



## **Fruit commodity development in Goma District through farmer-based improved fruit seedling supply system: Experiences from IPMS**

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## **Acknowledgement**

This paper documents interventions, results and lessons learned for fruit commodity development in Goma Woreda, based on a participatory market oriented value chain approach. The approach was introduced by the IPMS project/staff, who not only facilitated the introduction of the approach (technically and financially), but also played an important role as partner in the development process. The credit for the development results obtained go, however, to all the partners involved in this endeavor especially the nursery operator farmers, staff of the Goma Office of Agriculture and Rural development (OoARD) and Melkasa and Jima Agricultural Research Centres. Bogale Guta from the wereda OoARD, Dadi Gelashe and Habtamu Tiruneh who technically supported the farmers in their field activities are also acknowledged.

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## **Abstract**

In Goma, fruits considerably contribute in improving the nutritional status and income of the community. However, its production and productivity has been very low. The objective of this case study is to share best practices and lessons learned from farmer-based improved fruit seedlings supply system that could contribute to enhance fruit production in Goma Pilot Learning Woreda (PLW).

The assessment result highlights that fruits production in Goma is a recent phenomenon and all fruit farmers got their first planting material from unknown sources and hence agronomic and cultural practices required for each fruit type is less known. Consequently, constraints such as extended periods to fruiting, failure to set fruits, unmanageable fruit tree height, diseases and pests, low yield, etc. are very common.

Above all, introduction of various fruits to Goma Woreda was made much earlier than the institutional, skill and knowledge of the OoARD (the Office of Agriculture and Rural development) staff handling them. In addition, key technical limitation to fruits development identified through participatory commodity development approach includes scarcity of improved planting materials, large canopies, poor quality fruits, long time to maturity, among others. IPMS and OoARD initiated farmers-based improved fruits planting materials multiplication and distribution system in trying to solve the problem.

Six model farmers (3 female, 3 male) were trained and engaged in grafting avocado and produced 2,052 grafted avocado seedlings from internationally known varieties such as Hass, Ettinger, and Fuerte which were sold to 163 households in 28 Peasant Associations (Pas) at Birr 25 per seedling. The farmers earned Birr 42,000 among them in total. Also mother trees of Hass, Ettinger and Fuerte were established in each model farmer's plot for sustainable scion supply. Taking the advantage of this successful demonstration, OoARD started a scaling out program by including 3 additional model farmers. The 9 model farmers have now raised 17,000 avocado and mango root stock seedling at their own cost amounting to Birr 85,000 which will be ready for grafting starting from January 2010.

In addition 3 copy farmers in Kilole PA are also engaged in improved fruits seedlings production. The effort demonstrated that farmers could be good sources for technology multiplication and distribution, which has been a key challenge in technology uptake not only for fruits but for many other commodities in Ethiopia.

**Key words:** Fruit production, grafting, private fruit nurseries, sustainability, value chain

## **1. Introduction**

The IPMS project, funded by the Canadian International Development Agency, was established to assist the Ministry of Agriculture and Rural Development in the transformation of small holder farmers from a predominantly subsistence oriented agriculture to a more market oriented (commercial) oriented agriculture.

The project adopted a “participatory market oriented commodity value chain” approach which is based on innovation systems and value chain concepts. Crucial elements in the approach are the value chain instead of a production focus, the linking and capacitating of value chain partners and the assessment, synthesis and sharing of knowledge among the partners.

The project introduced this approach in 10 Pilot Learning Woredas (PLW) in Ethiopia with the objective of testing/adopting the approach so that it can be promoted nation wide. An integral part of the approach is the identification of marketable commodities and the value chain constraints and interventions. This was accomplished through a participatory process in all PLWs.

This case study focuses on the development of fruits in Goma Woreda with the objectives of documenting diagnostic results and value chain interventions, and providing proof of concept, challenges and lessons learned to be considered for scaling out.

Following the introductory section, the remaining sections are structured as follows. Section two deals with methods and approaches used in the study, while section three presents background information, including description of the PLW and the history and diagnosis of fruit development. In section four, value chain interventions - extension, production, input supply, marketing, and credit issues - are presented. Section five dwells on results and discussion on production/income, input supply/marketing, gender/environment, organizational and institutional aspects, while sections six and seven deal with challenges and lessons learned, respectively.

## **2. Methods and Approaches**

To start the development of a commodity, IPMS used a District level participatory market oriented value chain planning approach, aimed at identifying i) main farming systems, ii) potential marketable crop and livestock commodities by farming system, iii) problems, potentials and interventions for each value chain component iv) value chain stakeholder assessment with potential (new) roles and linkages. Different value chain stakeholders were involved and consulted in this planning exercise. Secondary biophysical and socio economic data were collected, followed by open ended interviews with focus groups and key stakeholders. The results were presented in a stakeholder workshop in which priority marketable commodities were decided upon as well as key interventions and partners.

This initial rapid assessment was followed by some more detailed studies on selected commodities. Such studies were conducted by partner institutions and/or students and or IPMS staff using formal surveys, interviews and observations.

To implement the program at Woreda, Peasant Association (PA) and community level the project facilitated different knowledge management and capacity development approaches and methods to stimulate the introduction of the value chain interventions by the actors concerned. The various value chain interventions are documented by the project staff in the six (6) monthly progress reports ([www.ipms-ethiopia.org](http://www.ipms-ethiopia.org)) and the annual Monitoring and Evaluation (M&E) reports.

To quantify the results from individual and/or combination of interventions, the project established a baseline and measured/documented changes. Several data sources were used to establish the baseline and to measure change.

## **2.1. Baseline information**

To establish a baseline, data from a formal baseline study and data from some special diagnostic studies were used. The initial PRA study also contributed to the quantitative and qualitative baseline information.

## **2.2. Documenting change processes and results**

Several sources were used for regular documentation of change processes and results, including six monthly progress reports, annual M&E reports, MSc thesis research, records kept by the OoARD, personal observations and diaries. In some PLWs, staff also monitored changes in production/productivity for a few selected farmers on a regular basis.

In 2009, the project also developed a set of guidelines for the PLW staff to systematically collect relevant information for the case studies including history, changes in extension services, value chain interventions (production, input supply, marketing and credit), results, challenges and lessons learned. Part of the information was obtained from the previously mentioned baseline and other sources and specially arranged key informant interviews and a commodity stakeholder workshop. The stakeholder meeting was organized to establish the evolution of the roles and linkages of the value chain actors.

Following the collection of all relevant information, a write-shop was organized to present information in a systematic manner. Drafts of the PLW specific commodity case studies were then reviewed by experts at the IPMS Head Quarters.

## **3. Commodity background**

### **3.1. PLW description**

Goma is one of the IPMS 10 PLWs representing a major cash crop (coffee) intervention area in Oromia region. It is located about 389 Km South West of Addis Ababa in Oromia region Jima Zone (Fig. 1). It has a total population of about 247,326 people distributed in 36 peasant associations (PAs) of which more than 49% are women. The farm households of Goma PLW are about 45,567 out of which 10,035 are female headed households (OoARD 2007).

Goma PLW has a total area of 96.4 km<sup>2</sup> with mid altitude covering 96% of the total area and with a small proportion of extreme lowland stretching along Didesa river basin in its north east border and an extreme high land in west bordering with Gera Woreda. Goma has an altitude ranging between 1387 and 2870 m above sea level (masl) and it has a hot and humid weather with maximum and minimum temperature of 13 and 21 °C, respectively (IPMS 2007). Livelihood in Goma is predominantly dependent on coffee. Other commodities, such as cereals and fruits as well as both small and large ruminant animals also play a considerable role.

Goma is recognized as the place of origin of Arabica coffee by Oromia regional state and more than 30% of its total area is covered by natural forest coffee with small area of plantations owned by state coffee farm and few individual farmers.

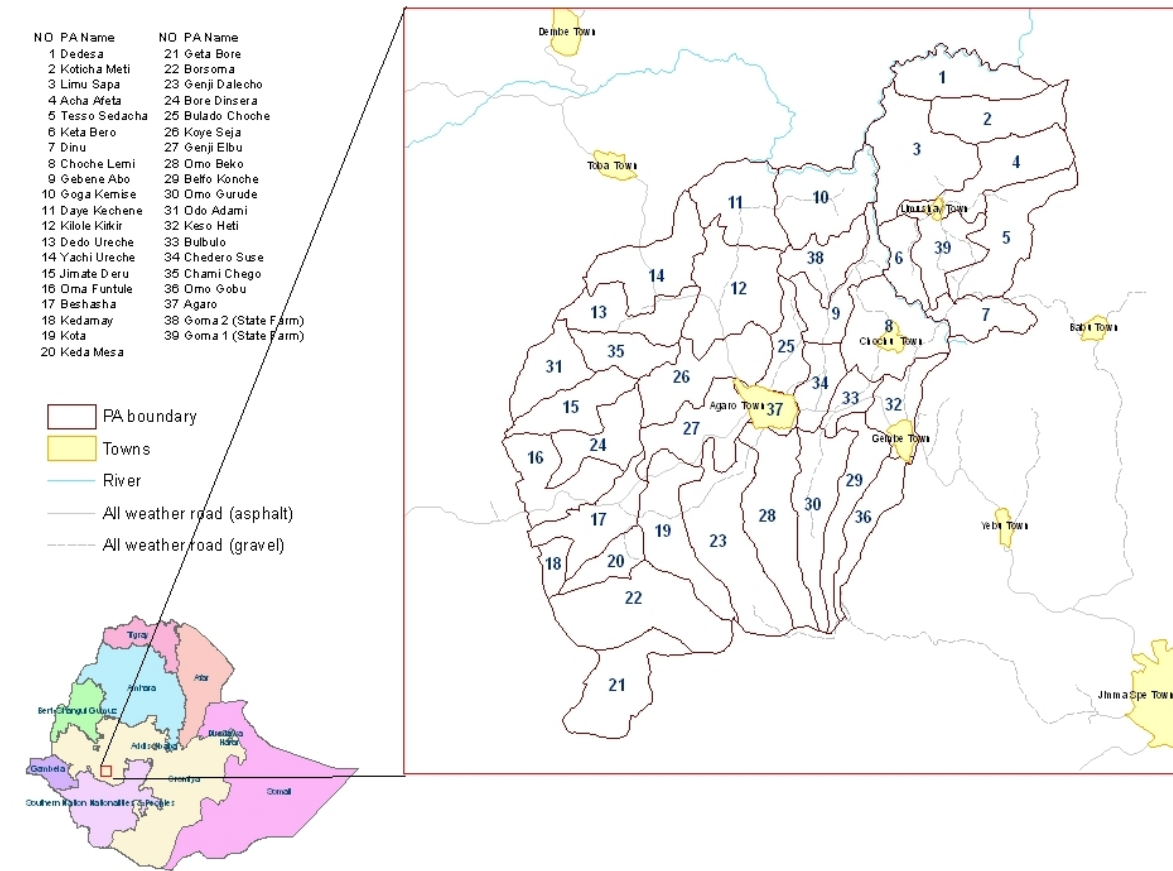


Figure 1. Map of Goma district

### 3.2. History and diagnosis

Fruits provide economic and nutritional benefits. First, they are a source of cash for farming communities and second, fruits are a reliable source of nutrition that is very essential for the health and growth of human beings. Thus, there has been an often repeated advice from the health workers that we should include fruits in our daily meals to make balanced diet. Owing to the diverse climatic conditions in the country, Ethiopia could produce numerous fruits in different corners of the country.

However, both the smallholder farmers and private sector engagement in fruit production and productivity is quite low. Total production in Ethiopia was estimated at about 320,000 t (FAO 2002). In 2003, Ethiopia exported only about 5,366 t of various fruits, and earned only about Birr<sup>1</sup> 13.3 million (equivalent to about USD 1.5 million) in foreign currency (CSA 2004). Some studies highlight that particularly small holder farmer' less engagement in fruits production is attributed to a number of factors. Yilma (2009) contends that because of the long period establishment cost of fruit trees before fruit setting, knowledge and market information limitations, smallholders are not practicing other fruit trees except banana.

In Goma, fruit extension is a recent phenomenon. According to the information of some senior staff, until 2000 fruits were promoted because of the interested individual experts rather than a regular activity planned and executed with necessary inputs and budget. Thus experts sometimes produced some local fruit seedlings in coffee nursery and distributed them to interested farmers. However, after the decentralization in 2000, the former coffee and tea department was restructured to accommodate fruits and vegetable and renamed as Coffee, tea, fruits and vegetable department and within this department one independent fruits and vegetables team was formed. It is since then that fruit got more attention by the OoARD.

Key informants indicate that fruit development in Goma PLW could be divided into two phases: the introduction of various fruit types by the community itself, and the first efforts of the public sector in fruit development since 2000. Over all, fruit farming is a new practice for Goma community while banana is the oldest and pineapple and apple the youngest (Table 1). Considerable increase in the number of farmers who adopted fruit farming has been recorded in the years between 1990 and 2008 which indicate that farmers are minimizing dependency on coffee and are diversifying their sources of income.

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<sup>1</sup> 1 USD was equivalent to Eth. Birr 8.5997 in 2003 (<http://unstats.un.org>)

**Table 1.** Major fruits introduction periods in Goma farmers

Fruit farming starting period	No of respondents					
	Avocado	Mango	Orange	Banana	Pineapple	Apple
1968-1978	Nil	Nil	Nil	2	Nil	Nil
1979-1989	Nil	2	7	5	Nil	Nil

Source: OoARD/IPMS field survey 2009.

Currently one could see at least one or more fruit plants in almost every farmer's plot. Some informants indicated that Goma fruit farmers have got the first planting material from different unknown sources. In some cases, source of planting material could be known but farmers were not aware of the variety name, its performance, appropriate agronomic and cultural practices etc. required for better management to improve production. In this regard, more than 89% of the farmers who started fruits production before 2000 reported that they got the first fruit planting materials from their neighbors (Table 2) without any advice on what to do or when.

**Table 2.** Source of the first fruit planting materials

No	Source	No. of Respondent	%
1	OoARD/DA	9	7
2	NGO	2	2
3	Neighbor	113	89
4	Others	2	2
	Total	126	100

Source: OoARD/IPMS field survey 2009

Some informants also highlighted that Goma farmers got some unimproved avocado planting materials from neighboring Gera Woreda and the Gera Woreda farmers also got this planting material from a Norwegian Aid organization which started its operation in the area around 1985. This indicates that the source of avocado in Goma was a Norwegian Aid Organization. Some informants also mention that unimproved mango seedlings also came from Assosa in Benshangul region with some Muslim religious people who frequently moved to Assosa for prayers many years back.

Different banana varieties locally named Kenya, Abesh, Mizan, etc are available in Goma and informants indicated that Mizan type was introduced by the Jima Agricultural Research Centre (JARC) while the origin and varieties of other banana types are unknown or at least not recorded. Orange is another important fruit crop in the PLW but again nobody knows the origin, the name of the variety and the year it was introduced. In sum, major fruits introduction to Goma PLW were the farmer's

own initiatives and the dissemination was processed from farmer to farmer very recently, for less than 15 years. However, the increment of the number of fruit trees since its introduction is quite notable.

In 2005 OoARD for the first time officially distributed 4100 potted avocado seedlings from local seeds prepared by the JARC. Some informants also indicated that some experts were producing bare rooted seedlings of mango, orange, avocado, etc from local fruits in coffee nurseries and used to distribute them to farmers prior to fruits unit establishment in OoARD.

The diagnostic study conducted in Goma and subsequent studies revealed that fruits are produced by the majority of Goma community and its role in the livelihood of the community both in terms of food diet and cash income is considerable. Moreover, field assessment by OoARD/IPMS (2009) highlighted that all the farmers interviewed (100%) are engaged in cultivating one or more kind of fruits depending on its location (Table 3). Further more the field survey shows that almost all of households (100%) in Goma who produce fruits consume considerable part of the production at home as part of daily diet in one or the other form. Home consumption level varied from household to household and some respondents reported that it could go up to 100% or the whole fruits produced could be consumed at home. Different fruits are consumed at different maturity stages and particularly mango, banana and oranges are consumed at green stage most of the time by children.

Different literatures reveal that 85% of the livelihoods of the Goma community is dependent on coffee where its production period only extends from October to April. No other income is expected or earned in the other part of the year (May to September). This part of the year, May to September, is commonly known as cash and food stress period for the PLW. In this particular period, the farming community members take different measures which usually erode their assets. To this end, most notably, fruits like avocado and mango play an important role in bridging the food and cash stress period among farming community. This is because the first harvesting period for mango and avocado is from May to July (Fig 2).

Despite fruits' important role in improved livelihoods in Goma, its development is moving at a slow very pace. A number of factors are attributed to less productivity and low speed in fruits development. Different fruit varieties introduced to Goma PLW by the community themselves were from unknown sources or with no information regarding their management and thus constraints such as failure to set fruit, extended periods on fruits setting, unmanageable height, diseases, pests, etc are very common. For major fruit crops such as avocado, minimum fruit setting takes 7 years and above (Table 3) which is a very long time for a smallholder farmer.

Figure 2. Food and cash stress period and fruits as bridging source.

Crop types	Harvesting period											
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Coffee					Critical food and cash stress period							
Avocado												
Mango												
Orange												

Source: Field survey OoARD/IPMS, 2009.

**Table 3.** Observed average number of years before fruit production

No	Fruit Type	Production Period (year)
1	Avocado	7
2	Mango	5
3	Orange	6
4	Banana	1.2
5	Papaya	6 months

Source: OoARD/IPMS field survey 2009

Diseases and pests attacking different parts of fruit trees are very common on locally adapted avocado, mango, orange and other fruit crops. Yield loss, particularly on fruits like oranges could go up to 50% and as a result some fruit farmers were forced to abandon orange production (Table 4). These oranges and mangoes were severely attacked by diseases because of the hot and humid weather condition of the PLW which favours the multiplication of fungal and bacterial diseases. As a result of the pest and/or disease attack it is believed to cause low market attraction and hence low market prices in the future. Currently however, fruits in Goma are marketed without consideration of quality. It will be very difficult to think of export market under these circumstances.

**Table 4.** Yield losses due to diseases

Loss range %	Avocado	Mango	Orange
<21	Nil	16	-
21-40	1	23	10
41-60	3	2	16
61-70	2	5	23

Source: OoARD/IPMS field survey 2009

An old avocado tree in OoARD compound.



The office guard named Ato Hussien A/Gisa (left) was one of the laborers who carried the two avocado seedlings on a tractor from Goma to state coffee farm to OoARD compound where the tree now stands. Ato Hussein explains that this particular avocado tree seedling was brought by the then head of OoARD named Formosa Saketa in 1994 and the tree started bearing fruits after 12 years in 2006. The fruits need more than 12 months to mature and more than 20 days to ripe, but they are very big fruits with small seed and much flesh. In addition, the tree produces a fruit which has a very rough skin and a hard cover to remove even after ripening. Ato Hussein further explained that this particular avocado tree has two major problems: it is too high to collect fruits and above all every year major branches which carry maximum fruit are broken before the fruits ripe because of the heavy weight and it is not possible to support the branches because of the height. The author of this paper also got a chance to see broken

branches with a high number of unripe fruits in 2009 production year.

Knowledge and skill limitation of technical staff is another constraint which contributed to low speed in fruits development. Since the formal start of fruits improvement intervention, very limited capacity building training was rendered to front line staff and few trainings conducted were also not focused. Thus, front line staffs were not in a position to render new approaches, technologies, practice and technical advices to farmers. Moreover, the linkage among research institutions, input suppliers, extension workers, farmers regarding fruits improvement was inadequate.

#### **4. Fruit value chain interventions**

##### **4.1. Extension service interventions**

The focus of the program is to develop a new fruit value chain system based on nationally, internationally acceptable varieties, which can produce fruits in a relatively short period of time, with the help of capacitated producers and support services. The key bottle neck to be addressed is the supply of grafted seedlings of improved varieties. The latter involves the development of a decentralized system of village based nurseries operated by entrepreneurial farmers or groups. These farmers or groups need to develop linkage among leading role players for better skill and knowledge sharing and technologies in the future.

The development started with defining roles to be played by innovative farmers, OoARD, IPMS, and other stakeholders involved in this particular exercise. In this

case research centres are expected to play the role of supplying improved planting materials and accompanying technical skills while facilitating the implementation of new approach such as identifying innovative farmers, developing awareness among farmers, field selection etc were leveled as the role of OoARD field staff and IPMS (Table 5).

**Table 5.** Role of stakeholders

No	Stakeholders	Expected role
1	OoARD	Developing awareness, selecting, organizing, training farmers, monitoring and data recording
2	JARC and Melkassa Agricultural Research Centre (MARC)	Training, providing scions, monitoring, evaluation of performances
3	Private sectors	Providing inputs such as poly bags
4	Farmers	Allocating plots for nursery, filling poly bags, collection seed for root stock, planting root stock and taking care
5	IPMS	Assessing available technologies & improved practices, linking, facilitating training, experience sharing events, demonstration. Support OoARD in setting technical and institutional requirements of farmers to be selected.

Since fruit related extension in Goma PLW is a recent development and less established as compared to other commodities, the project focused on capacitating the staff working as subject matter specialist (SMSs), DAs and farmers. In this regard, one SMS visited Upper Awash state fruit farms and then two levels of trainings were conducted.

In the first phase of training, only DAs, assigned in the PAs where innovative farmers were selected from, received focused training on grafting techniques, along with the model farmers. After being sure that the fruits development activity demonstrated was successful and farmers were able to easily do it, larger scale training was conducted for all the 36 crop science DAs serving in 36 PAs of the Woreda and experts at the district level. Field manual on all tropical and sub-tropical fruits on overall management, prepared by trainers from MARC, JARC and Kalehiwot church were organized and distributed to each trainee and also placed in Model FTCs and the Woreda knowledge center for reference. Again, CDs about grafting practice, prepared by MARC and other institutions were copied and placed in the model FTCs and Woreda knowledge center for reference. Record keeping was introduced to identify the different fruit type/varieties introduced and distributed. To this end, each nursery operator developed a recording system indicating the variety and the farmers to whom the seedling was sold to. A copy of this record was given to the respective DAs for follow up and technical assistance to the farmer(s) who bought the grafted seedlings.

Six innovative farmers (3 female, 3 male) were selected by OoARD and experience sharing tour was organized for these farmers to Upper Awash fruit farm which produces various grafted fruit seedlings. The major aim of the tour was to develop wider awareness among innovative farmers on fruits production in general. One of the innovative farmers was advised and technically assisted to produce 1000 avocado root stock for demonstration/training purposes.

An appropriate resource person was selected from JARC to undertake the training. When the root stock were ready for grafting, scions of the three internationally known avocado varieties named Hass, fuerte and Ettinger were brought from MARC and training was conducted with particular emphasis on improved seedling propagation, by grafting techniques. The trainees, (6 farmer, 3 DAs and 2 supervisors) were given an intensive hands-on training on grafting technique.

#### **4.2. Inputs supply interventions**

To support the development of private village level fruit nurseries, basic inputs including grafting tools, rootstock, scion, poly bags, compost, sand, soil, etc are required. Scion and polybag are the two major inputs which are not easily accessible to farmers, while other inputs such as root stock, sand and compost are available in the locality. At the start, the project has been facilitating the supply of polybags and scions for farmers. However, efforts are underway to engage local traders in the supply of polybags so that the service will be sustainable. As a result, few have already started supplying these materials. Also some of the nursery operator farmers have already started buying polybags in their own way, indicating that as far as the introduced technologies are viable, farmers will look for inputs by themselves and develop a permanent solution.

So far scion supply is from MARC and the project is facilitating and transporting the scions. To address this constraint in a sustainable manner, establishment of mother trees of known avocado varieties in each nursery operator's plot was considered as a viable option. To this end, grafted seedlings of the three known avocado varieties (Hass, Ettinger, Fuerte) were bought from Upper Awash through funds from the project and planted on each nursery operator's plot and tagged for easy identification. In addition geographic location of each farmer's plot including altitude was recoded using GPS (Table 6).

**Table 6.** Mother trees established by model farmers and their location

No	PA	Model farmer	Gender	Mother trees no.	Location		
					E-Latitude	W-longitude	Alt (masl)
1	Beshasha	Kalid	Male	80	7.80493	36.49686	2029
2	Kota	Fozia	Female	25	7.811703	36.51793	2003
3	Kota	Kedija	Female	10	7.8153	36.51682	1990
5	Kilole	Shito	Female	15	7.91495	36.55131	1624
	Chedero Su.	Zewde	Male	30	7.82716	36.6929	1654
6	Choche	Zelege	Male	80			
	Kilole	Twofc*	Male	15	7.90357	36.5547	1688

Source: OoARD/IPMS report 2008

Experts advised the use of separate cutting knife and pruning scissors made for grafting purpose for the nursery operators. However, use of local tools disinfected either using alcohol or fire was also suggested as an option by other experts. Some of the farmers have already started using local tools by sterilizing them with fire.

Nursery operators were trained in various techniques required to manage grafted seedlings. In grafted fruit seedlings removing suckers below the grafting point is a critical issue for nursery operators because these suckers may dominate the growing scion and ultimately cause death of the scion or some times mislead the grower because they resemble the scion. Also recommended spacing both for mother trees on nursery operator plots and grafted seedlings sold to individual farmers was strictly followed by both nursery operators and individual farmers.

#### 4.3. Credit service

Currently, fruit development intervention in Goma focused on improved technology multiplication and distribution by model farmers. Since the number of seedlings raised by each nursery operator is small, no farmer requested credit. However, some women operators who have planned to increase the number of seedlings started expressing their limitation to cover costs of inputs and even requested for credit. This issue will be reviewed and addressed in the next year's program.

#### 4.4. Production interventions

In 2008, OoARD in moved to introducing fruit planting materials from known sources and in the same year the office bought and transported 700 grafted mango varieties of Tommy Atkins and Kent from Upper Awash Agro-industry. The grafted mango seedlings were sold to farmers at 35.50 ETB on loan bases. In the same year the office transported and distributed 1,498 apple varieties of Crispin and Grany from Chenchu and Dawaro. Apple seedlings from Dawaro zone were not having any name and all the seedlings were sold to farmers at Birr 53.00 each on credit basis.

However, the purchase, transport and other logistical issues for the introduction of the improved seedlings was organized and financed by the Oromia Bureau of Agriculture and Rural Development and could not be continued by Goma OoARD because of lack of budget. Jima Agricultural Research Centre also started introducing different pineapple varieties and verification of these varieties on farmers' field is in progress.

**Table 7.** Officially introduced fruit types and source

No	Fruit kind	Year of introduction	Quantity Seedlings	Variety	Variety Name	Source	Potted/Bare rooted
	Mango	2008	700	Grafted	Tommy Atkins/Kent	Upper Awash	Potted
	Apple	2008	1498	Grafted	Crispin /Grany	Chencha/Dawro	Potted

Source: OoARD report 2008

#### **4.5. Output marketing**

Demand for the seedlings among the farming community was higher than the supply and hence market was not a problem for improved avocado seedlings. All the nursery operators sold their grafted seedlings with advance payment from farmers and this will continue for some time to come because of limited supply. Oromia Television program played a significant role in promoting the grafted seedling production in Goma PLW to larger audience which resulted in the purchase of grafted seedlings by neighboring Woredas.

No interventions have been made yet for the marketing of the improved fruits, since it will take a while yet before they reach maturity.

### **5. Results and discussion**

#### **5.1. Fruit production/coverage and income**

At the time the project started in 2007, most PAs which had the right agro ecology had local/unknown varieties of fruit trees, but little or no improved varieties. An overview of the number of households involved with local fruits is shown in Table 8.

**Table 8.** Households involved in local fruit production in Goma in 2007

Fruit	No of households*	No of sample HH producing/ selling fruits	Average		
			Volume sold (kg/HH**)	Income (Birr/HH**)	Price (Birr)
Avocado	6593 (30)	6/4	222	382	1.72
Mango	10030 (27)	22/22	96	139	1.45
Banana	6306 (23)	24/21	84	115	1.37
Papaya	6543 (27)	14/10	54	57	1.06
Orange	6902 (26)	22/20	105	148	1.41
All fruits		50		233	

IPMS baseline data 2007

\* In brackets the number of PAs,

\*\* sellers only

The household survey conducted in 2009 on the fruit system with local varieties showed the following performance data.

**Table 9.** Household survey data on fruit system local varieties in Goma in 2008/09

No.	Fruit type	For all growers			For sellers				Percentage of selling households
		Obs	Average volume sold (kg/HH)	Average value sold (Birr/HH)	Obs	Average volume sold (Kg/HH)	Mean value (Birr/HH)	Average selling price (Birr/kg)	
1	Avocado	6	214.3	633.33	3	428.5	1266.67	3.00	50.0
2	Mango	26	237.2	270.15	15	411.2	468.25	1.04	57.7
3	Orange	14	280.3	208.84	10	392.4	292.38	0.74	71.4
4	All fruits	33		512.65	23		735.55		69.7

Source; IPMS Household survey 2009

According to surveys, the average household income from local fruit production increased considerably as a result of increased quantities sold.

As far as the introduction of improved grafted fruit seedlings is concerned, the District more or less started from scratch with 700 mango seedlings and 1498 apple seedlings supplied by the OoARD in 2008 and the seedlings produced by the private nursery operators.

The grafted seedlings produced by the nursery operators were sold and planted by about 163 farmers in 23 PAs .In addition, people in Jima and Agaro town and in three neighboring Woredas namely Gera, Toba and Gechi bought the seedlings from these farmers. This shows that the coverage of improved avocado varieties is expanding and the benefit as well as beneficiaries will be increasing over time. The distribution of grafted avocado seedlings within and outside the PLW is shown in Table 10– also see Figure 3.

**Table 10.** Distribution of grafted avocado seedlings, 2008

No	Seedling producer name	No of seedlings produced	No of farmers received seedlings	No of PAs covered
1	Kalid shifa	1375	15	6
2	Fozia	120	37	2
3	Kedija	300	47	3
4	Tewofic	100	39	4
5	Shito	120	16	4
6	Zewde	130	15	4
	Total	2052	163	23

Source: OoARD/IPMS field report 2009

## 5.2. Input supply and marketing interventions

The trainees including the 6 model farmers, 3 DAs and 2 supervisors grafted 1000 seedlings and the success rate of grafted seedlings was quite remarkable for beginners (Table 11).

**Table 11.** Success rate for three avocado varieties grafted by model farmers, 2008

Name	Name avocado variety	No of grafted seedlings	Success rate at grafting (%)
1	Hass	333	280 (84%)
2	Ettinger	333	213 (75%)
3	Fuerte	334	270 (81%)
	Total	1000	

Source: OoARD/IPMS field report 2008

During the initial training, Hass variety showed the highest survival rate, (84%) followed by Fuerte (81%) and Ettinger (75%). The success rate of grafted seedlings highlighted that the improved planting material multiplication could be handled by farmers themselves. Following the training and also hands on exercise, each model farmer established his/her own fruit nursery with root stock from local avocado seed.

Scion for grafting was again collected from MARC and grafting was done by model farmers themselves. At this time MARC advised to increase the number of improved varieties (Pinkerton and Bacon) so that option to select the most appropriate varieties for Goma PLW could be widened. The survival rate for Hass, Ettinger and Fuerte, during the second round grafting was 50, 46 and 53 percent respectively and was much lower for the other two new varieties (Bacon and Pinkerton) (Table 12).

This drop in survival rate was in part due to lack of experience and lack of on the job assistance because in that particular period, DAs were not around to assist technically because they were engaged in meetings and were away from their locations. In addition, discussions held with MARC on the issue of less survival rate, revealed that because of shortage of scions, very young scions were provided and that this particular grafting was exercised during cooler time which could have influenced the survival rate. Though it is too early to comment, the varieties Hass, Ettinger and Fuerte seem to be performing well under Goma conditions. However, further observation is needed to come up with full evidence to propose the most appropriate varieties for Goma agroecology.

**Table 12.** Avocado grafted by each model farmer and survival rate, 2008

Farmer's Name	Total Grafted	Hass		Ettinger		Fuerte		Pinkerton		Bacon	
		Grafted	Survi. (%)	Grafted	Survi. (%)	Grafted	Survi. (%)	Grafted	Survi. (%)	Grafted	Survi. (%)
<b>Kalid</b>	500	70	70	100	61	200	78	30	43	100	46
<b>Foziya</b>	254	30	42	60	33	72	51	32	25	60	19
<b>Kedija</b>	160	32	58	32	48	32	43	32	29	32	27
<b>Shito</b>	300	40	38	60	38	100	41	50	32	50	31
<b>Tofik</b>	450	50	67	50	66	250	67	50	47	50	40
<b>Zewduie</b>	321	42	26	80	18	87	40	35	35	77	29
<b>Total</b>	<b>1985</b>	<b>264</b>		<b>382</b>		<b>741</b>		<b>229</b>		<b>369</b>	
Average survival rate			50		44		53		35		32

Source: OoARD/IPMS field report 2008

At the initial stage, the six model farmers were assisted by IPMS and the OoARD, but currently these farmers are managing to fulfill their input need from the income they have generated by selling seedlings.

This positive development has provoked OoARD to embark on a fruit development scaling out strategy under its regular program using its regular budget for monitoring and technical backstopping. The office has selected additional grafted seedling producers in order to cover the Woreda with easy access to all the fruit farmers. In this scaling out program, 9 fruits seedling producers are engaged to produce 11,800 avocado and 5200 mango seedlings with an estimated cost of Birr 85,000 totally covered by nursery operator farmers themselves (Table 13). About 4,000 seedlings from both fruit (avocado, mango) were grafted in January 2010, while the remaining will be grafted in May, 2010.

**Table 13.** Improved fruit seedlings production intervention, 2009

No.	Farmers' name	PA	Number of seedlings	
			Mango	Avocado
1	Jafer Mohamed	Acha Afeta	1000	1500
2	Mohamedali A/Mecha	Choche Lemil	1500	1500
3	Zewdie Zeleke	Chedro Suse	0	1000
4	Kalid Shifa	Beshasha	0	2000
5	Mohamed A/Mecha	Yachi Urache	1500	1500
6	Bulcha A/Dega	Omo Beko	500	2000
7	Fozea	Kota	0	1000
8	Kadija	Kota	0	600
9	Shito Nasir	Kilole	700	700
	Total	8	5200	11,800

Source: OoARD/IPMS field report 2009

Location of strategically distributed nursery operators selected by OoARD for scaling out is shown in Figure 3, including the 6 farmers selected in 2007. Mango seedling producers are located in lower altitude with hot weather while avocado seedling producers are located in higher altitude.

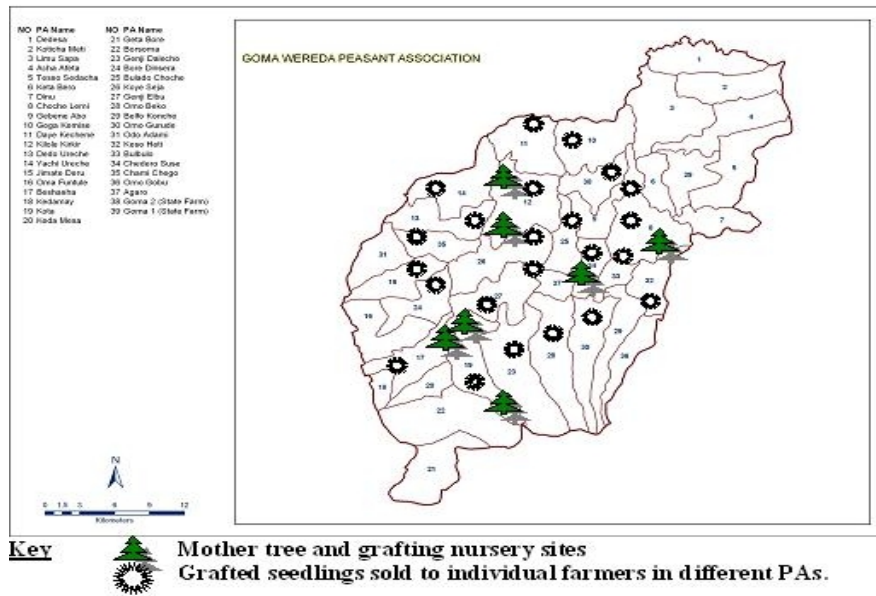


Figure 3. Distribution of nursery operators and PAs covered by grafted avocado seedlings

The cost may not be easy to calculate because nursery operators got the scions from MARC at a highly subsidized price and some for free for demonstration purposes and polybags were transported by IPMS. Moreover, polybags from some dead seedlings were refilled for growing root stock, and cost of other inputs such as sand, compost and soil, including, family labor may have not been properly accounted for. However, in this particular case, financial gain of nursery operators is calculated based on seedling production cost estimated by Kahsay *et al* (2009) in which case cost of one potted fruit seedling was Birr 5. The overall net financial benefit generated from participating in fruit seedling production by the 6 nursery operators was Birr 42,900 (Table 13).

**Table 13.** Grafted avocado seedling cost benefit analysis

PA	Farmer's name	No. of seedlings sold	Prod. cost	Total prod. cost	Price/ seedling	Gross income	Net income
Beshasha	Kalid Shifa	1375	5	6875	25	34,375	27,500
Kota	Kedija A/Raya	120	5	600	25	3,000	2,400
Kota	Fozeia Awol	300	5	1500	25	7,500	6,000
Kilole	Shito Nasir	100	5	500	25	2,500	2,000
Chedro Suse	Sewde Zeleke	120	5	600	25	3,000	2,400
Kilole	Tewofik Nedi	130	5	650	25	3,250	2,600
	Total	2052	5	10725		53,625	42,900

Source: OoARD/IPMS field survey 2009

### **5.3. Indirect benefits**

#### **Gender**

In Goma, three of the farmers engaged in fruit nursery operation are female farmers but all activities were shared with their male spouses. One of them was used to farming activities outside household chores, but two of them were not involved in farming activities before. Since their engagement in fruits seedling production, these women started to work directly in farm activities, like collecting soils, filling polybags and making shades with their spouses. This shows that the intervention has increased workload of the female farmers.

However, all the female farmers engaged expressed that they are more empowered over the income generated from the sale of grafted seedlings, thanks to the skill development and awareness created by IPMS and OoARD. On the other hand, before their engagement in this activity, some of them did not have good relationship with their spouses but now they started to listen to their wives. In addition, unlike other times, they call their wives to explain when visitors come to see the seedlings (Shito, Kilole PA). Regardless of the additional workload, all the female operators expressed their satisfaction in the intervention.

### **5.4. Changes in institutional/organizational arrangements**

The intervention brought fruits grafting skills which were not known or done by the community. Thus, one can see small scale enterprises engaged in improved seedlings production and marketing in the rural areas as a new set up. It has also developed small business running sentiments among seedling sellers such as advertising the unique nature of the new variety and overall performance of the varieties to buyers. Almost all the nursery operators who produced grafted seedlings are trying to do some knowledge sharing activity to their neighbors based on the experiences they gained. These farmers have gained knowledge through experience sharing tours, training and repeated visit by technical staff within and outside the Woreda.

Recording the type of fruit seedlings produced and names of farmer s who bought them is another initiation started by nursery operator farmers. This will assist in tracing the fruit varieties distribution in the Woreda for fruit marketing linkage and other uses. On the other hand, the nursery operators have become the alternative sources for improved fruit seeding supply to the neighboring Woredas. In almost all cases, when it comes to buying improved fruit seedlings what comes to mind is the Upper Awash State farms or the research system. This intervention has brought change in mindsets of people.

The project is trying to link the farmers and OoARD with the MARC. This has been done since the beginning of the intervention and should continue. A very good example for the start of linkage is that one farmer named Kalid Shifa (Beshash PA) directly communicated with MARC experts to get advice for one of his avocado mother tree which started wilting. He used a mobile phone which was shared during

the training in Agaro. The advise he got from the avocado expert helped him to recover his avocado mother tree.

See Table 5 for the actors presently involved in the development of the fruit value chain

## **6. Challenges for fruit commodity development**

Major challenges at the moment include adequate scion supply and access to polybags. Currently, scion is obtained from MARC but it is difficult to get sufficient quantities. Higher percent of failure after grafting observed in some of the farmers, particularly for some avocado varieties is becoming a challenge. However, strong technical assistance to nursery operators and maintaining the recommended grafting time are areas to focus for higher survival rate.

Once sufficient scions become available from the newly planted improved seedlings and/or mother trees in the nurseries, the introduction of grafted seedlings can be boosted, based on market demand. In the future, the stakeholders may also start considering new option to improve the existing old fruit trees by top working with scions from the newly planted varieties. However, number and size of scions currently available are not sufficient to carryout this activity now.

Through constructive engagement and discussion, some of the front line staff have increased their involvement in taking a lead but in some PAs it is not developing as expected and needs further work.

The approach is new to the farmers as well as the technical staff working with them and need organized technical backstopping and regular monitoring. It also needs systematically shaping improved technology multipliers to be trust worthy because adulteration of the technology could be one of the future problems. Thus it is advisable to develop fruit nursery operators in strategic locations for easy access to farmers in different corners of the Woreda and certifying them to avoid corruption which few farmers may be tempted to do.

Currently, there is no system to check for quality of these improved varieties produced by the nursery operators and it needs devising some mechanism to inspect and certify.

Now the improved fruit plants are in their fruit bearing stage and some have already set fruits. Scaling out of the demonstration results is planned in a very massive scale by office of agriculture and rural development and this will bring mass production of fruits in the PLW after two to three years. The current fruit product absorption capacity of local market may not be enough to absorb the product boosted by the intervention. Thus, assessing the market trend, potential and coming up with alternative market outlets including small scale fruits processing options is most recommended.

## 7. Lessons learned for scaling out

Developing a new value chain for improved marketable fruit varieties has made a very promising start in Goma with the establishment of a network of actors, centered around the a system of privately operated nurseries.

The introduced fruit varieties such as Hass, Etinger and Furte are internationally known varieties and as a result the probability of getting external market for the products is quite high. Thus the intervention will create a starting point for Ethiopia to engage in fruits exporting and earning foreign currency.

The involvement of innovative farmers in raising seedlings (including women) was successful and provided an additional source of income. As a result it is expanding throughout the District.

Developing the technical skills of the nursery operators is however required and needs the involvement/commitment of skilled staff with regular capacity building of these farmers made on schedule basis. Later on, some experienced nursery operators can transfer skills to neighboring farmers.

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