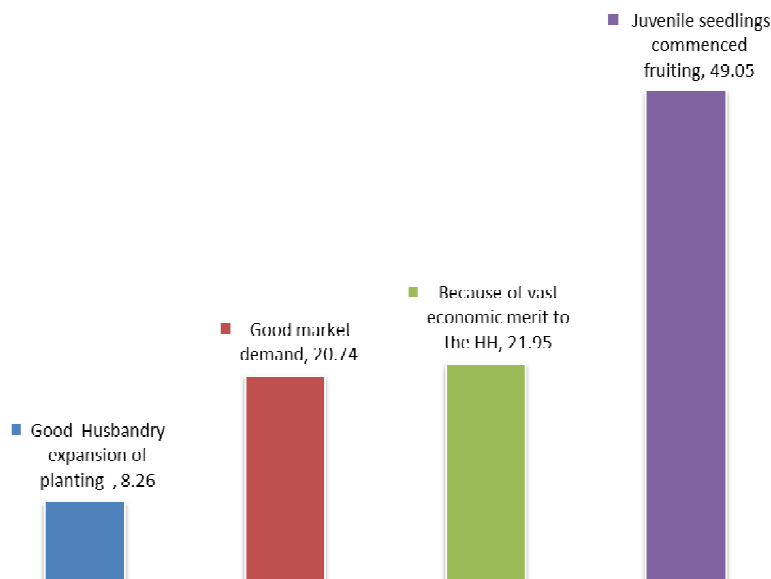
Gillard and Godfroy (1995) reported average yields in Kenya being 33.2 tons/ha but lower in Coted'Ivoire and Cameroon which produce less than 18 tons/ha. Edossa (1997), suggested that yield differences could results

from variation in productivity of cultivars, age of productive trees, and climate. The volume of avocado channeled to markets in tons is shown in Figure 1.

Total volume of production was 18721 of avocado fruit from the three study Woredas. Mana Woreda dominated by supplying 8725 ton (47%) followed by Seka-chokorsa and Goma Woredas with 61,500 (33%) and 38 45.8 ton (20%) of avocado supply, respectively. Avocado production from the study area is still increasing and 49% of this yield increase came from the commencement of fruiting from previously non-bearing trees.

### Input utilization for avocado

Avocado production in Jimma zone is characterized by low inputs with farm yard manure (FYM) the major amendment made to soil to boost productivity. About 20% of respondents do not apply FYM and 60% applied FYM rates of 3.7, 9.4 and 18.7 ton/ha, respectively. The assessment further highlighted that, chemical inputs are not used for fertilization or pest treatment. Even though



**Figure 2.** Reasons for boosted production in percentile. Source: Survey report (October, 2010).

this rate of application is drastically lower than the national recommendation (which is 29.84 ton/ha<sup>1</sup>), but it is greater than average rates of application [which is 0.55 ton/ ha in Ethiopia (Devi et al., 2007)]. In this study, the rate of FYM application was inversely proportional to increased number of avocado trees owned, as tree numbers increases, each tree got less FYM because of low availability.

### Sources of avocado planting material

Avocado production in Jimma zone is exclusively based on distribution of mixed unimproved varieties that have lower than desired productivity. For this reason, 40% of respondents acquired planting materials from Woreda Agricultural offices followed by local planting materials purchased from unknown market sources (29%). The JARC and self-production by farmers were reported as the 3<sup>rd</sup> and 4<sup>th</sup> sources of avocado planting materials in the study areas (Figure 2). Local seed production is the major source of seedlings for distribution. However, seeds never breed true to parental lines and the use of non-clonal forms adds a lot of heterogeneity to production systems which can result in variable flowering, fruiting, and harvesting times, and varying fruit quality, size, and shape. All of which affects marketability.

Woyessa and Berhanu (2010), and Zekarais (2010) stated that JARC and Woreda Agricultural offices are the main sources of avocado seedlings in South-western Ethiopia. Gillard and Godfroy (1995) reported that natural propagation from seed was the prominent means of avocado dissemination for West and Central Africa.

### Factors affecting availability of planting materials

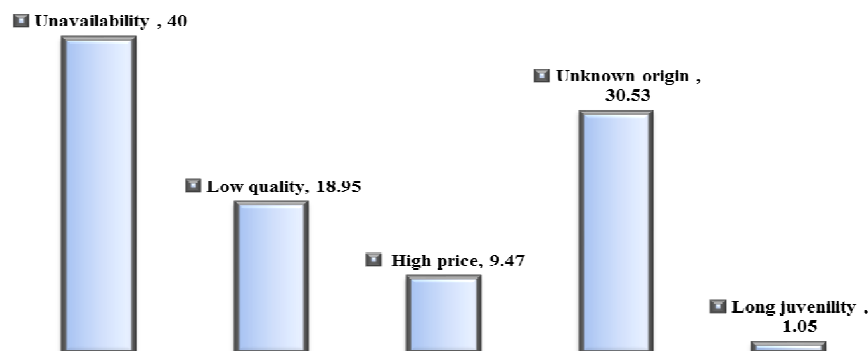
Unavailability of planting materials and seedlings from unknown origin are the principal problems affecting avocado production in the study areas (Figure 3). Elfring et al. (2007) reported that producers complained about the unavailability of planting materials in terms of quantity and quality.

### Fruit harvesting

Fruit harvesting usually commences at fruit drop, which is the principal maturity index used by farmers in the study areas. Around 76% of producers conduct harvesting subsequent to the commencement of fruit drop. This maturity index encouraged 23% of producers to leave fruit hanging on trees until better market prices appeared. Fruit harvesting is largely executed by child laborers who use picking hooks, shaking of trees, and knocking down fruit. However, the later practice has the potential to cause physical injury.

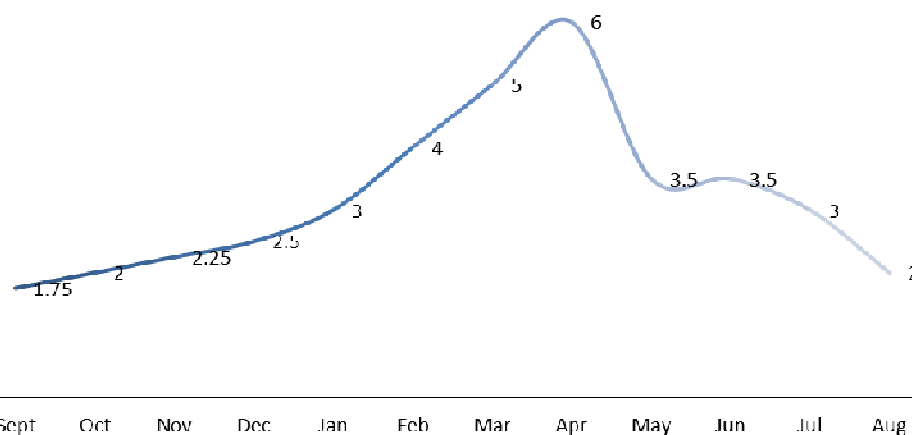
The research result supports findings by FAO (2005) which showed cuts, punctures and bruises to avocados increased ethylene production and hastened fruit softening and ultimately decay.

**Sorting, grading, loading, and packaging:** These functions are principally carried out at the farm gate and at primary procurement centers via the efforts of local collectors. Thus, fruit is sorted according to consignment needs of collectors where under-grades (that is, culls) such as shrunken, smaller sizes, with splits and



**Figure 3.** Problems encountered in using planting materials (percent). Source: Survey report (October, 2010).

Selling price of avocado across months (Birr/Kg)



**Figure 4.** Purchase and selling prices, respectively. Source: survey result (October, 2010)

punctures are removed. But unsellable under-grades are not wasted as they are commonly consumed in farming households.

There is a shortage of standardized packaging materials for avocado fruit, and synthetic fiber sacks “*madaberiya*” are a popular packaging material to transport fruits from farm gate to primary procurement centers. Avocado packaging is an open sector for large private investment and introduction of modern technology and entry for investors.

Wiersinga and Jager (2009) stated that most available packing material in Ethiopia does not meet required standards for avocados. Consequently, exporters in Ethiopia import packing materials from the Netherlands and Israel. Efforts were recently launched by several new companies to produce fruit packing material in Ethiopia. However, the Ethiopian Commodity Exchange (ECX) is hesitant to implement quality control and market

information services.

### Perishability

Around 73% of farmers have reported they are compelled to sell avocados at whatever price offered to them, while 15 and 9% of farmers have taken the risk to sell the fruit on another market day or to take it to another market, respectively in an attempt to get better prices (Figure 4).

Lack of effective post-harvest handling practices coupled with the short shelf-life of avocados has forced producers to sell at prevailing prices. Knowing this, wholesalers put pressure on producers to sell at low prices. Starting from production up to marketing, every farmer produces and sells on individual basis which affects their bargaining power during the sale of avocados. Local grower unions or cooperatives could



**Table 6.** Method of price setting and time of receive money after sale.

Price setting strategy	Average (%)
Negotiation with farmers	27.10
Set by demand and supply	38.90
Myself	34.03
<b>Term of payment</b>	
As soon as you sold	55.9
After some hours	11.8
On the other day after sale	32.4
<b>Method of attracting suppliers</b>	
Giving better price	58.8
By visiting them	23.5
Fair scaling /weighing	2.9
Giving pre-payment	5.9
Offering credit service	8.8

Source: Survey result (October, 2010).

greatly help producers get better prices for the fruit when they collectively bargain with fruit collectors.

### Avocado root rot (*Phytophthora cinnamomi* Rands)

Incidence of this root disease is high, 95% of trees were infected in the study area which highlighted that almost all production areas are suffering from avocado root rot. This pathogen is the prevailing malady affecting avocado production in the study areas. Respondents indicated that there is no commonly accepted name for this disease; though some reported it as “cholera” or “gogsa”. For this reason, most farmers communicate by describing its symptoms, but canopy desiccation is the most common symptom.

### Severity of avocado root rot

The assessment further signified a severity of 25, 18 and 16% of *P. cinnamomi* in Mana, Seka-chokorsa and Goma Woredas, respectively which indicated widespread presence. Thus, decline of avocado trees was detected in all the study areas.

Mohamed et al. (2009) reported that established avocado plots in the JARC research center were entirely devastated by avocado root rot disease; and survivors, about 30% of trees were drastically hampered by the fungus. Woyessa and Berhanu (2010), and Zekarias (2010) reported similar observations.

### Avocado root rot versus boosting production

Despite the severity of avocado root rot, avocado

production continued due to recent fruit setting by juvenile trees. Thus, 69% of respondents reported that, they will continue to farm avocados despite disease severity. Surprisingly, 82% of respondents revealed that they would plant new trees to replace those lost to avocado root rot. Most farmers consider avocados as a major means of financial insurance and a reliable relief crop when other crops fail. However, the result indicated that the practice of using resistant avocado rootstocks is absent indicating the need to start a root stock screening program to find rootstocks resistant/tolerant to avocado root rot.

### Price of avocado

According to the pooled assessment, the avocado industry in the study area operated under an unregulated environment. Prices were exclusively determined by traders negotiating with farmers at time of procurement. For this reason, farm gate prices for the previous 5 years, was 8 birr/kg of fresh fruit, and has now dropped to 1.75 birr/kg except when producers are able to evade intermediaries and directly supply to wholesalers.

Over supply of fruit is the principal reason for price declines which affected 58% of farmers. However, 31% of respondents reported that, they were aware of price declines and did not know the market forces that cause prices to fall.

### Price variation due to seasonality

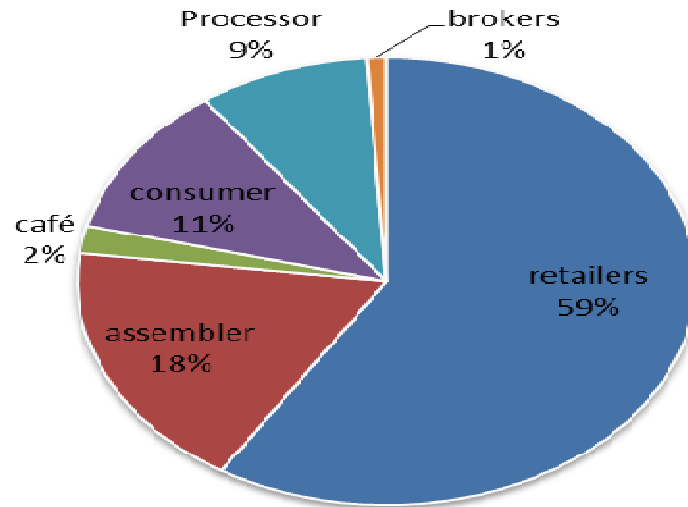
Price variation from 1.75 to 8.00 birr/kg was reported during the major and off season production periods at wholesale markets in Jimma, respectively. According to 58% of respondents, market prices are high for early arrivals but drop with an increase in supply, before increasing towards the end of the production cycle when supply gets scarce. June to early September are periods when prices are typically low and July to August is when prices are most depressed before increasing again in October.

### Price setting and term of payment

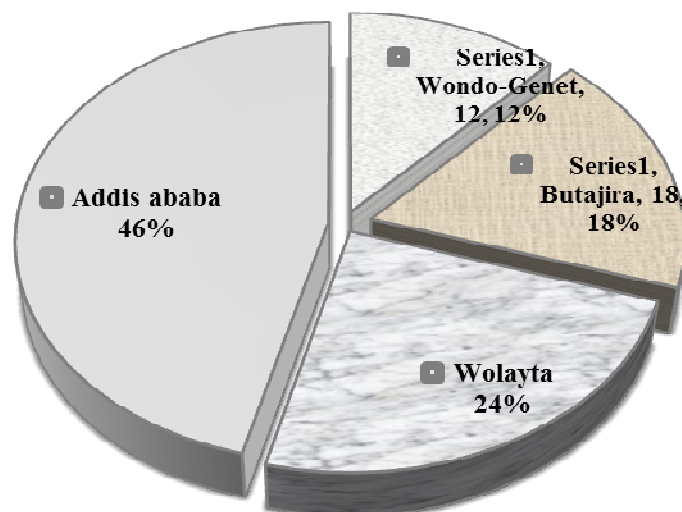
Approximately, 34% of traders' reported they set avocado prices. A large proportion of traders (55.9%) earn their money instantly after transactions, while some (32.4%) receive their money on a different day after the sale (Table 6).

### Place of sale

The research result indicated 59% of HHH sell avocados to retailers, while 18, 11 and 9% of them sold fruit to assemblers, individual consumers, and processors at



**Figure 5.** Actors role in avocado vale chain. Source: Survey report (October, 2010).



**Figure 6.** Preference of consumers to opt for their better variety. Source: Own survey (October, 2010)

local markets, respectively. But producers opted to sell their avocados to consumers due to their ability to pay better prices to farmers, followed by requests to sell to assemblers and cafés, respectively (Figure 5).

**Spatial arbitrage**

Failure to procure large avocado stockpiles for sale to meet local demand is the rationale behind spatial arbitrage in Jimma zone. Thus, 46, 24, 18 and 12% of consumers purchased avocado fruit from Addis Ababa, Wolayata, Butajira and Wondo-Genet, respectively

(Figure 6). Austin (2009) documented that the absence of a cold chain system in Rwanda led to importation of consignments of fruit from other locations to mitigate seasonality gaps in the supply of fresh fruit in local markets.

**CONCLUSION AND RECOMMENDATIONS**

Endowed with diverse range of agro-ecological zones, Ethiopia is one of the 10 major avocado producing countries of the world. But production is too traditional and poorly supported by scientific recommendations due

to failures in institutional, social and economic factors to be nationally and internationally successful. Simultaneously, marketing activity is poorly linked along production channels (e.g., product sorting, grading, packing, transporting and marketing).

Although comparative rewards such as regional suitability for production, proximity to local markets and cheap provision of labor are opportunities for boosting production. However, declining prices due to oversupply, deadly fungal diseases, poor market integration, an absence of improved technologies, and provision of extension packages for growers are major setbacks that hamper production and marketing of avocados in Ethiopia. With existing prominent organic production, avocados are not yet organic certified in the study area.

Constraints hindering the development of avocados are found in all stages of the production chain. At the farm-level, lack of clean disease-free seedlings and grafted seedlings has compelled farmers to use inferior and low yielding varieties. Storage facilities are scarce all along the chain and absence of collective bargaining power has forced individual farmers to accept unfavorable deals.

Due to entire absence of improved varieties, avocado production is exclusively based on distribution of mixed materials. Consequently, the local seed system has come out as a best-bet arena and is now a common route for seedling dissemination in Jimma zone. However, there are many problems for this industry that relies exclusively on a crop with non-uniform production characteristics.

Even though most payments are made instantly, payment in small installments were sometimes reported in the study areas. Scaling deductions, quoting of low prices, and lack of market information were common market malpractices in the study areas. Deficiency in capital and credit availability was also reported as major setbacks that compelled farmers to sell their produce at whatever price was offered by traders who had loaned to the grower earlier. Absence of organized institutional support and a system of group marketing has positioned traders in a strong position to dictate pricing to the disadvantage of producers. Despite the closeness of four governmental and nine private commercial banks and five non-banking institutions, denial to formal credit was prevalent. Thus, an informal credit system was customary feature for avocado growers to deal with in the study areas.

A number of actions need to be undertaken in order to promote the development of avocados as a valuable crop. This includes, capacity building, technological applications, improved extension and outreach, and plant breeding activities.

Infrastructural development is a key to support the avocado agricultural sub-sector. In this arena, emphasis should be given to improved storage and transportation systems and offering credit and other services to improve effective production and marketing of the crop. Thus:

1) Efforts should be exerted to envelope avocado into an

organized market through cooperatives which could further improve innovation and performance.

2) The Research-Extension-Farmers Advisory Council (REFLAC) should be strengthened to tackle constraints and to promote opportunities at local and regional levels.

3) Plausible post-harvest management and small-scale processing should be in place to strengthen and harmonize market chain development through effective and streamlined coordination among all workers involved in avocado production in Jimma zone. This could assist to eliminate duplication of efforts and promote greater production efficiencies.

4) The ECX should develop marketing services for avocados, similar to recently added commodities like sesame, haricot bean and maize. If done so, avocado prices will be stabilized and maintained at a premium.

5) Research should work towards generating improved production technologies e.g., variety and agronomic practices through cultivar diversification and practices mitigating avocado root rot. The disease management practice should include adoption of resistant root stocks in the production area.

6) Since high value crops are knowledge and technology intensive, the weak research and extension service should be built up and the necessary institutional supports should be put in place as quickly as possible to support this emerging industry. Thus, critical and continuous capacity building activities should be pursued to ensure success for avocado producers and marketers in Jimma zone.

7) Existing trees should be characterized in terms of growth habit, tree morphology, fruit quality, including post-harvest properties to assist in targeting markets and making selections that makes desirable varieties through cloning and grafting onto root rot resistant rootstocks

8) Establishing cottage industries for avocado processing should be entailed through micro enterprises to better manage surpluses when over production occurs.

9) Measures and incentive structures should be in place to encourage participation of stakeholder to solve the existing problems and promote the opportunities observed along the value chain of the industry.

10) Organize cooperatives to focus on avocado production starting with grass root structures that are developed up to the union level which empower them to compete with dominant groups by having their own sales outlets in major markets. Women should be particularly encouraged to join cooperatives and to participate in leadership positions.

11) Initiate a stakeholder co-ordination platform for future interventions on sub-sector development. Regular coordination meetings with regional stakeholders are recommended.

12) Training should be offered to dealers, nursery operators, growers, and small traders to help them understand the requirements for running a successful business and to better deal with shrewd operators in the

production and sales chain. Courses on basic business skills training, tax education, marketing, and demand analysis should be offered.

13) Impart skills to take participate in complementary activities such as nursery management, grafting services, and disease management.

14) Promote international standard good agricultural practices (GAP) through demonstration sites for growers to observe.

## REFERENCES

- Albertin A, Nair PKR (2004). Farmers' Perspectives on the Role of Shade Trees in Coffee Production Systems: An Assessment from the Nicoya Peninsula, Costa Rica, *Human Ecol.* 32:4.
- Austin JE (2009). Study on Marketing, Post-Harvest and Trade Opportunities for Fruit and Vegetables in Rwanda, Final Report. 22 July 2009.
- Belay K (2003). Agricultural extension in Ethiopia: the case of Participatory Demonstration and Training Extension System. *Journal of Social Development in Africa* 18(1):49-84.
- Bezabih E, Hadera G (2007). Constraints and Opportunities of Horticulture Production and Marketing in Eastern Ethiopia, DCG Report. P. 46.
- CSA (2008). the Federal Democratic Republic of Ethiopia, Central Statistical Agency, Agricultural Sample Survey, 2008, Volume I, Report On Area And Production Of Crops, (Private Peasant Holdings, Meher Season), Addis Ababa, June, 2008. *Stat. Bull.* P. 417.
- Edossa E (1997). Selection of Avocado (*Persea americana* M.). Collection of Desirable Fruit Characteristics and Yield at Jimma, Proceedings of the 8<sup>th</sup> Annual Conference of the Crop Science Society of Ethiopia, Feb. 26-27, Addis Ababa. Ethiopia. pp. 26-35.
- Elfring W, Yohannes A, Mulugeta T (2005). VALUE CHAINS IDENTIFICATION FOR INTERVENTION.
- Devi R, Kumar A, Bishaw D (2007). Organic farming and sustainable development in Ethiopia. *Scientific Research and Essay* 2(6):199-203.
- FAO (2005). Market Segmentation of Major Avocado Markets, Sugar and Beverages Group Raw Materials, Tropical and Horticultural Products Service Commodities And Trade Division. Food and Agriculture Organization of the United Nations.
- FAOSTAT (2010). Preliminary 2009 Data for Selected Countries and Products <http://faostat.fao.org/site/567/DesktopDefault.aspx?PageID=567#ancor>
- FARM Africa and SOS Sahel International (2004). Participatory Forest Management Program PFMP, Fruit Production in Agro-Forestry System in Bonga, [http://www.pfmp-farmsos.org/Docs/fruitproduction\\_bonga.pdf](http://www.pfmp-farmsos.org/Docs/fruitproduction_bonga.pdf) Accessed on 13<sup>th</sup>, March, 2010
- Gillard JP, Godefroy J (1995). *The Tropical Agriculturalist*, Avocado, Macmillan Education Ltd. London.
- Guinness Book of records (2010), Trippy Food, Holy Guacamole, Carpinteria. California.
- Hagblade SJ, Gamser MS (1991). Field manual for subsector practitioners <http://library.wur.nl/way/bestand/encl/189236.pdf> Accessed on 7<sup>th</sup> May, 2010.
- Heisman G (1995). *Research Method in Psychology*, Fourth Edition. Houghton Mifflin Company. Boston. USA.
- Jimma Agricultural Research Center (JARC), (2010). Center Profile, Jimma, Ethiopia.
- Joosten F (2007). Development Strategy for Export Oriented Horticulture in Ethiopia <http://library.wur.nl/way/bestanden/clc/1891396.pdf>.
- Kirby K, Potvin C (2007). Variation in Carbon Storage among Tree Species: Implications for the Management of Small-Scale Carbon Sink Project. *For. Ecol. Manage.* 246:208-221. [www.elsevier.com/locate/foreco](http://www.elsevier.com/locate/foreco).
- MOARD (2008). Draft Working Document to Establish National Agricultural Market Information Service in Ethiopia. June 2008.
- Mohamed Y, Wodirad M, Eshetu A, Girma A, Dereje T, Temama H, Meki S (2009). In: Abrham Tadesse eds., *Increasing Crop Production through Improved Plant Protection*. Vol. II, Plant Protection Society of Ethiopia (PPSE), PPSE and EIAR, Addis Ababa. Ethiopia. P. 542.
- Sonko S, Njue E, James M, Jager A (2005). Pro-Poor Horticulture in East Africa and South East Asia, the Horticultural Sector in Uganda, EAST AFRICA. January 2005.
- Wasilwa, LA, Njuguna JK, Okoko EN, Watani GW (2004). Status of Avocado Production in Kenya. *Kenya Agric. Res. Inst. Nairobi Kenya*.
- Weinberger K, Lumpkin TA (2005) Horticulture for Poverty Alleviation-The Unfunded Revolution. Shanhuu, Taiwan: AVRDC - The World Vegetable Center, AVRDC Publication. Working Paper. 15(20):05-613
- Wiersinga R, Jager A (2009). Business opportunities in the Ethiopian Fruit and Vegetable Sector, Wageningen University and Research Centre, Final version. February 2009.
- Wolday A (1994). Food Grain Marketing Development in Ethiopia after Reform 1990. A Case Study of Alaba Siraro. The PhD Dissertation Presented to Verlag Koster University. Berlin P. 293.
- World Bank (2004). Opportunities and Challenges for Developing High-Value Agricultural Exports in Ethiopia, Poverty Reduction and Economic Management, Country Department For Ethiopia. Africa Region.
- World Bank Group (2006). Ethiopia: developing competitive value chain <http://siteresources.worldbank.org/INTAFRISUMAFTPS/Resources/aftpsnote29F0610-17.pdf> Accessed on 17<sup>th</sup>, December. 2009
- Woyessa G, Berhanu T (2010). Trends of avocado (*Persea americana* M.) Production and Its Constraints in Mana Woreda, Jimma Zone: A Potential Crop for Coffee Diversification. *Trends in Horticultural research*, 2010 ISSN 1996-0735 / DOI: 10.3923/thr.2010.
- Zekarias S (2010). Avocado Production and Marketing in South Western Ethiopia. *Trends Agric. Econ.* 3(4):190-206, 204. ISSN 1994-7933, 2010 Asian Network for Scientific Information.