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Research Paper

The Status of Tropical and Subtropical Fruits Nursery Development in Urban and Peri-Urban Areas of the Central Rift Valley of Ethiopia

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ABSTRACT
Though efforts have been made by research and development entities over the last forty years the production of Tropical and Subtropical Fruits remained low. Quality planting materials and nursery management have been issue on whichthe success or failure of an orchards is based.This paper deliberateson the current nursery management statusand challenges of tropical and subtropical fruits nursery development in urban and peri-urban areas of the Central Rift Valley (CRV) of Ethiopia.For the purposeAdama, Ada`a, Lode-Hetosa and Hetosa districts, and Adama Special Zone were purposely selected. Data were obtained from all35tropical and subtropical fruitsof nursery owners in those districts using questionnaires.The result indicated that tropical and subtropical nursery management training enhanced the technical skills of nursery owners. A greatmajority of the fruit nursery owners believed in that tropical and subtropical fruits nursery would develop into a successful business enterprise.Likewise, nursery business was found to be a profitable venture among thegrowers. A grafted fruit seedling could fetch six times as that of ungrafted seedling. As to the markets of fruit seedlings, the demand came from urban and peri-urban dwellers, non-governmental organizations (NGOs) and government organizations (GOs). Accessing sources of quality planting materials mainly scions which so far sourced Melkassa Agricultural Research Center is a major ongoing challenge.Demand creation in and supply expansion to rural areas is of paramount importance for tropical and subtropical fruit nursery development. Hence, mother-tree establishment need to go along side with nursery development efforts.Likewise, upmost caution need be taken during seedling growth and transportation to control the spread of devastating resident and invasive pests such as white mango scale.

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I. INTRODUCTION

Tropical and subtropical viz, mango (*Mangifera indica*), avocado (*Persea americana* Miller) and citrus (*Citrus* spp.)fruits have a significant and direct contribution to the nutrition and livelihoods of subsistence farmers and pre-urban dwellers(Clarke et al., 2011). Fruitshaveversatile products, depending on need, can be consumed within the household or sold. Marketing fresh and processed fruit products generate income which serves as an economic buffer and seasonal safety net for poor farm households. Fruit production and their product diversification can generate employment foryouth and women in processing and marketing to complement existing income-generating activities (Clarke etal., 2011; MoFED 2015).

Tropical and subtropical fruits can play a significant role in Ethiopia by improving income, enhancing food and nutritional security, making input for agro-processing industries, and increasing export revenue. Environmentally, fruits substantially contribute to maintaining ecological balance. They provide employment opportunities particularly for dwellers of peri-urban, urbanand rural poor.Regarding fruit nursery, the business of tropical and subtropical fruits and their seedlings significantly contribute to improve the livelihood of farmers (Bezabih and Hadera, 2007).

The area and production of major tropical and subtropical fruits is growing very fastover the last one decade in Ethiopia where area and production increased by 10percent and 5.7percent respectively during 2006–2015 (Figure 1& 2). For instance, the area of avocado was increasedat16percent while production increased at 7.3percent per annum (Figure 1) during the same period. Similarly, the area of citrus has been growing very fast of the last decade2006–2015 (Figures 1). The productivity of these crops has been growing though the levels

are still low as compared with their potential respective yields on research fields. This has been partly because of low quality of the fruit seedling which poses the lasting effect on those crops production.

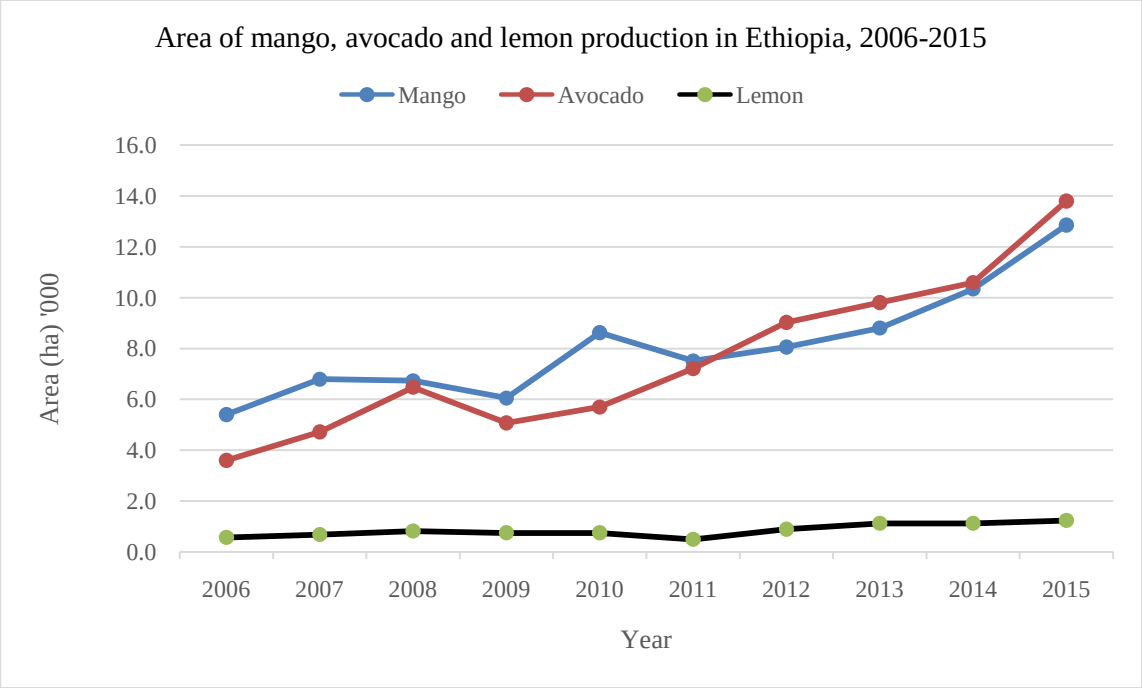

Figure 1. Area of mango, avocado and lemon in Ethiopia, 2006–2015

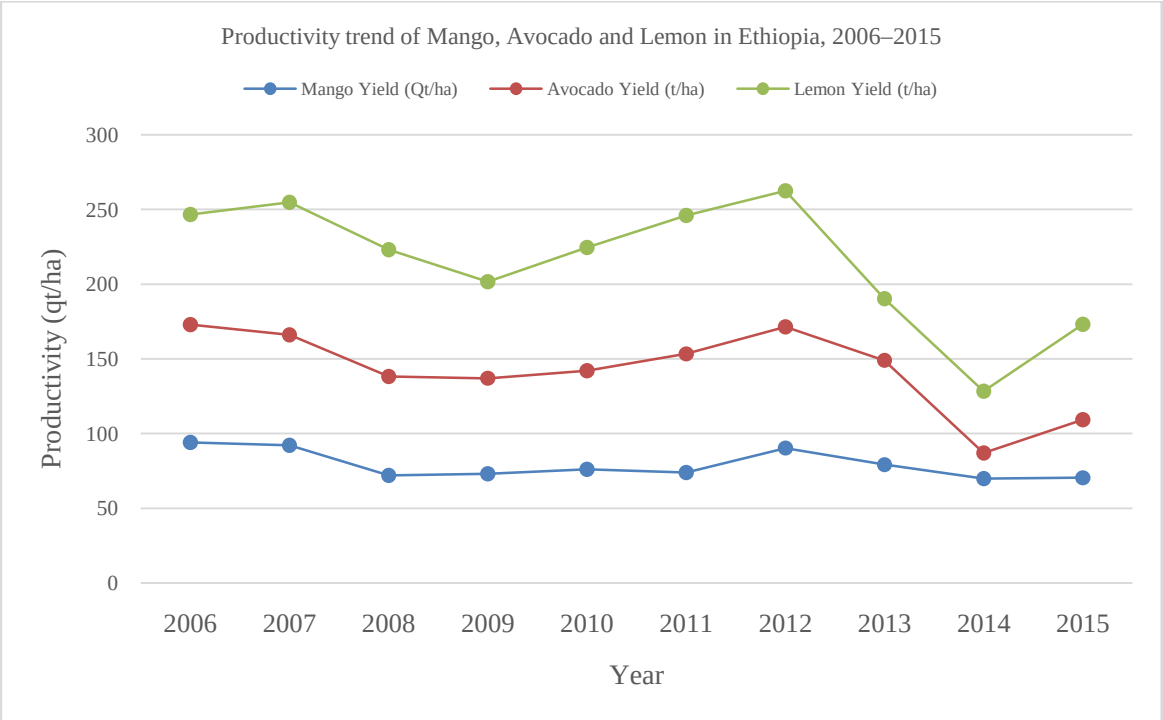

Figure 2. Productivity trend of mango and avocado in Ethiopia

The Central Rift Valley (CRV) of Ethiopia is suitable for tropical and subtropicalfruits production. Availability of favorable weather, water sources, suitable soil, ample labor, growing demand for tropical and subtropical fruit products due to the emergence of affluent urban dwellers in nearby city centers such as Adama, Hawassa, Shashamane, Bishoftu, and Addis Ababa. Similarly, the availability of infrastructure such as-weather roads, railway and expansion of telephone networks are important in enhancing tropical and subtropical fruit production, marketing and consumption. The CRV is the host for fruit industry such as Upper Awash Agro-

Industry and many others small production. The production of those crops, however, is constrained by lack of improved varieties, and their management practices (Seifu, 2003), unavailability of quality planting materials, and damage by invasive and resident pests (Gashawbeza et al., 2015). Mango observed to suffer from poor seedling establishment which affect and fruit size local variety are small, fibrous, large seeded, and poor storage on the tree. Major avocado production comes from seedling of which are late, grow tall and inconvenient for harvest suggesting for improvement by producing it from scion and rootstock of improved materials and adopting improved propagation techniques. Lemma and Asmare (2012) have developed a concise fruit crop propagation manual in Amharic for producers and frontline agricultural development workers.

In the same manner, the presence of agricultural research centers like Melkassa and Debre Zeit which are spear head in tropical and subtropical fruit research and development works provide high opportunity in giving technical back up and supplying start up quality planting materials. Melkassa Agricultural Research Center in collaboration with local agriculture and natural resources offices, community based organizations dispatched significant amount of improved tropical fruit seedlings (Table 1) also provided training. The supply from research center is in short of demand. Efforts have been made to tackle the issue. For example, Melkassa Agricultural Research Center in collaborationwith Association for Agricultural Research in Eastern and Central Africa (ASARECA) launched a year project in 2013, on tropical and subtropical fruit nursery quality materials provision, knowledge and technical skill development areas. The project was contributed through training, and quality planting materials production and supply.

This paper provides qualitative and quantitative accounts of smallholder tropical fruit nursery development in the Central Rift Valley of Ethiopia.It is organized as follows: Section 1 introduces the paper. Section 2 describes of the study area and tools used in data collection and analysis. Section 3 provides results and discussion. Section 4 provides conclusion and implications.

Table 1– Tropical and subtropical seedlings and scion distributed by Melkassa Agricultural Research Center

Year	Mango		Avocado		Citrus		Banana	Papaya	
	Seedling	Scion	Seedling	Scion	Seedling	Scion	Seedling	seedling	Seed(g)
2005/6		2100	2	2700	269		2159	40	900
2006/7	175	700		150			1231	104	
2007/8	299	2880	80	4985			3636	522	3860
2008/9	137	3200	122	1600			2047	1517	
2009/10	172	4862	276	5980	3	3450	1508		3895
2010/11		2100	2	2700	269		1159	80	1100
2011/12	368		529					1241	
2012/13	527		503					806	
2014/15†	1478	3868	2052	5582			3004		2832

Source: Fruit Research and Agricultural Extension research of Melkasssa Agricultural Research Center

II. DESCRIPTION OF THE STUDY AREA

The survey was conducted in four districts and one city administration, viz, Adama, Ada`a, Lode-Hetosa and Hetosa districts, and Adama Special Zone in 2014. The population projection of the study areas is presented in Table 2 which was based on 2007 census conducted by the Central Statistical Agency(CSA) of Ethiopia. For the projection, the national average population growth rate of 2.6 percent per annum was adopted for urban and pre-urban areas other than Adama town. For Adama town, 4 percent annual population growth rate was used to project the population. The reason for selecting urban and peri-urban areas for this study was that fruit nurseries are located to in urban and pre-urban areas to access to markets.

Table 2– Study area male, female and percent urbane population projection in 2016†

Zone/District	Zone	Population	Male	Female	% urban
Adama town	Adama Special	313430	154959	158472	100
Adama	East Shewa	195720	99546	96174	17
Ada`a	East Shewa	125896	60297	65599	-
Lode-Hetosa	Arsi	134974	67431	67543	14
Hetosa	Arsi	156500	78699	77801	15

† Population projection was done based on 2007 Ethiopian census

The districts were purposely selected for the study, due to their proximity to research centers (Melkassa and Debrezeit), suitability of soil and availability of irrigation water (Figure 3). Ten *Kebeles* were selected from those districts purposely based potential. . Thirty-five respondents were selected and interviewed (Table 3) using structured questionnaire. The respondents were taken from urban (80 percent) and pre-urban (20 percent). Female headed households constitute 40 percent of the respondents.

The questionnaire consisted of thorough information about the households including administrative and socio-geographic location, land holding size, socio-demographics, type of fruit grown,labor and land tenure

system, sources of planting materials, water sources, labor availability, training participation on tropical and subtropical fruits, fruit crop production expectations on prospects and challenges, and cost and benefits of the nursery production. The survey was conducted in dry season of 2014 by trained and experienced enumerators. Other than field data, a ten-year Central Statistics Authority (CSA) data or the period of 2006–2015 was consulted concerning area and production of tropical and subtropical fruits in Ethiopia. The results are presented in Figures 1 & 2

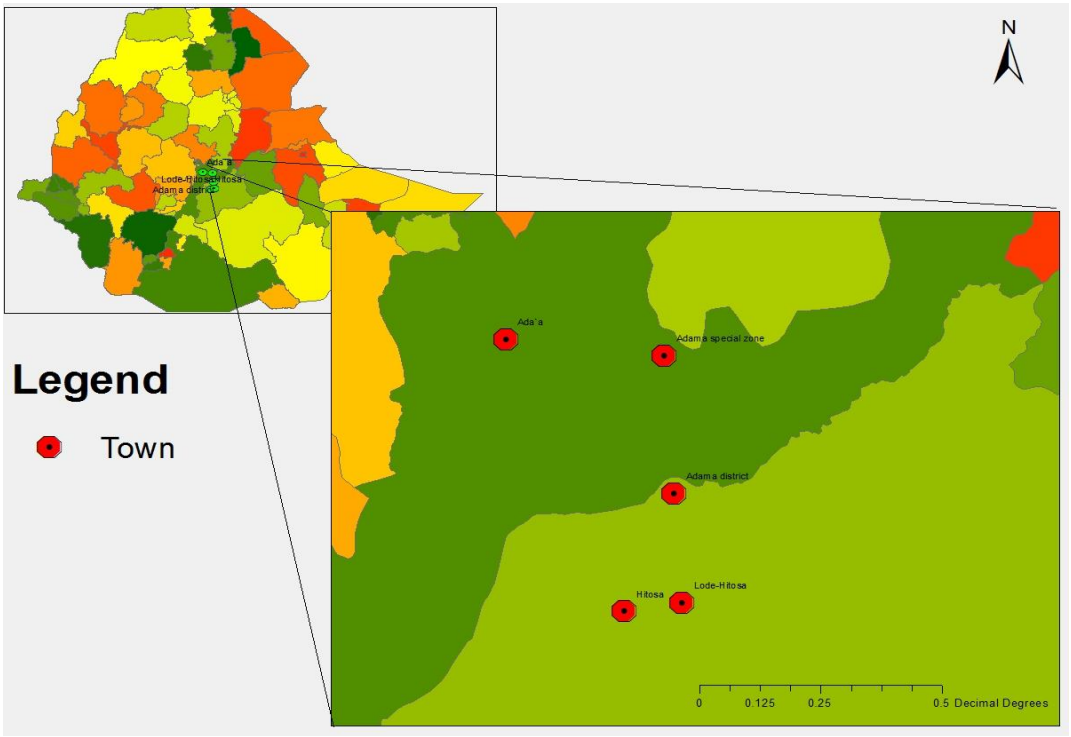

Figure 3: Map of study sites based on survey result

Table 3–Addresses and number of respondents involved in tropical and subtropical fruit nursery growers interview

District/Zone	Kebele	Respondent number
Adama special zone	03,05, 09, 11 & 12	10
Adama district	Awash Melkassa	3
Ada`a	01,02 & 09	17
Lode-Hetosa	Huruta 01	4
Hetosa	Itaya	1
Total		35

Data collection and analysis

Structured and open-ended questionnaires were used for data collection. The questioners were pretested before administering to the respondents. The data were collected by trained enumerators. Statistical Package for Social Science (SPSS), ver 20.0 was used for analysis. Descriptive analysis tools namely: frequencies, percentage, mean and standard deviation) to analyze the data.

III. RESULTS AND DISCUSSION

3.1. Fruit seedling production

The average size of fruit nursery per household was 293.5 m^2. The involvement of women in tropical and subtropical fruit planting materials was significantly high (40 percent) as compared to field crops. There are three types of tropical fruit nursery land tenure systems: private individuals (51.4 percent), micro-enterprise (45.7 percent) and church (2.9 percent) (Table 4). The nurseries were managed in open field and homestead. Accordingly, 37 percent of the respondents established their nurseries in an open field and 31.4 percent managed at the homesteads. The remaining 31.6 percent established their fruit nursery both at homestead and open field based on areas required. A few of them (5.7 percent) used shade houses.

Table 4– Tenure system by gender of fruit and tropical fruit nursery owners

Tenure type	Mean area (m^2)	Gender

		Male	Female
Individual	200	10	8
Micro-enterprise	383	10	6
Church	400	1	0
Mean/Sum	293.5	21	14

3.2. Types of tropical and subtropical fruits produced

The fruit seedling produced were mango, avocado, citrus and papaya. Twenty-one (61 percent) of the respondents practiced mango seedling production. Grafting skill in tropical and subtropical fruit mentioned to be is very essential in fruit seedling management. A significant number of them practiced grafting of mango and avocado seedlings to add their qualitiesand values. There were noticeable differences in the number of nursery owners practicing grafting among seedling growers across districts. Respondents in Hetosa and Lod-Hetosa districts did not yet practice mango seedling grafting. In Adama, only 3 (among 13) fruit seedling nursery owners started grafting whereas in Lode-Hetosa district only one respondent started grafting among four growers.

All the respondents grew avocado seedlings among whom 12 (one-third) grafted their seedlings. Remarkable difference was observed among locations (districts) in practicing grafting of avocado seedlings. For example, all respondents from Hetosa and Lode-Hetosa districts did grafting for avocado. In Adama district, six farmers among 13 did grafting on part of their avocado seedlings (17 percent seedling). Higher proportion of avocado seedlings were grafted as compared to grafted mango seedlings. This may be due to shortage of mango scion for grafting as well as mango seed shortage due to its seasonality and low success rate of grafted mango as compared to that of avocado. Seifu (2003) documented mango seedlings died in the nursery or in the field at Merti Jeju farm and the causes of failure expected to be method of grafting, irrigation water and pot size. The same author observed that a similar work failed at Melkassa Agricultural Research Center.

Citrus is grown by a few fruit nursery owners. Only six respondents grow citrus among whom only one did budding for orange. Others, sell their lemon and orange seedlings without any budding (Table 5). Although grafting and budding add value the number of nursery owners who sale out their seedlings without grafting was high (Table 5).

Table 5–Number of grafted and ungrafted tropical and subtropical fruit seedlings and number of their owners

District	Avocado		Mango		Citrus un-grafted
	Grafted	Ungrafted	Grafted	Ungrafted	
Ada'a	80(1) †	13570(17)	–	2920(10)	750(5)
Adama town‡	1188(6)	25322(13)	590(3)	16135(12)	1000(1)
Lod-Hetosa	7800(4)	25250(4)	5(1)	495(1)	–
Hetosa	3000(1)	5000(1)	–	–	–
Total	12068(12)	69142(35)	595(4)	19550(23)	1750(6)

†Figures in the bracket indicate number of respondents;

‡ Data for Adama town and Adama district (Awash-Melkassa town) is merged together since at the time of this report writing the two are under the same administration-Adama town.

3.3. Sources of rootstocks and scions for tropical and subtropicalfruit seedlings

The major source for tropical fruit seedling rootstock was local market. The volume of the rootstock obtained from open market accounted for 95.2 percent whereas that from fruit juice houses contributed the remaining for mango rootstock. Similarly, the major sources for avocado rootstocks were local market and a few used from own sources (2.9 percent). Similar trend was there for citrus rootstock sourcing. The issue was totally different when source of tropical and subtropicalfruit scion is concerned. The source of scions for avocado and mango was Melkassa Agricultural Research Center (MARC) The growers entirely depended on one source (Table 6).

Table 6–Sources of tropical and subtropicalfruit rootstock in the Central Rift Valley

Root stock source	Seedling type of & number		
	Mango	Avocado	Citrus
Open market	20(95.2) †	26(74.3)	6(85.7)
Juice house ***(chimaqi bet)***	1(4.8)	2(5.7)	1(14.3)
Open market and *juice house*		6(17.1)	-
Own source (from own trees)		1(2.9)	-
Total	21(100)	35(100)	7(100)

†Figures in the brackets denote percentage

3.4. Training participation and its effect in tropical & subtropical fruit seedling management

Over half of the respondents (51 percent) trained on grafting and other fruit nursery management practices such as pot media preparation (proper mix of soils-forest soil, sand and compost), spacing, pest and disease management and irrigation (watering). Data from this study showed that training has a positive and meaningful effect on developing and practicing of grafting skills. From 18 respondents those attended the training, 12 of them adopted grafting skills. In contrast, among 17 respondents who did not receive training only a grower practiced grafting. Therefore, training had a direct and strong effect on avocado seedling grafting practice (Table 7).

All of the respondents who attended fruit nursery management training reported to have developed skills in grafting fruit seedlings. Similarly, all respondents who receive training exclaimed that they were satisfied by the training provided on fruit grafting; among whom 44 percent of them reported to be highly satisfied. There were also a reasonable proportion of respondents (11.4 percent) who started fruit nursery production and management from their own observations, interest and motivation without receiving any training on the subject.

Table 7– Training attendances on tropical fruit seedling grafting skill development

		Grafting practice		
		Yes	No	Total
Training attendance	No	1	16	17
	Yes	12	6	18
Total		13	22	35
		Pearson χ^2 (2, n=35) =13.836***		

***= Significant at P<0.01

3.5. Information sources on tropical and sub-tropical fruit nursery management

Most of the respondents, 57 percent, obtained information about improved fruit nursery management from their fellow colleagues (friends, relatives and neighbors) followed by Melkassa Agricultural Research Center (MARC). Agricultural development agents, district agricultural experts and media were other sources of information on fruit nursery management. The fact that Melkassa ranked second as information source for fruit nursery seems that the main stream extension system does not focus on fruit production. We presume there is a weak link to be strengthened when technical back up and close technical support on tropical and sub-tropical fruits are concerned (Table 8).

Table 8– Sources of information for improved fruit nursery management

Sources of information	Number	Percent
Another fruit crop grower	19	54.3
Melkassa Agricultural Research Center (MARC)	11	31.4
MARC and another producer	2	5.7
Development agent or district Office of Agriculture	2	5.7
Mass media (radio and TV)	1	2.9
Total	35	100.0

3.6. Major clients of tropical fruit seedling

Major clients of fruit seedling buyers from tropical and subtropicalfruit nursery owners were: local residents (urban dwellers), NGOs, government organizations, petty seedling traders and farmers. Among those clients, local resident or urban communities around the nursery or display sites were the major clients of most respondents though they buy in small numbers. Whereas non-government organizations and government organizations were the second main clients respectively and they buy large number of seedlings for redistribution in different localities (Figure 4). The number of farmers buying fruit nursery was observed still low. This could probably because of the prevailing habit of low level of fruit consumption other than challenges such as shortage of water and livestock damages. The demand in rural areas need to be triggered by deliberately informing on nutritional quality and environmental benefits of fruits since farmers have wider land and rich experience in crop management if they developed interest in fruit production and consumption. Hence, in the future the tropical and sub-tropical fruit development training needs to include health experts and environmentalists (foresters) other than horticulturalists to show and emphasize the multiple benefits of tropical and subtropicalfruits.

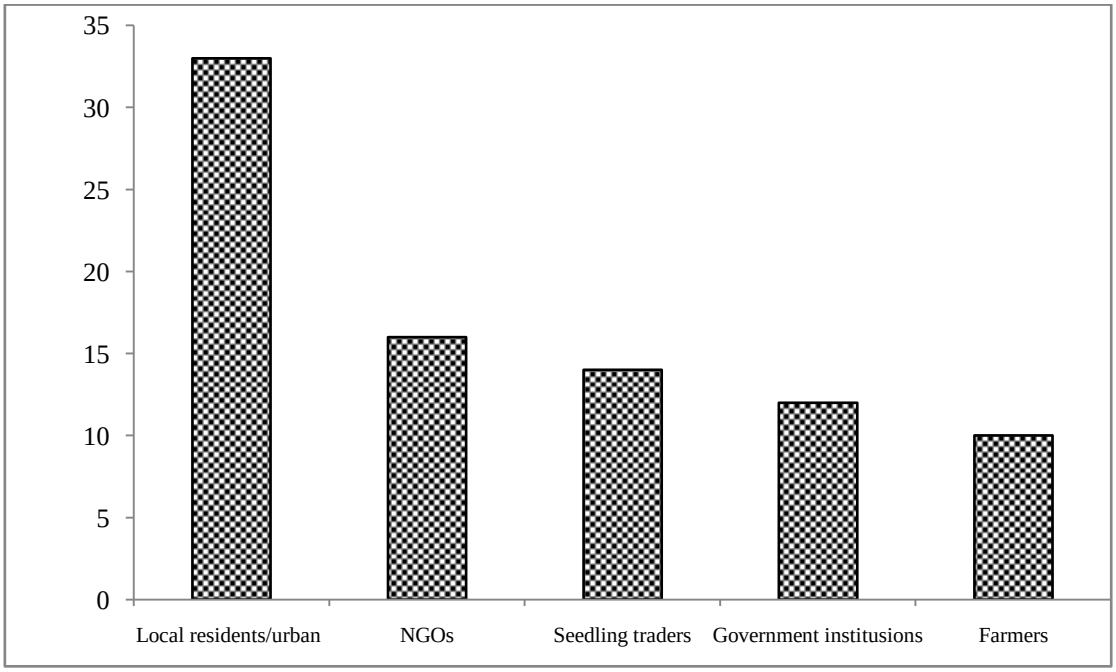

Figure 4. Major clients (by number buyers) of tropical and subtropical fruit nursery owners

3.7. Promotion techniques for seedling distribution

Displaying seedlings on public places such as road sides was the most common seedling sale promotion technique that the respondents used. Announcing on traditional gathering (*idir*, local meetings, etc.) and inviting visitors were the other important techniques (Table 9). Printed media like leaflets, billboards and posters have not yet come in to picture. In the future, innovative promotion techniques need to be adopted considering the cases of successful growers from different walks of the community (including urban residents, farmers, large farms etc).

Table 9–Tropical and subtropicalfruit seedling promotion approaches

Approaches	Frequency(N=28) †	Percent†
Display seedlings on public places (i.e., road side)	26	92.85
Invite visitors	2	7.14
Announce on traditional gathering (*idir*, meeting, etc)	2	7.14

†Figures do not add to 100 percent up since nursery owners use more than one promotion techniques

3.8. Nursery owners' perception on tropical and subtropicalfruit production prospects

Most of the respondents (85.7 percent) indicated that the shortage of improved fruit planting materials (root stock and scion) as the major bottleneck in fruit seedling production. Two-third of the respondents reported that major demand for tropical and subtropical fruit was from distant places (more than 25 km). Even though lack of planting materials was an issue, almost all of the respondents perceived that fruit nursery can be developed into a profitable business enterprise. They also asserted that tropical and subtropical fruit seedling business would improve household food security. A little more than half (57.1 percent) of the respondents, however, held a believe that fruit nursery establishment needs public organization's support to be profitable. Quite a significant proportion of respondents expect that tropical and subtropicalfruit nursery can be developed into a profitable business entity without public support. This later point is an encouraging one where dependency syndrome is breaking down and the clients of research may operate with a minimum technical support and help other to develop similar attitude. All of the respondents voiced that the tradition of consuming tropical and subtropicalfruits has been growing so fast in their areas and nearby towns suggesting a promising future for seedling and fruit business development (Figure 5).

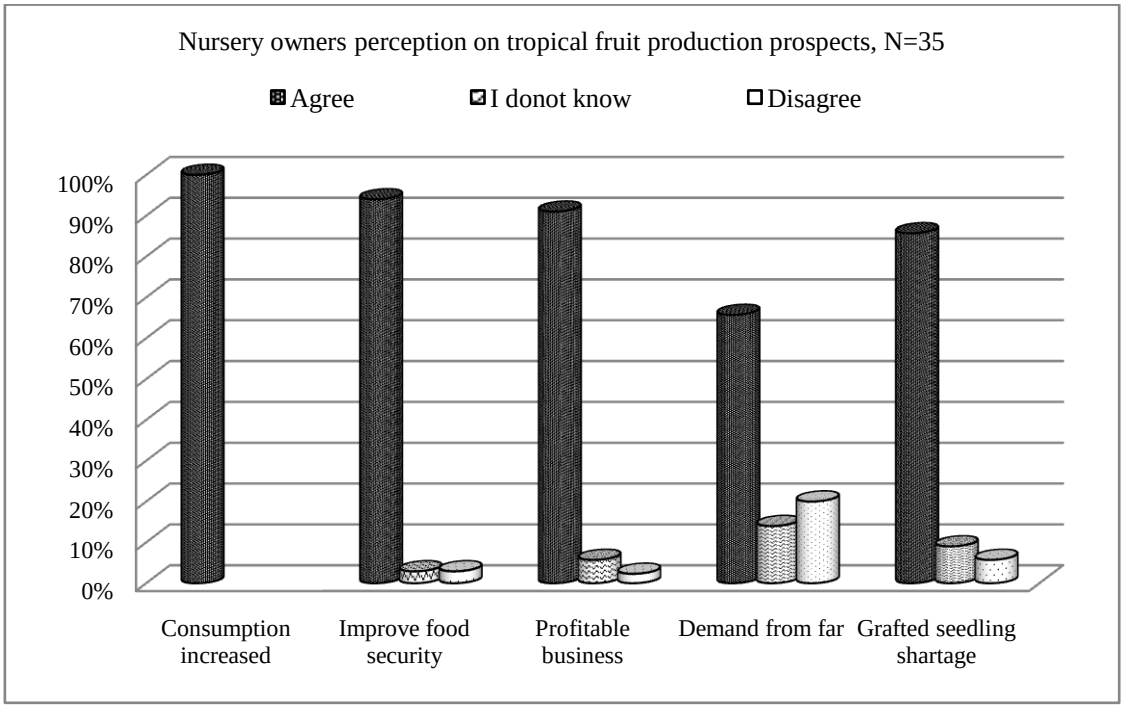

Figure 5 Perception on the challenges of tropical fruit production

One third of the respondents indicated that accessing rootstock was the challenging part of fruit nursery establishment whereas slightly more than two third of the respondents believed that obtaining scion for grafting was the major bottleneck of fruit nursery establishment to produce improved seedlings. Forty percent of the respondents informed that fruit nursery establishment was labor intensive and challenging in the absence of hired labor. Concerning technical skill, most of the respondents (66 percent) indicated that they believed that are technically capable in seedling management particularly the root stock whereas 46 percent of the respondents reported that they have sufficient technical skills in grafting fruit seedlings (Figure 6).

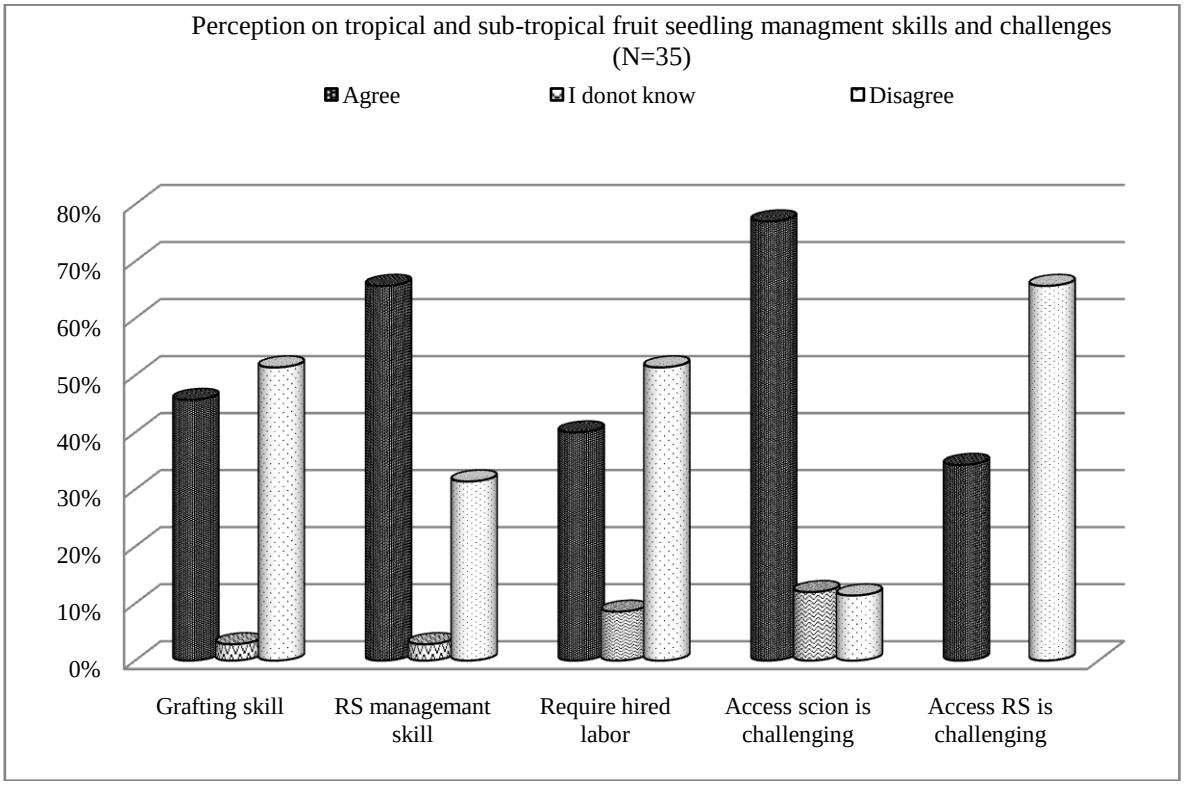

Figure 6. Perception of tropical and subtropicalfruit seedling producers on fruit production

† RS: Root stalk

3.9. Cost of tropical fruit seedling production

In production of improved tropical and subtropical fruit seedlings, the highest cost for all major fruits-avocado, mango and citrus-was labor. There were three types of labor sources: family, hired and salaried (relatively permanent as compared to hired one). Family labor claims the highest share. Salaried labor and hired labor expenses rank second and third places on avocado and citrus seedling production respectively. The cost of hired labor and salaried labors rank second and third place in mango seedling production respectively. The other costs of fruit seedling production were land rent, equipment and inputs (e.g., fertilizer, water, plastic bag). Equipment and inputs take the second place next to labor cost for three major tropical fruits seedling production and land rent was the third cost item. Production of avocado had the highest share of all when the three fruits production cost put together. For instance, 339, 509 ETB (Table 10) was incurred to produce 81,210 avocado seedlings (Table 10). Similarly, 103,889 ETB was invested to produce 595 grafted and 19550 ungrafted mango seedlings (Tables 10).

Table 10– Labor contribution and costs of tropical fruit seedling production

Cost item		Avocado (ETB)		Mango (ETB)		Citrus (ETB)		Total cost
		N	cost	N	cost	N	cost	
Labor	Family	34	97370 (28.7) *	21	33847(31.5)	4	710(23.9)	131927
	Hired	16	367811(0.8)	14	27250(25.3)	2	220(7.4)	64251
	Salaried	17	47725(14)	6	3730(3.5)	2	400(13.5)	51855
Land tax and rent		33	11482 (3.4)	11	17315(16.1)	1	20(0.7)	28817
Inputs & equipment†		34	146151(43)	24	25356(23.6)	5	1617(54.5)	173124
Total		34	339509	34	107498	34	2967	449974

†The equipment and inputs include plastic pots, grafting knives, scissors, soil, sand, compost, water and water container.

*Figures in the bracket indicate the percentage cost

3.10. Financial benefits of tropical fruit seedling production

For sustainable tropical and subtropical nursery development, the investment on the business has to be rewarding. From the study, a little less than half a million ETB was invested to produce mango, avocado and citrus seedlings. As presented in Table 10, major investment went to avocado seedling production followed by mango, then citrus. Avocado claimed the highest resources as compared to the other two because of its comparative advantages over others in terms of early maturity and higher seedling survival rate. Grafting of tropical fruit seedlings significantly boosted the values of seedling in terms of money obtained from sell. For instance, the price of mango seedlings was sold six times that of ungrafted mango seedling. If one has to make an analogy between the prices of hybrid maize seed and grafted fruit seedlings and open pollinated maize to ungrafted fruit, in similar way hybrid maize seed cost was 5times (Cromwell et al.1992) that of maize grain price. The details of seedling prices are presented as follow (Table 11).

The minimum price of a grafted avocado seedling was 32 ETB and the maximum price is 120 ETB whereas the average price was 73.65 (SD=30.17) ETB. Similarly, the lowest price of ungrafted avocado seedling was 5 ETB and the highest price was 20 ETB whereas the average price was 13.34 (SD=3.43) ETB. The lowest price of grafted mango seedling was 40 ETB and the highest price was 140 ETB whereas the average price was 82.5 (SD=43.08) ETB. The minimum price of ungrafted mango seedling was 7 ETB and the highest price was 20 ETB whereas the average price was 13.45 (SD=3.77) ETB. The minimum and the maximum price of non-grafted citrus seedling was 10 ETB and 15 ETB respectively with an average price 11.67 (SD=2.89) ETB. The difference between the grafted and ungrafted seedlings indicates not only quality improvement also translated into income enhancement of tropical and subtropical fruit nursery owner households(Table 11).

Table 11–Number of seedling, production cost and net income from tropical and sub-tropical fruit production in the Central Rift Valley of Ethiopia

Seedling type (1)	Seedling Number (N)(2)	Seedling Mean price (P) (3)	Estimated sale (P x N) (4)	Production Cost (5)	Net income Estimated (6) (4) -(5)
Avocado grafted	12068	74	888808	163473	725335
Avocado ungrafted	69142	13	922354	176036	746318
Subtotal	81210		1811162	339509	1471653
Mango grafted	595	83	49088	5926	43162
Mango ungrafted	19550	13	262948	97963	164985
Subtotal	20145		312036	103889	208147
Citrus ungrafted	750	12	8753	2967	5786

Total	102105		2131951	446365	1685586

3.11. Opportunities for tropical fruit nursery development

The respondents were probed to reiterate the opportunities for tropical fruit production. High market demand was the most important perceived opportunity for fruit nursery production. Whereas technical capability nursery management, interest on fruit nursery and good weather condition (temperature, altitude) were available opportunities in that order of importance (Table 12). The availability of functional infrastructure and environmental suitability is a widely-perceived opportunity to be utilized for maximized benefit.

Table 12– Opportunities of tropical fruit seedling production (n=21)

Opportunities	Frequency	Percent
High market demand	11	52.4
Good weather condition	7	33.3
Availability all weather roads	3	14.3
Total	21	100

3.12. Challenges of tropical fruit seedling production

Land scarcity was number one challenge (34.3 percent) of tropical fruit nursery owners whereas deficiency of technical skill (22.9 percent) and shortage of water (11.4 percent) stood in the second and third places respectively. There were also other challenges such as lack of capital, erratic demand, and shortage of planting material (mainly scion) , pest and disease problem (Table 13). Among the challenges some of them need technical solution while others qualify for both administrative and technical solutions. For instance, lack of technical skill can be solved through tailored training while shortage of finance may be solved though credit services.

Table 13– The primary problem of tropical fruit seedling production (n=35)

Primary problem	Frequency	Percent
Land scarcity	12	34.3
Lack of technical skill	8	22.9
shortage of water	4	11.4
Shortage of finance	3	8.6
Erratic demand	3	8.6
Shortage of scion	2	5.7
Disease & pest	2	5.7
Shortage of labor	1	2.8
Total	35	100

Other than those challenges identified during field study, a new insect pest on mango has emerged at catastrophic level in pockets mango production areas in the CRV and elsewhere in the country. The infestation level reaches 100 percent in certain pockets across the country. The occurrence of white mango scale in Ethiopia was known in 2010 (Mohammed et al. 2012). It appearance in the CRV was confirmed in June 2014 when an agricultural expert from Adama District Agricultural Development Office brought invested leaf sample from Melka-Oba kebele to MARC (Gashawbeza et al., 2015). At the time of finalizing this paper, a heavy mango white scale insect infestation was occurred at MARC. It would undermine the ongoing effort of disseminating improved mango seedlings in the CRV and other potential areas. Considering the level of damage caused by the insect, it is commendable to take up expert advice and implement possible control and management measures such as establishing effective internal quarantine to limit expansion and screening less harmful insecticides to mango white scale natural enemies, and limiting wide spectrum insecticide to control white mango scale insect (Gashawbeza et al., 2015).

IV. CONCLUSION AND IMPLICATIONS

The study concludes that there is sufficient demand for tropical and subtropical fruit seedlings from local communities, governmental and nongovernmental organizations. tropical and subtropical seedling production is a promising area that can be developed into profitable business enterprises and may enhance household food security. Training and follow up in tropical and subtropical fruit nursery management had successful result in enhancing technical skill of tropical fruit nursery owners. As to financial benefit of tropical and subtropical fruit seedlings, grafting tropical fruit seedling considerably boost seedling values. Shortage of quality planting materials (root stock and scion) are still bottleneck in tropical and subtropical fruit seedling production. Access to scion is challenging for which the producers 'heavily' depend on MARC need to get attention. On the other hand, lack of technical skill of grafting was an important area of concern. Shortage of land for fruit nursery production is important problem which need the attention from technocrats and administrators and efficient land use and natural resource management. From this study, it is commendable that

establishing mother blocks (improved variety fruit trees) around the fruit nursery sites will solve the problem of scion. Extension workers need to support tropical and subtropical fruit owners through technical back stopping tropical nursery seedlings production and using innovative approaches in seedling business incubation.

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