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Enhancing Household Food Security through Irish Potato Production in Gamo Highlands of Southern Ethiopia

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Food security is a national concern of Ethiopian government. The government has designed broad-based development policies and programs, and promoting the application of innovative agricultural technologies to escape the people from the structural poverty trap. These national policies emphasize on transforming the stagnant agricultural sector through improving crop production and productivity. Irish Potato is widely cultivated root and tuber crop in the highland and midlands of the country. It is a staple food in southern Ethiopia. Irish potato is the most productive crop and has a comparative advantage to slash food insecurity in the country. This study is, therefore, initiated to assess the current potato production and to investigate household food security situation of Gamo Highlands of Southern Ethiopia. For data collection, non-probability and probability sampling techniques were employed to delineate the study area, to select the sample kebeles and to draw the sample households. For data acquisition, structured questionnaire was administered to 180 systematically selected farm households. Rapid Rural Appraisal tools were also employed to extract qualitative data for the study. The study has revealed that despite its importance for food security and relatively high land allocation (26 percent of farmers plot); Irish potato production and productivity was low due to lack of improved varieties, low fertilization and poor research-extension-farmers linkage. The average yield of local potato which majority of the farmers depends on was only 24.25 quintals per hectare while improved Irish ware potato was 86.5 quintals per hectare. The per capita Irish potato consumption was only 1 kilogram in the survey year. The average per capita income of the studied households was much lower than the internationally accepted level (USD 1.25 a day). Regardless of their wealth rank, the community faces food shortage for six months, on average, October and May being the most critical months that challenge even the highest wealth groups while the poor have nothing to eat during these months. The study calls for coordinated efforts of all concerned bodies to improve the production of the staple food (Irish potato) and initiate development projects targeted to the poor.

Key words: Irish Potato, Food Security, Wealth Rank, Food Gap.

INTRODUCTION

Agriculture is the mainstay of the Ethiopian economy. Despite the marginal decline in its share to GDP in recent years, agriculture has been the backbone of the economy employing about 85 percent of the labor force, contributing about 41.6 percent of the GDP and around90 percent of the total export earnings of the country (Ethiopian Ministry of Agriculture, 2010). This shows that the overall economy of the country and the food security of the majority of the population heavily rely on what happens in the sector. Out of the total production of Ethiopian agriculture, about 70 percent comes from crop production and the rest 30 percent drives from livestock sub-sector. Likewise, the sector is dominated by about 11.7 million small holders cultivating about 95 percent of the national agricultural production and large farms contributed to only 5 percent of total production.

Despite its importance, Ethiopian agriculture is characterized by low productivity and over the last decades it has been unable to produce sufficient quantities to feed the rapidly growing population of the country. In fact, natural calamities, food insecurity and famine seem to have become the salient features and critical problems of the country (Belay, 2003). According to the Ethiopian Central Statistical Agency (2011), about 30 percent of Ethiopian population lives under poverty line. Food security is a national concern of Ethiopian government. The government has designed broad-based development policies and programs, and promoting the application of innovative technologies to escape the people from the structural poverty trap. The country has launched green economic strategy with the ambition to become the middle income country by 2025. These national policies emphasize on transforming the stagnant agricultural sector through improving crop production and productivity. Irish potato (Solanum tuberosum L.) is the world’s fourth largest food crop after wheat, rice and maize. World production reached a record 320 million tones in 2007 and production in the developing countries has almost doubled since 1991, with a corresponding increase in consumption. The tuber is an important source of food, employment and income in developing countries (FAO, 2008). Ethiopia has good climatic conditions for Irish potato production and productivity (Endale, et al., 2008a). Irish Potato is widely cultivated root and tuber crop in the highland and midlands of the country. It is both a staple food and source of household income. Irish potato is the most productive crop and has the potential to relieve the pressure of increasing cereal prices on the poorest people and contribute significantly to food security. Similarly, the Gamo highland of Southern Ethiopia has tremendous potential for Irish potato production and hence, the tuber plays a crucial role in ensuring food security.

However, the farming system in the study area is traditional which relies on rain-fed agriculture; thus, the potato production and productivity is low due to prevalence of disease and pests, poor soil fertility, variability in climatic patterns, shortage of agricultural input supply and application, poor research-extension and farmers’ linkage, post-harvest handling practices and poor marketing. This research, therefore, intends to assess the current potato production and to examine the household food security situation of Gamo Highlands of Southern Ethiopia.

RESEARCH METHODOLOGY

The study area

The study was conducted in Gamo highlands that cover most of Chencha and Dita districts and parts of Gofa Zuria, Boreda, Daramalo, Bonke, Kemba and Arbaminch Zuria woredas. The agro-ecology of the areas is highland and midland which is suitable for potato production. The present study is delineated to Chencha and Dita districts which constitutes majority of the Gamo highlands. The study districts are densely populated with small and fragmented land holding size (0.25 hectare on average). The agro-ecology of the districts is almost similar, where highland (82 percent) and a few (18 percent) is midland in Chencha while 80 percent and 20 percent of Dita is highland and midland, respectively. The mean annual average rainfall of Dita district is 800mm-1200mm while Chencha’s is 750mm-1000 mm whereas the mean monthly temperature ranges between 20°C-25°C. Meteorological records reveal that the rainfall pattern in Gamo highlands is bimodal which is characterized by two production seasons, traditionally known as ‘Belg’ and ‘Meher’. The Belg rains usually occur within the months of February to May whereas Meher takes place from June to December. The major means of livelihood of the study areas is substance mixed agriculture (Zonal Economic and Finance Development Office, 2013; unpublished).

Methods of data collection

Primary and secondary data were used for the present study. The primary data (quantitative and qualitative cross-sectional data set) was collected from sample households through structured and pre-tested questionnaires. In addition, Rapid Rural Appraisal (RRA) tools such as key informant interview, focus group discussion, wealth ranking and seasonal calendar were used to extract qualitative data. Secondary data was reviewed from published and unpublished sources (Zonal and district government institutions, Central Statistical Agency, Vita/Ethiopia, and other pertinent sources).

Sampling techniques and Sample size

Both probability and non-probability sampling techniques were employed to select the study areas and draw household respondents. The study areas (Chencha and Dita districts) were purposively selected due to their relative accessibility and production potential as well as intervention of various NGOs and development projects that focus on Irish potato (ware and seed) production in areas for the past few years.

The population of the districts is homogeneous in agro-ecology, socio-economic condition and share common culture and hence simple random sampling technique was used to select sample kebele administrations. Depending on the number of kebeles of each districts, a total of 5 kebeles (3 from Chencha district and 2 from
Dita district) randomly selected. Consequently, Gendo Gembele, Doko Losha and Lakana Maldo of Chencha district and Hayla and Megesa Bobbe kebeles of Dita district were drawn as sample kebeles.

In turn, the sample households were drawn using systematic random sampling from the kebele household list, which can be conveniently used to draw representative sample and to avoid sampling error (Kothari, 2004).

In doing that, since the sample kebeles have different household size, proportionate to household head size techniques was employed. Lastly, a total of 180 household respondents were included in the study as depicted in the following table 1.

Before the actual data collection, three day training was organized for enumerators on survey objectives, interview approach, data collection ethics and clarity of the questionnaire details to familiarize them. After the training, the questionnaire was pre-tested and modified accordingly.

**Method of Data Analysis**

Data collected from different sources was first triangulated and organized into themes. The data gathered from household survey through structured questionnaire were edited, coded and entered into SPSS (version 16) for analysis. Descriptive statistics such as frequency, percentage, mean standard deviation and cross tabulation were employed to analyze the data. Besides, qualitative data extracted through RRA tools were triangulated, organized and interpreted.

**RESULT AND DISCUSSION**

**Demographic and socio-economic profile of the households**

As already stated, the present study is based on the data collected from a total of 180 sample households 100 of which were from Chencha district and the remaining 80 were from Dita district. Gender wise, the sample households were composed of male headed (91.1 percent) and female headed (8.9 percent) households.

The marital status of an individual has a strong relationship with his/her fertility, migration, mortality, and household headship. The study revealed that above 90 percent of the household heads were married while 6.1 percent were widowed. Furthermore, almost 27 percent of women were widowed while only 2.6 percent of the male were widowed. This shows women have less probability for remarriage in the study area.

Age of an individual determines when he/she entries to school, employment and into marriage. Population age structure of a particular district helps to differentiate the productive and non-productive age group and to determine its manpower potential and the requirements for various goods and services like food, health, education, housing, and other services (USAID, 2000). Many studies have shown that rapid population growth in developing countries is closely associated with non-productive population structure and high age dependency ratio. Further, age of a farm household head in the district indicates his experience in farming, land ownership, cropping calendar and adoption of new technologies that in turn determines food security status of the household (Girmay et al, 2014). The mean age of the surveyed households in the districts was 49.56 while the minimum and maximum age found to be 20 and 92, respectively. On the other hand, the average age of sampled respondents in Chencha was about 46.08 while that of Dita was about 52.34 even though the mean difference across the districts was not statistically significant as verified by chi-square test.

The dependency ratio is the ratio of the number of dependents (age groups between 0-14 and 65 and above) divide by the productive age group (15-64). It is normally expressed as a percentage (Todaro and Smith, 2012). In line with this, the mean age dependency ratio of the sampled households in the study areas was equivalent to 0.3931. This shows on average, 39.3 percent of the surveyed family member’s livelihood depends on the productive age counterparts. Furthermore, the mean dependency ratio of Dita district was 0.41 where as that of Chencha was 0.38 even if

Table 1: Sampling procedure

<table>
<thead>
<tr>
<th>Target Districts</th>
<th>Sample Kebeles</th>
<th>Household Head Size</th>
<th>Sample size</th>
<th>Total sample</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MHH</td>
<td>FH</td>
<td>Total</td>
<td>MHH</td>
</tr>
<tr>
<td>Chencha</td>
<td>Gendo Gembele 229</td>
<td>50</td>
<td>279</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>Doko Losha 366</td>
<td>41</td>
<td>407</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>Lakana Maldo 277</td>
<td>34</td>
<td>311</td>
<td>27</td>
</tr>
<tr>
<td>Dita</td>
<td>Hayla 268</td>
<td>6</td>
<td>274</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>Megesa Bobbe 500</td>
<td>15</td>
<td>515</td>
<td>50</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1640</td>
<td>146</td>
<td>1786</td>
<td>164</td>
</tr>
</tbody>
</table>

Source: Own Calculation from kebeles’ list

* -Male headed Household, ** - Female headed Household
the mean difference is non-significant.

Basically, educational level of a person determines his/her decision power. It influences how a person behaves and manages resources. It further affects the adoption behavior of an individual.

The study found that more than 66 percent of the sampled households were literate. The rest 33.9 percent of the households were literate. The study investigated whether there is difference in literacy between male headed and female headed households in the study area. Accordingly, 61.6 percent female headed and 65.6 percent male headed were illiterate. However, there is no statistically significant difference in educational achievement between the two sex counterparts.

Family size determines the food security status of the household and the quality of life of the individuals. The family size may determine the living condition including the amount as well as quality of food (calorie) intake. Two households with the same income but different family size are expected to have different ways of living. But the family size only doesn’t determine the living condition of the household. The quality of the individuals such as the educational level, labor-force status, occupation, and the way the family is planned also affect the living condition (USAID, 2000). In northern Ethiopia, household family size has a direct relationship with land holding size. However, family size in the study area has nothing to do with landholding size of a household as evidenced by survey data. Thus, households with large family size are more likely to be food insecure and suffer from extended hungry period. The average family size of the studied households was found to be 6.56 where the minimum and maximum size equals to 1 and 20, respectively. Moreover, the average family size of Dita was 6.01 while that of Chencha was 7.24 though the mean difference was not statistically significant up to 10% significance level.

Land is the basic asset of rural communities. As far as land ownership is concerned, almost all (98.9 percent) of the sampled farmers possessed their own farmland. The population pressure on land is increasing from time to time causing depletion on other natural resources in turn the landholding size is decreasing continuously. The information gathered from community leaders and key informants of the districts support the diminishment and fragmented nature of the farmlands in the area. The participants of the discussion invariably disclosed that their landholding is very small and decreasing year after year. The farming system of the area is extremely subsistent. In line with this, the average size of land holding of sample farming households was about 0.4384 hectare. The sampled farmers in Dita cultivated, on average, a smaller area of land (0.3170 hectare) than those in Chencha (0.5356 hectare). The mean difference was significant at 1 percent. According to the perception of key informants and group discussants, the soil fertility status of the area is poor. As a result, crop production and productivity is low. The results obtained from focus group discussion and key informants revealed that shortage of land, soil erosion, poor soil fertility status, and fluctuation of rain fall are the major constraints of efficient land use among the farmers in the study area.

**Crop production in the districts**

Agriculture is the main economic base of the rural people in the study areas. The crop production sub-sector of the area is based on bimodal (Meher and Belg) cropping season as mentioned earlier. The major crops, cultivated in the areas are enset, Irish potato, wheat, barley, maize, bean and peas. Sweet potato, maize, Irish potato, wheat and barley are the major produces in midland parts of Dita while enset, wheat, and Irish potato are mainly produced in Chencha.

Adoption of improved technologies such as chemical fertilizer and improved varieties is the prerequisite to increase agricultural productivity especially for farm households with small plots of land. About 66 percent of the sampled households use chemical fertilizer while only 28.9 percent of them used improved seeds. However, the supply of improved seeds was restricted to Irish potato and wheat. It is believed that optimum application of chemical fertilizers is important to improve crop productivity. In line with this, the survey result found out that the average amount of DAP used per hectare was 20.32 kilo grams with the minimum and maximum being 7.5 and 75 kilo grams, respectively. Correspondingly the average amount of urea used per hectare was 9.45 kilo grams with 2.25 and 37.5 kilo grams being minimum and maximum respectively. These physical application rates of fertilizers used by sampled farmers were well below the recommended rates by the extension programs - 100 kg DAP and 50 kg urea per hectare (Belay Kassa, 2003). This inefficient utilization of chemical fertilizers might be the cause for low crop productivity of study areas.

**Irish Potato production**

According to chencha district agricultural office, the total annual production of *Irish ware potato* in the district was about 200,000 quintals while the productivity was about 185 quintals per hectare. Similarly the total annual production of *Irish seed potato* was about 3230 quintals while the productivity was reached 250 quintals per hectare in 2012/13 cropping season. This implies seed potato is more productive than ware potato. Thus, Irish potato is one of the potential crops in the areas. The survey also confirmed that majority (92.2 percent) of the sampled farmers cultivated potato in the survey cropping season. However, the productivity was low due to limited use of improved seed varieties and low application of chemical fertilizers. For instance, information obtained
Cultivation of Irish potato by Dis

from Chencha district agricultural office shows that of the total of 45,600 quintals required seed Irish potato, only 22,880 quintals were supplied in the surveyed year. This indicates that about half of the improved seed demand of the farmers was not yet met. As a result, about 84 percent of the sampled farmers were forced to use unproductive local Irish potato which might be the reason for the low productivity.

As far as the type of Irish potato cultivated in the area is concerned, almost all sample respondents produce ware potato while negligible portions of farmers engaged on seed potato cultivation. In addition, improved Irish potato varieties have been introduced in the study areas since 2011. However, since then, only 14.4 percent of sampled farmers have adopted the varieties where the lion share goes to ‘Guddene’ variety. Even though the production of improved Irish potato was limited in the area, the mean difference across districts is statistically significant as evidenced in table (2). The main suppliers of improved Irish seed potato in the study area are Vita/Ethiopia, World Vision and other non-governmental organizations.

Irish Potato productivity

Farmers are not naive. They are effective managers in their own. Whatevever the productivity of a particular crop, farmers never allocate their whole plot of land to one crop at one cropping season. The main reason behind this is in order to avoid, or minimize potential risks of crop production and diversify their source of income. Analogous to this, the size of land farmers allocated to potato cultivation in the previous cropping season was addressed in the household survey questionnaire. The result of the survey indicated that farmers, on average, allocated 0.1136 hectare of land in the study areas; the minimum and maximum being 0.01 and 0.62 respectively. This shows that farmers allocate about 26 percent of their plot to potato cultivation. This is quite large compared to the average holding size of the areas. Explicitly, the average land size allocated for potato production is 0.1522 hectare in Chencha while 0.0712 hectares in Dita. The mean difference across the districts is highly significant. Paradoxically, potato productivity in the area is surprisingly low. The result of household survey indicated that the average yield of local Irish potato where majority of the farmers depend on, was only 24.25 quintals per hectare; the minimum and maximum being 7.5 and 63 quintals, respectively. Information collected from community figures and districts experts also confirmed that the average yield of local Irish potato is estimated to be about 30 quintals per hectare. As a result, potato cultivation is confined to home consumption in the study area. On the other hand, the result of the household survey shows that the average yield of improved Irish wares potato was 86.5 quintals per hectare; 48 and 180 quintals being the minimum and maximum respectively. Information gathered from model farmers and key informants also confirmed that the yield of improved Irish potato (Gudene) reaches 200 quintals per hectare. This shows that productivity of improved Irish potato is encouraging though a big assignment is left to development practitioners to outreach all farmers including the resource poor ones in the target districts.

Potato consumption habit

Irish potato is considered as a cultural food in southern Ethiopia in general and the study districts in particular. Despite the low production and productivity of Irish potato in the areas, it is the second staple food next to enset; thus, the community consumes it in their daily diet. The survey result also shows that almost all (97.2 percent) the sampled households consume Irish potato in their daily diet either by cultivating or purchasing from local markets and neighbors. The average amount of Irish potato consumed per day is 6 kilograms per average family with minimum and maximum of 1 kilograms and 20 kilograms, respectively during production time. This shows on average, an individual consumes about 1 kilogram per day in the study areas. As far as consumption pattern is concerned, the community in the study area consumes potato in different forms with different crops culturally. Focus group discussion held with community figures and women representatives on feeding habit of the community revealed that the following dishes are the most common forms of cultural foods prepared from

### Table 2: Cultivation of Irish potato by Districts

<table>
<thead>
<tr>
<th>Descriptions</th>
<th>District of the household head</th>
<th>X²</th>
<th>Tota l</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dita</td>
<td>Percent</td>
<td>Chencha</td>
<td>Percent</td>
</tr>
<tr>
<td>Type of Irish potato</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>product produced</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>seed potato</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ware potato</td>
<td>79</td>
<td>100</td>
<td>82</td>
<td>97.2</td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
<td>100</td>
<td>16</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Survey data, 2013
Potato:
- Petela (with Kocho prepared from enset tuber crop)
- Kurchka (with Barely)
- Toka (with Cabbage)
- Possesses (with Maize) and either of their combination or all, while others consume it alone.

Post-harvest handling of Potato

It is understood that farmers store the output produced at least to meet their seed requirements. In addition, the resourceful farmers store the potato product for future consumption and sale during short supply to get comparative advantage of the market. Hence, the farmers use various traditional storage facilities based on availability of materials at their disposal. Most of the farm households in the study areas commonly use traditional storage facilities such as sacks, pits, container made of bamboo and mud. Only few sampled farmers store their potato products in modern storage facility (Diffused Light Storage). The use of the aforementioned traditional storage facilities lead to high post-harvest loss of the production. In addition, rodents and heavy rain were resulted in production loss. Information collected from potato farmers during focus group discussion implies Diffused Light Storage reduces the post-harvest loss even though it unaffordable for the farmers.

Constraints of potato production

Despite the potential of the area for potato production and its contribution for household food security, the constraints of potato production are multifaceted. According to focus group discussion participants and key informants, the main constraints of potato production in the study areas include among others;

- Poor agronomic practices
- Limited use of improved agricultural technologies
- Poor soil fertility resulted from long lasted farming
- Heavy rain during flowering stage
- Shortage of rain on the early stage of plantation
- Fluctuation of rainfall
- Flood
- Late plantation
- Diseases such as late blight, Cutworm and wilt
- Lack of pesticides and insecticides
- Wild animals
- Lack of modern potato storage facilities and
- Poor marketing channels

Household livelihood Situation

Community livelihood situation was addressed in the household questionnaire and also extended in the community leaders and key informants discussions. The community livelihood was measured by ranking the wealth of the whole community in the sampled kebeles.

The community livelihood of the study areas was largely dependent on agriculture (crop and livestock production). Next to crop production, livestock rearing is the most important means of livelihood for the rural households in the study districts. It is used as a source of food, draught power, income and energy. Cattle are reared for the purpose of ploughing, milk and milk products, and as a source of energy while the small ruminants are ranched for cash income (from live sales) and meat requirements of the households. Poultry production contributes to the household income in addition to the consumption requirements. The equine cover the transportation requirements of the households. Moreover, livestock is an index of wealth, prestige and used as households’ insurance during miserable period in rural community. About 85 percent of the sample households reared livestock, which consists of cattle, small ruminants, equine and poultries.

Weaving and petty trade also serve as a means of livelihood for substantial number of sampled households in Chencha district. Distinctly looking to each district, 92.5 percent of sampled farmer’s livelihood of Dita depends purely on agriculture while 41 percent respondents of Chencha rely on it, where the remaining share goes to the combination of agriculture and weaving (38 percent), petty trade (8 percent) and others (13 percent). Thus, the mean difference in terms of livelihood means across the districts is highly significant as evidenced by Chi-square test.

Household Income Sources

In Ethiopia, majority of rural households derive their income from agriculture. For instance, only 25 percent and 3 percent of rural households are engaged on non-farm and off-farm activities respectively (Ethiopian Ministry of Agriculture, 2010). This shows that food security of the majority of the population heavily rely on substance agriculture. Like any other rural areas of the country, farmers of the study area generate their income mainly from agriculture (crop, livestock and livestock byproduct sale). Non-farm and off-farm activities serve as a supplementary source of income in the area. The common non-farm activities in the study areas are weaving, sale of firewood and charcoal, wood work, handcraft and food for work (Productive Safety Net Program). Weaving takes a lion’s share of all the non-farm activities as a supplementary source of income in the area, especially in Chencha. Over 58 percent of the respondents were engaged on agricultural (crop, livestock and livestock byproducts sale) and non-agricultural activities (weaving, petty trade, food for work, remittance, and the like) to generate their income.

In Dita, about 44 percent of the respondents generate
their income from on-farm (basically crop sale) while 42.5 percent of them generate income from both farm and non-farm (especially Productive Safety Net). On the other hand, more than 70 percent of the sampled households in Chencha generate their income from on-farm activities (mainly crop sale) and non-farm activities (basically weaving) for their livelihood. Thus, the difference across the districts is statistically significant as chi-square test signifies. Besides, hiring-out labor is the common source of off-farm income for the sample respondents in both districts, particularly in the poor wealth group of the community. The survey result as well shows that the estimated average annual income of the sampled households was about birr 5069.067 with minimum and maximum being birr 200 and 162600, respectively during the baseline survey. This average figure is equivalent with euro 211.21 (converted in current exchange rate of 24). Furthermore, the average annual income per average family size was about birr 772.72. This means on average, each family member of the sample respondents can generate around 32.2 euro per annum. Thus, the per capita income per day is much less than internationally accepted level (USD 1.25 per day).

Food security situation

According to FAO (1980) cited in USDA (2000), food security is defined as access by all people at all times to enough food for an active, healthy life. Food security requires “physical and economic access to adequate food for all household members, without undue risk of losing such access”. Access to food is a measure of entitlement to food from own production, income, gathering of wild foods, community support, and assets. Food security includes at a minimum:

1. the ready availability of nutritionally adequate and safe foods,
2. an assured ability to acquire acceptable foods in socially acceptable ways (e.g., without resorting to emergency food supplies, scavenging, stealing, or other coping strategies).

On the other hand, food insecurity is defined as limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways.” Hunger is the uneasy or painful sensation caused by a lack of food. It is the recurrent and involuntary lack of access to food. Hunger is a potential, although not necessary, consequence of food insecurity (USDA, 2000).

In line with the above facts, sampled household heads were asked whether the annual production was enough to feed their family throughout the year or not. Consequently, almost all of respondents reported that their annual production could not feed their family for the whole year (Table-3). On average, the annual production of the sampled household heads feed their family for about 6 months where the minimum and maximum became 3 and 9 months respectively. However, more than half of the sampled households faced food shortage for sometimes in the survey period. This could be because the survey study was conducted during production period while almost all households were eating limited varieties of food due to lack of resources.

While looking nutritional status of the respondents, about 52 percent of the sampled respondents reported that they were often eating limited varieties of food due to lack of resources while 41.6 percent of them were not eating the food they preference for sometimes due to shortage of resources. Eating a limited variety of food could be attributed to severe malnutrition. Consumption of dishes like meat, milk and milk products, and egg is an implication of wealth status in the community. With this regard the survey addressed whether the households consume these dishes regularly other than holidays or not. Accordingly, about 69 percent of the respondents indicated that they rarely consume the dishes while 17.2 percent of them consume the dishes occasionally. About 12 percent of the sampled households never eat the dishes at all.

Frequency of meals taken a day by household members at different age group has nutritional and the food gap implication. Thus, the study has addressed the household’s daily food intake frequency on age basis. Consequently, more than 65 percent of the respondents indicated that their children under 5 years were feeding four meals a day (morning meal, mid-day meal, between mid-day and evening meal, and evening meal). This implies whatsoever the food situation is, the family heads especially the mothers feed their children first what they can. About 34 percent of the respondents revealed that their children under 5 years were feeding three meals (morning, mid-day and evening meals) a day. Accordingly, 91.4 percent and 6.8 percent of the respondents indicated that their household members in the 5 to 15 years age group consume three meals (morning, mid-day and evening meals) a day, and two meals (morning and evening meals) a day, respectively. In the same way, more than 66 percent of the respondents reported that their children above 15 years were feeding three meals a day and the remaining reported twice a day.

Community wealth ranking and food gap coping mechanisms

A given community wealth can be measured based on various components of wealth ranking. The wealth ranking in the study area is often based on the access to and control over productive resources like land, livestock, draught oxen, enset and apple cultivation, livelihood diversification, corrugated sheet roofed house possession, and so on. In light with this fact, community
Table 3: Food security and nutrition situation of sampled households

<table>
<thead>
<tr>
<th>Descriptions</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is your annual production enough to feed your family throughout the year?</td>
<td>178</td>
<td>98.9</td>
</tr>
<tr>
<td>No</td>
<td>2</td>
<td>1.1</td>
</tr>
<tr>
<td>Total</td>
<td>180</td>
<td>100</td>
</tr>
<tr>
<td>How often did you face food shortage in the last 30 days?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rarely (once or twice in the past 30 days)</td>
<td>28</td>
<td>15.7</td>
</tr>
<tr>
<td>Sometimes (3-10 days in the past 30 days)</td>
<td>103</td>
<td>57.9</td>
</tr>
<tr>
<td>Often (more than 10 times in the past 30 days)</td>
<td>47</td>
<td>26.4</td>
</tr>
<tr>
<td>Total</td>
<td>178</td>
<td>100</td>
</tr>
<tr>
<td>Did you or any household member eat a limited variety of foods due to lack of</td>
<td></td>
<td></td>
</tr>
<tr>
<td>resources?</td>
<td>2</td>
<td>1.1</td>
</tr>
<tr>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>178</td>
<td>98.9</td>
</tr>
<tr>
<td>Total</td>
<td>180</td>
<td>100.0</td>
</tr>
<tr>
<td>How often you eat a limited variety of food due to lack of resources?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rarely (once or twice in the past 30 days)</td>
<td>12</td>
<td>6.7</td>
</tr>
<tr>
<td>Sometimes (3-10 times in the past 30 days)</td>
<td>74</td>
<td>41.6</td>
</tr>
<tr>
<td>Often (more than 10 times in the past 30 days)</td>
<td>92</td>
<td>51.7</td>
</tr>
<tr>
<td>Total</td>
<td>178</td>
<td>100</td>
</tr>
<tr>
<td>Frequency of meal per day for children less than 5 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Three times</td>
<td>47</td>
<td>34.3</td>
</tr>
<tr>
<td>Four times</td>
<td>89</td>
<td>65</td>
</tr>
<tr>
<td>Five times</td>
<td>1</td>
<td>0.7</td>
</tr>
<tr>
<td>Total</td>
<td>137</td>
<td>100</td>
</tr>
<tr>
<td>Frequency of meal per day for household members aged 5-15 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Twice</td>
<td>11</td>
<td>6.8</td>
</tr>
<tr>
<td>Three times</td>
<td>148</td>
<td>91.4</td>
</tr>
<tr>
<td>Four times</td>
<td>3</td>
<td>1.8</td>
</tr>
<tr>
<td>Total</td>
<td>162</td>
<td>100</td>
</tr>
<tr>
<td>Frequency of meal per day for household members aged above 15 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Twice</td>
<td>61</td>
<td>33.9</td>
</tr>
<tr>
<td>Three times</td>
<td>119</td>
<td>66.1</td>
</tr>
<tr>
<td>Total</td>
<td>180</td>
<td>100.0</td>
</tr>
<tr>
<td>Frequency of consuming dishes like egg, meat, milk and other animal products</td>
<td></td>
<td></td>
</tr>
<tr>
<td>other than holidays</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Usually</td>
<td>4</td>
<td>2.2</td>
</tr>
<tr>
<td>Occasionally</td>
<td>31</td>
<td>17.2</td>
</tr>
<tr>
<td>Rarely</td>
<td>124</td>
<td>68.9</td>
</tr>
<tr>
<td>Not at all</td>
<td>21</td>
<td>11.7</td>
</tr>
<tr>
<td>Total</td>
<td>180</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Survey data, 2013

figures and key informants participated on the discussion differentiated higher wealth group, medium wealth group, and poor wealth group strata of the community as follows.

Higher wealth group

- At least having one pair of oxen and other livestock
- Own 0.5 to 1 hectare of land
- Engaged on weaving
- Cultivate relatively small enset
- Diversified income sources
- Having corrugated sheet roofed house
- Led their life through grass, firewood and charcoal selling.
- Frequently migrating to urban centers to sustain their life.

Medium wealth group

- At least having one ox and other livestock
- Own less than or equal to 0.25 hectares of land
- Landless households
- Having no oxen
- Engaged on daily laborer
- Does not cultivate enset

Poor wealth group

- Own more than one hectare of land
- Own less than or equal to 0.25 hectares of land
- Landless households
- Having no oxen
- Engaged on daily laborer
- Does not cultivate enset
- Leading their life through grass, firewood and charcoal selling.
Table 4: Wealth group, food gap months and their respective coping mechanisms

<table>
<thead>
<tr>
<th>S/No.</th>
<th>Wealth group</th>
<th>Food gap period in month (months)</th>
<th>Coping mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Higher wealth group</td>
<td>Two months (October and May)</td>
<td>• Cutting meals&lt;br&gt;• Reducing amount and variety of meals&lt;br&gt;• Consumption of mature enset and enset products&lt;br&gt;• Household property selling&lt;br&gt;• Sale of large animals</td>
</tr>
<tr>
<td>2</td>
<td>Medium wealth group</td>
<td>Five months (September, October, mid-November, April, May and mid-June)</td>
<td>• Cutting meals&lt;br&gt;• Reducing amount and variety of meals&lt;br&gt;• Household property selling&lt;br&gt;• Consuming mature enset and enset products&lt;br&gt;• Borrowing money from friends &amp; relatives&lt;br&gt;• Remittance&lt;br&gt;• Seasonal migration (last resort)</td>
</tr>
<tr>
<td>3</td>
<td>Poor wealth group</td>
<td>Seven months (September, October, November, mid-December, mid-March, April, May and June)</td>
<td>• Cutting meals&lt;br&gt;• Reducing amount and variety of meals&lt;br&gt;• Eating immature enset tuber and enset products&lt;br&gt;• Food aid&lt;br&gt;• Grass, firewood, and charcoal selling&lt;br&gt;• Hiring-out labor&lt;br&gt;• Food for work&lt;br&gt;• Borrowing money from friends &amp; relatives&lt;br&gt;• Seasonal migration</td>
</tr>
</tbody>
</table>

Source: Survey data, 2013

In line with the above facts, information collected from focus group discussion and key informants revealed that on average the community faces food shortage for six months in the areas. The food gap months are September, October, November, April, May and June. The participants further mentioned that September, October, May and June are miserable months where majority of the local community are in difficult situation. The participants underlined that October and May are the most critical months that challenge even the highest wealth groups while others having nothing to eat during these months. This result was also confirmed by the survey result obtained from sampled households. About 36 percent of the sampled households revealed that they face food shortage for six months (April, May, June, September, October, November) while about 18 percent of them face food shortage for eight months (March, April, May, June, September, October, November and December). In the same token, over 16 percent and 15 percent respondents reported that they face food shortage for four (May, June, September, October) and seven months (April, May, June, September, October, November and December), respectively. Of course all the household members are not equally exposed to food shortage. There are the most vulnerable sections of households. Over 48 percent of the sampled respondents reported that women are the most vulnerable members of households during food shortage periods. Similarly, about 32 percent and 18 percent of respondents revealed that children and the elders are the victims of the problem. Information gathered from focus group discussion and key informants indicated that the local community uses diversified coping mechanisms during food shortage to curb the problem. These include among others;

- Cutting meals
- Reducing amount and variety of meals
- Consuming immature enset tuber and enset products
- Food aid
- Grass, firewood, and charcoal selling
- Hiring-out labor
- Food for work
- Borrowing money from friends and relatives
- Seasonal migration
- Remittance
- Household property selling
- Sale of large animals (as the last resort)

According to the participants of the discussion and key informants, however, the coping mechanisms are used on the basis of the severity of the food shortage and wealth status. As indicated in the table (4), the participants prioritized the coping mechanisms as per their capacity.

CONCLUSION

Despite the marginal decline in its share to GDP in recent years because of growth of other sectors, agriculture is still the backbone of the Ethiopian economy. The crop
production sub-sector is the main means of livelihood for the rural societies in particular and for the country in general. Gamo highlands are populous and hence the land holding is very small and fragmented. In addition, the average family size of study areas is high compared to regional and national levels. In such a situation, production of Irish potato can contribute its part for food security due to its capacity to provide comparably high yields per plot of land if it is well managed and its very nature to be harvested with in short period of time. In the study areas, Irish potato is considered as the most important staple food next to enset. Though its importance and contribution to food security, its productivity is low due to sole dependency on local variety and limited provision of improved varieties, poor research-extension and farmers’ linkage, decline in soil fertility, poor application of fertilizers and diseases. Thus, it is recommended that the coordinated effort of concerned bodies through provision of improved varieties, extension services and, research and development is a paramount important in expansion process.

The community faces food shortage for six months on average. Regardless of their wealth rank, the community faces critical food shortage in October and May. Thus, an alternative agricultural technology packages has to be provided to enhance food security of the community.

ACKNOWLEDGEMENT

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REFERENCES