

Irish potato production in Doyo Gena Woreda

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1. Understanding the context

a. Doyo Gena Woreda

Doyo Gena is a mountainous Woreda located in Kembata-Tembaro Zone, which belongs to the Southern Region of Ethiopia (SNNPR). The Woreda is located on the highlands, with an altitude ranging from 1900 up to 2800 meters. The rainfall pattern is quite favorable for agriculture; with a bimodal distribution¹ and an annual rainfall around 1800 mm. mixed agriculture (animal breeding and crop cultivation) is the major economic activity of the farming communities of Doyo Gena. Major crops cultivated in the highlands are ensete, cabbage, potato, barley, wheat, fava bean, field pea. In the lower part of the Woreda, farmers also cultivate sugar cane and small quantity of maize (either for animal or green maize for human).

Regarding the soil type, the top layer (up to 50cm in the best conditions, with a depth thickness varying with the slope) is mostly black clay loam, rich in organic matter. The sub soil over one meter depth is a red clay loam soil. The quality of the soil is another asset of the area for agriculture. But, due to the population growth and a high density (more than 700 hab./km² in some areas), individual landholdings have gradually been fragmented and the average surface per family is today around 0.5 hectare. The pressure exerted on the land has become more and more acute, and in the absence of adequate measures, soil and fertility have severely been affected by erosion. Animal breeding is also challenged by the growing scarcity of fodder. Farmers' production are also mainly constrained by the little number of crop diversifications available for the area, related to the high altitude which limits the range of crop species, but also the poor productivity of the existing varieties and the absence of adapted food and cash seeds locally.

Next to ensete, Irish potato (IP) is the most important staple food crop for the farmers, and the major annual food crop traditionally cultivated during the Belg season. This production is usually fully dedicated to home consumption, with a stock of potatoes available from June to August or even to October for some families.

b. Potato production in Belg and Meher season

Following the data provided by the Ministry of Agriculture, 95% of the families of Doyo Gena produce IP during the Belg season and 43% during the Meher, but on smaller surfaces. In Belg, average land allocated for potato production varies mainly according to the socio-economical status of family. "Better-off farmers" usually allocate 1 timad (¼ ha) whereas "vulnerable families" cultivate IP on less than 1000 m². During Meher, most of the farmers cultivating IP do not allocate more than 600m², and only very few "better-off farmers" cultivate up to 2.500m².

Several reasons explain why farmers prefer cropping IP during the Belg season. The first one is linked with the lack of alternative possibilities during Belg: except barley which is cultivated by only few farmers, IP is almost the only crop available for this season. There is therefore very little competition for space, capital and labor during the Belg, as most other major annual crops are cultivated during the Meher season. Quite amazingly as regard to the economical situation of the families, a significant portion of the fields even remain under fallow during Belg. This situation underlines somewhat the potential of IP intensification and also of diversification during this season. Added to that, potato diseases, such as late blight, highly constrain the Meher production. Late blight is the major potato disease in the area and is favored by the cold and humid weather of the Meher season. If all categories of farmers are involved in IP production in Belg, only farmers who can afford taking some risk as well as phytosanitary products engage in Meher production.

c. Cultural practices

The practices described below are based on field observations, farmers' interviews and sample survey.

For the **Belg**, seedbed's preparation and planting times are mostly determined by the onset of the rains. Early land preparation and planting is of course preferred by most of the farmers met, as it reduces the risk of crop exposure for late blight. Usually, the land is prepared with 4 ploughing by a yoke of oxen, with the last plough (usually end of January) dedicated to establish the furrows on which IP seed are planted. The depth of planting is the same as the length of the plough (called "Maresha" locally); this is to say about 20cm. On the fields that are close to the house, farmers usually put some cow dung and household waste. On more distant fields, they use commercial fertilizers: DAP at time of planting and UREA during the first weeding. For

¹ with a first rainy season called 'Belg' from February to May and the second season called 'Meher' from June to August

the **Meher**, potato cultivation starts at the same time than wheat (end of June / July) with similar land preparation for both crops, meaning to 5 or 6 times ploughing before planting. Farmers also apply more fertilizer during the Meher as they believe that the plant must be in better conditions to face the diseases. All farmers make earthening up during the 2nd weeding time for Belg potato and on the 3rd weeding for Meher season. For some very vulnerable farmers, accessing a yoke of oxen represent a real bottleneck which compromise IP cropping or reduce the surface that can be allotted for IP.

Concerning plant spacing, the local varieties are spaced by 30cm between the plants and 40cm between rows during the Belg. For the Meher season, the plant density is increased with 20cm spacing between plants and about 40cm between rows. Although not logical as regard to the exposure to late blight, the choice of increasing the plant density in Meher is mainly led by space competition with other alternative crops during this seasons;



Harvesting for the Belg season is mainly done in June (complete harvesting at once, as farmers need the field for Meher crops), though most intermediate and vulnerable already start harvesting in May as they seek to fill the food gap. Farmers often keep some relatively bigger size tubers as seeds (generally, the tuber size for local red variety is quite small) and keep them in cooler place until they plant for the next season. Regarding the quantity of seeds used, farmers usually plant their local variety in high density (up to 8 seeds/m²) using tuber size of 40 to 60 grams.

The Meher season harvest mostly depends on the onset of the Belg rains: if the rains come early harvesting is done in January, otherwise farmers keep the tubers in the soil until rains start.

d. Agricultural input used

81% of the sample farmers are using DAP fertilizer for their Belg production and 40% also use UREA on top of DAP. The quantity of fertilizer applied mainly depends on the financial situation of the farmers and the soil condition. However the use of fertilizer observed is much higher during the Meher season in order to help the plants to better resist to late blight, which again contribute to increase the production cost during the Meher.

In addition, farmers also try to control late blight disease by applying fungicides. Different types are available locally (i.e. Mancozebe, Ridomil...) and some farmers, who have a sprayer, buy fungicides and spray their potatoes. They also give services to their neighboring farmers by charging some fees. For instance to spray the content of 1 sprayer 15 liters of chemical solution, the owner charges 30 ETB all included (labor, 2 coffee cups of fungicide, sprayer). By this, the owner of the sprayer gets some margin of profit. In the Meher season, with their local varieties, all farmers producing potato are obliged to spray fungicide to control late blight. They spray more than three times (richer farmers spray up to six times) and incur on average 220 ETB. However during the Belg season, only 38% of farmers spray fungicide once or two times during the whole season, to control late blight. For those farmers, average costs incurred on fungicides is on average 50ETB.

e. Type of IP varieties used in the area

Local "red" and "white" potatoes are the two varieties traditionally cultivated since a long time in the area. Both varieties can be produced during the Belg and Meher seasons. The name of these 2 varieties is only related to the outer skin colors. Otherwise, the "red potato" has white color inside and also white flowers. The "white potato" has got light yellow color inside and purple flowers. Because the red potato variety is relatively less sensitive to late blight as compared to the white one, this variety is the most cultivated one currently in the area. The white potato variety has been observed in very small quantity on few farmers' field. These 2 local available varieties have very short dormancy period. This characteristic enables the varieties to be cultivated continuously during the two consecutive seasons of Belg and Meher seasons. This is a common practice in the area: some of the farmers deliberately maintain a small quantity of "remnant" tubers on their field, without harvesting it, in order to use it as planting material and maintain the variety for the next season. On the opposite, the improved varieties proposed by the MoA have longer dormancy period (up to 6months) and are therefore not suitable for double cropping in the year. Maintaining improved variety requires either reliable external source for seeds' provision every year, or local capacities to conserve and manage the seeds during the dormancy.

Although some efforts have been made during these last 3 years by the MOA and partner organization to introduce improved varieties, none of the 44 farmers randomly interviewed were found to cultivate improved varieties before the project intervention. This observation indicates that the new varieties have not reach a large number of farmers yet, or that they are not adopted by the farmers.

f. Yield comparison

The following data relies on farmers' claims and emphasize significant differences observed between the local and the improved varieties introduced by the project with the MoA this last year. The local red variety does not exceed 100 quintals/ha in very good conditions. For the improved varieties introduced by the project this last year (see *after*), farmers have reported a yield close to 250 quintals/ha². *Further yield measurements need to be done on the field at harvesting time to validate this data.*

g. Source of potato seeds

To secure the planting material for the **Belg** production, different strategies have been observed:

- 45% of the farmers mainly buy their seeds from the market to complete re-growing remnant tubers left on the field. These farmers spend 237 ETB on average to purchase seeds outside. This investment is quite important, especially for vulnerable families, who are obliged to secure their seeds in order to fulfil the critical period of May, June and July.
- 38% mainly get their seeds from the last Meher production, which is harvested in January or February, depending on the onset of the Belg rains. They harvest these seeds and plant them back in the soil quasi immediately, to complete some remnant seeds left from the previous Belg.
- 14% of surveyed farmers only depend on re-growing remnant tubers and cannot afford completing this source with seeds from the market.
- Very few farmers (2%) get their Belg IP seeds through a grant from other neighbouring better-off farmers.
- Very few farmers also are not able to either have the necessary liquidity to purchase the seeds or the capacity or surface to maintain some seeds during the Meher season for the next Belg.

For the Meher production, nearly all farmers secure their seeds from the previous Belg harvest (in June or July).

Regarding the **supply of improved IP varieties**, the MoA, in collaboration with different actors³, is trying to develop local multiplication and diffusion of improved high yielding and disease resistant varieties (such as *gudenie*, *jalanie* and more recently *beletech* varieties). In Doyo Gena, the introduction and multiplication started with some groups of farmers. As per Ato Teshale, Woreda Cooperative Officer, there are currently 3 cooperatives active in the production of improved IP varieties seeds, in 3 different Kebeles, with the total of 70 members. (Wonjela 16, Dinika 22 and Gomera 32). These cooperatives are supported by government, Better Potato for Better Life program from USAID and CIP. Within this framework, 6 relatively big size stores have been established in different Kebeles. The objective of these seeds' producing cooperatives is to multiply improved varieties of IP seeds locally and to sale it to farmers of the Woreda and of neighboring Woreda. Ato Teshale also reports that these cooperatives encounter some difficulties to sell all their produced IP seeds. Except some external organizations purchasing seeds for other areas, local farmers buying seeds from within the Woreda are not so significant. Mainly better off farmers from the same Kebeles purchase improved IP seeds from these cooperatives.

Two major bottlenecks may be put forward as regard these difficulties to sell this local seeds' production:

- The first one seems to be related with the selling price, which is relatively expensive as compared to local varieties, which corresponds on average to 700 ETB/quintal for the Belg season as compared to 150ETB for the local varieties. As these seeds' producers are obliged to incur high cost of production to produce potato seeds, either in Belg or Meher seasons, selling the seeds on lower price is of course not profitable. At the same time, the majority of farmers cultivating IP during the Belg for their own house consumption do not want to buy IP seeds with higher price.
- The second reason is related with the dormancy period of these new varieties, which induces to store and conserve the seeds during this period until the seeds break dormancy, before planting on the subsequent season. For that, specific storage conditions are required. The seed producers of the cooperative have access to a Diffused Light Store. Other farmers, who do not have necessarily the skills to setup adequate conservation mechanisms in their farm, would then have to purchase new seeds every season or year from the cooperatives. This might not be convenient for those farmers, considering their financial capacities and the fact that major part of the production is dedicated to house consumption.

² average of 230qts/ha for 90 farmers with the Jalenie, and of 279qts/ha for 9 farmers with the Gudenie

³ Agricultural Research Centers, USAID financed project entitled "Better Potato for Better Life", CIP

h. Potato disease problem

Late blight is the major potato disease caused by fungus (*Phytophthora infestans*) widespread in all parts of the Woreda where IP is cultivated. Its prevalence is very high during the Meher season production. It is reported that late blight is the major cause for most of the farmers, in IP growing places of Ethiopia, to shift production from main rainy season (high yielding potential period) to short rainy season (Belg) (*Bekele Kassa and Eshet Bekele*). As mentioned before, the major expenses for the Meher production in Doyo Gena is related to fungicides to control late blight. Yield losses in relation to late blight infection can reach up to 67% of the production, depending on the susceptibility level of potato varieties used (*Bekele Kassa and Eshet Bekele*).



Another important potato disease observed in the area is wilt caused by bacteria (*Ralstonia solanacearum*). Since recent years, farmers started to observe this disease in their farm. It causes wilt of some IP plants before flowering stage. Most farmers lack awareness on the characteristic of this disease and on its propagation process. But, from our discussions on the field, all farmers agree that its incidence is increasing from year to year on infected field and also on different farms in the area. Although the disease incident is more common on the hotter areas, the prevalence of the disease seems to progress in Doyo Gena. The traditional potato production system is certainly the major factor that favors the propagation of the disease: continuous potato production on

the same plot, often consecutively between the Belg and Meher season, without any diversity of varieties.

i. Allocation of potato harvest and duration it serves

From the sample, except some 17% of Belg potato producers sale some portion of their potato harvest (either because they are better-off or on the opposite, because they need liquidity to face a shock); almost all farmers use Belg season potato production for home consumption. The survey indicates that the duration of the Belg production can supply the better-off families for about 4 months (June to October) and for about 3 months for intermediate and vulnerable families⁴.

More than 50% of the vulnerable farmers interviewed say that they are constrained to buy IP from the market when their production is fully consumed. 77% of respondents belonging to the intermediate and vulnerable group category claim that their production is not sufficient to reach the first harvests of the Meher season, facing food shortages from September to November.

It is important to mention also that potato vines represent a substantial source of fodder during the dry season, allowing families to resort less on ensete leaves.

Regarding the Meher production, 74% of the production is sold as cash crop, 15% is used as seed basis for the next Belg season and the remaining 11% is consumed, especially in January and February.

Out of all surveyed farmers, 83% give more importance to the Belg production considering it as a vital source of food for their family between June and October. The other farmers (17%) explain their preference for the Meher as regard to the economical opportunity as the selling price for IP considerably increases around January. The Meher harvest is the major source of seeds for the Belg growers (representing the majority of the community), which results on very high demand for potato seeds for the Belg plantation which is correlated with a subsequent price escalation.



⁴ Observations were as follows: 4.1 months for « better off » category of farmers, 3.3 months for « intermediate » category and 2.8 months for « vulnerable families ».

j. Conclusion

To summarize, the context of Irish Potato cropping in Doyo Gena can therefore be characterized as follows:

- A significant role of the IP on the food security of the families, as it represents the main staple food crop with Ensete for the Belg
- A very large number of farmers cropping IP during the Belg, mainly for their own consumption.
- Less than half of the farmers, mainly better-off ones, cropping IP during the Meher, but on smaller surfaces due to the competition with other alternative crops (such as wheat).
- For the Meher production, farmers are constrained to purchase fungicides as the prevalence of late blight is very high. They also use more chemical fertilizers. The production cost is then much higher for the farmers.
- Less disease prevalence in the Belg season and lower cost of production are important reasons for the farmers to prefer Belg season potato production.
- Traditional practices consisting in letting some remnant tubers in the soil to maintain seeds contribute to increases the risk of bacterial disease (*Ralstonia solanacearum*)
- Majority of the intermediate and vulnerable categories of farmers cannot produce sufficient IP to reach first harvests of Meher. This gap affects farmers' food security and there is thus a critical bridging period at 2 periods of the year (April-May and September-November).
- A constrained access for families in precarious situation to access local red potato seed for the main planting season (Belg).
- Initiatives supported by the government, USAID and CIP aim at introducing and diffusing improved varieties locally, through the setup of cooperatives of seeds producers. If this initiative is valuable, the diffusion of the seeds are constrained by the higher cost of the seeds and the longer dormancy period, which induces the setup of appropriate conservation mechanisms or yearly renewal nearby the local cooperative.

Covering foliage of Irish potatoes – Doyo Gena



2. Project objectives and proposed approach

Considering the context of Doyo Gena, the objective of the project activities related to Irish Potato is, with the farmers, to search, experiment and document concluding solutions that contribute to:

- Facilitate access for all categories of farmers to improved and/or adapted existing varieties, by establishing connections between farmers and external actors (MoA, Research Centers, local cooperatives...);
- Strengthen the capacities of the farmers to produce and conserve their own seeds;
- Improve the production and reduce related expenses & labor (in Belg and Meher), through improved agronomical practices;
- Improve soil preparation, fertility and fertilization (especially for the cropping of IP), through alternative and/or complementary solutions to chemical fertilizers;
- Enable families, and particularly the ones in precarious situation, to shorten the bridging period, by setting up an earlier access to IP during the dry season
- Improve access to fair market for the selling of the production dedicated to generate incomes.

For the moment, the project mainly focused on the introduction, diffusion and conservation mechanisms for the improved varieties, and the question of fertility, as described here below:

a. Access and conservation of improved and/or adapted existing varieties

For Irish Potatoes, unlike for wheat, very few new varieties are released in Ethiopia and made available for farmers. However, having 3-4 varieties with different characteristics is interesting from several points of view:

- shorter cycle varieties (early maturing), allows to shorten the bridging period;
- varieties more resistant to late-blight are particularly interesting to develop the Meher production (which is limited for the moment to better-off families who can afford fungicides⁵;
- increasing the number of varieties may contribute to reduce exposure to pathogens and diseases;
- varieties with longer dormancy periods avoid the need of continuous cropping as it is the case for the current two local varieties, which contributes to favor disease propagation.

As we saw, farmers of Doyo Gena are not use to conserve the seed of the 2 available local varieties out of the soil, especially because these 2 varieties have very short dormancy periods. If they want to maintain them, they must therefore let some plants in their fields during the rainy season, which increases the risk of bacterial diseases. Otherwise, they have to buy seeds to other farmers or on the market for the Belg season.

In 2006 EC (2013 JC), Inter Aide has implemented a pilot experience aiming at **enabling farmers to access and conserve improved varieties**. The experience is done in collaboration with the *Iddirs*, who manage the distribution of a small quantity of improved varieties, and then the reimbursement of the seedling after the harvest and their conservation. This diffusion process aims at gradually allowing all interested families to increase and diversify their own seeds resources. To do that, the *Iddirs* construct, by themselves, *Diffused Light Storages* (DLS), specifically designed to conserve the plants in good conditions during the dormancy period. When they receive the seed for multiplication, the beneficiary families are also requested to establish similar small system in their houses. It is necessary that the plants are kept in a dry, slightly exposed to light, and aerated (from top and from bottom).

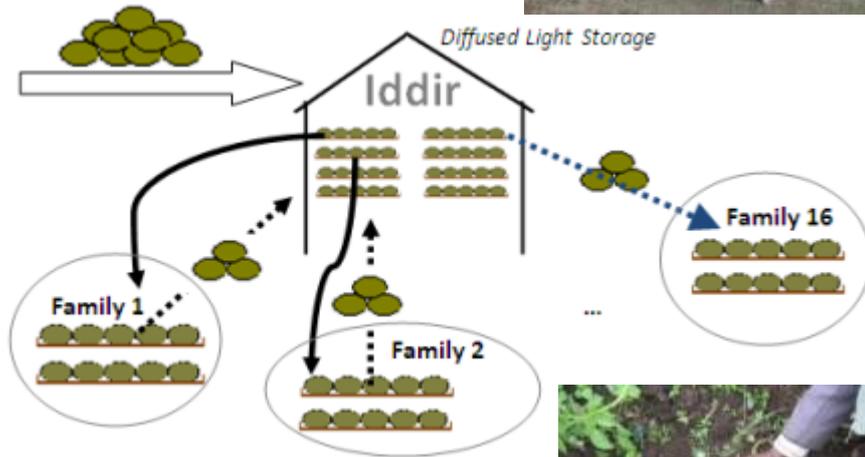
The schema on the next page presents the proposed approach. The *Iddir* play the role of representing the farmers. They access small quantity of the desired variety, which is then "lent" in small quantities (around 50 kg) to several farmers who multiply it, and then reimburse it back to the *Iddirs*. In this experience, the initial quantities acquired by the *Iddirs*, with the support of the project, allowed to provide seedling for self-multiplication for 15 farmers. After the harvest, the *Iddirs* get back the seed, usually with a small additional quantity (60kg per farmer) and conserve it in their DLS. On the second year, additional 20 farmers can by this way be supplied. When the variety is well introduced and diffused in their community, the *Iddir* could then decide to sell their "seeds capital" in order to purchase and introduce another new variety, following the same revolving approach. Previous experiences conducted by Inter Aide and RCBDIA already showed the strong capacity and legitimacy of the *Iddirs* to correctly manage collective resources. As source of evidence, the reimbursement rates observed from farmers to *Iddirs* are systematically close to 100%⁶. At their level, the farmers have been able to establish by themselves (only with technical advices from the project and peer-farmers) adapted locally-made structures to conserve and maintain their own produced seeds, as illustrated by the picture on the bottom-left.

⁵ In Rwanda and Burundi, the variety called "Gasore" is particularly appreciated since several years. There is also the known Sarpò Mira variety which has for the moment never been affected yet by late blight.

⁶ A study on the *Iddirs* entitled "Ethiopian *Iddirs* mechanisms. Case study in pastoral communities in Kembata and Wolaita" has been conducted by Inter Aide and is available on the following website: http://interaide.org/pratiques/sites/default/files/iddirs_wolayita-kt.pdf



Project/local supplier



During this first year, this pilot experience has concerned 99 families through 7 Iddirs. All these 7 Iddirs have constructed by themselves their DLS, with some support of the project (technical advices, nails and iron sheets; the wood and labour being provided by the Iddirs). Two varieties have been introduced during this first experience (Jalenie and Gudenie) with an average of 50kg per beneficiary families. Totally, 47 initial quintals of seed have allowed producing 337 quintals during this first season by the farmers themselves. All families have reimbursed the received quantities to their Iddir at harvesting time. This revolving system would then normally allow these Iddirs to supply additional families next year. It will of course now be interesting to assess how Iddir manage this diffusion towards new farmers.

Another important point is that this first year experience showed the capacities of the families to establish, by themselves simple storing systems, often inside their house (tukul where conditions are ideal with very few light) or in small existing granaries close to their houses. This demonstrate the possibility to develop conservation mechanisms allowing farmer to conserve their own seeds, "out of the soil" as traditionally done with the local variety, releasing by the way some surfaces dedicated to maintain seeds during the Meher.

This experience will now be extended to about 15 additional Iddirs in Doyo Gena Woreda as well as in the Woreda of Damot Sore.

Important remark: the potato seed producers' cooperatives, that are already established in the Woreda, also need to be capacitated in order to secure permanent supply of high quality breeders and pre-basic seeds of improved or interesting potato varieties. The MoA and different organizations are involved on that. These cooperatives can serve as source of certified seeds provders for the Woreda as well as for other Woredas in the Zone. Linking farmers, through Iddirs, and these cooperative, as well as developing the skills of the farmers to then multiply and maintain new varieties by themselves seems particularly relevant.

b. Soil preparation, fertility and fertilization

Very few serious alternatives to chemical fertilizers seem to have been studied in Ethiopia in correlation with Irish Potato cropping. Investing complementary solutions might decrease the dependence of the farmers to chemical fertilizers, especially for more vulnerable families who encounter difficulties to afford it. Added to that, **there is certainly the need to work, with the agents of the MoA, on the recommendations to optimize the quantities used by the farmers** (the dosage and the period of application as regard the plant requirements in nutrients).

In the farms of Doyo Gena, nearly all organic matter produced in the field is exported out of the field, mainly for the ensete plantations and for home gardens. There is nearly no restitution of fertility to the field, which increases the need of chemical fertilizers.

Some very promising experiences are currently implemented by the project in Doyo Gena on “improved fallow”, with the introduction of green manure. The use of Vetch (*Vicia villosa*) prior the cropping of wheat seems to be appreciated by the farmers and adapted to the high altitude. But these practices are mainly done during the Belg, when not all fields are used, and could mainly be relevant to test for Meher IP production. Cropped and used green manure, *Vicia villosa* is reported to be able to bring 100 to 150 kg N/ha/year, which is quite significant even considering a shorter cropping period, as regard the needs of IP in nitrogen. The project plans to test with some interested farmers this solution before IP cropping in the coming year. Added to that, other possibilities that maybe would deserve to be investigated are the incidence of leguminous cropping during Meher on the Belg production (like fava bean, associations with cow peas...), the relevance of associating IP with fava bean, a better valorization of farmyard manure, production of liquid manure and of course composting... But for this latest, the existing organic matters are already well valorized by the farmers. Developing further the composting mainly depends on the capacity of the farms to increase their biomass (in particularly forage), which is the core of another project component implemented in Doyo Gena.

The farmer on the picture here below is from Doyo Gena and tested Vetch cropping as improved fallow before planting wheat. On the right, an observation with the farmer of the nodes that develop on the roots, indicating the activity of the bacteria fixing the nitrogen. The farmer being interested to renew the experience, he then decided to produce some vetch apart, on a small backyard nursery, to maintain the seeds for the next season.



c. Other perspectives

Shortening the bridging period: cropping some IP in the home garden might be interesting for vulnerable families for 2 main reasons: first, home gardens, with enset plantations, belong to the most fertile place of the farm, it may considerably decrease the need of chemical fertilisers. But above all, it would be interesting to plant earlier some plants (possibly shorter maturing varieties) to ensure a production at the early critical stage of the Belg season.

Agronomical practices: different documents documenting recommended practices have been published by the CIP. Confronting these recommendations with the know-how of the farmers will progressively allow designing a very simple illustrated booklet with demonstrated advices for the farmers, especially practices to reduce risks of diseases, IP plant selection on the field; the density of the plants, rotation... *The project needs to further work on this aspect in the coming year.*

Market: finally, exploring capacities to improve fair market access might be studied in a further phase.

Appendix

Translation of an extract of the internship conducted in Doyo Gena by Inter Aide in 2005 EC - 2012 JC: *Role of the Irish potato in the food security of farmers in Doyo Gena, Kembata-Temabro Zone – Noémie Rullier*