Vegetables value chain development in Fogera district: Experiences from IPMS project interventions

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March 2010
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Acknowledgement

This paper documents interventions, results and lessons learned for vegetable commodity development in Fogera district, based on a participatory market oriented value chain approach. The approach was introduced by the IPMS project, 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 actual results obtained go however to all the partners involved in this endeavor especially farmers, staff of the Fogera OoARD, Adet ARC, and students who conducted studies in support of irrigated agricultural development, and private sector input suppliers and traders.

Besides the authors, several people contributed to the realization of the report including Lemlem Aregu who reviewed the first draft, Rebeka Amha/Abraham Getachew who provided summarized baseline data, Dr Moti Jaleta who provided household level cost/benefit impact data, Yasin Getahun who provided maps and Genevieve Renard who edited the final version of this document.

Ato Yirgalem Asegid the former Fogera district Research and Development Officer who had in-depth understanding of the entire IPMS project vision at early stage and prepared fertile ground to achieve the project objective is highly appreciated. My gratitude also extended to Ato Dessalew Kassa the district IPMS Field Assistant who was organizing data collection and providing the first insight interpretation.

Finally, my deep appreciation also goes to Fogera district OoARD staff Ato Solomon Hagos Horticulture Expert and Worku Mulat the Head of OoARD who have providing ample information to validate the data collected from the producers. Last but not least thanks goes to Worku Mengiste, Niguse Alie, and the Fogera district tomato and onion seed and bulb producer who are always supporting the project in providing information and sharing valuable experiences with us.
Abstract

Onion and tomato are among the largest production and highly commercialized vegetable crops in the region. In Fogera district, regardless of the existence of year round rivers and high ground water availability to supplement irrigation, favorable climate and soil type, the productivity and gross production of vegetables is low. This low production is attributed to shortage of input supply, lack of skills, and price collapse during peak harvest periods. With the aim of enhancing vegetable production through improving linkages among multi-stakeholders and developing market linkages to improve livelihood of vegetable producers, the district stakeholders/IPMS introduced new high yielding varieties, onion seed production system and staggered planting production techniques.

These stakeholders also created onion seed producers’ platform, worked on onion market linkages, introduced better management skills and also strengthened linkages among actors along the value chain. The combined effects of all these interventions resulted in a tripling of the irrigated vegetable area from 2005 to 2008, and an onion seed production system by entrepreneurial farmers which not only services Fogera itself but also sells seeds to other districts.

The introduction of staggered production in tomato prevented market price deterioration and improved volume of production where as market network for onion bulb created high volume of absorption outside the district. Onion seed certification improves confidence and traceability and creates marketing outside the district and the region. Ensuring seed producers’ certification was a complex process which required the involvement and commitment of many stakeholders, including intensive technical support and follow up from input to post harvest handling and marketing. Despite all these hurdles, onion seed production proved to be a lucrative business. While significant progress has been made by using the value chain development approach, challenges/opportunities remain and/or are emerging which require continuous responses from the actors involved. In particular, more attention needs to be paid to improvement of agronomic and irrigation practices, since yields observed for the major vegetable crops are well below their potential. Also more attention/ knowledge is required on appropriate storage technologies as well as a nationwide market intelligence system.

Keywords: Extension, onion, tomato, innovation systems, market
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 smallholder farmers from a predominantly subsistence oriented agriculture to a more market (commercial) oriented agriculture.

The project adopted a “participatory market oriented commodity value chain development” approach which is based on the concepts of innovation systems and value chains. Crucial elements in the approach are the focus on all the value chain components instead of only a production technology focus; the linking and capacitating of value chain partners and the assessment, and 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 nationwide. 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 irrigated vegetables in Fogera district with the objective 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 irrigated vegetable 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/labour use, 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 at farming system level, (iii) constraints, potentials and interventions for each value chain component, and (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 together with key intervention areas 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 district, Peasant Association (PA) and community levels, 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-monthly progress reports and the annual monitoring and evaluation (M&E) reports.

2.1. Data sources

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

2.1.1. 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.

Amongst others, the formal baseline study used PA level interviews and records to collect information on irrigated area coverage and the number of households involved in irrigated agriculture. This information was used to compile district level information on irrigated acreage by crops and households.

2.1.2. 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, including farmers who grew onion bulbs and onion seeds and farmers who tested a new tomato variety.

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, a commodity stakeholder workshop and a household level survey.

The stakeholder meeting was organized to establish the evolution of the roles and linkages of the value chain actors.

In Fogera, 11 PAs (Hagere Selam, Wojj, Alembur Zuria, Zeng, Woreta Zuria, Kidist Hanna, Kuhar Michael, Tihua Abua, Shena, Nabega, and Abua Kokit) targeted by IPMS for market development were included in the formal household survey conducted in 2009. Representative PAs were selected purposively to include both PAs targeted and non targeted by IPMS for market development. The survey data consists of relevant production and marketing information on vegetables including area allocation, production costs and inputs use, level of production, and marketed surplus. In selecting the sample households, with the aim of getting some idea about the effect of the different interventions, a distinction was made between households who had adopted/benefited from the various interventions and households who did not. In both sample groups, both wealth and gender criteria were considered to get a representative distribution of sample households.

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 IPMS Head Quarter.

3. Commodity Background

3.1. Description of the district

Fogera Wereda is one of the 106 districtss of the Amhara Regional State and found in South Gondar Zone (Figure 1). It is situated at 37° 29' to 37° 59' latitude and 11° 41' to 12° 02' longitude. Woreta is the capital of the district and is found 625 km from Addis Ababa and 55 km from the Regional capital, Bahir Dar. Woreta and Alem Ber are two major towns in the district. The district is divided into 30 rural Peasant Associations (PAs) and 5 urban PAs.

The total land area of the district is 117,405ha. Flat land accounts for 76%, mountain and hills 11% and valley bottom 13%. Average land holding per household is about 1.4 hectare with a minimum and maximum of 0.5 and 3.0 hectares, respectively. The total human population of the district is 233,529. The rural population is estimated at 206,717. The proportion of male and female population is almost similar in both rural and urban areas. The number of agricultural households is 42,746.

Fogera district is endowed with diverse natural resources and can grow diverse annual and perennial crops. Fogera is one of the eight districts bordering Lake Tana and has an estimated water body of 23,354 ha. The district is classified as
one of the surplus producing districts in the Region. Altitude ranges from 1774 to 2410 masl and is predominantly classified as Woinadega agroecology.

Based on the existing data, mean annual rainfall is 1216.3mm ranging from 1103 to 1336 mm. Belg (small rains) and Kremt (long rainy season) are the two cropping seasons. Farmers mainly depend on the Kremt season for crop production.

According to the district OoARD, the dominant soil type in the Fogera plains is black clay soil (ferric vertisols), while the mid and high altitude areas are orthic Luvisols. There are two major rivers (Gumara and Rib) that are of great economic importance to the district. These rivers are mainly used for irrigating horticultural crops, mainly vegetables, during the dry season. Gumara River passes through Gazen, Arida, Kinti Merewa, Guramba, Abagunde Sendega, Aba Kidros, Bebeks, Quahr Michiel, Shena, Kidist Hanna, Wagatera PAs and ends into Lake Tana. Rib River passes through Wetemb, Addis Betekerstian, Reb Gebriel, Debasi Fatra, Aba Kokit, Shaga, Nabega PAs and also ends into Lake Tana. An interesting characteristic of Fogera district is the seasonal (rainy season) flooding of the PAs bordering Lake Tana as a result of the overflow of Lake Tana and the above mentioned rivers. These flooded areas are used for rice production during the rainy season.

Figure 1. Location of Fogera district and PAs
3.2. History and diagnosis of (irrigated) vegetables development

Fogera district has both ground water and surface water resources for irrigated vegetables production. Two Rivers (Gumara and Rib) and hand-dug wells constructed by farmers are sources of irrigation water for vegetables during the dry season.

Farmers in the seasonally flooded areas traditionally had shallow wells which were used as a source of drinking water for the cattle during the dry season as well as to irrigate some (vegetable) crops, mainly for home consumption.

Commercial oriented vegetable production in Fogera district started in two peasant associations (PA), namely, Aboa Kokit and Bebeks in 1997 and 1999, respectively. The former was a public irrigation project, which was supported by the Fogera Office of Agriculture and Rural Development (OoARD) using both motorized and gravity irrigation by diverting water from the Rib River. The Bebeks project was initiated by Aba Alemayehu Bihonegn, a business person who lived in Debre Tabor town, with four farmers through sharecropping arrangement by pumping and diverting water from Gumara river. After two years of production, these four farmers who were working under sharecropping arrangement with Aba Alemayehu managed to have their own motorized pump.

Since then, vegetable production in the district expanded considerably. In 2005, when IPMS introduced the value chain approach in Fogera, about 1135 hectares of land were under irrigated vegetable (shallot, onion, garlic and tomato) production (OoARD, 2009).

Motorized and pedal pumps (supplied by the OoARD) were utilized in the district to lift water from rivers and hand-dug wells respectively. To irrigate vegetables, several institutional arrangements were made to get access to irrigation water, including private access (from shallow wells and rivers), sharecropping with traders who supply pumps and other inputs, and/or buying of water (by time or area) from private pump operators. Improving access to irrigation was identified by the stakeholders in 2005 as a potential intervention to expand irrigated vegetable production. A particular problem with the shallow wells was the collapsing of the walls as a result of the seasonal flooding of the area (IPMS, 2005).

To support the development of irrigated onion production, the supply of seeds went through different stages. Initially, in 1999, individual farmers and businessmen who had contact in Addis Ababa and Ziway started importing small quantities of seed. From 2000 to 2003, OoARD provided 50-60kg of vegetable seeds to farmers free of charge every year. The district OoARD also supported the establishment of irrigation cooperative and assisted to bring onion seed from ETFRUIT Company and other private traders from far places (up to 6-7 quintals) and distributed the seeds on credit basis to their members until 2004/5. During the PRA in 2005, the stakeholders identified the existing seed supply system as
a bottleneck for the expansion of the irrigated area due to its unsustainable supply, low seed quality, and very expensive prices (IPMS, 2005).

Supply of vegetables from Fogera is very seasonal resulting in periods low (April-May) and high prices (October). Vegetable marketing in Fogera was furthermore characterized by price setting by the intermediaries (brokers) and traders from outside. Prices also fluctuate daily and even within a day, for instance, the daily price of onion could fluctuate by 20-30 birr per quintal between mornings and afternoons. Price fluctuation was worse in tomato due to the perishable nature of the crop (IPMS, 2005).

Finally the institutional support to bring knowledge and skills was also limited since there were only two horticulturists at the district OoARD supporting vegetable development.

4. Value Chain Interventions

4.1. Extension interventions/approaches

4.1.1. Knowledge sharing and capacity development approaches

To introduce new production technologies, different capacity building and knowledge management approaches were used. Study tours and field days were used to expose farmers/staff to new vegetable technologies as well as irrigation and seed supply systems. Testing of new varieties like Shanty hybrid (tomato) was conducted with demonstration farmers. Consecutive field days were organized for many farmers who would be willing to try the new varieties in the following season. Discussions were facilitated on seed demand among the producers, interested farmers, extension agents, etc. Similar mechanisms were also applied for the introduction of new agronomic practices to the area, like using stake for tomato, and row planting for onion bulb production. In response to a problem diagnosed during the 2008 season, onion bulb producer farmers were advised not to apply water on onion fields before harvesting so as to improve the shelf life and hence marketability of the commodity.

An overview of major capacity development and knowledge management activities for irrigated vegetable production in the PLW is presented in Table 1.
Table 1. Summary of capacity building and knowledge management events on vegetable production and marketing

<table>
<thead>
<tr>
<th>Types of events</th>
<th>Public</th>
<th>Private</th>
<th>NGO</th>
<th>Farmer</th>
<th>Total Male</th>
<th>Total Female</th>
<th>Total participant</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
<td></td>
</tr>
<tr>
<td>Study tour to Ziway</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>13</td>
</tr>
<tr>
<td>Field days, and promotion of onion seed</td>
<td>2</td>
<td>395</td>
<td>200</td>
<td>2</td>
<td>1</td>
<td></td>
<td>398</td>
</tr>
<tr>
<td>Onion seed producers Training</td>
<td>3</td>
<td>1</td>
<td></td>
<td>18</td>
<td>1</td>
<td></td>
<td>22</td>
</tr>
<tr>
<td>Field days</td>
<td>3</td>
<td>1</td>
<td></td>
<td>29</td>
<td>1</td>
<td></td>
<td>32</td>
</tr>
<tr>
<td>Commodity w/shop</td>
<td>14</td>
<td>4</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td>18</td>
</tr>
<tr>
<td>Demonstration tomato seed production</td>
<td>1</td>
<td>3</td>
<td>7</td>
<td>3</td>
<td>11</td>
<td>3</td>
<td>14</td>
</tr>
</tbody>
</table>

Source: Compiled from IPMS progress report (2005 – 2009)
4.1.2. Platforms

The project facilitated the establishment of two types of platforms for vegetable commodity development; these are onion bulb and onion seed platforms. Meetings for onion bulb platform are conducted on a yearly basis during peak production periods, mainly to stabilize the marketing and minimize the brokers’ interference. Whereas the onion seed platform has three main activities; (1) identifying source of bulbs for planting materials, where, how and who is going to collect the sample for laboratory analysis, (2) quality control, and (3) certification and market promotion. Hence at least 3-4 meetings are conducted every year. The platforms facilitated to share their experiences and participated in different exhibitions for market promotion. Onion seed platform also assigned a committee of five to follow up seed certification procedures, marketing promotion and preparation of internal bylaws so that producers will meet minimum quality standards. The platform on onion seed production helped seed producers to share experience among themselves, including, on how to produce quality seed and improve traceability since the seeds are sold under the same brand name “FOSP” (Fogera Onion Seed Product).

4.2. Vegetable input supply interventions

4.2.1. Seed

Onion seed

To tackle the identified seed system deficiency, a farmer-to-farmer seed production system was initiated in 2005/6 by the the Fogera OoARD/IPMS, which was joined at a later stage by the Adet Agricultural Research Center (AARC). Upon critically evaluating their status, 7 farmers were selected for their interest on the action research of onion seed production. Amongst these members, 3 farmers decided to go for bulb to seed while the other 4 farmers went for seed – bulb – seed production. A visit was then organized for these potential onion seed producers to Ziway, where farmers have good experience in producing seeds. Following the visit, the 3 farmers accessed bulbs from Ziway and planted 0.25ha each. Feedback was obtained from the producers that they had very good market. For the four farmers who intended to go from seed to seed, foundation seed was accessed from Melkasa Research Center. However, keeping the bulb for four months was found difficult and farmers decided to go for bulb-to-seed production in the next season (Yirgalem Assegid, 2006).

To produce the seeds, bulbs were “imported” from outside of the district since there was no bulb production during the rainy season in the district. Attempts to preserve bulbs harvested in April over the rainy season were not successful. Bulbs for seed production have been obtained from distant places like Afar, Shewa Robit and Ziway. Onion seed producers organized themselves to bring the bulbs from these places. The project assisted in providing linkages with the Regional BoARD which conducted phyto sanitary tests (for soil borne diseases).
Once seed production reached sizable quantities, linkages where again made with the Regional BoARD to test and certify the seeds under the brand name “FOSP”.

**Tomato seed**

Non-hybrid tomato seed production was also started in some innovative farmers’ fields in small quantity to satisfy their seed requirement. During harvesting of tomato, farmers selected over ripened tomato fruits which would otherwise rot. They were then dried on the ground and later soaked in water to remove all the mucilage which otherwise is a germination inhibitor and then kept in a piece of cloth in dry place until the next sowing season. There are about 150 to 300 seeds or more per fruit. IPMS together with OoARD captured this knowledge and attempted to popularize it through demonstrations. At this moment, lesson learnt and feedback based on the demonstration was conducted and in 2010 the project will support more tomato seed production.

**4.2.2. Irrigation water supply**

**Shallow well wall reinforcement**

There are over 15,357 hand-dug wells in the district. Some households in Shaga and Kidist Hanna PAs constructed up to 10 hand-dug wells each for irrigation of some horticultural crops and as a source of drinking water for human and cattle. To tackle the problem of collapsing walls of these shallow wells (IPMS, 2005), the project demonstrated a hand dug well retained with perforated barrels that is surrounded with red-ash (oxidized soil) as a concentric between the barrel and the heavy vertisol. The intention is that the gravel with huge hydraulic conductivity could enable easy transmission of water from the nearby polarity into the barrel. The cost is estimated to be 950Birr for a 10m deep well which is very low compared to the concrete structures promoted by FINIDA (at a cost of 6000Birr) but two times higher than the traditional wooden reinforcement. The demonstration was done in four villages, three in the plains and one in the hill sides. Targeting farmers was based on their past efforts to construct wells. One of them (a women headed household) has attempted 3 times and failed to retain a 15m deep well. On the other hand demonstration was conducted on cost sharing mechanisms to test affordability. A local garage was capacitated on the modifications of the retaining material (Yirgalem Assegid, 2006).

**Water lifting devices**

Motorized pump and pedal pump technologies (supplied by the OoARD) have been utilized extensively in the district to lift water from rivers and hand-dug wells, respectively. Motor pumps are used by farmers with more than a quarter of a hectare and are mostly used to cultivate onion and tomato where as pedal pumps are used around homestead to extract water from shallow wells. Such
households usually cultivate less than a quarter of a hectare with pepper, cabbage, tomato, lettuce and some fruit trees.

To boost irrigated agricultural production, the OoARD with support of the BoARD stimulated the use of both pedal and motor pumps. Better-off farmers bought motorized water pumps on cash from Bahir Dar. In 2008/09 production year, OoARD and Amabassel Plc. brought 530 Chinese made water pumps to the district and distributed them on credit basis. Pumps were used in different ways; (i) most farmers used pumps to irrigate their own plots, (ii) some farmers provided water pump services to their neighbors on a rent basis at a cost of 5-6 Birr per hour, and (iii) a considerable number of farmers also used motorized pumps through sharecropping arrangements with traders who have close contacts in the area. Table 2 below illustrates the number of Motorized and Pedal pumps by PA in the district.

Table 2. Distribution of different pumps and hand dug wells in the Fogera district

<table>
<thead>
<tr>
<th>Name of PAs</th>
<th>No. of Motor pumps</th>
<th>No. of Pedal pumps</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Abakiros</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>2 Abua kokit</td>
<td>80</td>
<td>0</td>
</tr>
<tr>
<td>3 Addis Betechristian</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>4 Alember zuria</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>5 Arida</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>6 Bebekas</td>
<td>116</td>
<td>3</td>
</tr>
<tr>
<td>7 Chalmana</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>8 Diba Sifatira</td>
<td>60</td>
<td>3</td>
</tr>
<tr>
<td>10 Gazeen</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>11 Guramba</td>
<td>26</td>
<td>5</td>
</tr>
<tr>
<td>12 Hagere Selam</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>13 Kedest Hanna</td>
<td>24</td>
<td>223</td>
</tr>
<tr>
<td>14 Kuhar Abo</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>15 Kuhar Michael</td>
<td>51</td>
<td>6</td>
</tr>
<tr>
<td>16 Meneguzer</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>17 Nabega</td>
<td>25</td>
<td>9</td>
</tr>
<tr>
<td>18 Reb Gebriel</td>
<td>51</td>
<td>5</td>
</tr>
<tr>
<td>19 Shaga</td>
<td>5</td>
<td>47</td>
</tr>
<tr>
<td>20 Shina</td>
<td>42</td>
<td>289</td>
</tr>
<tr>
<td>21 Tihua Zakena</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>22 Wagateria</td>
<td>66</td>
<td>18</td>
</tr>
<tr>
<td>23 Wetenb</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>24 Woj Arba Amb</td>
<td>18</td>
<td>9</td>
</tr>
<tr>
<td>25 Zeneg</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>642</strong></td>
<td><strong>662</strong></td>
</tr>
</tbody>
</table>

Source: Fogera OoARD progress report, 2009
Out of the total 642 motorized water pumps which are in use, 168 were distributed on credit in 2008/09. In addition to these however, it is also noted that 362 motor pumps are still in OoARD warehouse.

**Small check dams**

To avoid water shortage, because of high competition for irrigation water between the upper and downstream streams, temporary check-dams are under construction on Rib River through community participation. IPMS and OoARD made financial contribution and advised farmers regarding this scheme. This temporary check-dam construction idea was generated by Vegetable growers and IPMS and shared with the two neighboring districts for implementation through OoARD and the district Administration. Similar initiatives are underway with Rib River, after some resistance with the neighboring district called Dera district.

4.3. **Vegetable production interventions**

Farmers were advised to focus more on highly productive and commercialized vegetable crops. Hence many new varieties were introduced including Bombay red and Neptune (onion) and Shanty (tomato). In addition, staggered production system (tomato), row planting, improved water management (including use of various irrigation devices), and minimum utilizations of agrochemical were introduced. Vegetable producers were also advised on other agronomic practices, including frequency of watering, proper spacing, compost preparation, fertilizer and pesticide utilizations and the use of crop rotation.

4.4. **Vegetables marketing interventions**

To improve vegetables marketing, several initiatives were started. These initiatives include creating market linkages with traders, staggered planting method, tomato processing/juice making, and post harvest storage facilities.

The OoARD conducted a rapid assessment of market potentials with traders in the North after a failed attempt to link producers with traders in Bahir Dar (Yirgalem Assegid, 2006). Market linkages were then created through study tours to different areas in Tigray, Dessie and Gondar along with the producers. Following the study tour and invitations of traders from different areas, 40 traders from Mekelle, Adigrat and Shire arrived and collected a large volume of onion bulbs during the same year. Since then, through their address, the project facilitated linkage between the producers and traders in exchanging market information.

OoARD/IPMS conducted a rapid assessment of market prices trend in the community and it was learnt that prices are crushing in late May (since it is land preparation time with commencement of rain) and rising again after planting time (as of Mid June). To tackle this problem the following interventions were introduced:
• Staggered plantation on tomato started in 2007 on 16 farmers’ demonstration plots in 5 PAs (Bebeks, Tihua and Kuhar Michael, Kuhar Abo and Woreta) along the main highway, which started through provision of free seed handouts from the project. This was meant to encourage a new idea on staggered planting, which had not been in practice before. This system was believed to help in solving problems related to marketing vegetables. For this purpose, seedlings were planted in July, before the usual time of planting period which is normally in September. Although farmers were reluctant to accept due to pests and diseases, they finally agreed to try it. The benefits were encouraging. Consecutive field days and informal visit were organized to more than 600 farmers. In fact, as compared to the usual time of plantation (September), the overall production was less by up to 20%, due to cold temperatures during flowering period in October and November; and because some of the fruit was affected by worms. However, the net return was high due to high unit price as a result of early production (see result section).

• In order to contribute to marketability and diversification of tomato products, value addition attempts were made on tomato. In 2006 home made tomato paste training and demonstration was made to two women at Woreta town and Temporary shop was opened through the project support. Likewise, tomato juice promotion was made in 2007 in two campuses at Bahir Dar University for one week and a total of 130 kg tomato fruit was processed to juice. But the effort was not successful since the product was new for the area and, secondly, the promotion was done just only once and did not have a follow up. As Tadesse (2008) reported “Tomato has to enter local processing like to juice making through an intensive advertisement via television in order to create demand. The one shot practice of IPMS should be supported by chemical analysis of the content and an intensive promotion of its use be carried as was done by SOS-Sahel for AMAR honey.”

• Traditional way of onion bulb post harvest handling to improve the shelf life of onion bulb up to three months to sell during the rainy season (July and August) has demonstrated using photos and power point to more producers and WALC members.

• To promote onion seed outside the district, Pamphlets and leaflets has prepared and provided to buyers to give additional information about the overall aspects of onion seed production activities in the district.
5. Results and Discussion

5.1. Area, households, production/productivity and income

The effect of the various interventions in terms of area coverage, production/productivity and income can be assessed at individual household level and at district level.

*Household level data*

The household survey conducted in 2009, covering 2007/08 compared area covered, production, productivity, cash cost, gross revenue and return to family labor for adopters and non-adopters (see Table 3).
Table 3. Household level data individual vegetables

<table>
<thead>
<tr>
<th>Vegetable type</th>
<th>Farmer type</th>
<th>Obs</th>
<th>Av. Plot size (timad)</th>
<th>Av. Production (per household)</th>
<th>Av. Productivity (kg/timad)</th>
<th>Av. Price(^a) (Birr per kg)</th>
<th>Av. Cost (cash outlay)</th>
<th>Av. Gross revenue</th>
<th>Net return to family labour(^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onion</td>
<td>Adopters</td>
<td>13</td>
<td>1.788</td>
<td>3831</td>
<td>2443</td>
<td>0.82</td>
<td>1181</td>
<td>3141</td>
<td>1959</td>
</tr>
<tr>
<td></td>
<td>Non-adopters</td>
<td>4</td>
<td>1.5</td>
<td>2919</td>
<td>1592</td>
<td>0.82</td>
<td>1208</td>
<td>2393</td>
<td>1184</td>
</tr>
<tr>
<td>Tomato</td>
<td>Adopters</td>
<td>8</td>
<td>1.094</td>
<td>7526</td>
<td>3549</td>
<td>1.16</td>
<td>8730</td>
<td>7975</td>
<td>5341</td>
</tr>
<tr>
<td></td>
<td>Non-adopters</td>
<td>5</td>
<td>1.25</td>
<td>5558</td>
<td>2860</td>
<td>0.96</td>
<td>3779</td>
<td>3519</td>
<td>4242</td>
</tr>
<tr>
<td>Pepper</td>
<td>Adopters</td>
<td>20</td>
<td>1.11</td>
<td>506</td>
<td>267</td>
<td>23.43</td>
<td>404</td>
<td>12370</td>
<td>11987</td>
</tr>
<tr>
<td></td>
<td>Non-adopters</td>
<td>14</td>
<td>0.821</td>
<td>389</td>
<td>251</td>
<td>23.43</td>
<td>188</td>
<td>9121</td>
<td>8955</td>
</tr>
</tbody>
</table>

Source: IPMS Household survey 2009

\(^a\) Except for tomato where the price difference comes from staggered production, average price received by all households (adopters and non-adopters) is considered the same.

\(^b\) Net return to family labour is the difference between gross revenue and cash outlays.

As can be seen from the table, adopters on average had a higher acreage, productivity, gross income and net return than non-adopters. However none of these differences were statistically significant, indicating the wide variation in performance within each of these groups.
According to key informants, the productivity of onion did improve due to replacement of the Adama red variety by Bombay red. Nowadays, most of the onion fields in the district are planted with Bombay red. According to some respondents who have used both varieties, Bombay red produces an additional 30-40 quintal/ha as compared to Adama Red. Still it is noted that average productivity levels were low as compared to yields which can be obtained under better management (20-30 tons/ha).

The average production of tomato in the district for adopters was 140 qt/ha (see Table 3). Shanty hybrid tomato was introduced in two demonstration areas and average productivity per hectare was 450 and 550 quintals with different types of management (Table 4). Besides increased production, the variety is fleshier, has less fluid, and has better shelf life. From farmers' field days, it was learned that farmers accepted the variety and there is high demand for seed.

Table 4. Yield/ha of a new hybrid tomato variety, Shanty in Fogera

<table>
<thead>
<tr>
<th>Demonstration</th>
<th>Area (m²)</th>
<th>No of harvests</th>
<th>Yield obtained (qt)</th>
<th>Conversion to qt/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demonstration 1</td>
<td>500</td>
<td>5</td>
<td>23</td>
<td>450</td>
</tr>
<tr>
<td>Demonstration 2</td>
<td>230</td>
<td>9</td>
<td>13</td>
<td>550</td>
</tr>
</tbody>
</table>

Source: Field observation, 2009.

Introduction of staggered production technique helped improvement of farm-gate price for tomato and increased the area coverage because more farmers got motivated to be engaged in tomato production, and hence increased the production of tomato in the district. Staggered production technique is quickly spreading to many farmers and PAs. Before this production intervention, production usually started around February and March but nowadays production starts first week of November. Hence, supply gradually increases and is peak during February and then gradually reduces around June. On the other hand, price follows the opposite pattern with supply i.e. the price of the first production usually starts at about 4.5 Birr/kg and gradually decreases during the peak supply period, February, and becomes about 1 Birr/kg and again peaks up around June when production is low which again gets back to the initial price which is around 4.5 Birr/kg. From July to October there is no tomato supply in the market at all.
Table 5. Average household vegetable area, cost and production value data

<table>
<thead>
<tr>
<th>Woreda</th>
<th>Farmer type</th>
<th>Average Area (timad)</th>
<th>Variable costs a</th>
<th>Labour (AE)</th>
<th>Value of vegetables production (Birr/household)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Obs</td>
<td></td>
<td>Own</td>
<td>Hired</td>
</tr>
<tr>
<td>Fogera</td>
<td>Adopters</td>
<td>34</td>
<td>1.808***</td>
<td>645.49**</td>
<td>82.5***</td>
</tr>
<tr>
<td></td>
<td>Non-adopters</td>
<td>28</td>
<td>0.991</td>
<td>208.50</td>
<td>49.2</td>
</tr>
</tbody>
</table>

Source: Household survey 2009

Note: a Variable cost here is the sum of money outlay for seed, fuel, fertilizer and pesticides used for vegetable production per household.

***, ** and * refer to higher mean compared to the other group at 1%, 5% and 10% significance level

Similarly, staggered production technique was attempted in onion production but the amount of harvest during the rainy season was small. However, the market price is high during that period (November - January) which gets to between Birr 3.5-5/kg unlike the 1.5 Birr/kg during peak harvest period (April – May) so that the lower production is compensated for by high unit price. Still this technology is not very much adopted by the farmers.

Finally, the average performance of vegetable production was computed which showed significant differences between adopters and non-adopters for area, variable cost, own labour and average income.

**District level data**

As a result of the various value chain interventions, irrigated vegetable production tripled between 2005 and 2008. Of which the lion share was attributed to onion which increased almost 5 times in area. This high increase in area was partly as a result of an improved seed supply system combined with motorized pump introduction by the regional government (Table 6). However a significant drop in onion area took place in 2009, mainly due to market failure in 2008, which was the result of unexpected rainfall just before harvesting. This lead to poor quality bulbs (high moisture content) and very short marketing period because of the threat of spoilage. Tomato has also increased from 88 ha in 2005 to 863 ha in 2009. This increase was mainly attributed to the introduction of staggered production and improvement in market absorption.
Table 6. Area of main irrigated Vegetable crops in Fogera

<table>
<thead>
<tr>
<th>Crop</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shallot</td>
<td>299</td>
<td>227</td>
<td>776</td>
<td>652</td>
<td>45</td>
</tr>
<tr>
<td>Onion</td>
<td>526</td>
<td>1,223</td>
<td>2,179</td>
<td>2,420</td>
<td>1,233</td>
</tr>
<tr>
<td>Garlic</td>
<td>222</td>
<td>144</td>
<td>421</td>
<td>382</td>
<td>408</td>
</tr>
<tr>
<td>Tomato</td>
<td>88</td>
<td>100</td>
<td>169</td>
<td>150</td>
<td>863</td>
</tr>
<tr>
<td>Total</td>
<td>1,135</td>
<td>1,694</td>
<td>3,545</td>
<td>3,604</td>
<td>2,549</td>
</tr>
</tbody>
</table>

Source: OoARD records, own assessment

5.2. Input supply/credit/marketing

5.2.1. Onion seed production

Other than the increase in bulb production, seed production has been a successful intervention which is becoming a profitable business for the producers. The area coverage and the number of producers are steadily increasing after some marketing problems in 2007 (Table 7).

Table 7. Number of farmers producing onion seed, area and volume of production since 2004/5.

<table>
<thead>
<tr>
<th>Year</th>
<th>No of households producing onion seed</th>
<th>Area allocated for onion seed production (ha)</th>
<th>Volume of onion seed produced (kg)</th>
<th>Total onion seed value (Birr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>Female</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004/5</td>
<td>3</td>
<td>0</td>
<td>0.12</td>
<td>60</td>
</tr>
<tr>
<td>2005/6</td>
<td>3</td>
<td>0</td>
<td>0.75</td>
<td>600</td>
</tr>
<tr>
<td>2006/7</td>
<td>26</td>
<td>0</td>
<td>12.35</td>
<td>7,000</td>
</tr>
<tr>
<td>2007/8</td>
<td>5</td>
<td>2</td>
<td>6.50</td>
<td>2,700</td>
</tr>
<tr>
<td>2008/9</td>
<td>14</td>
<td>3</td>
<td>6.75</td>
<td>3,900</td>
</tr>
<tr>
<td>2009/10*</td>
<td>89</td>
<td>3</td>
<td>16.88</td>
<td>NA</td>
</tr>
<tr>
<td>Total</td>
<td>39.97</td>
<td>14,260</td>
<td>2,361,000</td>
<td></td>
</tr>
</tbody>
</table>

Source: IPMS project leaflets, 2009

Note: * Since activities for the current production season are just beginning, we are expecting more producers than what we have reported here.
Excluding the 2009/10 production, total onion seed value generated in the district was worth Birr 2,361,000. Out of this, around Birr 440,000 worth seed was sold outside the district but the remaining was sold within the district on a farmer to farmer transaction basis. Price of 1 kg of onion seed ranged from Birr 120-200. Due to shortage of seed during planting period last year, (September 2009), 1 kg onion seed was sold at around 410 Birr/kg.

The benefit from onion seed production in the district enhanced farmer to farmer transactions without the involvement of the government, created reliable supply, high purity and germination rate reached up to 93%, reduced price from around Birr 350-400 to about 150-200 per kg.

Onion seed produced in this district is currently having high demand by farmers in far away districts such as Alamata and Meholi in Tigray Region. So far, 18 quintals were sold to Alamata and Meholi. One farmer also sold to one merchant who came from Addis Ababa.

Farmers nowadays are more inclined to seed production than to bulb production due to higher return from seed production. In 2010 production season, more than 44 farmers are participating in seed production, which is an increase in the number of participants by more than two folds compared to the previous year (see Table 8).

Table 8. Cost-benefit analysis of onion bulb and seed production from a quarter of an hectare

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Bulb production</th>
<th>Seed production</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Costs</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.1. Opportunity cost of land (5 months)</td>
<td>2,000.00</td>
<td>2,000.00</td>
</tr>
<tr>
<td></td>
<td>1.2. Seed cost</td>
<td>250.00</td>
<td>5,126.40</td>
</tr>
<tr>
<td></td>
<td>1.3. Fertilizer cost</td>
<td>-</td>
<td>612.00</td>
</tr>
<tr>
<td></td>
<td>1.4. Pesticide cost</td>
<td>75.00</td>
<td>60.00</td>
</tr>
<tr>
<td></td>
<td>1.5. Watering (fuel) cost</td>
<td>394.38</td>
<td>315.50</td>
</tr>
<tr>
<td></td>
<td>1.6. Annual depreciation cost</td>
<td>226.67</td>
<td>226.67</td>
</tr>
<tr>
<td></td>
<td><strong>Subtotal</strong></td>
<td><strong>2,946.05</strong></td>
<td><strong>8,340.57</strong></td>
</tr>
<tr>
<td>2</td>
<td>Revenue (Birr)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.1. Total production (kg)</td>
<td>4,871.75</td>
<td>162.50</td>
</tr>
<tr>
<td></td>
<td>2.2. Average price (Birr/Kg)</td>
<td>3.20</td>
<td>195.00</td>
</tr>
<tr>
<td></td>
<td><strong>Subtotal</strong></td>
<td><strong>15,589.60</strong></td>
<td><strong>31,687.50</strong></td>
</tr>
<tr>
<td>3</td>
<td>Return to labour (Birr)</td>
<td>12,643.55</td>
<td>23,346.93</td>
</tr>
<tr>
<td>4</td>
<td>Estimated labour cost (from transplanting till harvesting)</td>
<td>2,690.00</td>
<td>2,438.00</td>
</tr>
<tr>
<td>5</td>
<td>Profit per timad</td>
<td>9,953.55</td>
<td>20,908.93</td>
</tr>
</tbody>
</table>

5.2.2. Moterized water pumps

Since the beginning of vegetable production in the district in 1999 till 2008/9, credit in vegetables production, especially for water pump was almost unavailable. Instead, farmers were inviting private business people in towns like Woreta and Bahir Dar to supply motorized water pumps through sharecropping or land leasing arrangements. In 2009, Ambassel trading and Amhara Credit and Saving Institute (ACSI) provided motorized water pumps through credit. Accordingly, 168 Chinese made water pumps were distributed. These pumps had some technical problems during operation and farmers asked for training where efforts were made to solve these problems. The process of the problem identification and suggestion of possible solutions was done by OoARD and IPMS’s advice and financial support. Currently, discussion is underway to train some (10%) of these farmers who own the new water pumps. This training envisages establishing a village level maintenance system.

5.2.3. Shallow well development

No data are available on the uptake of the shallow well reinforcement technology. It is noted however that nowadays barrels are replaced by old tyres provided by the OoARD free of charge.

5.3. Other indirect results

Women's involvement in vegetable production has been improving from time to time, including the marketing of these vegetables. For instance, in Abuakokit PA alone, out of 180 households involved in vegetable production in 2009, 69 were women headed households. However, 23 of them grew vegetables by sharecropping arrangements on their irrigable land. Women are also involved in some onion seed platforms and contributed on some technical aspects of plantation, post harvest management and quality control.

5.4. Changes in institutional/organizational arrangements

Several stakeholders are now involved in the development of the irrigated vegetable value chain development. Some of them and their roles are listed below.

- The efforts of Fogera OoARD and IPMS facilitated the transfer of responsibility of the government as the sole supplier of onion seed. Currently, onion seed supply is farmer to farmer. The platform is also taking responsibilities to bring different stakeholders together in relation to onion production.

- The OoARD was the sole source of knowledge, this time many stakeholders, including AARC, IPMS, individual farmers and others are also involved in knowledge transfer.
• In 2009/10, there are five irrigation experts and a horticulturist in support of the commodity. This shows that the OoARD has responded to the expansion of the commodity development and the need for expert support in irrigation. Technical needs for improved irrigation systems have been one of the challenges in the district. These experts are expected to help further promote the development of the commodity in the district.

• ACSI and Ambasssel trading are now providing inputs like agrochemicals, seeds and motorized water pumps.

• AARC is also involved in training onion producers and in providing technical support,

• Regional plant laboratory is testing onion seeds produced by seed growers against potential diseases.

• BOARD follow up and regulatory activities both at field level and post harvest management and ensuring seed certifications

• Irrigation cooperatives involvement in input supply (seeds) and marketing has been much reduced and issues related to use of water are dealt with by the Kebele Administration

• Linkages between Fogera onion seed producers were created with various onion Almata and neighbouring districts in Tigray, with the help of IPMS.

• IPMS promoting linkage among the seed producers, AARC, organizing study tour, trainings and platform to gain experiences, Regional plant laboratory, financial support to perform different tasks, market promotion, brand naming etc

6. Challenges for Scaling Out

6.1. Onion seed production

Though securing seed for bulb production is a big achievement, source of bulb for seed production remains to be a challenge. Nowadays, the Fogera district OoARD and IPMS have been discussing with Metema OoARD on the possibility of producing bulbs in Metema during the rainy season so that this bulb will be used for the October and November planting. This is the time when seed producers plant bulb for seed production in Fogera.

Seed certification is still a major challenge for producers. IPMS attempted to guarantee certificate for seeds harvested during 2007 with OoARD, however after many efforts only six of the major producers were assured of the certificate.
Certification helps the onion seed producers to market their produce outside of the district.

Bulbs brought to the district from other areas for onion seed production need special attention. So far, IPMS has been playing key roles in planning, organizing and financially supporting until the producers themselves takeover the entire activities. Nowadays, through the regular onion seed platform meetings, some of the active members have been aware of the sustainability issue in the absence of IPMS. As a result, the farmers are interested to take over the responsibility from IPMS. This means that they will be engaged in bringing sample bulbs from appropriate areas for laboratory testing and certification before the bulk of the planting material (bulb) is bought for wider distribution to Fogera onion growers. In the previous years, at least 2-3 people were involved for collecting sample and then the planting bulbs. This year (2009/10), however, only one person is involved in bringing three truck loads of bulb (300 qt) and sold to the seed producers with a reasonable profit margin and uniform price throughout the district.

Selling bulk seed out side of the district requires seed certification. The process needs special attention from the planting material (bulb) laboratory testing until post harvesting. IPMS together with OoARD played a vital role in organizing technical experts’ field supervisions at different growth stages, facilitating trainings and experience sharing to ensure minimum quality standard, organizing seed sample collection for laboratory test etc. Officially, seed certification is the mandate of BoOARD and OoARD. One consultative stakeholders’ workshop will be organized by the project for smooth handover of responsibilities in the coming three month period, before the project phases out.

6.2. Agronomic and irrigation practices

As can be observed from the household survey data, productivity (yield) of the major crops are well below their potential, due to inadequate introduction of advanced practices.

The amount of irrigation water applied in onion fields lacks uniformity. Some fields are over watered which will create long term salinity while others are in short supply, which ultimately affects production. Hence, for efficient utilization of water, the extension system should support with more qualified irrigation experts to help solve this problem.

Lack of training of farmers on chemical use to control vegetable pests and diseases may lead to ineffectiveness of the chemicals to the expected level. This could be attributed to the wrong type and quantity of chemicals used because of lack of knowledge or application rate.
6.3. Irrigation equipment

The newly introduced motorized water pumps (2008/09) have frequently been failing, mainly due to lack of technical operating skills. The project and OoARD identified this as a knowledge gap and training was facilitated through financial support from the project. As a result, experts in this field have explained now that farmers are getting the required skill so as to be able to fix damage at village level.

6.4. Marketing

While progress had been made with marketing, the interference of brokers in onion marketing is still affecting the benefit of the producers. During high production periods, when supply is more than demand, producers become desperate to sell. This creates good ground for the broker to fix the price. Traders coming from Mekelle, Adigrat, Shire and Dessie purchased the produce at higher prices from the brokers though the prices received by farmers were relatively lower. Constant attention is required by producers and the OoARD to avoid the situation “slipping back” into the previous system, especially during periods of “stress”.

7. Lessons and Challenges in the Intervention Process/Approach

- Value chain approach is very important for all types of agricultural commodities. High production by itself does not guarantee the profitability of the producers unless it is linked to market. For successful commodity development, availability of various inputs like seed, fertilizer and other agrochemicals should be well considered ahead of time. Identification of relevant stakeholders and their level of involvements are important for the overall achievement of its objectives. Establishing platform and commodity stakeholders are the key approaches along the value chain development. The following points were concluded as a recommendation. Establishing an efficient smallholder farmer seed system relieved the OoARD to do other activities.

- Row planting decreases the amount of onion bulb used for planting by 3-4 quintals/ha which could reduce onion seed production cost by about 1,200-1,600 birr

- Improvement in onion seed supply lead to speed up the expansion of onion bulb production and increased the producers’ household income.

- Seed production is a lucrative business and certification is essential to sell products outside the district.
• Distribution of motorized water pump and other irrigation technologies should be based on the availability (potential) of water in the district
• Stager production, especially on tomato was a successful intervention
• For efficient utilization of water for irrigation, the extension should support on creation of full awareness on water requirement for different plant, frequency of irrigation.

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