MEETING REPORT

New Models for Legume Seed Business: Resilience, Nutrition and Reaching Farmers at the Last mile

March 1-2, 2017 | Washington, D.C.

Acknowledgements

This meeting was supported by grants from USAID/Office of US Foreign Disaster Assistance and the CRS Program Impact and Quality Assurance (PIQA) Department. Special thanks to Peter Morris and Julie March (US OFDA) and Shannon Senefeld, Maureen Capps, and Shaun Ferris (CRS).

The logistics of bringing participants from four continents are formidable and warm recognition to the many CRS in-house staff professionals who made the meeting happen: among others, Troy Hoppenjan, Linnea Wilson, Mary Riddick, Bryan James, Renee Murray, Steve Koresko (and his wonderful IT group); Tom Price (and the full, gifted communications group).

Finally, a note of gratitude and recognition to the speakers themselves. A respectable number opened their business books and talked frankly about the challenges of: seed business overall, legume seed business, trying to reach a set of underserved clients, and aiming to juggle lofty goals—like boosting nutrition and resilience—with actually making money!

Thank you for this important discussion.

Proceedings edited by: Louise Sperling, Bhramar Dey, and David Leege

Cover page photo credit: J.C. *Rubyogo, PABRA/CIAT*

Contents

Acronyms

BMGF	Bill and Melinda Gates Foundation
CGIAR	Consultative Group of International Agriculture Research
CIAT	International Center for Tropical Agriculture
COMESA	Common Market for Eastern and Southern Africa
CRS	Catholic Relief Services
CSB	Community Seed Banks
DiNERs	Diversity and Nutrition for Enhanced Resilience Fairs
EAC	East African Community
ECOWAS	Economic Community of West African States
FAO	United Nations Food and Agricultural Organization
FtF	Feed the Future
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
ICT	Information and Communication Technology
IITA	International Institute of Tropical Agriculture
ISSD	Integrated Seed Sector Development
LSB	Local Seed Businesses
MoFA	Ministry of Food and Agriculture
NARS	National Agricultural Research Systems
OFSP	Orange Fleshed Sweetpotato
PABRA	Pan-African Bean Research Alliance
PSP	Private Service Provider
QDS	Quality Declared Seed
SADC	Southern African Development Community
SME	Small and Medium Enterprises
TL	Truthfully-labelled
TLI +II	Tropical Legumes Programs
ToT	Training of Trainers
UN	United Nations
VC	Value Chain

PREFACE

Globally, humanitarians are responding to more concurrent disasters than ever before. As needs in sectors such as health, nutrition and food security grow and issues such as conflict, climate change and repeated shocks erode resilience , we are under pressure to consider and address some of the underlying issues that affect food security and livelihoods. Looking at the potential for resilience or transitional programming, we must begin to consider responses that go beyond acute emergency response to mitigate the impact of chronic stress on smallholder farmers and to explore linkages to existing development opportunities.

Considering how seed systems can support the global caseload of food insecure households is a complex issue with tremendous potential . New business models offer the promise of innovation within the agricultural sector by focusing on the intersection of seed and markets and farmers' needs. Strengthening seed systems to create the capacity to support nutrition, resilience, and to help get new varieties out—on a sustained basis—reaching farmers at 'the last mile' --- can have important transformative effects.

With an improved understanding of emergency market systems and the underlying causes of suboptimal nutrition in chronic and acute stress situations, we are poised to leverage the power of seed systems in ways that can make real changes in the food security and nutrition of vulnerable smallholder farmer families globally. We have the benefit of a large number of lessons learned (both positive and negative) from emergencies and development programs around the world. This workshop is a gathering of more of those lessons and will undoubtedly move the global knowledge of seed systems (in particular legume business models) forward.

Julie March

Food Security & Livelihoods Team Lead
Office of U.S. Foreign Disaster Assistance
Bureau for Democracy, Conflict, and Humanitarian Assistance
United States Agency for International Development

INTRODUCTION

by Louise Sperling

Convened by Catholic Relief Services (CRS), the two-day conference brought together private sector seed companies (European and African), major donors (Bill and Melinda Gates Foundation, World Bank, USAID), key legume field actors (Legume Innovation Lab, Pan-African Bean Research Alliance) and other stakeholders (e.g. Alliance for a Green Revolution in Africa) to identify ways to get high quality legume seeds to all smallholder farmers. Practical insights drew on experience from Southeast Asia, Latin America and the Caribbean, Europe, and especially from ongoing programs and businesses in east, south, and west Africa.

Seed can be an incredibly cost-effective input for smallholders, often with little additional investment. Increasingly, seed, or the right seed, can also meet multiple goals - not just promoting food security and income, but seed can also bolster nutrition (legumes, vegetable seed) and resilience (clusters of crops and varieties, including those specifically bred for stress—such as drought-tolerant varieties of maize or bean). Overall, legumes, the focus for this meeting, play a special role in diets, especially for poor and vulnerable farmers, and some even refer to legumes as the 'meat of the countryside'. Finally, seed is a key vehicle for widespread innovation—getting new varieties to farmers.

However, the problem is that better quality of seed is not reaching farmers. Recent studies in six African countries show that the channels being routinely supported to deliver seed to smallholders (the formal sector channels like agro-dealers), are only supplying 2.4% of the total seed smallholder farmers sow – across all crops. For legumes, the percentage is even smaller, with fieldwork documenting less than 1% of smallholders' legume seed being sourced from formal sector channels (McGuire and Sperling, 2016)[1]. The case for getting new varieties is also a challenging one, which raises questions about where investments are made. While studies show that over a third of farmers have received a new variety 'within the last five years' (Ibid.), such novelty has generally been accessed through gov't/NGO/FAO and has generally been given free and one-off. Note that maize dominates the new deliveries and there are few ongoing delivery channels by which farmers can screen, test, and buy seed of the range of other crops they want and need.

New innovative **legume-centered seed business models** are needed. Standard seed sector production and delivery is highly focused on maize. Yet maize has multiplication rate of 1 for 100 seeds versus legumes' 1 to 15 or 20, and hybrid maize might be bought year after year, while legume farmers (depending on the legume) may only renew seed every five to six seasons (or more!) Simply put, the crop sets, maize and legumes, are different animals in terms of costs and returns and the seed business model for the first may not necessarily be the most effective base model for many other crops.

The goal of this conference has been to convene partners and stakeholders to examine and develop a concrete set of building blocks for getting new varieties and quality legume seed into farmers' hands. We have been aiming to find practical breakthroughs to reach all smallholders with better variety and quality seed products. The foci within these proceedings were:

[1] McGuire, S. and Sperling, L., 2016. Seed systems smallholder farmers use. (S. McGuire and L. Sperling) Food Security, 8:179–195.

- **Seed quality for smallholders**—what seed quality is affordable and meets farmers' needs. Is Quality Declared Seed a viable option? If so, when, where? (and where is the data?)

- **Seed systems that promote resilience. How can out to** farmers a broad range adapted crops and varieties. How can we deliver them to stress prone geographies in a sustained manner?

- **Seed systems to promote nutrition** -What are specific features to a 'nutrition-sensitive seed business and how can nutritious seed options reach special client groups, the malnourished and vulnerable populations?

- **Last mile approaches** - Are there better ways (even ones not yet explored) how to get seed in remote geographies (without just relying on emergency aid)?

Organization of Proceedings

This volume brings together the multiple conference exchanges. Twenty-one abstracts immediately follow, clustered by the seven conference session themes:

1. ***Expanding the vision for seed system goals***
2. ***Building blocks for seed systems – seed quality***
3. ***Seed companies, customers, and reach***
4. ***Seed company support***
5. ***Integrated models for scale / last mile***
6. ***Information systems: complementary to seed***
7. ***Community-based / decentralized models***

Working Groups' reflections are then presented covering the following topics:

a) ***Seed systems for nutrition***
b) ***Seed systems for last-mile***
c) ***Enhancing seed sourced from local markets: working with potential seed traders***
d) ***Quality Declared Seeds (QDS)***

Annexes provide conference program details and list of participants.

Key in interpreting these exchanges is to view a set of businesses and programs trying to push the bounds, that is -- get high quality seed of more crops out to the smallholder clients who can access and buy them; reach remote areas; reach the malnourished; and serve regions that urgently need climate-smart and resilient seed systems.

For further information, contact, agricultureunit@crs.org

ABSTRACTS

SESSION I

EXPANDING THE VISION FOR SEED SYSTEM GOALS

Prioritizing Health over Wealth in Orange-fleshed Sweet Potato Dissemination

Jan Low[2]

The primary goal in the development and promotion of adapted varieties of biofortified orange-fleshed sweet potato (OFSP) is the adoption and consumption of OFSP by households, especially those with women and young children. In this context, the seed "system" is the conduit (and potentially the bottleneck) for improved varieties released by national programs to reach smallholder farmers. During the past decade, several dissemination models have been tested: (1) Single Shot, mass distribution every 4-5 years (2) Annual Access, limited number of trained vine multipliers (3) Annual Access, substantial number of small-scale, trained vine multipliers, decentralized so each serve 100-300 households. The choice of the appropriate distribution model and the degree to which it is subsidized is driven by four sets of drivers: (1) variations in agro-ecologies (2) characteristics of the varieties to be distributed, (3) socioeconomic and demographics, and (4) institutional.

In the nutrition context, the primary goal is to have as many individuals at risk of vitamin A deficiency as possible consuming OFSP and capable of accessing planting material annually (own farm conservation or from multipliers). Working with a vegetatively propagated crop, whose planting material is easily shared among neighbors, several key lessons have emerged. First, the yield superiority or at least equality of the improved variety compared to the dominant local variety is requisite as is the ability to sprout for the next season. Second, a cost-effective demand creation campaign, adapted to the cultural context, must be implemented. Third, the major purchasers of seed from multipliers are institutional buyers (NGOs; government) not individual farmers. Fourth, seed demand can fluctuate from season to season; hence, vine multipliers evolving to become vine-root enterprises is recommended. Fifth, in most instances, the distribution of improved OFSP varieties is combined with the use of quality (i.e. disease-free) planting material. Appreciation of the latter requires field level demonstrations. Sixth, rules requiring payback in kind or market-based promotion days enhance spillover. Seventh, dissemination efforts that have a component developing markets for fresh roots are more likely to see an increase in willingness-to-pay (WTP) for vines. Examples from Kenya and Rwanda highlight these points.

The prospects for building commercially oriented vine multiplication schemes are clearly context specific. In most countries, subsidized distribution needs to take place for the first year to build awareness about the yield benefits of clean planting material and the characteristics of any new varieties being introduced. Then in subsequent years, a decision can be made about where and with whom to develop more commercially oriented systems. Factors identified as contributing toward WTP are (1) the availability of new varieties; (2) drought-prone conditions; (3) recognition of OFSP nutritional benefits; (4) awareness of the yield benefits of disease-free vines; (5) markets with specific varietal preferences; (6) awareness of where vines can be obtained; and (7) access to appropriate transport for distantly located vines. In contrast, major factors working against WTP are (1) the existence of a tradition of vine sharing within the community; (2) the presence of other organizations distributing vines for free; (3) limited purchasing power; and (4) the limited importance of sweet potato in the diet.

[2] *International Potato Center*

Seed Systems for Resilience – Specific Features

Shawn McGuire[3] and Louise Sperling[4]

Abstract

For farmers to maintain production in the face of stress or meet other goals such as nutrition or income-generation, they need resilient seed systems. Humanitarian and development organizations spend significant amounts each year on seed-related activities in response to stress or disaster. For example, the FAO purchased $41 million worth of seed for emergency distribution in 76 different countries in 2015, which is but part of the full costs of seed responses. Immediate (emergency) responses predominate, with the direct distribution of seed to farmers the most common activity, generally providing them a limited range of crops and varieties. However, many of the stresses farmers face are cyclical or recurrent, such as water stress, and their underlying challenges are often long-term in nature, such as poverty or poor access to innovations. Therefore, short-term responses (which often recur season after season) may not be the most effective way to help farmers over time. Rather, fostering resilience should be the goal – but what does this mean for seed systems?

Generally, resilience comes from systems, so it is about more than just crop varieties, but also how farmers can access them, learn about them, and benefit from them. Resilience is not about preserving specific features (such as a crop profile) from year to year, but about preserving outcomes (such as production or income), as conditions change over time. And resilience is not about finding an 'optimal' strategy, as shocks are varied and unpredictable.

Relating these broad principles to seed systems, we highlight four key features for resilient seed systems:
1) diversity of crops and varieties, which helps support production and absorb shocks;
2) information systems that allow farmers to make choices about what they sow;
3) seed delivery systems that reach to where farmers are;
4) systems that operate with speed and flexibility.

We briefly outline a stress scenario in Ethiopia, to illustrate how all these features are important for a resilient seed system. We outline a range of different practical actions for supporting resilient seed systems, both short-term and longer-term, which respond to specific constraints (e.g. availability, access, quality of seed).

We conclude discussing implications for moving forward on seed system resilience. For resilience, a sole focus on a single crop, such as stress-tolerant maize, is misplaced. There are multiple entry points for supporting resilience, not only in crop research, but also, in numerous other fields of activity. And supporting resilient seed systems should not wait until a disaster but could usefully start well in advance of any stress.

[3] *Agricultural Officer (Seed Security), FAO*
[4] *Senior Technical Advisor, CRS*

SESSION II

BUILDING BLOCK FOR SEED SYSTEMS: SEED QUALITY

Legume seed production in emerging economies - Challenges to make it work commercially

Niels Louwaars[5]

Good seed doesn't cost--- it pays. Only if we have solutions to farmers' problems can we sell good seeds. The farmer is our customer, but also, our competitor. This is because, farmers can readily access farm-saved seeds at the right time and without incurring additional transport costs.

Characteristics of Legumes

Legumes have some key characteristics which affect seed system design. Overall, they are very important for nutrition security and for soil enhancement in crop rotations with non-N binding crops such as cereals.

In terms of seed-related criteria

- Low multiplication factor (7-20)
- Often bulky compared to cereals
- Often produced mainly for home consumption
- Self-fertilizing
- Store well (except soybean)
- Suffers from several seed transmitted diseases

*Because of the above, when thinking of legume seed, the drive should be to keep costs low***.** Seeds might best be produced in a decentralized fashion, keeping transport costs low. Also, decentralization can help control overheads: local seed business based on farmer groups might be a better option to large- scale enterprises.

Costs for standard, official quality control very much affect seed production—including for the legumes. Official quality control costs include – registration, field inspection, seed testing, and labelling – the objective being to avoid fake seeds in the market. Seed quality controls also require infrastructure and trained and trustworthy staff. Where road infrastructure is poor, seed certification is very expensive.

Note that cost of seed certification can be an important bottleneck in stimulating seed entrepreneurship, especially in remote areas and low-margin products such as legume seeds. Thus, expensive seed certification may reduce availability of quality seed for farmers. Also, it is worse to have a poor implementation system than having no certification system at all. This is because farmers may plant substandard seeds when traders can label fake seed as officially certified.

Quality Declared Seeds (QDS)

QDS may be an important option, for the legumes as well as other crops. It offers low-cost farmer protection and might be considered as a solid 'silver standard' (full certification being the 'gold'). QDS is a risk-based seed quality control system (as proposed by FAO), where not all seed lots are inspected, but only a sample. When lots of certain producers repeatedly fail to meet standards, inspection intensity (and costs) increase. Seed standards may also be adapted to local possibilities and needs. Thus, the goal is to provide sufficient levels of protection to farmers (our customers) while avoiding excessive costs. This should go together with market control to weed out fake seeds and needs to be backed by the laws.

- aims at making more quality controlled seed available to poor farmers
- helps to reduce fake (legume) seed in the market

[5] *Plantum*

- focuses on local seed trade, i.e. does not compete with fully certified seed markets. In case fully commercial certified seed is feasible, policies can avoid possible conflicts

Key Takeaways

- Legumes are important for nutrition security and soil health
- Good seeds are essential for the promotion of legume production
- Legumes require seed strategies different from commercial crops like maize and vegetables
- Official seed quality control rules can be an important impediment
- Quality Declared Seed approaches can be an important contribution in reducing fake seed in the market—and in lowering costs.

Local seed businesses in Uganda, an entrepreneurial way of providing affordable seed to farmers at the last mile

Astrid Mastenbroek[6], Christina Adong and Geoffrey Otim

Local Seed Businesses (LSBs) - farmer groups producing, and marketing quality declared seed (QSD), is a business model that avails affordable seed to smallholder farmers at the last mile. In Uganda QDS is a newly introduced seed class that enables farmers to multiply and market seed of self-pollinated crops. Though the volumes per group are still small, and access to foundation seed remains a challenge, the smallholder farmer customer base has been slowly growing over the past 4 years. The LSB customers are mainly local farmers in areas where they operate. LSBs have a simple business model canvas with 9 components guiding their production and marketing. This tool is particularly helpful for semi-literate farmers. The LSBs have good marketing strategies based on:

- **Product:** they produce and sell what smallholder farmers demand; mostly legume seed. Packaging is done in smaller packs of 1, 2, 3, 5 and 10 Kgs that farmers can afford. The LSBs have good internal quality control mechanisms. In addition, the seed is inspected by District agricultural officers and tested in the National seed lab.
- **Price:** is affordable to the smallholder farmers. Prices are set based on cost of production plus a small mark-up. Seed prices generally lower than for seed companies as the production and processing technologies are relatively simple and labour is mostly provided by LSBs
- **Place:** LSBs have sales points near farmers. Most groups have a joint seed store to maintain quality during the period between harvest and sales.
- **Promotion** of QDS has been on-going through various forums in meetings, gatherings, demos and tradeshows among others and through door to door sales on request.

For coordination purposes, LSBs have organized themselves into zonal associations that support the LSBs in access to foundation seed, inspection services, and bulk purchase of inputs.

[6] *Wageningen University and Research-Centre for Development Innovation*

Comparative analysis of early generation legume seeds production and delivery in seed channels in Tanzania

Latha Nagarajan[7], Richard Jones and Vianey Rweyendela

For a long time, seed systems have been differentiated into formal and informal systems. In many countries of sub-Saharan Africa, "formalization" involves the imposition of internationally accepted seed standards on seed producers that are policed by government agencies. The bulk of seed produced by commercial seed companies that dominate the formal system is hybrid maize where the regular demand for high volumes of fresh seed can support profitable businesses. This model has several flaws that is constraining the development of commercial seed companies and denying smallholder farmers access to a broader choice of crops and varieties that are needed to increase crop productivity and enhance the resilience of farming systems.

First, new varieties are required to be officially released before they can be made available to farmers. When formal seed systems were dominated by government monopolies, a supposedly independent variety release system had some merit, but in the increasingly competitive commercial seed market that is rapidly developing in many countries, decisions on which crops, and varieties can be grown should be left to the farmer, and if seed companies fail to meet farmer needs they will go out of business. Regional seed trade harmonization designed to reduce the need for official release country by country only partially addresses this bottleneck as agreements have yet to be fully implemented.

Variety release disproportionately affects non-hybrid crops, including all legumes, as research and development is predominantly publicly funded, and funds not readily available. If varieties overcome the release barrier, the next hurdle is the need to have seed certified. The imposition of internationally accepted quality standards policed by government agencies adds additional costs to "formal" seed and are largely impractical for small scale seed entrepreneurs interested in marketing packaged legume seed.

In Tanzania, the government has allowed production of Quality Declared Seed (QDS) that has less stringent, and thereby less costly, seed certification costs. However, there are restrictions placed on the marketing of QDS beyond the district in which it is produced.

It is demonstrated that smallholder farmers are interested in and willing to pay for small quantities of legume seeds of new varieties, but once they have the new variety, informal exchange mechanisms meet the demand for fresh seed.

Since 2013, the USAID funded AGRA project on Scaling Seeds and Technology Partnerships in Africa have been involved in promoting sustainable partnerships in accelerating the adoption and access to new seed varieties in SSA. This includes initiatives promoting quality legume seed production and delivery through innovative partnerships with private, public and other organizations.

In this paper we examine the cost structure and impracticability of existing seed regulations imposed on legume seed producers wanting to formalize their production in Tanzania. The cost advantages and dis-advantages that exist across seed value chain actors in two different channels – formal and informal, in producing early generation seeds of pigeon pea and common beans, will be the major focus of this study. Preliminary analysis recommends for more robust, innovate public private partnerships that offer

[7] *IFDC*

flexibility and a wide range of options towards producing alternative seed classes including Quality Declared and Truthfully Labeled seeds for publicly developed legume varieties.

The economics of local seed entrepreneurship: A case study of the Association Song Koaadba (ASK), Burkina Faso

Mywish K. Maredia[8] and Dieudonné Ilboudo[9]

Introduction: Millions of smallholder farmers worldwide rely on their own or other farmers' harvested 'grain' (accessed from the local market) as the main source for seed (i.e., planting material). An advantage of this informal seed system is that it can meet diverse seed needs at lower cost (i.e., at or close to grain price). However, this informal system is not directly linked with the research system, and thus not able to quickly channel improved varieties generated by the research system. It also produces lower quality 'seed,' which reduces varieties' genetic yield potential. This paper presents a case study of a business model developed by a farmer association in Burkina-Faso called *Association-Song-Koaadba* (ASK) that addresses some of these challenges. The business model of ASK involves training its members as part-time seed entrepreneurs to produce quality declared seeds (QDS) of improved cowpea varieties for sale to other farmers.

Objectives: Through this case study we investigate whether, and how the ASK model serves as a conduit in linking farmers to the research system and can meet the need for quality seeds in communities it serves. We also identify the strengths and weaknesses of the model and draw implications for strengthening this model for sustainability.

Method: The case study uses a combination of qualitative and quantitative methods comprised of:

1) Key informant interviews (KII) conducted in 2015 with the staff members of the ASK management team, INERA, the National Seed Service (SNS), the Union Nationale des Production Semenciers (UNPS) and other farmer organizations that purchased seeds from ASK

2) Survey conducted in 2015 of 225 cowpea farmers across 25 villages where ASK is active, including ASK member seed producers (53), non-seed producers (99) and non-members (73). These villages were randomly selected from a list provided by ASK of 58 village with seed producing member farmers and non-seed producing members. From each village 9 farmers were surveyed. In 14 seed producing villages 4 farmers were randomly selected from the list of seed producing farmers, 3 farmers from non-seed producing member list, and 2 farmers were selected to represent non-members. In 11 non-seed producing villages, 5-member farmers and 4 non-member farmers were randomly selected. Data was collected using a structured questionnaire by trained enumerators

About ASK: Established in 1993 with 350 members, ASK currently has about 7000 members, belonging to 72 farmer groups across 58 villages in 7 provinces. Farmer groups pay one-time registration fee of 10,000 CFA (about US $17), then annually each member pays 500 CFA/year (~US $0.85) to maintain membership; Individual farmer members pay 1000 CFA/year (~$1.7). ASK is governed by an Executive Board made up of 12 Board members. There is one annual General Assembly held in which major decisions are made. ASK also has six paid employees that provide technical and managerial support in implementing ASK's activities.

1 *Agricultural, Food and Resource Economics, Michigan State University, East Lansing, MI*

2 *Institut de l'Environnement et des Recherches Agricoles (INERA), Burkina Faso*

The mission of ASK is to promote food self-sufficiency and food security based on the principle of 'self-help,' It achieves this mission by providing following services/products to its members, all free of charge: a) Test, adapt and promote technologies; b) Capacity building (train farmers, trainers, farmer field schools); c) Technical monitoring, inspection and 'certification' of quality declared seeds produced by ASK members; d) Facilitate the purchase and sale of excess seeds produced by members.

Total operating budget of ASK in 2014 was about 70 m CFA. On average 30% of their budget is supported from sales of seeds (20%) membership fees (5%) and renting equipment (5%). The other 70% comes from donor or NGO funded projects and is tied to the implementation of specific activities/services listed above.

Seed business model: Seed activities of ASK encompass crops such as cowpea, millet, and soybean. Most of their seed activities focus on cowpea, although recently soybean seed production is gaining traction. ASK started its activities on cowpeas in 1995 with training and technical support from INERA. The seed business model consists of supporting two systems/channels of seed production and dissemination.

1. *Direct involvement model:* ASK gives the members who express interest in becoming seed producers, foundation seeds (FS) obtained from INERA (at price=2,500 CFA/kg). ASK provides all the technical support/training to these producers in seed production, storage and marketing. After harvest the seed producers pay back the cost of FS. Some of these seed producers register themselves with UNPS to become certified seed producers.[10] However, many them end up producing quality declared seed (QDS). This QDS seed is sold to other members or non-members in the community by the farmers themselves or sold to ASK, who in turn facilitates the sale of these seeds to other farmers or organizations. Since by law, only 'certified' seeds can be sold as seed, the QDS seed is sold by the producers or by ASK as '*seed produced from foundation seed, following seed production guidelines and technical support from ASK*'. Price of QDS seed that channels through this model is set by ASK. In 2014, this was 700 CFA/kg for members and 800 CFA/kg for non-members (compared to price of grain=300 CFA/kg and certified seed=850 CFA/kg). In 2014, ASK was directly involved in seed production through this model in 5 villages. However, in 2016 this number was zero. Thus, seed production through this model varies from year to year and depends on expressions of interest from new farmers to become seed producers or special project funding ASK receives from NGOs or INERA.

2. *Autonomous seed producers:* Once the farmers are trained through the direct involvement model, they become autonomous (independent) seed producers who devote part of their land for cowpea seed production. To these producers, ASK provides only the monitoring and certification service, but not the day-to-day technical assistance on seed production activities. According to ASK, there are about 100-250 autonomous seed producers active in any given year.[11] In their estimate, in 2014, there were about 125 seed producing members who devoted a total of about 80 ha for cowpea seed

[10] The requirements to become a certified seed producer in Burkina Faso are: the seed entrepreneur must devote at least 3 ha of contiguous land area to seed production on a given crop, be trained by UNPS, pay a one-time registration fee of 10,000CFA to becomes a member of UNPS, and pay annual fees to SNS to cover the cost of seed inspection services.

[11] ASK was not able to provide a complete and up-to-date list of these seed producers. In general, there was poor record keeping of cowpea seed production and sales data by the Association. Thus, all the numbers reported are approximations or educated guesses by the ASK management team interviewed by the authors.

production and produced 54 t of QDS cowpea seeds.[12] According to ASK 60% of this QDS seed is sold by seed producers directly to other farmers; 30% is sold through assistance from ASK and 10% is sold or saved as grain by farmers. ASK plays no role in determining the price of QDS seed sold directly by farmers. This price can vary from farmer to farmer and is determined by the local demand and supply factors, and social relationships between the seed buyer and seller.

Key achievements: Through these two channels of seed production, over the past 20+ years, ASK has promoted to farmers several improved varieties of cowpea generated by the research system (*Table 1*). Seed entrepreneurs trained by ASK with the assistance of INERA have produced and sold hundreds of tons of quality seed of these improved varieties to member and non-member farmers. However, the quantity of cowpea seed produced per year has varied over the years and range from as high as 100+ t in some years to no seed production in other years (Table 1). This year to year fluctuation in the quantity of seed produced could be due to the ebb-and-flow of project-driven demand for seed. It may also reflect the supply response by independent small-scale seed producers to fluctuations in the demand for fresh seeds within the local communities where they operate. This (i.e., unpredictable demand for seed) is one of the characteristics of legume seed market, which makes it difficult to sustain the long-term interest of private sector or individual seed entrepreneurs. However, as an Association, ASK has been able to survive these business cycles for over 20 years because of its two-pronged approach. On the one hand, at an individual level, autonomous seed producers may operate their small-scale seed business only for a few seasons or may not produce seeds continuously every year. But as an association, ASK has continued to build the capacity of new seed producers, and kept on replenishing the capacity of communities to meet the seed needs. This direct involvement approach through training new seed entrepreneurs has ensured that as a group of 7000+ member farmers, there are always 100-200 active seed producers who are able to meet the fluctuating demand for seed from year to year. This group dynamics has provided INERA a reliable partner for channeling improved varieties to farmers' fields.

Table 1. Quantity of cowpea seed produced by ASK members, 1997-2014

Year	Quantity (Kg)	Cowpea varieties promoted by ASK
1997	42,000	Kvx396-4-5-2D; Kvx414-22-2; Kvx414-22-72; CR0607
1998-1999	44,500	Kvx396-4-5-2D
2000	12,000	Kvx396-4-5-2D
2001-2003	--	Kvx61-1
2004	3,750	
2007	109,271	Kvx396-4-5-2D
2008	--	Kvx61-1
2009	16,220	Kvx61-1
2010	39,810	

Source: Key Informant Interview with ASK management staff, 2015

Performance of the business model from the perspectives of seed producers and seed users: The case of ASK provides a good example of how a farmer based local seed entrepreneurship model can be combined with a group based technical support and oversight of quality control to produce quality seed of improved varieties generated by a research system. The broad-based services provided by ASK to its

[12] In comparison, as reported by UNPS, the formal sector devoted about 500 ha and produced 300 t of certified cowpea seeds in the country that year. About 95% of certified seeds produced in the country is purchased by the government, NGOs or donor funded projects, and distributed to farmers at subsidized price or free of cost.

members is highly valued and is also one of the reasons for its long-term operation. However, there is much room for improvement as reflected in the following measures of model effectiveness based on the seed producer and seed user surveys.

Main results from the seed producer survey

1. Volume and quality of seed production: The relaxed criteria of requiring only one ha to qualify as a seed producer encourages seed production at smaller scale and is one of the features that promotes broader participation from small scale farmers. However, the survey indicates that only 30% of farmers followed this guideline. Two-thirds of the plots on which seed production occurred were less than one ha. The average quantity of seed harvested per seed producing plot was 262 kg (on per ha basis, the average yield was about 465 kg). On average 20% of harvest was reported by seed producers as rejected due to quality issues related to diseases and low germination rate. The result of small area and high rejection rate is that on average a seed producer harvested a little over 200 kg of approved seed per plot. According to producers surveyed, 36% of seed produced was sold to others; 34% to ASK and 30% retained for self-use. More than 50% of seed producing farmers did not sell any seeds, and among those that did sell, a seed producer on avg. sold seed to about 13 farmers. Some of these numbers on seed production, yield and sales are extremely low and reflects the challenges of the sustainability of individual small-scale farmer-based seed enterprises.

2. Role of ASK in technical oversight: Producer surveys reveal several irregularities in ASK's role in providing technical oversight. For example, about 11% of seed producers reported receiving no monitoring visits from ASK during seed production season, and another 20% did not receive monitoring visits in all three stages of seed production (i.e., planting, flowering and harvesting). This inability to provide the needed technical oversight to seed producers can be a potential reason for inferior quality seed produced. On the positive side, most seed producers reported receiving the high-quality foundation seed in a sealed bag from ASK in a timely manner before planting.

3. Cost of seed production and seed price: On average cowpea seed production costs were reported to be about ~50% more than the cost of cowpea grain production. But rejection of seed due to quality issues potentially increases the unit cost of producing the 'seed' much higher. The average price at which seed producers sold their harvests as 'seed' to others was 480 CFA, which was about 60% more than the average cowpea grain price.

Main results from seed user survey (ASK member and non-member farmers):

1. Volume and frequency of seed purchase: 70% of members and 30% of non-members in the 25 villages surveyed reported having purchased seed from ASK in the past. They purchased on average 5.6 kg seed and 90% paid cash. The last time a farmer purchased seed was on average 3 years ago.
2. Sources of seed planted: 77% of cowpea plots were planted to own saved seed; 14% to ASK seed; 6% to seed purchased as grain; and 2% to seed purchased in the market or received for free.
3. Use of improved varieties: As reported by farmers, 35% of cowpea plots surveyed were planted to an improved variety (IV). This average figure across the 25 villages may seem lower than expected given that ASK has been active in this area for many years. However, this is a significantly higher percentage of adoption of IV compared to 10% estimated for the whole country in 2010 (DIIVA report).
4. Perceived advantages and disadvantages of ASK model: Proximity of the seed source and timely availability of seed were cited as the main advantages of the local seed producer model promoted by ASK. On the other hand, uncertainty about seed quality was cited as the main disadvantage. Farmers

that reported never purchasing seed from the local seed producer also cited 'unknown seed quality' as the main reason.

Key insights gained:

The presence of ASK in the communities it serves has brought several benefits to the community, including: a) access to several improved varieties of cowpea generated by the research system; b) access to quality seed; and c) timely availability of seed for planting. It has also given opportunities to hundreds of farmers to get training in quality seed production for sale to others in the community. However, the seed producer and user surveys indicate several challenges that need to be addressed to increase the effectiveness of this model. Top among these is the need to enhance small-holder farmers' ability to grow seeds that meet quality standards. Increasing the yield of cowpea seed that meets quality standards is key to lowering the price of seed, to increase the quantity and frequency of fresh seed purchase by farmers, and still make it profitable for small-scale seed producers to remain in the seed business.

SESSION III

SEED COMPANIES, CUSTOMERS, AND REACH

Delivery of Legume Seed at the Last Mile: Theory and Practice

Charity Hanif[13] and Louise Sperling with contributions from an external Advisory Group

---

For about the past 15 years, several donors have increased the investment in varietal and seed technology development and other agricultural input innovations. There has been recognition among donors and implementers that the results of the research and technology development efforts are still not reaching farmers at the scale and breadth desired for reasons that include issues of access, availability, quality, and adoption. As a result, the last 5-10 years, have seen numerous donors and implementers (private sector and non-profit actors) actively test and implement varied delivery models, and strengthen potential delivery systems; an intention to address the access issue of farmer adoption.

Much of this input delivery investment has been on maize seed (especially hybrids) and fertilizer dissemination and distribution channels. Significant questions have emerged within the broader implementing community to understand better the technology distribution and dissemination experience to date, as well as the relevance and opportunities that may exist for other technologies to move through those channels. In addition, these experiences (models/channels) need to be understood in their context – their reach, the volumes moved, their replication, the supporting or inhibiting enabling environment, the incentives for the key actors, and the characteristics of the products moved. Unfortunately, the investments and interventions have been focused on the supply side, and the documentation and understanding of their reach and customer segments have not received the same level of attention.

Donors, the development community, and those actors in the formal seed sector generally categorize 'smallholder farmers' as one broad customer segment. As noted previously, most of the commercialization experience has been with maize. It isn't known if a more nuanced customer segmentation for maize exists. However, in practice, because hybrid maize is most often promoted, the smallholder customer is seen as one who needs improved varieties and certified seed—as a package—and one who buys sufficient seed for the entire area to be planted, every time sowing takes place.

Legume seed customers, in contrast, seem to be a great deal more diverse. Review of the specific experience with delivery models, and especially of the broader seed system literature, suggests that farmers are buying legume seed for quite diverse reasons.

There are at least six legume segment customers, representing different purchasing patterns, required value propositions, and outreach/marketing strategy opportunities. Those segments are – those that want access to new variety; need seed to feed into discerning cash or value chain market; sell own seed/grain stocks for quick cash and routine rebuys; sell own seed/grain stocks to shift risks of storage; need to renew seed due to deterioration; lost seed due to stress-tolerant, emergency, or poor harvest conditions. It is key to learn about these customer segments and tailor the commercial delivery pathway and business model to each. Farmers' buying seed to access modern varieties or to link to a well-defined value chain are basically the only two client groups addressed by major donor and formal sector strategies

---

[13] *Independent Consultant*

to date. However, in terms of people number and volumes moved, these two client groups are likely to be the smallest. Further customer work is needed to not only better understand the relative scale of each segment, but to develop customer focused seed delivery models. Obviously, these broad categories will differ some between legume crop type, location, and planting period, but the framework has heuristic value for suggesting that there are diverse client segments contained within the single rubric of 'smallholder'.

There have been significant advancements in developing commercial pathways for maize seed and associated inputs, specifically fertilizer, over the past decade. Much less specific support has been focused on legume seed, even though there is an increasing focus on legumes (especially given their role in nutrition and soil enhancement). An alternate vision is needed for commercial delivery of legume seed based on the expanded customer segmentation and the unique characteristics of the legume technology itself. While analysis and consideration of the existing general seed technology commercial delivery models offer some insights and experience, it is important to be aware of the limited relevance of such models, mostly focused on moving maize seed and other agriculture technologies.

There are 7 current commercial pathways or models delivering legumes to smallholder farmers to some extent; although, these models are primarily moving maize seed and other technologies; these are:[14]

Commodity Traders
Community-based Seed Producers
Agrodealers
Village Based Advisors (Private Service Providers)
Seed Company Agents
Supply-chain facilitated access
Integrated service via Social Enterprise

The commercial delivery models supported by donors and development professionals focus on the formal seed sector (all the above to some degree - except for the commodity traders), and the customer segments that represent a relatively small volume of total legume seed purchased. In addition, the emphasis has been on the formal seed supply, with investment linked to certified seed bottlenecks that rely on availability of breeder and foundation seed as well as new varietals. With 64% of all legume seed acquired from local markets as 'potential seed'; and only1% from commercial pathways (McGuire and Sperling), learnings from formal seed systems may be of only limited relevance to scaling commercial delivery of multiple crops.

Certified seed and QDS seed, the current 'gold' and 'silver' standard qualities on the market, are offered at varied price points. Considering the price of seed over the price of grain may be a useful ratio for categorizing the current seed offerings available to customers. Because of the relative small volumes still purchased from the formal sector, it isn't clear that these higher price levels reflect the willingness to pay on the part of the broader customer market. In addition, there is a need for research and evaluation to understand if the value obtained by the farmer customers of the certified seed is delivery results over and above the potential seed at a rate that warrants the significantly higher price.

[14] Each model is briefly discussed in the subsequent section. More information on the models and examples of programs can be found in the accompanying literature review.

It also appears that most of the legume seed businesses that have some sustained commercial sales to farmers (through one of the commercial delivery models above or direct to farmers) are in higher potential agroecological legume zones. While this makes commercial sense for supply management in terms of seed multiplication, the assessment found that many of the commercial sales are also located in these higher potential agroecological zones. While some grain legumes are particularly suited to higher agro-ecological stress zones, such as cowpea, most of the examples of legume seed businesses with sustained commercial sales had those sales (where farmers purchased seed and not receiving seed through other institutional programs) in common bean (bush and climbing, depending on the market).

The enabling environment is another driver of the business model development. There are two key enabling environment issues, free seed and seed supply related policies and regulation.
Current interventions and support for seed system development have been supply driven and focused almost exclusively on the 'gold' standard, or certified seed supply. This is the seed that is most often available in the market at between 2-5times the grain price (while most legume seed are purchased at only 30-50% over the price of grain.)

Due to the enabling environment constraints and emphasis on supply, programs are only working with new varieties. There is no formal work on 'cleaning up' existing popular varieties or offering quality seed of existing widely produced varieties. The enabling environment plays a role here as certified seed and QDS can only come from breeder seed and foundation seed out of research. Quality seed of existing varieties may offer very interesting value to at least some of the larger volume customer segments.

Finally, in considering the experience within these models there doesn't appear to be a market focus within these delivery model development or support programs. They are supply push focused on seed need estimates within the country assuming all legume producers 'need' access to the new varieties for the full acreage they plant. A customer focus is needed by the enterprises and more realistic market segmentation and market sizing is necessary.

The programs also appear to reinvent the wheel with each new launch; starting channels from scratch. The consultations and review of available literature presented a complete absence of channels utilized for piggybacking commercial delivery. For instance, there have been no attempts to utilize alternative rural enterprises or to piggyback through the informal seed channels. There is an underlying hypothesis though that once these new channels are established (for cereals, legumes, or other ag inputs) that other crop seeds, ag products, inputs, or varieties will move through these channels in the future. Yet each time, programs made little to no attempt to build upon existing multi-functional channels into those communities.

So much of the existing legume commercial delivery experience is of limited timeframe, is focused on moving other crops (particularly hybrid maize) or is of very limited scope (located in high potential agroecological zones, as an example.) The investments and interventions are largely tackling the important formal seed supply side challenges and opportunities with very little to no analytical consideration of; nuanced customer focus; or existing markets selling majority of legume seeds. Due to the supply focus and in some cases enabling environment constraints, all the investments and interventions are prioritizing only new or recently released varieties. As such, metrics and evaluations are

focused on metric tons of seed produced and 'in some way' moved into the hands of farmers generally (regardless of pathway.) Significant gaps remain between the theory of legume seed access and commercial delivery and the implementation and experience in the field. The relevance of the existing limited experience to legume seed and to the objectives of the donor and development community is yet to be proven.

Legume Seed Business – Drylands Experience

Ngila Kimotho[15]

Dryland Seed Ltd's (DSL), an emerging private seed company, based in Machakos town, Kenya producing legume certified seed under license by KALRO, has been interfacing with small scale farmers in this region at varying capacities.

Legumes seed production in the arid and semi-arid regions (ASALs) in the lower eastern region of Kenya has been mainly dominated by Bean, cowpea and green grams. Seed sourcing by the small holder farmers, who are the main producers of the legume crops, has been from the local grain stores within the farmers reach. The quality of seed from these sources is not determined and thus the seed germination and seedling vigor depends on chance. As a result, many farmers end up doing multiple planting sessions which increases cost of production, leads to non-uniform crops, and low yields due to late planting.

Differences in strategy between maize seed and legume seed in general— as a business

Over the years, maize breeding has been given more attention than other crops. This is because maize is the most widely cultivated crop in Kenya, given its importance for food security. Also, the productivity of hybrid maize declines significantly whenever seed is recycled, unlike beans and cowpeas that are openly pollinated. This ability to recycle lowers demand for bean and cowpea seed, thereby discouraging investment in legumes.

In terms of seed rate per acre, more seeds for beans is required (16 – 20 kg) unlike maize, which is usually 8 – 10 kg making production of legumes more expensive than maize. In Kenya, the cost of purchasing maize currently is Kshs. 350.00 per 2 kg packet, whereas, for legumes the same packet size cost about Kshs. 500.00. Moreover, the rate of returns per acre for maize is higher 20-30 bags as compared to legumes which ranges between 4-9 bags.

Cowpea versus beans

Cowpea is well known for its ability to withstand adverse weather conditions like drought and extreme heat areas compared to beans, making it a more preferred choice in wider locations. In the farmers view, beans earn more returns per unit sale when compared to cowpea because the farm gate selling price for beans is always higher than that of cowpea.

DSL customers

Green gram – since most of regions in Kenya are ASAL this legume is preferred by small scale farmers and NGOs due to its ability to withstand drought conditions as well as its high nutritive value.

Cowpea – the varieties offered by Dryland Seed Ltd (M66 and K80) are drought tolerant and are preferred by small scale farmers as well as institutions such as NGOs, because it can be used both as a trade commodity as well as food security crop.

Beans – customers are usually agro-dealers and small-scale farmers, because of its high nutritive values, and low production and maintenance costs during favorable conditions compared to the other legumes. This is attributed to its higher productivity per unit area when compared to the other legumes.

[15] *Dryland Seed Ltd.*

Institutional Buyers vs Individual Buyers - Shares

Year	Individual buyers (MT)	NGOs (MT)	Individual buyers (%)	NGOs (%)
2015	149	26	85	15
2016	89	31	74	26
TOTAL	238	57		

Meeting Customer Needs

During farmers training in the demonstration plots, field days and exhibitions, Dryland Seed Ltd usually interacts directly with its customers. The participants usually express their needs and feelings about certain varieties. To address customer feedback and issues, mostly negative ones, DSL provides technical advice to them through its several sales agronomies.

Production strategy

DSL contracts out- growers with 5 acres and above per farmer either individually or within a cluster or group.

Marketing strategy

- DSL channels its legume seeds to the customers mainly through trained agro – dealers
- Demonstration plots are established in strategic areas showing attributes of certain products
- Field days and exhibitions – after maturity of the crops within the demonstration plots, a field is usually organized and farmers who attend the event are trained on the products.
- Small packs – use of affordable seeds packed in 100g, 250g, 500 g and 1 kg to introduce the products to the market.

DSL customers

DSL markets the legumes geographically irrespective of which legume- Eastern, Western, Nyanza, Coastal, Central and North Eastern Kenya.

Strategies to extend DSL reach

- Radio and TV adverts
- Reflections on how to extend geographic reach
- Increase general legume seed production and improve distribution as well as making the seed available to the farmers at the grass roots

CEDO legume seed credit model

Charles Katabalwa[16]

Community Enterprises Development Organization (CEDO), is an indigenous agro development agency, that began in 1995 as a community-based seed producing group with a goal of empowering the impoverished small holder farmers by providing them with a source of income while improving household income and nutrition security. The intervention began with one group comprising of thirteen farmers. Production was from one variety of K132, the yield was 900kgs in 1998, since then the number of varieties has increased to thirteen (13) and production has increased to 389 tons annually while the farmer outreach is at 20,908 small holder farmers.

Beneficiaries in the community were drawn to our seed production program because we use an agreement/contract farming technique, access quality seeds, and offer premium prices. They can access seeds and inputs through their group production committees at the start of the season with no upfront costs. The price of the seeds is deducted from the payment given for the new seed at the end of the growing season with support from the marketing committees that guide the members with the pre/post-harvest processes. In this way we were able to build our seed production program within the community quickly, the intervention is reaching 20,908 farmers with 1,771 acres being planted annually.

Since 2000, our model attracted the attention of the National Agriculture Crops Resources Research Institute (NaCRRI). NaCRRI now partners with us to provide new bean seed varieties that are high yielding yet quick maturing, market preferred and stress tolerant for multiplication and distribution alongside the technical package on cost effective crop management practices. However, this was development intervention to support small holder's farmers to improve their livelihoods. This partnership supports our program to improve the diets of the community with higher nutrient dense beans as well as increasing our overall seed output with higher yielding varieties.

In 1997 we also partnered with the International Center for Tropical Agriculture. CIAT provides improved bean seed varieties that are of market class and nutrient dense, support in establishing learning sites, as well as brochures and manuals to support our various programs with information and communication messages. They also assist us with market information, linkages and surveys to help track our impact in the community.

In 1997, with increased volumes of bean seed, CEDO partnered with Lutheran World Relief who provided a bean seed processing facility with a destroner, gravity separator, dresser and quantity machine. This has seen the improvement in quality of seed and timeliness of satisfying orders. Both partnerships link us to other organizations for funding support and access to agricultural information and communication messages.

In Uganda, in the 1990s, bean seeds supplied through the formal system exhibited low quality e.g. low germination, low yields, and admixes. Smallholder farmers who formed the bulk of bean producers had limited access to quality seed of improved bean varieties.

In 2005, as demand of quality bean seed increased, CEDO opted to venture into bean seed production and multiplication as a seed company as opposed to a community seed producer group. This enabled us to tap into the premium price offered for bean seed and engage with other bean seed value chain actors.

[16] *CEDO Seeds*

Using the initial skills, the production costs remained lower and efforts were also geared toward enhancing capacities of the farmer seed producers under contracts. Wider dissemination of information during field days, participatory variety selection, seed fairs and exhibitions as well as use of small packs enabled access to information and viable seed to remote small holder farmers. To make our seed program self-sustainable we developed CEDO Seeds. This branch functions as an independent for-profit which in turn supports our not-for-profit programs. The goal is to make our seed program fully independent so that we can use external funding for additional programs aimed at improving our community.

The participating members have been able to improve on the four capitals of the value chain of: (1) human capital their capacity has improved regarding good agronomy practices and skills in records keeping and contracting, (2) social capital changes in regards to agreements, establishment of technology transfer centers and quality observance, (3) financial capital access to pre-finance during production at affordable interest rates, linkages to premium price that has bearing on income and profits, and (4) physical capital where beneficiaries have been able to construct permanent houses and business premises, as well as acquire tools, fixtures and fittings.

NaCRRI provided CEDO with high yielding, quick maturing and stress tolerant varieties of NABE15, 16, 17, 19, 23 and biofortified varieties of NARO BEAN 1, 2 and 3. These enabled a shift in the total volume produced from 90 tons to over 389 tons annually. They also provide information and communication messages and technical expertise in good agronomy practices. CIAT supported us with informational materials on bean pests and diseases, small packs that saw the small holder farmer's access over 150tons of improved high yielding yet tolerant to stress bean varieties and introduced value addition. The crop yield is 1-30kgs as opposed to 1-9kg initially while the information messages have enabled the small holders constantly reflect on the appropriate agronomy practices.

Our success shows that by using partnerships with national and international organizations and creating a good reputation within the community for supply of viable seeds, it is possible to develop a self-sustaining seed program. This program can not only provide access to household income for the impoverished, but it also opens the door to spread other valuable information like nutrition, sanitation, and good agronomic practices.

Our programs support human, social, physical and financial capitals. Human capital is increased through the dissemination of knowledge on safe handling of agricultural inputs, record keeping and contract management. Our smallholder farmer partners increase their social capital through the farmer group memberships required for access to our seed contracts. For physical capital many smallholder farmers have been able to develop their homesteads because of our partnership. The farmer groups with which we partner have been able to establish permanent post-harvest handling structures as well as access better tools, fixtures and fittings. Financially, our partners have seen an income increase from USD50 to USD356 annually due to premium prices offered. There is also easy access to credit through links to financial institutions and pre-finance options directly from CEDO. Our success is manifested in the development of these four capitals.

CEDO seed production increased from 149.1 tons in 2010 with only two varieties released in the 1980s to 398.1 tons with 13 varieties released after 2010 in 2015 and marketed through 10 agro dealers using small packs, Village Enterprise Agents and open daily markets. Five agro development agencies are engaged with CEDO SEEDS for production and dissemination of improved bean varieties. This demonstrates that through technical support, capacity building and continuous linkage with research organizations, a farmer-based seed producer group can evolve into a national seed company.

SESSION IV

SEED COMPANY SUPPORT

Incentivizing Businesses to Commercialize Seeds for Smallholder Markets – Marketing & Distribution

Brenna McKay[17]

Feed the Future Partnering for Innovation's Model

Feed the Future Partnering for Innovation helps the private sector enter new markets and commercialize agricultural innovations for smallholder farmers though investment and knowledge exchange. The program reduces the risk for commercial entities to move into or expand in smallholder markets by providing the initial capital needed to enter these markets. Partnering for Innovation negotiates investment installments with partners based on partners' meeting businesses goals that contribute to increasing sales. Such partnerships with seed companies contribute to formalizing commercial seed markets in emerging markets.

Partnering for Innovation targets seed investments at two key critical stages of commercialization; first, at the production stage to ensure sufficient volume and quality of production so there is seed available in the market; and second, at the marketing and distribution stage to generate knowledge, demand, and access to seed. Each partnership is uniquely designed to consider company capacity, market demand, and country context. For the purposes of the event - New Models for Legume Seed Business, we will focus on marketing and distribution through bundling. Bundling is one model among many for improving distribution and sales to smallholder farmers in remote regions and with modest purchasing power. We will begin by focusing on bundling, presenting cases where bundling is being tested by Partnering for Innovation partners, and then share examples of other innovative distribution models.

That said, it is important to understand two important aspects of Partnering for Innovation's investment model that allow USAID to develop and manage public private partnerships that strengthen formal market systems that benefit smallholder farmers:

- **De-risking market entry:** A major component of Partnering for Innovation's overall approach is to reduce the risk of entering smallholder markets. Despite the size and potential of smallholder markets, they are often targeted for sales by companies, which are uncertain about the returns on entering these markets. Partnering for Innovation's approach accelerates companies' entry or expansion in smallholder markets. Partnering for Innovation's investment absorbs some of the company's risk by providing early-stage financing, allowing the company to operate at a loss or smaller margins for a brief period while building its capacity to market and distribute to these hard to penetrate markets.

- **Refining business models:** Partnering for Innovation also provides expertise on commercializing agricultural products in smallholder markets. Having a quality, affordable product that is smallholder-appropriate is not in and of itself sufficient to sell in smallholder markets. Companies must understand the unique characteristics of this market and the various approaches to efficiently operating in them. Partnering for Innovation develops resources and facilitates strategy development that help companies learn about different business models for operating in smallholder markets, from production to marketing and distribution. To successfully commercialize seed in smallholder markets, companies must understand efficient ways to produce seed and the most effective method of last

[17] *Feed The Future Partnering for Innovation*

mile distribution, and this often requires innovative distribution models like bundling seed with fertilizer or advisory services.

What is Bundling?

Bundling is a product delivery and marketing strategy that packages, delivers, and markets two or more complementary products together. Companies see little incentive in selling small volumes of low-margin products, as the high mark-up necessary to turn a profit makes products unaffordable to the low-income segment. Smallholder farmers, in turn, lack access to products and services that could potentially increase their livelihoods. Reducing the costs of bringing the bundle to market makes the bundle more affordable for low-income segment customers.

For companies, the reduced price point and greater product margins enable them to penetrate new, low-income market segments. Bundling can also significantly reduce distribution costs by reducing the number of deliveries, amount of necessary inventory, and other logistical expenses. Establishing a single point of sale for the bundled products, particularly if it is close to where the farmers live, greatly reduces marketing and retailing costs.

For smallholder customers, bundling packages complementary goods and services that farmers might not purchase or easily afford individually, but when bundled, increases the benefit to cost ratio of larger purchases. Bundling often combines intangible services like training or crop insurance with tangible products like seed, accelerating customers' uptake of the bundle and its impact. These goods and services often generate benefits in different time horizons, increasing customers' focus on the short-term benefits of inputs while also providing the valuable long-term benefits of increased knowledge or security.

Additionally, engaging a single point of sale for multiple products lowers a customer's transaction costs and fosters a stronger relationship between customer and vendor, allowing for a higher touch relationship that can provide benefits like training, education, and after-sales support.

For bundling models to work well in the seed and other sectors, there must be latent demand for the bundled product and service to avoid costly demand stimulation via marketing, and price points must be attractive. Selling the bundle through trusted, knowledgeable, and easily accessible vendors increases the effectiveness of bundling.

What are Promising Examples of Bundling for Last Mile Delivery?

Several partners are exploring bundling as a way of distributing their product to last mile markets. In Kenya, the fertilizer company MEA is increasing its production of Biofix, a legume inoculant that increases legumes' natural nitrogen fixation, and has recently partnered with seed companies to bundle Biofix with legume seed. Additionally, bundling legume inoculant with legume seed enhances the performance of the seed, as well as, demonstrating the value of the inoculant. Agro-Input Suppliers Limited (AISL), which is commercializing a similar product in Malawi, is also exploring the seed and inoculant bundling model. Though it has not yet implemented this model, it may prove to be a simpler process for AISL, since unlike MEA, AISL is itself a seed company.

In Mozambique, few agro dealers exist, so seed companies Lusosem and Phoenix are developing a network of farm business advisors that can market and distribute certified seed in rural areas. Along with seed sales, these farm business advisors provide advisory services to smallholder farmers who purchase seed. The farm business advisors are compensated by charging a markup on the cost of the seed. By bundling advice on using the certified seed with the seed itself, and delivering the seed to the farmer, these companies are providing added value and ensuring that seeds are used in a way that maximizes their effectiveness and therefore their appeal to customers.

In Kenya, Partnering for Innovation is developing training videos for agro dealers selling Strigaway, an herbicide-resistance maize seed that suppresses the growth of the invasive weed striga. A recent in-depth survey of partner African Agriculture Technology Foundation and the seed companies it is working with in Kenya to commercialize Strigaway showed that agro dealers selling this new seed were not well-versed in the benefits of the seed and how it works to kill striga and were therefore not promoting the seed to farmers whose fields were being decimated by this noxious weed. Once agro dealers are trained, the seed companies will be bundling sales of Strigaway seed with advisory services provided through the agro dealers, increasing first-time and repeat sales.

Scale and Sustainability

Bundling reaches scale by driving enough sales such that total returns on the bundled product and services are greater than the cost of building or maintaining a distribution network and the cost of training sales agents. Using bundling to scale is cost-effective because it controls cost metrics like total distribution network costs and cost per point of sale, and by maximizing sales and bundle margins. Scaling strategies can include bundling greater numbers of products and services together, driving a greater number of sales through existing points of sale, and expanding to new geographies. Finally, bundling achieves financial sustainability by moving sufficient sales volume to generate positive returns for the product and service provider, the distributor and retailer, and for the sales agent. Partnering for Innovation's partners are refining the bundling model to contribute to their long-term financial sustainability.

Other Innovative Distribution Models

Of course, bundling is only one potential model for last-mile distribution in smallholder markets. Phoenix Seeds in Mozambique is expanding its reach into rural areas by developing input hubs that are located closer to farmers and that can supply additional, smaller hubs reaching even more rural areas in a timely manner. Read more about this model on the AgTechXChange. Export Trading Group (ETG), also in Mozambique, is building hubs that provide warehouse storage, access to inputs (including seed), and mechanization services all in one place. Storage facilities and agricultural input shops were previously prohibitively far from farmers in the areas where ETG is building these hubs. By creating one-stop-shopping hubs, ETG is streamlining distribution of its products and services and increasing its presence near customers to which it previously did not have access.

Some companies are trying a model of last mile distribution where they train entrepreneurs to be distributors of their product or service in the entrepreneurs' community. The Metal, in Bangladesh, is commercializing small-scale reapers that dramatically increase the efficiency of harvesting rice. To reach customers in rural communities, the Metal recruits and trains local service providers who purchase a reaper and then provide reaping services to farmers in their community for a fee. This ensures that

farmers who cannot afford to buy a reaper themselves and may be located far from The Metal's distribution centers, still have access to needed reaping services that make harvesting far more time and cost efficient.

Summary

Examining several cases of bundling next to other innovative distribution models provides some understanding of how each country's context – from population density and the maturity level of agro dealer networks to the existence of government seed subsidy programs – will affect the relevance of a distribution strategy. In the meantime, potential gaps to fill include:

- Providing knowledge and information that support businesses' understanding of country context for designing distribution models that respond to those contexts. This requires funding and research into enabling environments and distributing findings from that research to those working to reach the smallholder market.
- Additional donor funding for de-risking company entry or expansion into last mile markets has a greater potential for long-lasting accessibility and affordability of productivity-enhancing seed technologies than conventional donor program funding. It will also directly support formal markets rather than informal markets that tend to have lower quality products and services (e.g. recycled seed) and counterfeit inputs, both of which affect improved seed sales.
- Ensuring that production meets demand is very important to justify marketing expenses. After all, there is little business incentive to market a product if it cannot be accessed by the customer to whom companies are marketing. Marketing tools like demonstration plots and farmer trainings are not worth the expense if agro dealers are unable to stock the seed on their shelves.

It is difficult to find a silver bullet model that works for every seed business in every country. The best model for a given company will depend on the country context, the company's internal production and marketing capacity, and the company's ability to build trust with rural risk-adverse farmers.

Building Stronger Legume Seed Markets: How AgResults is using pull mechanisms to create a legume seed market in Uganda

Parasto Hamed[18]

Legumes are high-impact crops that have positive impact on income, nutrition, and soil health for smallholder farmers and their farms. Despite their potential for impact, because of the high amount of time, food, and money required to purchase, clean and cook legumes, consumers in Uganda often opt for cheaper, less healthy alternatives. Furthermore, farmers often opt for high-yielding crops that provide quicker return on money. Because of this lack in both consumer demand, and farmer supply, seed companies often opt to not produce or sell quality legume seeds, regardless of their potential to have impact on the health and economic outcomes for smallholder farmers.

To address these gaps, AgResults initiated a five-year project designed to incentivize seed companies to increase their participation and focus more resources on the legume seed market in Uganda. The Uganda Legume Seeds Pilots employs a results-based pull mechanism that uses annual, proportional monetary prizes to seed companies who increase legume seed sales while providing the necessary working capital to allow companies to reinvest and grow their business year over year. The project requires seed companies to join a private sector seed certification consortium that will certify quality legume seeds. Only legume seeds sold that have passed private sector seed certification will be counted towards the sales thresholds that trigger the monetary prizes.

Pull mechanisms, also referred to as prizes, prize competitions, pay-for-success, or pay-for-results, offer donors a model in which they can harness the private sector's innovation and ingenuity to find solutions to societal challenges. Donors offer a prize, or prizes in certain cases, to companies to solve a problem. The method used to solve the problems at hand is entirely up to the participating companies, as long as they reach the predetermined goal(s).

The pull mechanism model allows donors to efficiently use their funds. By incentivizing the private sector actors, donors can partner with the private sector to enable entry into markets they usually would deem unattractive. Additionally, because prizes are only given once the desired goal is reached, donors can make sure funds are only used in service to finding solutions. If no solution is found, the funds can be allocated to some other purposes.

The AgResults Uganda Legume Seeds Pilot will incentivize the private sector actors to promote certified and quality legume seed varieties in order to provide a number of important benefits including - increased yields for farmers due to seeds that are more tolerant to diseases and drought; potential increases in net income for farmers in part resulting from diversification of crops; improved soil health; and an increased source of low cost, reliable protein for all Ugandans.

The Uganda Legume Seed Pilot was originally designed under the understanding that because of constrained breeder capacity, seed company reluctance, poor distribution networks, consumer risk aversion and affordability concerns, and unreliable output markets, farmers' access to improved legume seed is significantly limited. Most importantly, risk averse and conservative seed producers are key barriers to increasing farmer's access to improved legume seed. Seed companies in Uganda produce a

[18] *Field Coordinator, AgResults*

limited amount of legume seed and instead tend to focus on the more reliable hybrid maize market. Legumes can, however, play a key role in seed companies' portfolio. Production of legume seeds improves asset efficiency because they can be produced before the start of the maize season, meaning there is little associated opportunity cost. Inclusion of non-maize crops in the product portfolio also provides a source of diversification. That said, Ugandan seed companies tend to be conservative, and tend to undershoot demand for legume seeds rather than risk overproduction.

Therefore, the original pull mechanism centered on the use of a volume guarantee for improved legume varieties to address the key challenges of demand uncertainty and limited working capital; this in turn facilitates increased production. A volume guarantee assures the purchase of a certain volume of product at a set price; in this case, AgResults would guarantee the purchase of a set volume of improved legume seeds at a pre-specified price. For seed companies, this has two important benefits; 1) it places a floor on seed company losses, which limits the risk of overproduction; and 2) the second is that these guarantees can act as collateral, serve as a basis for companies to obtain bank financing. Under this scenario where companies face lower risk, they will be inclined to expand production so as not to 'leave money on the table.'

In addition to the volume guarantee, there is a proportional end of pilot prize that encourages seed producers to increase sales as much as possible. While the volume guarantee creates the conditions for seed companies to grow their sales in and of themselves, a proportional prize awarded at the end of the five-year pilot provides an additional incentive.

The Uganda Legume Seed pilot however has had to make modifications to the original pilot design described above. The pilot was originally designed to intervene in the legume seed marketplace with seed companies to combat demand uncertainty from farmers for legume seed. This design assumed that providing a volume guarantee, which would protect seed companies against losses created by excess inventory, and provide a proportional, end-of-pilot prize to increase seed companies' revenue and ultimately incentivize them to more aggressively produce and market legume seeds to farmers.

While the original design addressed the demand issue facing seed companies, we realized it failed to account for seed quality uncertainties that hindered farmer demand for legume seeds. The Uganda National Seed Certification Service (NSCS) lacks the current capacity to fully monitor the legume seed market, resulting in widespread counterfeiting and ultimately fear of purchasing counterfeit seeds by the farmer.

Given this, AgResults has therefore redesigned the pilot so that the intervention in the value chain focuses on both demand uncertainties. To address the demand uncertainty caused by the seed certification, we have contracted AgVerify, a private-sector seed certification consortium that runs a self-monitored, audited, and independently verified system that certifies seed in Uganda to internationally recognized seed standards such as COMESA and ISTA.

Additionally, because of the potential for wasted seed due to the volume guarantee, AgResults decided to replace the volume guarantee with guaranteed cold storage. The pilot rents, subdivides, and subleases refrigerated storage containers with a capacity of 20 – 60 MT. Seed companies then pay for the space they use to store unsold seed from one season to the next, making it possible for them to store seed without leasing an entire cold storage container. Furthermore, companies can use the stored seed as collateral to access short-term loans from commercial banks until the seed is sold. Guaranteeing cold storage will

prolong the seed shelf life while maintaining quality. This would enable seed companies to preserve their value added until the next season.

To determine the issues in demand uncertainty, we used several studies including the Seed Demand Study by the Uganda Bureau for Statistics, Uganda National Agricultural Policy (2014), Uganda National Seed Policy (2015), UNDP Uganda, Uganda Beans Value Chain Report (2014), and Gatsby, Boosting Ugandan Beans Production.

The pull mechanism requires a rigorous verification process to ensure success. There is a risk that seed companies will attempt to take advantage of the volume guarantee and/or misrepresent their performance to claim the end of pilot prize. Verification should both discourage companies from fraudulent behavior and serve as the basis for disqualifying those who breach the terms for continued participation. Verification will assess a company's production, marketing, and unsold stocks of the volume guarantee seed to ensure that they are participating ethically. In addition, marketing efforts will be verified and sales to farmers monitored to ensure that seed companies are directing their efforts towards increasing sales to farmers themselves.

AgResults is a US $122 million multi-donor initiative between the governments of Australia, Canada, the U.K. and the U.S. as well as the Bill & Belinda Gates Foundation to incentivize and reward high-impact agricultural innovations that promote global food security, health, and nutrition and benefit smallholder farmers. The initiative employs innovative finance mechanisms known as pull mechanisms that provide monetary prizes that incentivize private sector actors to overcome market barriers that hinder them from entering into markets that serve those living in poverty. The initiative is currently running six pilots in Kenya, Uganda, Zambia, Nigeria, Vietnam, and one globally.

SESSION V

INTEGRATED MODELS FOR SCALE/LAST MILE

Reaching the Last Mile: PABRA's Experience

R. A. Buruchara[19], J. C. Rubyogo, L Sperling, E.K. Maereka, S.M. Kalemera and I. Obilil

Introduction

Beans, an important food crop in east, central and southern Africa, is increasingly becoming a cash crop with farmers keen to invest in production inputs, including quality seed. Informal sources continue to supply the bulk of the seed (about 95%) used in bean production. In Uganda, for example, informal sources provide seed for 89% of the farmers (ISSD, 2014). With no single solution, farmers use diverse ways to access (buy) bean seed. For each channel of choice, there is a major reason (Sperling and McGuire, 2010), advantages and disadvantages that may be related to quality (Almekinders and Louwaars, 1999), and geographical coverage (Rubyogo et al. 2010). The Pan Africa Bean Research Alliance (PABRA) partners have spearheaded efforts to improve access by farmers of quality bean seed, by catalyzing innovative approaches and exploiting synergies of various actors and sources (formal and informal) to ensure seed reaches the end users. This article highlights cases that illustrate multiple approaches or strategies that PABRA supports to enhance farmers' access (buy) of bean seed.

A. Farmer access of certified seed (new and old varieties)

Seed companies are still a limited direct source of bean seed to small scale farmers. However, those that market bean seed sell to NGOs or Government seed operations. This is because this tends to be costly and/or is sold in large package (50kg) sizes, or not easily accessible to small scale farmers, due to limited seed distribution network of this type of seed. Targeted bean seed marketing approach using small packs (one kg and less) is an innovation to overcome the above challenges. Initiated in Kenya in collaboration with private companies under the Tropical Legume II project, the approach has used various sale strategies e.g. agro-dealers, open market and seed fairs/agricultural shows to enhance access, affordability and efficiency by (a) allowing farmers to test multiple varieties at minimum risks; (2) allowing vulnerable but viable farmers including women and poor to purchase quality seed of the varieties of their choices; (3) allowing seed companies to create demand widely and fast; (4) allowing companies to penetrate lower income farmers. In Kenya some companies are now packing at least 10% of the seed in 1kg or 500g. Through PABRA, the approach has been expanded to other countries (Uganda, Tanzania, Ethiopia, Zimbabwe, Burundi) enabling farmers to access seed.

Another approach used to support purchase and use of certified seed is the engagement with the private sector to catalyze demand creation. Tools used include demonstrations, training of lead farmers, local extension and agro-dealers and multiple information tools /channels on bean varieties and complementary improved agronomic practices. This has shown that farmers are willing to pay for seed. In Zimbabwe, its relatively advanced seed industry largely relies on formal system (10 seed companies) to supply seed for most field crops including common beans. Certified seed is purchased and distributed through outlets that include supermarkets, and ordinary rural grocery stores. One of the challenges which is being tackled is to increase the efficiency in the supply e.g. how to aggregate seed demand.

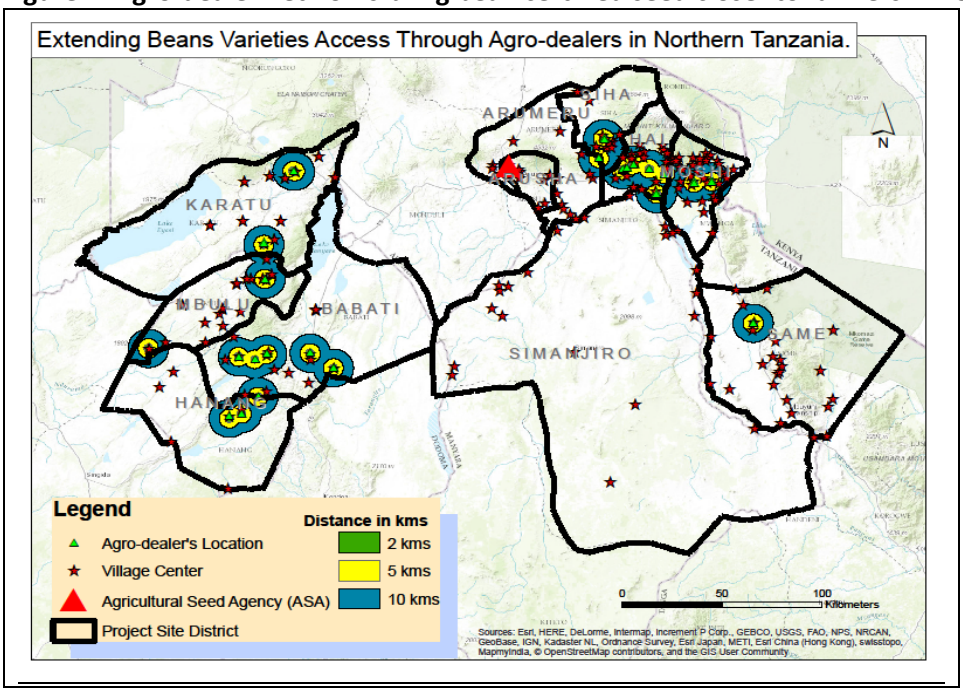
[19] *PABRA; International Center for Tropical Agriculture (CIAT)*

B. Farmers' access of seed through agro-dealer networks

Certified seed marketing and distribution takes place through limited numbers of officially recognized seed outlets, on a cash basis and hence have limited spatial reach. For instance, in Mozambique, Rohrbach et al. (2001) reported an average of less than one agro-dealer shop selling seed per district. Some districts had no seed retail store and an average ratio of one shop to more than 40,000 farmers (World Bank, 2006). Several other countries face similar seed production and distribution challenges. For instance, in 2013, the supply of certified seed in Tanzania was less than 5% of annual national bean seed requirement (Centre for Development Innovation, 2010). Prior to 2015, the larger proportion of certified bean seed was supplied by the public Agricultural Seed Agency (ASA) through sales to public organizations and NGOs. ASA had limited distribution network and bean seed supply through agro-dealership was almost non-existent, yet bean is increasingly becoming a commercial crop in the major production areas.

Against this background, a partnership established in 2015 between AGRA and CIAT/PABRA through the Scaling Seeds and Technologies Partnership (SSTP-USAID) project, aimed at testing the approach of offering farmers opportunities to access and purchase quality seed of highly marketable bean varieties through agro-dealer networks. The approach is being tested in 10 districts of northern Tanzania. Through this initiative, one public (ASA) and two private (Meru Agro and BEULA) seed companies obtained basic seeds from national bean research programmes at Selian Agricultural Research Institute (SARI) and Agricultural Research Institute of Uyole (ARI Uyole), and produced certified seed of four varieties [Lyamungu 85, Lyamungu 90 released in 1985 and 1990 respectively, Jesca (purple and released in 2008) and Njano Uyole (yellow and released in 2004)]. In 2015 the companies sold 30 tons and in 2016, 100 tons of quality seed (certified and treated), through village based agro-dealers (see *Figure 1*) in small and affordable size packs. These being highly popular and marketable (locally or to Kenya) varieties, farmers tend to sell all the harvested grain, but buy seed during the planting season. The agro-dealer shops which are closer to farming communities have become increasingly important in the supply of seed and other complementary inputs by increasing farmer access point shortened the distances to seed access points (to less than 2km) (*Figure 1*).

Figure 1: Agro-dealer networks bring bean certified seed closer to farmers in northern Tanzania.



Through this initiative, 12.1 and 20.4 tons of seeds were produced by ASA in 2015 and 2016 and reached 845 and 5456 respectively (*Table 1*). The volume of seed sold by seed companies through agro-dealer network has increased and the latter offers linkages between farmers and seed companies.

Table 1: Number of farmers reached with bean seed through agro-dealers network in northern Tanzania

Year	Varieties		Certified seed (t)			Farmers Reached		
	No.	Name	Seed company	Produced	Sold	Male	Female	Total
2015	4	Jesca, Lyamungu 90, Njano Uyole, Lyamungu 85	ASA	37.2	12.1	323	522	845
2016	3	Jesca, Lyamungu 90, Njano Uyole	ASA, BEULA, Agr0-Meru	143				5654

C. Farmers accessing seed through links to contracting arrangements (with private sector or NGOs).

PABRA has supported decentralized individual seed enterprises or farmer group seed producers across many PABRA member countries whose seed policy/laws support or accommodate Quality Declared Seed (QDS) grade. Produced seed is supplied through farmer to farmer (local small demand) or in bulk when bought by development organizations. Through this approach, some of the farmer seed producer groups have graduated to become small and medium seed companies. In addition, QDS production sites are used as demonstration sites to create demand for quality seed and create market opportunities for certified seed. A significant feature of this approach is establishing access points of quality and affordable seed closer to farmers, Continuous linkages with research/breeding programme is also ensured. We illustrate PABRA's support to this approach by examples in Southern highlands of Tanzania, Burundi, and in Uganda.

C1. Southern Highlands of Tanzania: The Agricultural Research Institute of Uyole (ARI-Uyole) has released several varieties of diverse bean types (reds, purple, cream, yellow and sugar) that are on demand and grown in Southern Highlands Zone of Tanzania. Seed of these varieties have been made available to farmers through the Agricultural Seed Agency (ASA) and two seed companies. However, these two outlets, have not been able to offer a wide coverage and reach to rural farmers. In absence of affordable and sources of seed which are closer to farmer, the latter opts to use farm saved seed or from grain markets. In 2014, Raphael Group Limited (RGL) (a consortium consisted of grain a trader/exporter, micro finance bank and Agri Experience Seed Company) opened opportunities for farmers by marketing the sugar bean variety Uyole 03 and generated demand of grain. The market offered opportunities for farmers to be organized to produce grain for RGL and in turn required access to quality seed. To fast track the process the consortium contracted farmers groups to produce seed quality declared seed (QDS) using certified seed from ARI Uyole. PABRA partners through ARI Uyole and district extension teams offered technical expertise to QDS producing groups that included, training on pre- and post-harvest seed management, backstopping and provision of resource manuals on seed quality management particularly of diseases and pests. To increase farm-level productivity and raise sufficient grain volumes of Uyole 03, RGL advanced

farmers with inputs (e.g. seed and fertilizer) and recovered seed cost and other inputs from farmers' sales of grain to the company. Production of QDS in districts (Mbeya, Mbozi, Ileje and Rungwe districts in the Southern Highlands (*Figure 2*). in which RGL's contract grain producers are located contributes in easy access of seed to grain growers. The partnerships in the Southern Highlands of Tanzania has demonstrated multiple and mutual benefits: increased numbers of farmers accessing quality seed of Uyole 03, increased farm yields, and a steady supply of beans for the markets continue running the business.

QDS Production and sale in Southern Highlands of Tanzania under Raphael Group Ltd between 2014-2016

Year	Seed produced/sold (tons)	Number of farmers accessing seed as input credit
2014	26.9	3,362
2015	35.8	4,475
2016	33.9	4,242
Total	96.6	12,079

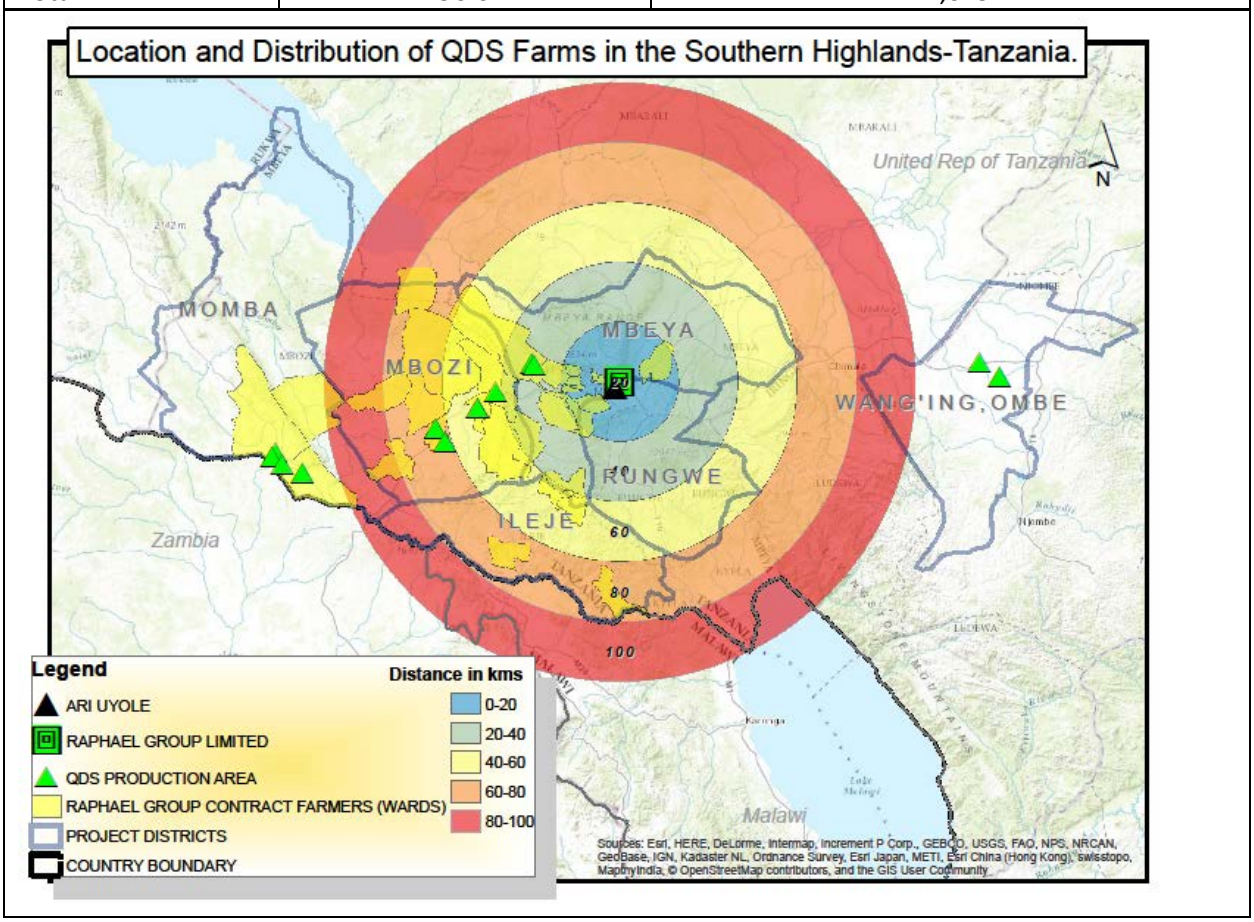


Figure 2: Location of QDS producers and contract growers for Raphael Group Limited in SH Tanzania

C2. Burundi: Commercial private seed (companies) sector is almost non-existence. Seed production is mostly undertaken by farmer groups, independently or affiliated to some non-governmental organizations (NGOs). Key players include ADECA, ADISCO, CRS, World Vision and COPROSEBU. This support focuses on organized groups for ease mobilization of inputs such as seed. One approach used is providing initial seed to farmers (groups) which after a cycle of multiplication, is sold by farmers to other farmers in local grain markets and seed fairs etc. (*Figure 3*). PABRA through the national bean research

program (ISABU), support production of early generation seed and offers training in seed production. Following the adoption of the quality declared seed notion in Burundi, some NGOs are supporting QDS production. However, there is an emerging entrepreneurial spirit in seed production involving several individual entrepreneurs who are producing an average of 10 ton per year. Again, in the absence of seed companies, the use of QDS does provide alternative source of better quality seed and availability closer to farmers. This is important particularly in a country where bean production is almost all consumed or sold, and farmers must buy seed for planning.

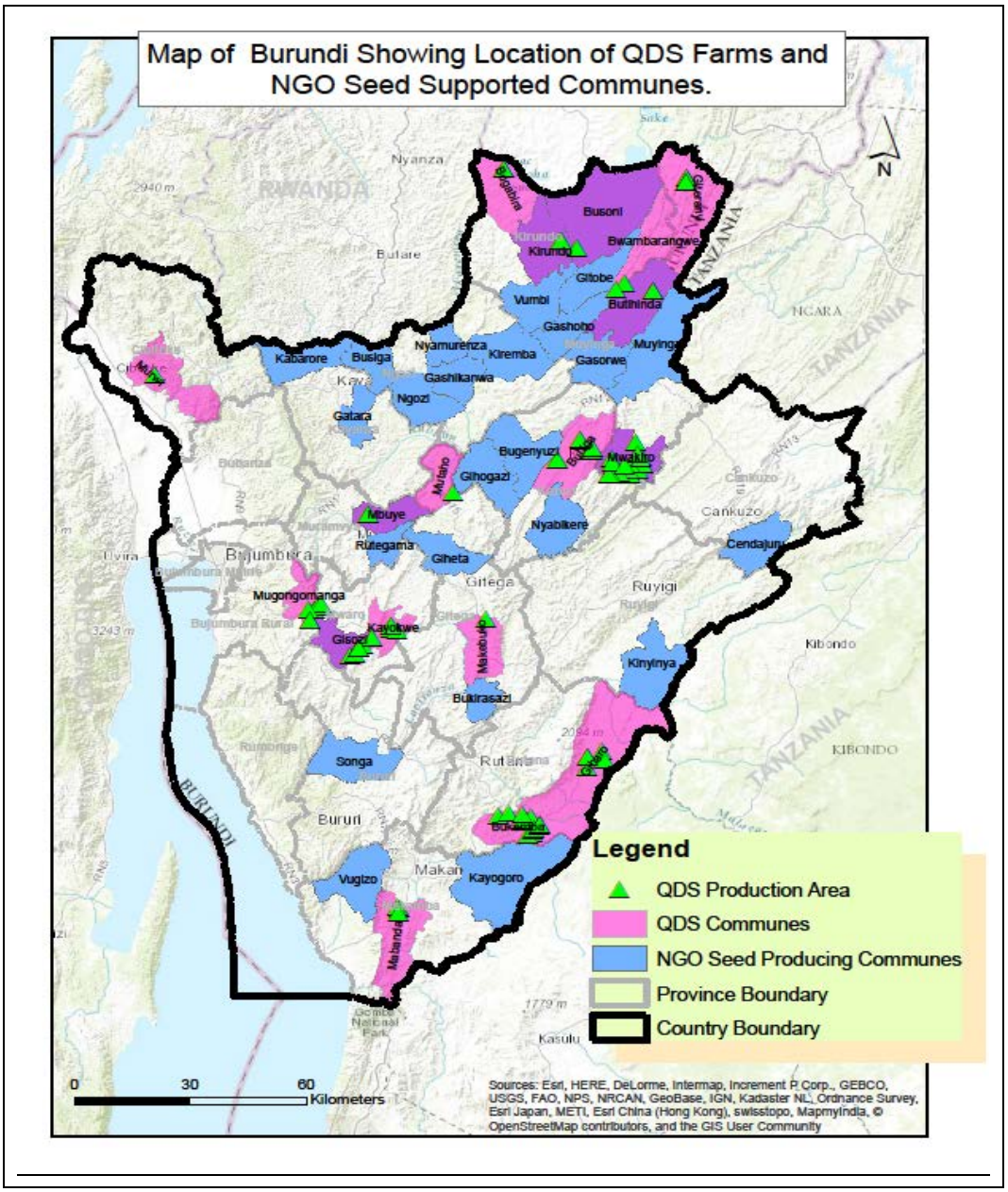


Figure 3: Community and QDS seed production in Burundi

The two options, certified and QDS widened the farmers' choices for source of planting material. The combination of the systems has enabled more than 80,000 farmers to access varieties of the common bean between 2012 and 2015 (*Table 2*)

Table 2: Bean seed production and reach in Burundi: 2012-2015

Seed Class	Seed production (t)					Number of farmers reached
	2012	2013	2014	2015	Total	
Certified Seed	5.2	12.8	2.7	2.4	23.1	11,621
QDS	9.0	4.6	12.2	111.0	136.8	68,453
Total	14.3	17.4	15.0	113.5	160,2	80,074

C3. Uganda: Bean seed demands coupled with limited production from private companies provides an opportunity to enhance local seed production. For example, in Uganda, use of seed from agro-dealers or seed companies is still very low (5 % - ISSD, 2014), justifying the need for alternative sources of quality seed. PABRA has supported the use of diverse approaches including decentralized individual seed enterprises or farmer group seed producers across many PABRA member countries whose seed policy/laws support or accommodate quality declared seed (QDS) grade. Six out of 60 private seed companies in Uganda produce common bean seed. Produced seed is supplied through farmer to farmer (local small demand) or in bulk when bought by development organizations. In Uganda, PABRA has partnered with several stakeholders to support decentralization of seed production including QDS in several districts of Uganda (*Figure 4*). Through this approach, some of the farmer groups have formed small and medium companies such as CEDO and SHUPO. Each of these two companies produce more than 200 tons of certified bean seed every year.

CEDO sold more than 100t of certified bean seed per season in 2016 through 13 agro-dealer shops in Masaka District and other districts. In addition, QDS production sites are used as demonstration sites to create demand for quality seed and create opportunity for certified seed supplied by seed companies. In this case, QDS is used as a stepping stone towards the use of certified seed and create business opportunities for seed entrepreneurs (decentralized and seed companies). The combination of the produced 28,814 t of quality seed of bean in four years (*Table 3*)

Table 3: Certified and QDS production (t) for the period 2012-2015 in Uganda

Seed Class	Seed production (t)				
	2012	2013	2014	2015	Total
QDS		81.7	138.5	89.0	309.2
Certified Seed	5378.0	7662.5	6672.1	8793.1	28505.7
Total	5378.0	7744.2	6810.6	8882.1	28814.9

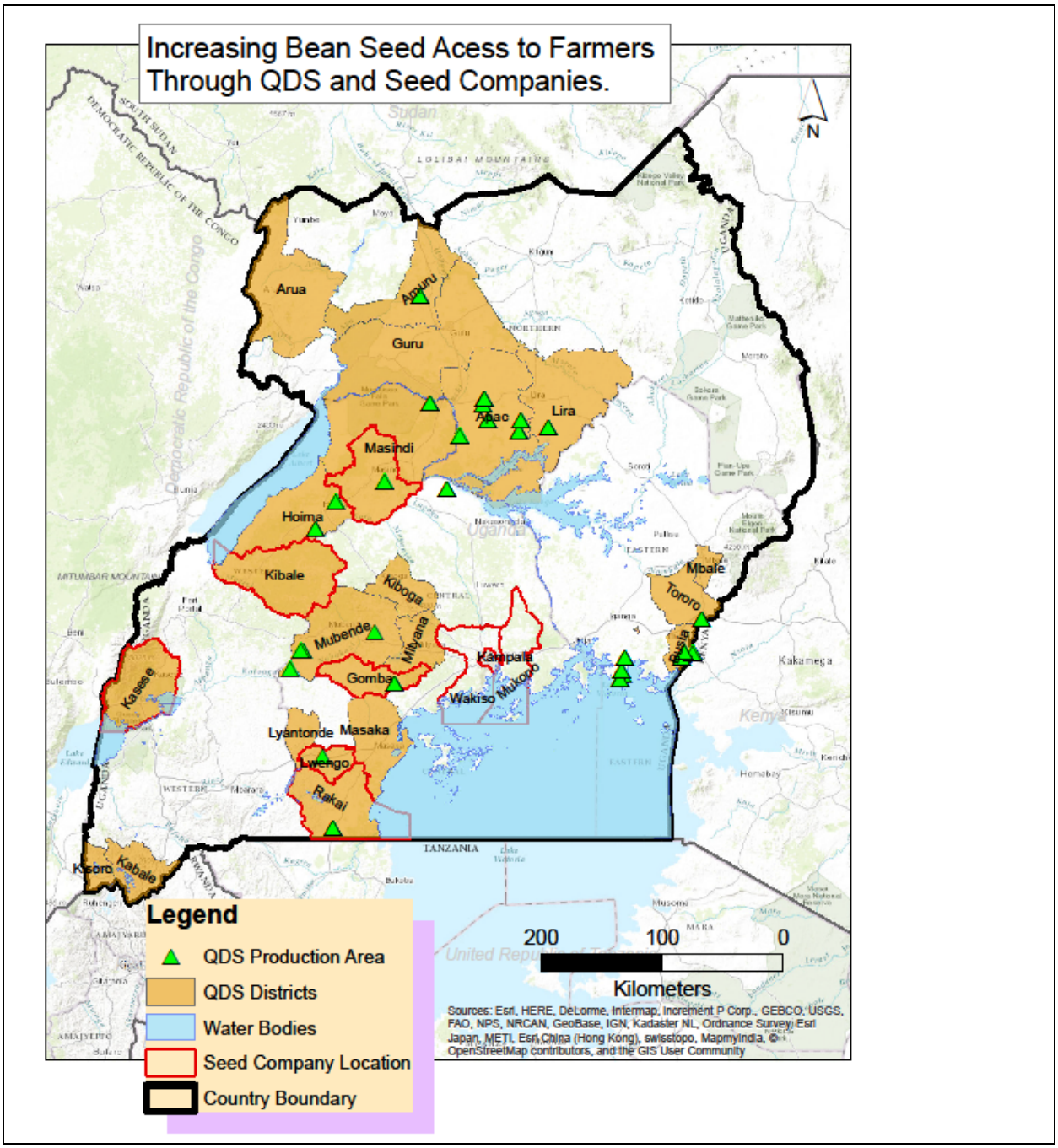


Figure 4: Location of seed companies and QDS producers in Uganda

D. Access of seed from community seed producers.

Homabay county in Kenya is a bean producing area where, beans have been considered a "woman's crop in a man's land", hence to an extent compromising productivity. In 2007, KALRO and PABRA partners working with Caritas Kenya, introduced new varieties and management approaches. Farmers selected three varieties through participatory methods, but certified seed of these varieties was unavailable due to lack of interest by traders and agro-dealers and no distribution networks. To address this constraint, Caritas facilitated the establishment of local seed production by acquiring 10 kilos of each of the three

varieties (KATB1, KATB9 and KATX56) from Kenya Agricultural and Livestock Research Organization. The seed was multiplied with 30 farmers using a principle where each member gets seed, multiplies and gives back to the community an amount of seed equal to the amount borrowed for further distribution to other members. This increased the reach every season while farmers retained the rest of the grain.
Over the years, farmers have managed to build stock of seed, and Caritas has supported capacity building, infrastructure, and group dynamics and seed fairs, whereas PABRA supports training bean and seed production and management. Other actors included microfinance institution. The community has bulk storage facilities for long term centralized storage of seed, quality control and selling point. Members selling on their own can only sell at lower prices, and not as seed.

The Ministry of Agriculture local office inspects storage facilities and tests for germination of seed before members can sell to others. After approval from Ministry of Agriculture, farmers sell seed at US$0.60 /kg compared to US$2.50 - 3.00/kg of certified seed. This seed production scheme seems sustainable among the farmers as they have not had to seek new injection of seed. Meanwhile, the groups have received seed of a variety that was released in 2016 to initiate a new cycle of seed multiplication and grain production. Through this scheme, more than 20 t of community seed has been produced by nearly 1000 farmers, the majority of whom are women (*Figure 5*). In addition to seed access, farmers have also been able to access loans from micro-finance institutions such as Kenya Women Finance Trust, which have enabled some farmers to purchase more land and increase the area under common bean.

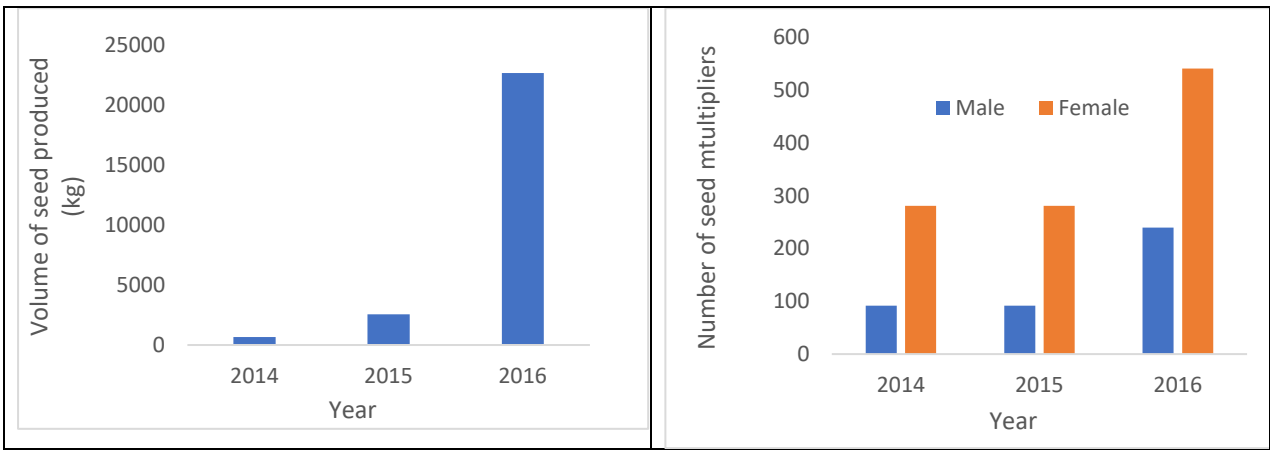


Figure 5: Increase in the volume of farmers' seed (left) and number of seed multipliers in Homa bay

What has been KEY to get reach

- Availability of highly preferred varieties which pull farmers to pay in cash for seed of new or highly marketable varieties
- Coordinating and formalizing collaboration between all key public and private organizations for multiple and complementary seed channels to respond to various farmers' bean seed needs
- QDS is at least 15 % cheaper than certified seed in Uganda and Tanzania
- Through use of agrodealers, access to seed was made easy by a 70% reduction in the distance travelled to purchase, in some instances to less than 2km in Tanzania
- QDS production and dissemination moved seed sources to farmers
- Approaching seed system with entrepreneurial and value chain mindsets

- Exploiting the role of research to support design of a client-oriented seed systems, and testing and facilitating scaling up of viable and ''bankable'' approaches
- Increased investment by different stakeholders geared for utilization of research products
- Catalyzing role of PABRA through multi-stakeholder strategic approaches

References

Almekinders, C. J. M. & Louwaars, N. P. 1999. *Farmers' Seed Production: New Approaches and Practices,* London, Intermediate Technology Publications.

ASARECA/KIT, 2014. Tanzania Seed Sector Assessment: A Participatory National Seed Sector Assessment for the Development of an Integrated Seed Sector Development (ISSD) Programme in Tanzania. April 2014, Entebbe, Uganda

Centre for Development Innovation, 2010. Innovation for Seed System Development: The case of Tanzania/Malawi. Wageningen UR. The Netherlands.

ISSD. 2014. Baseline report on farmers' access to seed and other planting material. Integrated Seed Sector development Programme in Uganda, Wageningen UR Uganda.

Rohrbach, D.D., Low, J., Pitoro, R., Cucu, A., Massingue, J., Boughton, D., Rafael, G., Paulo, A. and Jocene, D. 2001. Investment Priorities for Development of Mozambique's Seed System. Ministry of Agriculture and Rural Development, Research Report No 44E.

Rubyogo, J.C. Sperling, L. Muthoni, R, & Buruchara, R. 2010. Bean seed delivery for small farmers in Sub-Saharan Africa: the power of partnerships. , Society and Natural Resources, 23 (4):1-18.

Sperling, L. and McGuire, S. 2010. Understanding and strengthening informal seed markets. Experimental Agriculture 46(2):119-136.

World Bank. 2006. Mozambique Agricultural Development Strategy: Stimulating Smallholder Agricultural Growth. Report No. 32416-MZ. World Bank. Washington DC, USA

World Bank 2012. Economic and Sector Work. Agribusiness Indicators: Mozambique. Washington DC, USA: World Bank.

Lessons from Local Seed Businesses in Ethiopia: Developing a Business Model for Producing Grain Legume Seed More Sustainably

Amsala Aga[20] and Stephen Walsh

Abstract

Grain legumes occupy about 10% of the total cultivated land under grain crops in Ethiopia. The national research system has developed improved crop varieties of major grain legumes, including fava bean, haricot bean, field pea, chickpea, lentil, groundnut and soybean. These crops play a key role in soil fertility management, serve as a critical source of protein, and earn income both in domestic and foreign markets. Since the 1960s the national research system developed and released dozens of improved varieties of grain legumes. Despite significant investment into the development and deployment of improved varieties of grain legumes, Ethiopian farmers demonstrate low access and use of new and farmer preferred varieties for the different grain legumes.

To alleviate the low access and use of locally demanded quality seeds of farmers preferred varieties, including grain legumes, the Integrated Seed Sector Development (ISSD) Ethiopia Project launched the local seed business (LSB) model in 2009. In the LSB model, voluntary farmers are organized into seed producer and marketing cooperatives to pull their resources (land and other physical resources, cash, and human resources) to produce and market quality seeds of improved/farmer preferred varieties that have high demand in the locality and beyond. LSBs are supported in technical aspect of pre and post-harvest seed production, business plan development, input and output market linkages, monetary management, internal organization, and human resources. The expectation is that after initial public support, LSBs will grow into more viable local seed businesses, serving seed supply of crops that are not adequately addressed by public and private seed companies.

This paper will identify a sub-set of the 270 ISSD Ethiopia supported LSB's since 2009, those involved in legume seed production for at least 4 years. Based on production and sales data, and a follow up qualitative discussion with each LSB, we will discuss the extent to which the individual LSB's have grown into viable local seed businesses, have linked to nearby research centres, and have facilitated the deployment of newly released legume varieties. We will draw lessons from the LSB experience and provide recommendations for how legume seed production can be more business oriented and sustainable while addressing the interests and needs of Ethiopian farmers.

Introduction

During the period 2009-2015, the Integrated Seed Sector Development program in Ethiopia had organized over 270 LSBs in the four regional states of Ethiopia: Amhara, Oromia, SNNPR and Tigray. A total of 86,936 quintals of seed was produced between 2012-2015 at an average of 2,173.4 ton per year. Among grain legumes, seed production was highest for chickpea (3,664.4 ton), followed by lentil (1,843.1 ton), haricot bean (1,255.6 ton) and fava bean (1,058.5 ton). Over years, LSBs in Oromia produced more seeds of the grain legumes than the other regional states. Chickpea and fava bean are mostly produced in Amhara and Oromia regions, while haricot bean is produced in Oromia and SNNPR. Seed production of fenugreek, groundnut and soybean is only in Oromia. These local seed businesses have contributed more to grain legumes seed production and access in Ethiopia than the formal public and private seed companies. The LSB's are known to produce seed with lower overhead cost making the production price lower and more

[20] *ISSD Ethiopia*

affordable by farmers.

However, there are many questions which remain unanswered and which we will attempt to address through a modest effort to select and then review the experience of a sub-set of ISSD LSB which produced legume seed for at least four years in Ethiopia.

- Under what general conditions do these legume seed producing LSB become more sustainable businesses in terms of grain seed production?
- What are institutional arrangements between the legume seed producing LSB and public, private, and research actors which leads to more success?
- How have the buyers of legume seed producing LSB evolved over the years? i.e., To what extent has there been an increase in sales to individual farmers and contracts to NGO's and a decrease in sales to Seed Unions and BOA?
- Under what conditions do farmers and institutional buyers (NGO's, Seed Unions, BOA) become more recurrent (repeat) buyers from legume seed producing LSB?
- Under what conditions has seed policy and seed regulation facilitated an enabling business environment for legumes seed production by LSB?
- To what extent have farmers (living in proximity to the LSB) increased access and use of legume germplasm as result of the LSB production of grain seed?

SESSION VI

INFORMATION SYSTEMS: COMPLEMENTARY TO SEED

Exploiting information technology for efficient delivery of quality cowpea seeds in Benin

Ayenan, Mathieu Anatole Tele[21]

The model

In Benin, the underlying reasons of low use of improved seeds remains poor access to information on improved varieties and their potentials, poor seed production and distribution systems limiting farmers' access to quality seeds. Nevertheless, almost all farmers have now a mobile phone even in the most remote areas. Using this opportunity, a private initiative is being implemented by the Coopérative Agro-Pastorale et Agro-Alimentaire du Bénin (CAAG) with the aim of producing and supplying quality cowpea seeds to farmers. For this purpose, a platform operating on mobile phone whereby information is sent to farmers in villages where extension agents and traditional seed enterprises do not reach was set. For the pilot stage, three villages (Mendegbé, Sowignandji and Oké Okounou) located in the Department of Collines were selected (**Figure 1**). In each village, an existing farmers' organization was selected. Using the mobile platform, the production unit, located at Kassehlo village, provides farmers with information on improved cowpea varieties, their traits (seed colour, cycle, and resistance to major pests) and seed costs through text messages. When farmers are interested in acquiring seeds, their organizations receive a pre-order from them and send the request to the cooperative. Seeds are then delivered to farmers using transportation companies. Upon receipt of the seeds, the money is transferred to the cooperative. The farmers' organizations receive an incentive as per the quantity of seed sold. This incentive is a source of income for the organization. Farmers' leaders are then motivated to encourage their fellows to buy seeds.

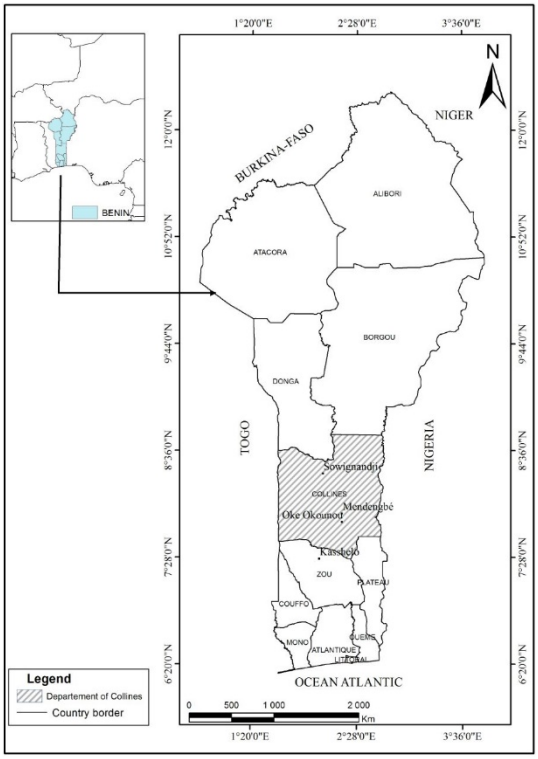


Figure 1: Location of Pilots

The model has been running for two years (2015 and 2016 i.e. four cropping seasons) and involves on average 255 farmers in the three villages. These are smallholder farmers (acreage per farmer ranges from 0.2 ha to 1.2 ha of cowpea). They buy on average 10 kg of seeds per season. The seed cost per kilogram is about 0.79 US Dollar (*Table 1*).

For now, the turnover on the cowpea seed business is still very modest but the business is sustaining itself and we expect to significantly increase our profit with the expansion of the business production.

[21] Coopérative Agro-Pastorale et Agro-Alimentaire du Bénin (CAAG), Republic of Benin

Table 1: Cost benefit analysis

	Seed quantity (kg)	Cost per kg	Turnover	Charge (production cost and transaction cost)	Profit	Ratio (Profit/charge)
Year 1	2 000	0.79	1580	502	1078	2.14
Year 2	2 500	0.79	1975	601	1373	2.28

Identification of success factors

Cooperation with farmers' organizations

Cooperation with already existing farmers' organization is key for the success of the model. In fact, not only do they serve as contacts, but they also sensitize their fellow farmers to buy seeds. Doing so reduces the transaction cost for the cooperative. For instance, it would not be cost effective to engage staff in selling seeds in these villages, but the farmers' organization do that with little cost involved.

Pricing policy

The basic question at the beginning of the project was ''How much should we sell the seed to make it affordable to farmers and have a sustainable business?''. To answer this question, farmers' willingness to pay for cowpea seed was assessed. The result of the study was backed up with group discussion with farmers and the price per kilogram of seeds was jointly set. This step was important in building mutual trust.

Incentives for farmers' organization

Reward farmers' organizations involved in the model is essential to keep them motivated. Without the incentive, they would not be willing to have such a level of engagement in the seed model. An agreement was reached on their incentive which was set at 2.5% of the total amount sold.

Reliability and timeliness delivery of seeds

One of the factors of the success of the model is the timeliness delivery of seeds to farmers. Even though orders are sometimes made late, the cooperative strives to satisfy farmers. As a failure to do so may result in disappointment and loss of customers' confidence.

How we cope with farmers' varieties preference?

Farmers' varieties preferences are dynamic and vary based on socio-economic and bio-climatic factors. Since the cooperative can only multiply a limited number of varieties (3 to 4 varieties), through discussion with farmers three representative varieties (*Tawa, Assanssan, Podjiguèguè*) of groups of preferred varieties were identified and those varieties are now being multiplied with the assistance of seed quality officers in charge of certification. The certification ensures the quality of marketed seeds.

Challenges

1. Farmers sometimes request for varieties which are not part of those the cooperative is multiplying. When this happens, we are left with no option.
2. Seed renewal was not a customary practice with cowpea farmers. However, through sensitization led by their leaders, the trend is being reversed.
3. Ideally, the pre-ordering system should enable the cooperative to know in advance the demand and take actions accordingly. But, this system is still not very effective to achieve this goal as farmers often do not make decisions on land and other resource allocation ahead of the start of

the cropping season. This sometimes puts a lot of pressure on the cooperative as farmers' order may come in late and delivery must be done in time. To cope with this challenge, cooperation with organizations teaching farmers managerial skills is needed. This will enable farmers to be equipped with planning skills.

4. The certification process sometimes takes long, and the situation may worsen when the cooperative will expand its production. Owing to the lack of human resource in charge of certification and the delay that occurs in the process, quality declared seed is being considered as alternative to certified seeds. However, in the national seed policy (MAEP, 2015) and in the regional seed harmonization regulations (ECOWAS, 2008), no provision is made for quality declared seed. This may limit the adoption of quality declared seed.

Perspectives

The cooperative is going to scale up the model to cover more villages in the Department of Collines and include more legumes crops especially soybean. For this purpose, the identification of farmers'-based organizations in the selected villages and the presentation of the model to farmers are on-going.

In the perspective to expand the model to other areas and crops, the cooperative should engage in an outgrowing seed production scheme since its production capability will not be able to satisfy the demand. To this end, motivated and skilled farmers in seed production will be selected and trained. A seed multiplication contract will be signed with the selected farmers.

Recommendation

In addition to certified seeds, other form of seed quality assurance, especially quality declared seed, should be considered in national and regional seed regulatory frameworks.

References

ECOWAS. 2008. Regulation C/REG.4/05/2008 on Harmonization of the Rules Governing Quality Control, Certification and Marketing of Plant Seeds and Seedlings in ECOWAS. Abuja: ECOWAS. http://www.coraf.org/wasp2013/wp-content/uploads/2013/07/Regulation-seed-ECOWAS-signed-ENG.pdf.

MAEP (Ministère de l'Agriculture, de l'Elevage et de la Pêche). 2015. Projet de Document Actualisé de Politique Semencière Nationale Au Bénin. Cotonou.

Making Bean Seed Systems Nutrition-Sensitive in Southern Africa Closes the Access Gap and Attracts Private Sector Participation

Enock K Maereka[1], Rodah M Zulu[2], Virginia Chisale[3], Fungai Gamu[4], Bruce Mutari[5], Luisa Penicela[6], Manuel Amane[7], Sydney Khando[8] and Jim Goodman[9]*

[1,2]International Center for Tropical Agriculture (CIAT), Chitedze Agricultural Research Station, P. O. Box 158, Lilongwe, Malawi
[3]Department of Agricultural Research Services (DARS), Chitedze Agricultural Research Station, P. O. Box 158, Lilongwe, Malawi
[4]Department of Agriculture Technical and Extension Services (AGRITEX), P. O. Box CY 2505, Causeway, Harare, Zimbabwe
[5]Crop Breeding Institute (CBI). Department of Research and Specialist Services, P.O. Box CY550 Causeway, Harare, Zimbabwe
[6,7]Instituto de Investigação Agrária de Moçambique (IIAM) P O Box 3658, Maputo Mozambique
[8]Catholic Relief Services (CRS) - Malawi Country Programme, Private Bag-B 319 Lilongwe 3, Malawi
[9]Exagris Africa Limited, P.O Box Box 3291, Lilongwe, Malawi

*Corresponding author: E.Maereka@cgiar.org

Abstract

Micronutrient malnutrition due to iron deficiency anemia is of public health importance in sub Saharan Africa. Biofortification of staple crops such as common bean with micronutrients is recognized as an inclusive approach to addressing micronutrient malnutrition. However, an effective biofortification approach requires an impact-oriented seed delivery strategy that connects agriculture and nutrition. Bean breeding efforts produced varieties rich in iron and zinc, but seed systems were not well equipped for their promotion due to information and institutional constraints; demand was not apparent and national agricultural research institutions typically have limited capacity to conduct nutrition campaigns and to produce early generation seed resulting in delayed access to varieties. We explored in three countries in southern Africa to answer the following questions: should nutritious crops be promoted differently from other crops? Could nutrition education reduce the lag period between variety release and access by farmers, hence increase the demand for seed of nutritious crops? Using NUA45, a first-generation bean variety biofortified with iron and zinc released in seven southern African countries and non-biofortified bean varieties released at the same time, this previously untested approach was piloted in Malawi, Mozambique and Zimbabwe. Creating awareness through nutrition education with clear messages on biofortification, cooking demonstrations, and field days, reduced the knowledge gap and increased demand for NUA45 compared to non-biofortified bean varieties. In response to the demand, cost-sharing breeders' seed production between research and private sector and community seed production models were instituted, resulting in 10-fold increase in breeders' seed volume, rapid access to the variety and increased investment from community and private sector seed producers. Making seed delivery system nutrition-sensitive through appropriate information, education, and communication (IEC) materials was key to stimulating demand for biofortified bean and private sector participation.

Key words: Biofortification, common bean, seed delivery strategy, nutrition-sensitive, nutrition education, private sector

Introduction

Undernutrition especially due to stunting and micronutrient deficiencies has far reaching consequences on the quality of life especially among women and children. Governments of several countries put in place nutrition-specific interventions such as supplementation and fortification to address the immediate determinants of undernutrition and to help accelerate progress in improving maternal and child nutrition (Black et al 2008 and 2013). Yet, child stunting and hidden hunger - especially anemia among children and women including adolescent girls - remain highly prevalent. The prevalence of stunting in children under five years old is 27%, 37% and 43% in Zimbabwe, Malawi, and Mozambique respectively (*ZIMSTAT, 2015, NSO, 2015 and MDHS 2010*). The Lancet 2013 series on maternal and child nutrition reports that scaling up key nutrition-specific interventions in countries with a high burden of malnutrition only reduces child stunting by 20 percent (Bhutta et al 2013), hence implementing nutrition sensitive programmes and approaches that address the underlying determinants of malnutrition are a prerequisite complement.

There is growing global recognition that agriculture can be leveraged to optimize nutrition outcomes, especially among mothers and children (Black *et al,* 2013). Lately countries have adopted biofortification as part of the strategy for addressing micronutrient malnutrition. Biofortification is recognized as an inclusive approach to reduce malnutrition among the resource constrained, but it requires that the varieties be accessible to users and consumers. While there is a clear anecdotal linkage between agricultural production and improvements in nutrition outcomes, the empirical evidence base for this relationship remains weak (Black *et al,* 2013) as agricultural investments are often packaged in value chains that are nutrition-sensitive. For instance, while evidence shows the need for frequent consumption of adequate portions of biofortified beans (Lung'aho et al, 2015), traditionally, bean varieties have a long lag phase between release access (David and Sperling 1999). Linking agriculture to nutrition is critical, therefore, the need for an impact-oriented seed system that delivers nutrition goals. Over the years, farmers have lacked access to quality seed of improved legume varieties in many sub Saharan countries (Cromwell et al, 1992; Tripp, 2003; Minot 2008). The challenges often stem from inadequate early generation seed (EGS) of public varieties, limited private sector interest (Mabaya et al, 2013), inadequate coverage due to poor distribution network (Rubyogo et al, 2010) and inadequate varietal information services.

Following the release of biofortified varieties in Malawi, Mozambique, and Zimbabwe, this study sought to transform bean seed systems for increasing timely access and consumption of biofortified beans. Against this background we developed the following questions: i) Can the involvement of the private sector shorten the lag period between release and access to biofortified varieties and ii) Could nutrition education and variety information enhance timely access to biofortified bean varieties.

Methods

Varieties

NUA 45, a red-mottled variety was released as a first generation biofortified variety in nine southern African countries including Malawi, Mozambique and Zimbabwe between 2010 and 2013. At the time of its release, other varieties (non-biofortified) were also released: VTTT924/4-4, a sugar type variety in Malawi (2011), CAL 143 (same colour as NUA45, in Mozambique (2012) while in Zimbabwe MG 38 (same

colour as NUA45) was released as "Cherry" in 2012) (*Figure 1*). NUA 45, a typical bush/bush bean matures in 60-70 days after planting while the other varieties mature between 80 and 90 days. The varieties mention above are all public varieties, released by the national agricultural research systems (NARS).

Figure 1: Bean varieties compared in the study clockwise from top right, NUA 45, MG 38 (Cherry), VTTT924/4-4 and CAL 143

Seed production and dissemination models

Seed systems were not geared for dissemination of the newly released biofortified bean varieties; seed companies stuck to their old varieties and the national agricultural research systems (NARS) could not produce adequate breeders' (pre-basic) seed. Breeders' and pre-basic seed production of the public varieties listed above is a responsibility of the national bean research programmes within NARS. In Malawi and Zimbabwe, the national bean research programmes invited the private sector to invest in joint pre-basic seed production. In the joint production scheme, the private sector provided resources while the national programmes provided initial seed and technical expertise. Basic and certified seed production was carried out by seed companies and other contracted growers. Working in specific districts in Malawi and Mozambique, CIAT/NARS established variety demonstration plots of the varieties highlighted above. From the demonstration plots, farmers selected the varieties they wished to grow. The demonstration was also accompanied by nutrition education.

Nutrition education

Focus group discussions were conducted in target districts to understand the underlying factors that contributed to malnutrition, gather information on how communities prepared and consumed beans. Communities were not aware of the health benefits of consuming biofortified bean; therefore, nutrition awareness creation was identified as a need. Also, there was no distinct way of preparing beans for

feeding young children; a practice that might have been partly responsible for perpetuation of undernutrition despite reasonable bean consumption at household level. CIAT/NARS and extension-initiated campaigns on nutrition education, covering the importance of a balanced diet to human health, the contribution of the common bean to nutrition. Diverse bean preparation methods for enhanced consumption were demonstrated during field days and other events such as seed fairs (DiNERS). Information Education and communication (IEC) materials and promotional materials such as T-shirts were available to pass messages. Community radio was also used to create awareness on nutrition and biofortified beans.

In Zimbabwe, the nutrition team carried out a bean consumption survey in 2011 which identified gaps in nutrition knowledge on biofortified beans and skills in preparing a variety of products from beans. Through engagement of the National Food and Nutrition Council and close collaboration with the Ministry of Health and Child Welfare, it was agreed that the biofortified bean variety initiative be made part of the broader efforts of the Nation in combating challenges in Nutrition in the country. The major activities to be used to promote biofortified beans were therefore identified these included Introducing the Healthy harvest initiative and creating awareness on biofortified beans to the Food and Nutrition Security Committees: A team composed of representatives from FNC, the Ministries of Agriculture (AGRITEX), and FAO went out in September 2012 and held meetings with the District Food and Nutrition Security Committees in the 12 selected districts. Presentations by AGRITEX included biofortified beans and their integration in the Healthy Harvest Initiative, to promote their uptake and acceptability in communities. Other carried out to promote biofortified beans and bean-based products included Training of Trainers, setting up demonstration at the agricultural shows, distribution of fliers and display of variety poster and promotional activities. CADS, an NGO demonstrated NUA 45 in rural areas in addition to nutrition education.

We carried out nutrition campaigns and seed dissemination required partnerships with different organizations as shown in Table 1.

Table 1: Partnerships for nutrition sensitive seed systems

Partners	Roles
CIAT/NARS	Production of bean breeders' seed Training partners in seed business, nutrition education and establishment of initial demonstration plots.
NGOs (Catholic Relief Services, Mzuzu CADECOM, CADS, World Vision)	Organizing farmers, delivering day-to-day technical support to farmers on nutrition education, seed production. Organize seed fairs.
Private Seed Companies	Pre-basic (joint with NARS), basic and certified seed production
Agricultural extension systems (unified)	Provision of advisory services in crop production, nutrition, seed production.
Farmers' Associations	Mobilization of member for training, awareness events such as field days and cooking demonstrations. Provide trainees to training of trainers (ToT) courses
Ministry of Health	Nutrition education through health centres, health advisory services

Results

Due to efforts on awareness creation, the demand for seed of NUA 45 increased in the three countries and responses were based on each country's seed industry set up. In Malawi and Zimbabwe, the major bottleneck to availability of certified seed was identified as pre-basic seed limitation. In Mozambique, the challenges were greater; there were very few seed companies, there was limited capacity to produce all classes of formal seed and the certified seed distribution network was very poor.

In Zimbabwe, both NUA 45 and Cherry were available for commercialization by the private sector and the national bean research programme produced breeders' seed of both varieties. However, due to sudden interest in NUA 45, a corresponding focus on NUA 45 pre-basic and basic seed was required to meet the certified seed needs (*Figure 2*). On the other hand, Cherry remained static until 2015 and 2016 when certified seed production commenced, albeit at low volumes compared to NUA 45. Four seed companies are involved in NUA 45 certified seed production in Zimbabwe, while only one markets Cherry.

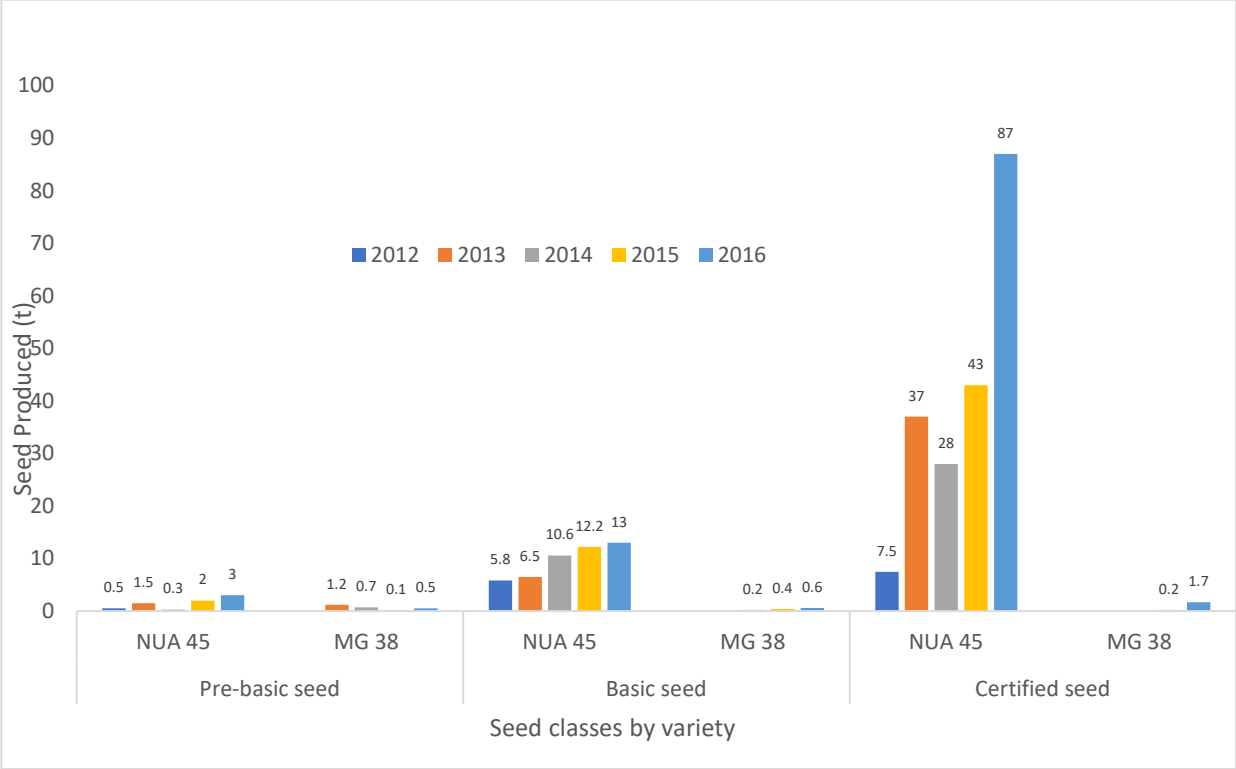


Figure 2: Seed production comparison: biofortified and non-biofortified in Zimbabwe

Like Zimbabwe, in Malawi, NUA 45 seed production progressed faster compared to that of VTTT924/4-4 despite the two varieties being released at the same time. Due to demand from both farmers and NGO's working in nutrition interventions, a cost sharing scheme for pre-basic seed production was instituted in 2014 between NARS and a private seed company, Exagris Africa Limited. The effect of the cost sharing was immediate (*Figure 3*) as pre-basic seed production volume increased more than eight-fold within one calendar year. Production efficiencies were better at the private seed companies compared to the NARS.

Associated with the increase in production was the increase in seed companies marketing the variety from two in 2011 to five in 2016.

The scenario in Mozambique in the absence of seed companies, CIAT/NARS had to rely on community seed production to move varieties from research to other farmers initially in Angonia and Gurue districts. Following nutrition education and demonstrations, three private seed companies developed interest and eventually increased seed production volumes. The breeding programme maintains a minimum volume of pre-basic seed for each variety, but seed production by the communities and seed companies indicates preference of NUA45 over CAL 143 (*Figure 4*). Meanwhile, community seed production has continued to increase in Mlangeni area of Angonia district. To support seed business by local agrodealers. To build the capacity of local agrodealers in marketing of bean seed, CIAT/NARS engaged seven (7) private agrodealers from the Agrodealer Association of Angonia to pilot sales of small packs of 100g, 250g, 500g, and 1kg. The effectively demonstrated farmers' willingness to purchase bean seed in remote areas of Mozambique.

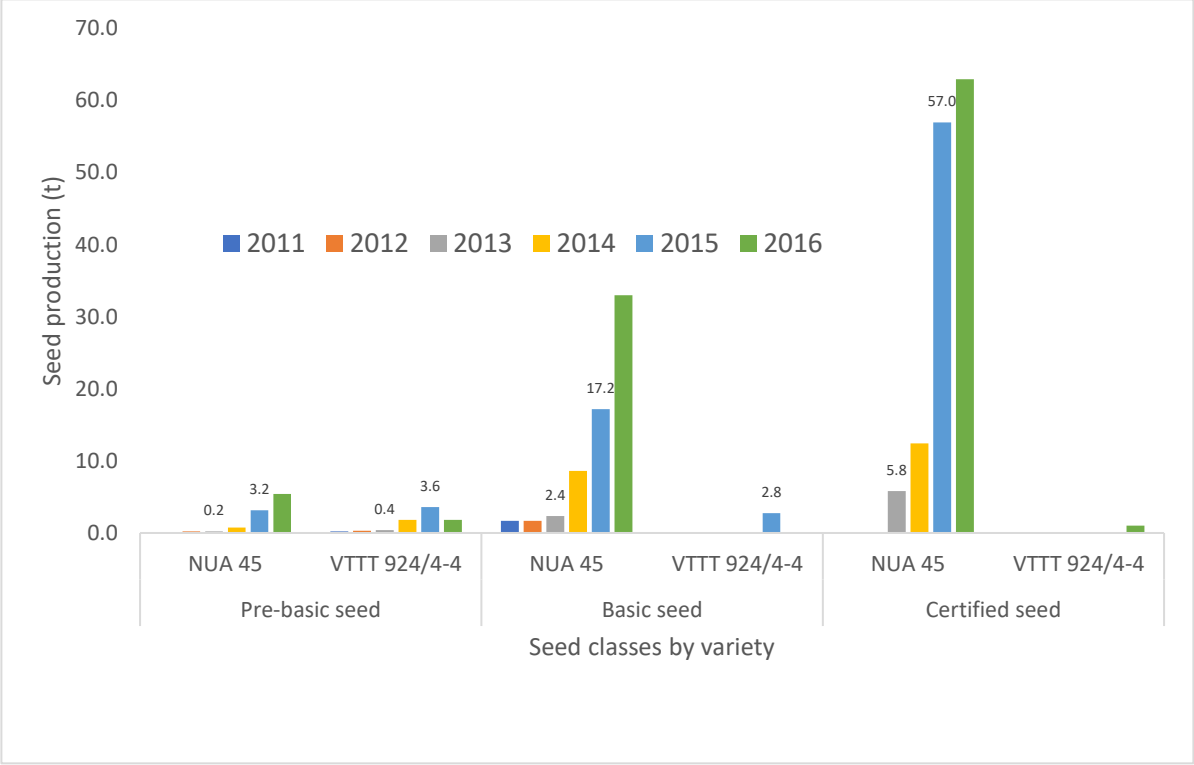


Figure 3: Relative increase in bean seed production for NUA 45 and VTTT924/4-4 in Malawi showing the effect of cost-sharing pre-basic seed production between DARS and Exagris Africa Limited in 2014

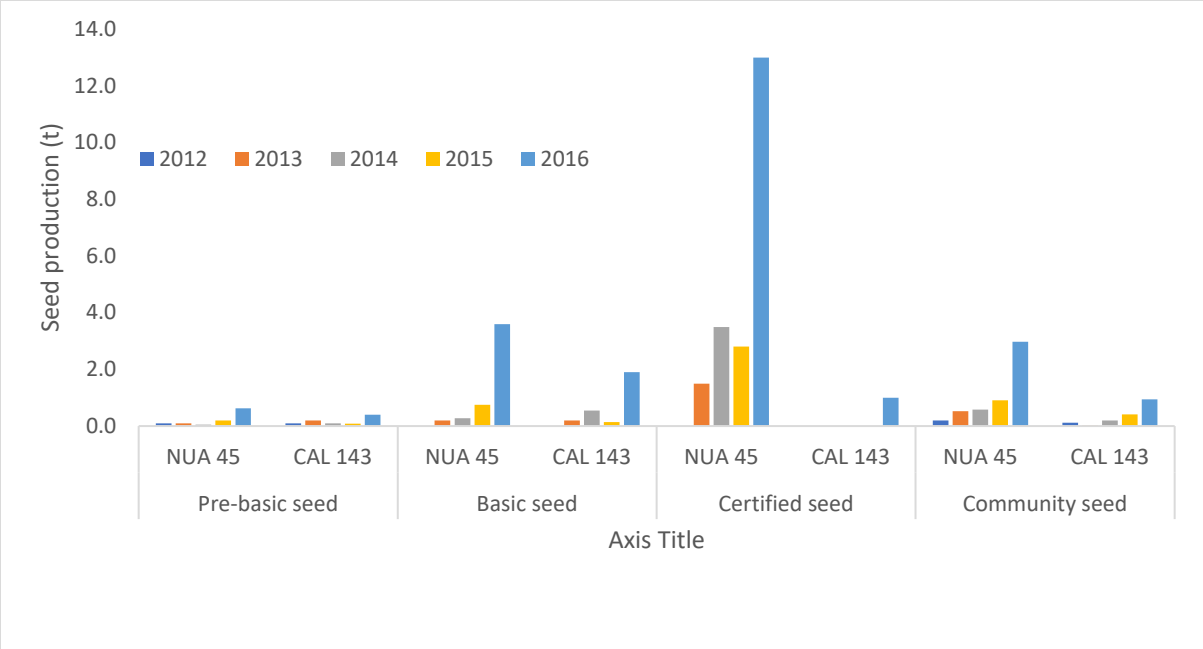


Figure 4: Increased investment in NUA 45 seed production in both formal and informal seed systems in Mozambique; note the higher production volumes for NUA 45 compared to CAL 143

Community Seed production schemes increased production over the years (Mlangeni and Nkhamenya). Nutrition education coupled with training on diverse ways of preparing bean-based dishes using the food basket approach to enrich existing dishes was conducted resulting in participatory documentation of recipes with farmers, local caterers and extension personnel.

Table 2: Bean seed volume sold by rural agrodealers in during planting time in January 2015

Agrodealer	**Location**	**Volume of seed sold in 10 days during planting time**
Econia Bikap	Chipindu	100
Gervasio Vitori	Domue	50
Damiao Dickson	Domue	200
Emelio Magagula	Domue	50
Jacobo Ndawo	Mlangeni & Vila Ulongue	400
Alfredo Dique	Tsangano	100
Josef Raphael	Kamphessa	100
Total		**1,000**

Interest from NGOs

Overall, the nutrition education efforts stimulated the demand for NUA 45 seed as farmers looked upon the available channels to deliver seed. *Figure 5* shows the increase in number of farmers reached with NUA 45 seed over the years in the three countries, emphasizing that women are the main bean farmers. A total of 63,355 farmers accessed NUA 45 seed over the five-year period. In contrast, the non-biofortified comparisons only reached 2% of the households reached with the biofortified variety in the three countries. In these countries farmer accessed seed through cash purchases (certified seed) and through context-based community schemes such as seed loans or pass-on systems. Small scale farmers demonstrated capacity to build from small start-up volumes of seed, especially in Malawi where some started with 10kg only, but multiplied that to more than 10,000kg in four years.

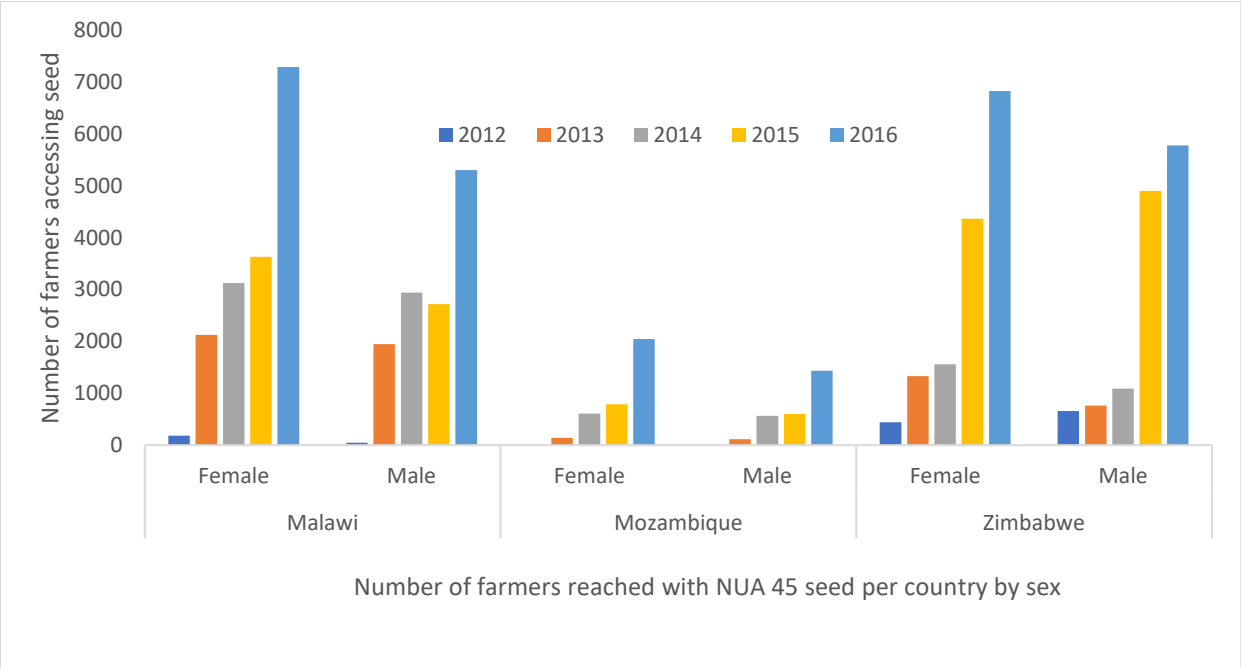


Figure 5: Outreach by Gender

Key lessons

Seed systems are complex; identifying different partners and adapting each system to respond to emerging demands is key for access to varieties. For instance, in the study, country and context-based strategies had to be deployed to move biofortified varieties. It also became evident that information is key for farmers to distinguish between varieties that look similar in colour. Farmers use sets of characteristics to select varieties. For instance, in addition to biofortification, farmers also preferred NUA Increase in demand for NUA 45 seed was a result of both push and pull strategies (*Table 3*).

Table 3: Push and pull strategies for increasing demand for NUA 45 in Malawi, Mozambique and Zimbabwe

Push strategies	Pull strategies
Increasing pre-basic and basic seed production	Nutritional awareness campaigns
Diverse seed delivery mechanisms	Specific target groups campaigns
Unified extension services	Business opportunities for artisanal processing
	Varietal information provision

Needs to scale up:

- Biofortification with iron and zinc is an invisible trait; biofortified varieties need to be produced in higher volumes to ensure they displace similar looking non-biofortified varieties.
- Partnership is required to bring seed closer to farmers at scale through existing and new rural agrodealer networks

Conclusion

Nutrition education can play a critical role in facilitating prompt access to biofortified bean varieties. Hence, there is a need for deliberate efforts to realize the goals of biofortification, a feat that silent promotion would not achieve. Nutrition education creates demand to which the pro-profit private sector can respond. Nutrition attributes are important when developing varieties, but farmers also look for other desirable attributes in biofortified varieties.

References

Bhutta ZA, Das JK, Rizvi A, Gaffey MF, Walker N. and Horton S. 2013. Evidence-based interventions for improvement of maternal and child nutrition: what can be done and at what cost? Lancet. 2013; 382:452–477

Black RE, Allen LH, Bhutta ZA, Caulfield LE, de Onis M, and Ezzati M. 2008. Maternal and child undernutrition: global and regional exposures and health consequences. Lancet. 2008; 371:243–60.

Black RE, Victora CG, Walker SP, Bhutta ZA, Christian P and de Onis M. 2013. Maternal and child undernutrition and overweight in low-income and middle-income countries. Lancet. 2013; 382:427–51.

Cromwell, E., Friis-Hansen, E. and Turner. M. 1992. The Seed Sector in Developing Countries: A Framework for Performance Analysis. Working Paper 65. Overseas Development Institute. London.

David, S. and Sperling, L. 1999. Improving technology delivery mechanisms: Lessons from bean seed systems research in eastern and central Africa. *Agriculture and Human Values,* 16**,** 381-388.

Lung'aho M., Birachi E., Butare L., Musoni A., Muhinda, M.J.J., Ngabo, F. and Buruchara R. 2015. Rwanda Nutrition, Markets and Gender Analysis 2015. Nairobi: Government of Rwanda/International Center for Tropical Agriculture (CIAT).

Mabaya, E., Omanga, P. and DeVries, J. 2013. Status of Seed System Development in Sub Saharan Africa. Africa Agriculture Status Report: Focus on Staple Crops 2013. Alliance for Green Revolution in Africa (AGRA). Nairobi, Kenya. Pp 54-68

Masset Edoardo, Haddad Lawrence, Cornelius Alexander, Isaza-Castro Jairo. 2012. Effectiveness of agricultural interventions that aim to improve nutritional status of children: systematic review. BMJ. 2012. 344:d8222

Ministerio de Saude (MISAU) *Instituto Nacional de Estatistica* (INE) e ICF International (ICFI). Mozambique Inquerito Demografico e de Saude 2011, Calverton, Maryland USA, MISAU, INE e ICF.

National Statistical Office (NSO) [Malawi] and ICF International. 2016 Malawi Demographic and Health surveys 2015-16 Key indicators report. Zomba, Malawi and Rockville, Maryland USA. NSO and ICF International, pp28-33.

Rubyogo, J.C. Sperling, L. Muthoni, R., and Buruchara, R. 2010. Bean seed delivery for small farmers in Sub-Saharan Africa: the power of partnerships. Society and Natural Resources, 23 (4):1-18.

Tripp, R. 2003. How to Cultivate a Commercial Seed Sector. *Sustainable Agriculture in the Sahel.* Bamako, Mali: Overseas Development Institute. London.

Venkatesan, V. 1994. Seed Systems in Sub-Saharan Africa: Issues and Options. *World Bank discussion papers* Washington DC. USA.: World Bank.

Zimbabwe National Statistics Agency and ICF international. 2016 Zimbabwe Demographic and Health Survey 2015. Final report. Rockville, Mary land USA, Zimbabwe National Statistic Agency (ZIMSTAT) and ICF International.

SESSION VII

COMMUNITY-BASED/DECENTRALIZED MODEL

An Assessment of the Local Bean Seed Production and Marketing Model: The Case of Community Seed Banks in Nicaragua

David De Young and Mywish K. Maredia[22]

Introduction

Many models of legume seed production and distribution have been tried in developing countries that are based on a combination of private, NGO, and public-sector partners playing niche roles in filling the gap between seed supply and demand. In recent years, the Government of Nicaragua has implemented a locally managed and operated model termed "Community Seed Banks" (CSBs)[23] to produce and market *Apta* seeds of improved varieties of various crops including beans. The CSBs address the challenge of disseminating improved varieties (i.e., varieties generated by a research system) of bean seed to farmers in geographically dispersed communities that traditionally source bean seed from the informal seed system. This study takes a closer look at the business models of these CSBs as implemented in Nicaragua under the Bean Technology Dissemination (BTD) project and addresses the following research questions: 1) What characteristics of the CSBs determine their success or failure? 2) Can community-based seed system produce quality seeds?

Method

CSB level data were collected from 154 CSBs through a survey targeted to all CSBs participating in the project in 2011. Project reports in subsequent years gave the number of years of operation of each of the 154 CSBs included in the study. The duration analysis technique was used to identify characteristics of the CSBs that were correlated with the duration of their operations; with longer duration considered more sustainable.

The CSB model in Nicaragua

The CSBs followed a model of self-governance with technical assistance from the Nicaraguan Institute of Agricultural and Livestock Technology (INTA). Local extension agents were responsible for assisting farmers in the development of local CSBs, training the members in quality seed production, and providing the registered seed and other inputs for seed production. The survey of 154 CSBs distinguishes three different organizational structures. 1) The classic CSBs were based on a community or group structure for decision making on all aspects from seed production to the use of harvested seed. Seed production under this model took place on a community plot. 2) Parceled CSB were like classic CSBs in the community level decision making, except that the seed was produced on multiple plots owned by individual farmers. 3) The individual CSB structure was made up of one experienced seed farmer and did not have community input. In the context of the BTD project, INTA used such farmers to produce seed for dissemination in other regions of the country.

---

[22] *Agriculture, Food and Resource Economics, Michigan State University, East Lansing, MI*

[23] The term Community Seed Bank refers to different organizations with varying structures, functions and priorities. Examples of different CSBs are presented in *Community Seed Banks: Origins, Evolution and Prospects* edited by Ronnie Vernooy, Pitambar Shrestha and Bhuwon Sthapit. In this study, however, CSBs have a definition limited to the activities and structure created by the Nicaraguan government through INTA with the goal of disseminating seed of improved varieties of common bean (*Phaseolus vulgaris*). The seed is not certified seed but is multiplied from Registered Seed with quality supervision from INTA technicians.

Over the three years of the BTD project 234 communities received support to establish CSBs. These CSBs produced 168 metric tons of seed and disseminated seed to an estimated 16,065 farmers. According to the national agricultural census, this represents 23% of farmers growing bean on 7 hectares or less.

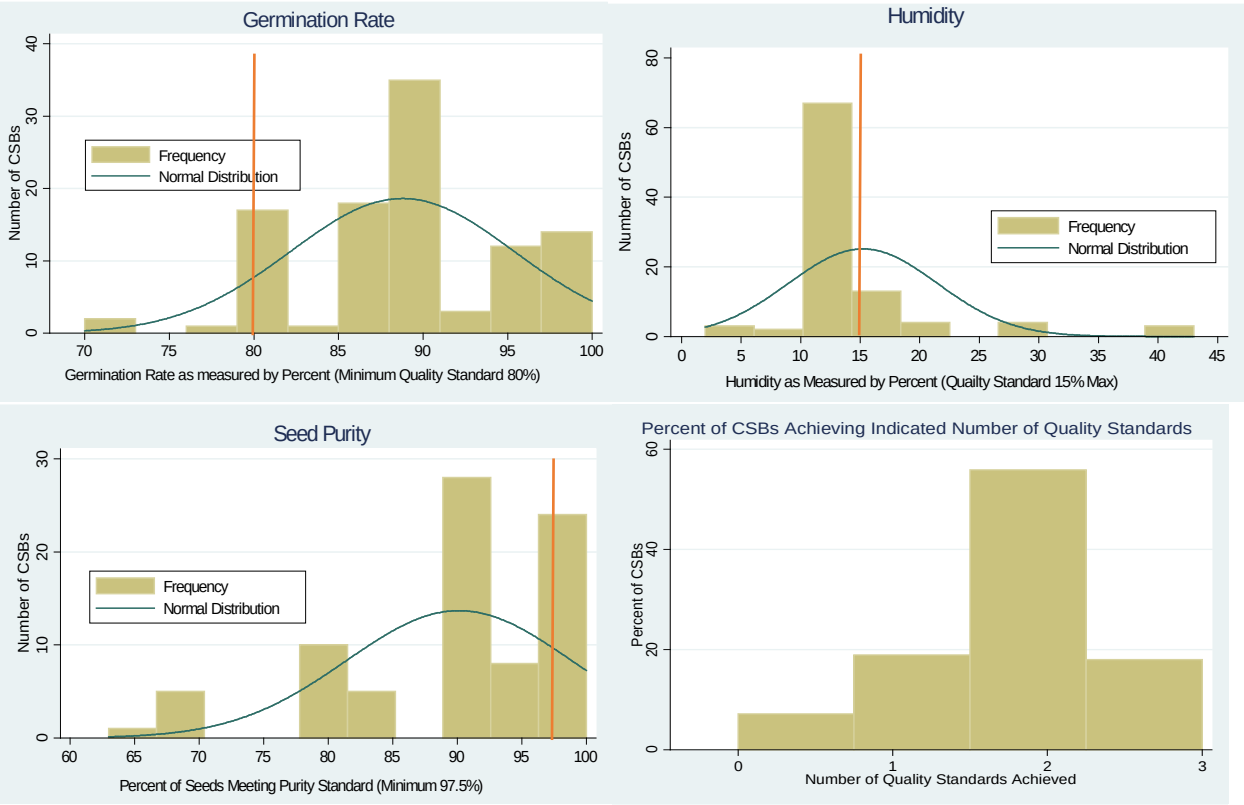
Sustainability of CSB model

A survival analysis (also called duration analysis) of 154 CSBs participating in the project beginning in 2011 revealed the characteristics associated with lower risks of failure or longer operations. The characteristics used in the analysis were identified from the existing literature including case studies of successful seed dissemination models using local seed enterprises like CSBs. The decision to continue or terminate a CSB each year is expressed as a function with the characteristics from the literature as the independent variables (right hand side) and the years of CSB operation as the dependent variable (left hand side). We present the results of the analysis for each set of these characteristics to understand what factors potentially contributed to the success or failure of CSBs.

Seed quality

The results indicate that CSBs are widely distributed across the spectrum of quality standards as measured by acceptable humidity level (at most 15%), seed germination rate (minimum 80%), and purity (minimum 97.5%). Only 18% of CSBs met all three quality standards (Figure 1). Seed purity was the most difficult standard to achieve. The perceived quality of seed reported by clients was available for only a subset of CSBs but indicate a 43% lower risk of failure of CSBs if it produced good quality seed. Figure 1 provides graphs of the three quality standards and number of quality standards achieved by the CSBs surveyed.

Figure 1: Quality Standards met by CSBs *(red line represents minimum standard of quality)*



Leadership

Experienced leadership was associated with a 42% longer survival of CSBs in the study. Since CSB members ultimately choose their leaders, projects and governments supporting CSBs should include the desired characteristics of CSB leaders in training prior to internal elections. Although no difference was found in the final model, there was evidence in earlier (albeit less robust models) that female led CSBs have higher failure rates and can benefit more from transportation assets. Institutions promoting CSBs with female leaders should assess cultural gender roles to ensure access to readily available and appropriate transportation and other assets and their acquisition method.

Formality and organization

The results indicate that CSBs that hold meetings and document decisions survived 25% longer than CSBs lacking this formality. The implication for future CSBs is to operate in a transparent, organized and formal manner that provides the opportunity for participation and communication to all CSB members.

Productive assets

Although multiple assets are vital to seed production, additional storage silos increased the time of operation by 6% and access to a fertilizer sprayer increased the survival by 16%. Projects and governments that promote CSBs should ensure adequate resources are available for the CSBs to access the needed equipment and facilities to increase their successful operation.

Seed market training

Results suggest that receiving seed marketing training reduced the failure rate of CSBs, especially for those that had lower seed yields in the first year of operation. For example, CSBs with low yields, such as 8 qq/mz and no seed marketing training had a higher risk of failure (and thus less sustainable) than CSBs with yields of 8qq/mz that did receive seed marketing training. For most CSB members, producing seed may involve only slight changes from their previous production practices. However, marketing seed is entirely a new practice for many farmers, and thus training in this aspect was found to contribute to the success of the CSB, despite the lower seed yields.

Intensity of operation

The number of clients (per unit area of seed production) had a negative effect on sustainability. The results indicate that CSBs face increased risk of failure when they lend seed to more farmers per unit of operation (i.e., when the intensity of seed operation is very high). An additional client (per unit area) shorted the survival time by 0.5%. The faster time-to-failure of CSBs with more clients per unit of land used for seed production indicates operational deficiencies and diminishing capacity of CSBs to manage many clients. This result again emphasizes the importance of seed marketing training as well as training in business operations to increase the operational efficiencies of CSBs and their survival rates.

Cost recovery

CSBs received payment for the seed produced in the form of cash, harvested grain, or other agricultural products. The BTD project proposed repayment of two pounds of harvested grain for each pound of seed received. The CSBs that secured repayment of double the weight of seed from a higher share of clients survived and operated longer than CSBs with lower shares of clients repaying at the agreed rate. Each 10% increase in repayment increased the length of survival by 2.5%. Repayment is important at a

price that covers the cost of seed production (reinforcing the importance of seed marketing to grow acceptance for a seed price above grain price). *Cost and benefit of CSB seed production*

For the BTD project the cost of establishing a 0.7-hectare (one *manzana*) seed production plot was less than $370. This included the cost of registered seed of the desired improved variety and the necessary inputs to ensure quality seed production. Even with lower than desired seed production of 10qq, the value of seed if sold at twice the price of grain was $780 using the 2013 grain price and $1320 using the 2011 grain price of beans[24]. The margins suggested here do not include land, labor and management costs of operating a CSB, most of these are in-kind contributions by the community. While these estimates of gross margins do not suggest CSBs are highly profitable, they do suggest that community members collectively interested in quality seed and willing to invest their time and community resources can operate a self-governed seed production enterprise that ensures access to quality seed while covering the cash production costs. While these results are encouraging, a major assumption is that clients are willing to pay double the price of grain for seed and that CSBs can ensure repayment.

Conclusions

The decentralized model of CSBs address the challenge of disseminating improved varieties of bean seed to farmers in geographically dispersed communities that traditionally source bean seed from the informal seed system. This study has identified the factors that were important in contributing to the success of CSBs supported under the BTD project in Nicaragua. The results also indicate the economic viability of this model if CSBs can maintain a decent seed production level, if community members are willing to provide in-kind services to support the operation of the seed banks and if clients can repay the seed in the form of double the quantity of grain. At the same time, governments and organizations must recognize the risks of shifting seed production closer to rural communities. Proper seed production protocol must be followed to ensure CSBs produce quality and disease-free seed. While 100% self-sustainability is a noble goal, periodic financial infusions or donated inputs might be needed to ensure CSBs are operating and can be relied upon to disseminate seeds of improved varieties to farmers on a regular basis, especially during shocks and disasters.

Finally, CSBs can be considered both a stimulus and a complicating factor for the typical free or subsidized seed dissemination efforts by governments and organizations. While governments that use the decentralized CSB model can reduce the costs of disseminating seed, they could also negatively impact the CSB business model by offering free seed to potential CSB clients. To support the CSB models, it would be important if governments and organizations planning to engage in seed distribution procured the seed from CSBs for subsequent dissemination. This of course, requires that CSBs can produce quality seeds to serve as the source of such large-scale seed dissemination efforts.

[24] The consumer price of bean varied from $1.46 per kg ($0.66/lb) in 2011 to $0.86 per kg ($0.39/lb) in 2013

Community-Based Seed Production: Seed system in the hands of the community

C.O. Iyangbe[25], D. S. Ogundijo[1] and E. Sangodele[2]

Abstract

In response to the challenges faced by most farming households in Nigeria, Catholic Relief Services and International Institute of Tropical Agriculture (IITA) signed a partnership agreement to collaborate in the joint implementation of agricultural components of Feed the Future Nigeria Livelihoods project through IITA's N2Africa program. The scope of this partnership extended to FCT and Kebbi State, but there was also a mutual understanding that the collaboration would also include activities in Sokoto State. The collaboration was aimed at increasing agricultural production, incomes, and improving nutrition of farming households with a focus on cowpea, groundnut and soybean. One of the major intervention areas is the promotion of community-based seed production that allows communities to take ownership of the seed system. To support a community-based seed system, the project facilitated activities that included the formation and clustering of producer groups, establishment of farmer managed demonstration plots, identification of seed entrepreneurs; training on seed production, support for seed certification, training of seed entrepreneurs on seed cleaning/packaging and marketing. The collaboration made remarkable progress in enhancing access to high quality seeds at the community level with over 11,500 farmers having increased access to not only seed of improved varieties, but also to other agricultural inputs. Their knowledge was also improved on the best agronomic practices. 147 seed entrepreneurs produced 3345Kg of cowpea, 5296kg of soybean and 716kg of groundnut. 74.5% of quantity of seed given as foundation seed was also recovered from the seed entrepreneurs. The intervention has led to an increase in adoption of early maturing, high yielding disease and pest-resistant legume varieties, which has resulted in increased yield of these crops, and has helped the farmers cope with the effect of climate change. To consolidate the gain of the community-based seed production and to scale up the concept in Nigeria seed system, a committee of seed experts were constituted by the national agricultural seed council (NASC) to study the existing seed policy and come up with practicable draft proposal for the institutionalization of community-based seed production in Nigeria seed law. The committee which is chaired by one of the seed experts from the N2A-FTF project is currently working with NASC directorate of seed industry to make recommendation to the federal government of Nigeria.

Keywords: Seed Entrepreneur, community, legumes, certification, and agricultural production

Introduction

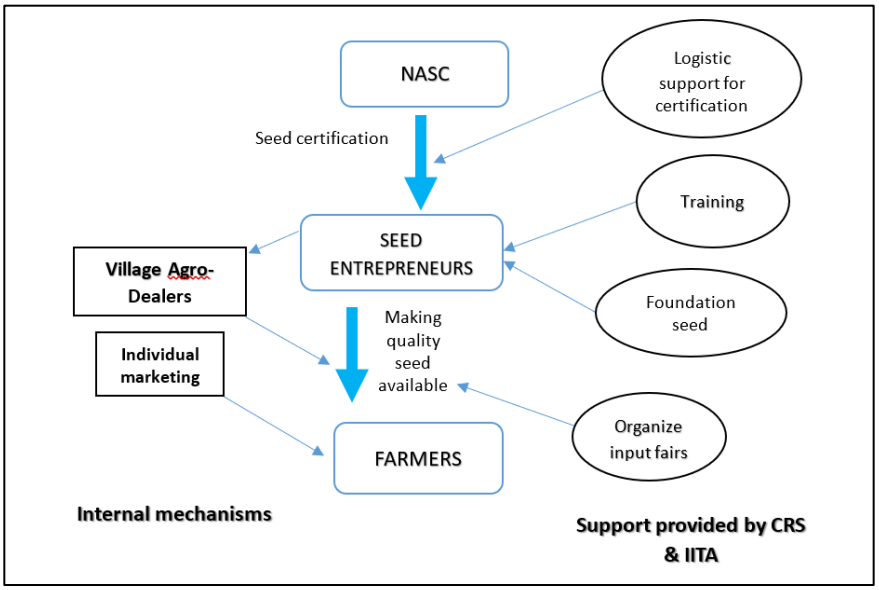
Seed is an important catalyst for the development of agriculture. The availability of quality seed is the foundation for food production and productivity and a precursor to crop and food diversification, a goal presently pursued by the Federal Government of Nigeria. The quality of seeds alone is known to account for an increase in productivity by at least 10–15% (Oyekale K.O. 2014). Efforts to improve the performance of the agriculture sector should include seed production and delivery systems. The Nigeria agricultural research institutions and international agricultural research centers have worked together to develop new, stress tolerant crop varieties that are well adapted to smallholder farmers' conditions. However, most farmers, especially the resource poor farmers have little or no access to improved seed and continue to recycle saved seeds that have lost their genetic purity after many generations of cultivation. Unfortunately, farming communities continue the practice of exchanging these planting materials among

[25] Catholics Relief Services, Plot No 477, 41 Crescent, Off Fourth Avenue, Gwarinpa, FCT Abuja, Nigeria
[2] International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria

the farmers; hence, yields have remained poor, resulting in persistent food insecurity, especially in Northern Nigeria. Several programs have initiated community-based seed production activities, but many of these projects have achieved only limited successes due to several factors, including lack of a sustainable model for seed production and marketing; lack of access to foundation seed; lack of tailored training on quality seed production and lack of information about the availability of quality seed. Through the collaborative efforts of CRS and IITA, interventions were implemented that focused on increased access to improved seed by resource-poor farmers in Northern Nigeria, with the aim of strengthening the informal seed sector. This paper focuses on the achievements recorded and lessons learnt in one year of implementing community-based seed production interventions under the USAID-funded Feed the Future Nigeria Livelihoods Projects being implemented by Catholic Relief Services in collaboration with IITA-N2A project.

Methodology

The project is being implemented in FCT, Kebbi and Sokoto states in the Northwestern part of Nigeria. Generally, in the northern Nigeria, the soils are sandier and support the production of crops like groundnut, cowpea, sorghum and millet. The sandy nature of the soil makes it prone to leaching and thus requires care. Resource-poor farmers cannot afford the inputs such as fertilizers required to maintain the productivity of the land. Agricultural production remains at subsistence level as many of the small-scale farmers also have poor access to quality seed, finance and extension services.



Both Feed the Future Nigeria Livelihoods and N2A projects attached immense importance to adoption of improved agricultural practices that will lead to increase agricultural production and productivity. One of the methods used by the project for the adoption of improved agricultural practices that will lead to increased production and productivity is the promotion of interventions that will increase access to high quality seeds through the strengthening of community seed systems. Emphasis was placed on legumes, which have been neglected by the formal seed sector. The main methods used in the promotion of community-based seed production include the formation and strengthening of producer groups, identification and training of interested seed entrepreneurs (SE), establishment of demo plots to promote adoption of improved technologies, which include early maturing and drought-resistant varieties, support for seed certification, training of SE on seed cleaning and packaging, organizing farmers field days and agricultural input fairs.

Results

Formation and strengthening of producer groups

In the first year of the intervention, the project facilitated the formation of 509 producer groups with 11,574 members (8,659 males and 2,915 females) and they were all trained on group organization to

ensure that the groups are dynamic and sustainable. 146 of the groups were registered with local authorities to function as a legal entity. They were all also trained on best agronomic practices using a training of trainers approach to reach large numbers of farmers.

Establishment of farmer-managed demonstration plots

Six improved technologies, which include the use of improved varieties, right spacing, seed treatment technology, use of hand-held planters, use of inoculant in soybean and Aflasafe in groundnut to prevent aflatoxin to the farmers, were introduced to the farming communities through the establishment of 280 farmer-managed demonstration farms across project locations.

Identification and training of Seed Entrepreneur

The project introduced 5 high yielding, tolerant and disease resistant varieties of leguminous crops. To ensure that farmers have access to most of these introduced varieties within the communities in subsequent planting seasons, 257 seed entrepreneurs were identified and trained. Sensitization was carried out among the producer groups in the project communities and interested farmers that had an interest in seed production were identified. The training was then facilitated by a team of experts from IITA, ICRISAT and NASC. The training focused on seed production and it covered site selection, land preparation, seed selection and treatment, planting date/distance, fertilizer, fertilizer application, weed, pest and disease control, field isolation and rouging, harvesting, drying and storage.

Support for certification of seed farms

The project supported 168 Seed entrepreneurs with foundation seed of improved varieties of soybean, cowpea and groundnut in FCT (50), Sokoto (61) and Kebbi (57) to establish seed farm of maximum of 0.25Ha per SE. All the seed farms were inspected by the National Agricultural Seed Council (NASC) out of which 147 were duly certified. The foundation seeds were made available to the SE by IITA (FCT and Kebbi) and ICRISAT (Sokoto) with the understanding that after harvest the SE would return double the amount of foundation seed they had received. 74.5% of quantity of seed given as foundation were also recovered.

Table 1: Number of seed farms certified, and quantity of certified seed produced

State	Crop	No. of Seed farms certified	Certified Seed produced (Kg)
FCT	Cowpea	18	885
	Soybean	3	2345
	Groundnut	20	105
Kebbi	Cowpea	11	130
	Soybean	28	2951
	Groundnut	11	611
Sokoto	Cowpea	56	2330

Training of SE on seed cleaning and packaging

Both field agents and seed entrepreneurs were trained and given a practical demonstration on seed cleaning and packaging, seed drying, sorting, grading, cleaning, packaging, labeling, post-harvest certification process and the use of PICS bags for safe storage. The training enabled SE to package the seed produced and make it available for sale within the community and during input fairs.

Marketing and demand creation

To ensure that the improved seeds are accessible to the resource-poor farmers within the community, the seeds were packaged in 500g, 1kg and 2kg. Farmers were sensitized during the group meetings by

Field Agents and lead farmers on the availability of certified seed within the communities and information was circulated through word of mouth by the SE to farmers. The highest quantity of seed was sold during the agricultural input fairs organized across the project communities.

Table 2: Quantity of seed Sold and Amount

State	Soybean		Cowpea		Groundnut	
	Quantity sold (Kg)	Amount (Naira)	Quantity sold (Kg)	Amount (Naira)	Quantity sold (Kg)	Amount (Naira)
FCT	1580	378,000	485	134,000	40	6,000
Kebbi	1,900	240,000	120	20,000	450	100,000

Note: The quantity of cowpea produced in Sokoto was small, SE decided to make use of the seed in subsequent season

Discussion

The project has made remarkable progress in increasing farmers' access to quality seed using community-based approaches while expanding the farmers' knowledge on focus crops in the targeted locations. Farmers' knowledge is critical in adoption of any improved technology. To ensure farmers were reached in a timely manner, and in the face of the wide-spread nature of the project communities, farmers were grouped and trained through an identified change agent (Lead Farmer) within the group.

The establishment of demonstration plots proved to be effective and aided the adoption of the improved varieties and new technologies. Considering that many farmers are not literate, technology like right planting space, method of fertilizer application and the use inoculants in soybean were demonstrated. Adoption of these technologies is seen as key to the sustainability of this model as it will determine the success of seed entrepreneurs. Farmers will be willing to buy seed from SE only if there are noticeably positive benefits from the previous seed used. The project has so far been able to generate demand for good quality seed through this approach within the focus communities.

The cheapest and closest source of seed for farmers is his/her own farm. Farmers source seed from both informal and formal systems (Sperling et al., 1996; Sperling and Cooper, 2003). Tripp and Rohrbach (2001) found that most smallholder farmers either give or receive seed each year, through gifts, barter or sales. The CRS/IITA collaboration focused on strengthening the community seed systems to ensure farmers have access to newly introduced early maturing varieties of high quality. With adequate support, including training and providing guidance through the certification process, seed farmers got their fields certified. The major reason for some farms failing the certification test was poor field management, especially in terms of weed management. Those that did not pass will be supported the following season to manage their farms properly to become certified.

Some challenges, like early cessations of rainfall in Sokoto State and the invasion of fields by herdsmen in FCT, which resulted in complete crop failure were encountered. The reported challenge in Sokoto State was the late distribution of the input to participating farmers, which shows the need for early input distribution the next season to achieve the anticipated success.

Conclusion

In the last one year, the collaborative effort of the Feed the Future Nigeria Livelihoods and N2A projects has played a catalytic role in the dissemination of improved varieties of seed by ensuring that communities take ownership of the seed system of focused legumes; a business model has been developed for soybean, groundnut and cowpea through community seed entrepreneurs.

The collaboration has led to an increase in adoption of high yielding disease and pest-resistant legume varieties, which has resulted in an increase in the yield of these crops. The promotion and adoption of varieties which are also early maturing have also helped the farmers to cope with the effect of climate change which is noticeable in the annual rainfall duration which has significantly reduced. Training farmers on best agronomic practices, along with the establishment of demonstration plots, will have a sustainable effect on their productivity and coping mechanism on climate change.

With the support from research institutes and NASC, the project recommends production of foundation seed at the community level by registered seed companies with the aim of supplying foundation seed to SE who are engaged in production of certified seed in the community. This seed system is considered a sustainable approach to community seed production. However, supervisory and monitoring support from regulatory body like NASC must be adequate to ensure success of this approach.

References

Oyekale, K.O. 2014. Growing an Effective Seed Management System: A Case Study of Nigeria. Journal of Agriculture and Environmental Sciences 3 (2), 345-354

Sperling, L. and Cooper, H.D. (2003) Understanding seed systems and strengthening seed security: a background paper. In: Improving the Effectiveness and Sustainability of Seed Relief: A Stakeholders' Workshop. Food and Agriculture Organization, Rome.

Sperling, L., Scheidegger, U. and Buruchara, R. (1996) Designing Seed Systems with Small Farmers: Principles Derived from Bean Research in the Great Lakes Region of Africa. Agricultural Research and Extension Network (AGREN) Network Paper No 60. ODI, London.

Tripp, R. and Rohrbach, D.D. (2001) Policies for African seed enterprise development. Food Policy 26(2), 147–161

Improving Legumes Certified Seed Production and Access Through Breeding for Pests Resistant and Innovation Platform

J. Y. Asibuo[26], E.A. Adjei[1], A.S. Osuman[1], H.M. Bortey[1], S. Amoah[1], S.N.T.T. Addy[1], N.N. Denwar[2], F. Kusi[2], H. M. Mohammed[2], and S. A. Ennin[1]

ABSTRACT

Cowpea (*Vigna unguiculata* L, Walp) and groundnuts (*Arachis hypogea*) are important food security crops which help in improving the productivity of resource poor farmers in multiple ways. They are cheap sources of plant protein which can improve the nutrition of farm household and reduce malnutrition which is very common among resource poor farmers. Cowpea and groundnut can grow in dry areas where most crops cannot thrive. Additionally, population increase with reduced fallow periods deplete soil fertility, however, incoperation of cowpea and groundnuts into cropping systems ensure sustainable soil. Nothwithstanding, pests and diseases control have been a major challenge faced by farmers who cultivate these crops with losses ranging between 50-100%.

Recent breeding activities have focused on varieties resistant to insect pests such as aphids, flower thrips, cercospora and *Striga gesneroides*. In 2015 and 2016, nine improved cowpea varieties were released in Ghana by the Crops Research Institute (CRI) and Savannah Agricultural Research Institute (SARI) of the Council for Scientific and Industrial Research (CSIR). After identification of new sources of cowpea aphid resistant genotypes and subsequent identification of SSR marker link to the aphid resistance gene in 2008, CSIR-SARI initiated a research program aimed at improving the field resistance of cowpea genotypes to aphids using marker-assisted backcrossing. In addition to resistance to *Striga gesneroides* and drought, these varieties reduced the cost of production through reduced cost of insecticide, labor and spraying regimes. About 95% of cowpea is produced by small-holder farmers. Average yields on farmers' fields ranged from 0.5-0.8 Mt/ha however, with the use of insect resistant varieties farmers can achieve 1.5-2.8 Mt/ha. Other indirect benefits associated with the cultivation of the insect resistant varieties include less environmental pollution, chemical residues on beans, reduced loss of beneficial insects, among others. Using insect resistant varieties, Seed Companies and Seed Producers have added cowpea seed production to their predominantly maize seed business.

Smallholder farmers in most districts in Ghana face challenges in getting reliable access to sufficient quantities of quality seed of superior varieties at the right time and at an affordable price, which affects their agricultural productivity and income. Farmers generally get their improved maize seed from agro-input dealers which may be very far from their communities. Unlike the cereal seed system, the legume seed system is poorly established. Farmers therefore get their seed through informal seed systems. Different seed systems have been identified; farmer saved seed, farmer to farmer seed exchange and buying of grain as seed from the market. Four innovation platforms (IPs) were formed by multi-stakeholders with the objective to identify development challenges and together find ways to address them. There were two IPs in each of the two districts- West Manprusi (Wungu and Wulugu) and Atebubu-Amantin (Atebubu and Amantin). The four communities identified unavailability of improved cowpea and groundnut varieties and unavailability of fodder during the dry season for their livestock as a major

[26] CSIR-Crops Research Institute, P. O. Box 3785, Kumasi, Ghana
[2] CSIR-Savannah Agriculture Research Institute, P. O. Box 52, Tamale, Ghana

constraint and one of the entry points for intervention. Dual-purpose (grain and fodder) legumes for human and livestock were selected by the IPs. The innovation platforms collaborated in the evaluation and selection of preferred improved cowpea and groundnut varieties on their fields. IP field fora were organized during pod formation and at harvest to select varieties of their choice. Seeds of the selected varieties were multiplied and given to the IPs to produce seed for the community. However, farmers on the Amantin IP opted for seed production by selected individual IP farmers rather than community seed production. Information was shared on all IPs on seed production procedures and legislation.

The innovation platforms collaborated in the evaluation and selection of preferred improved cowpea and groundnut varieties on farmers' fields in 2012 and 2013. Four improved varieties of groundnut (Adepa, Nkosour, Nkatie SARI and Sumnut 22) and four improved cowpea varieties (Soronko, Padi-tuya,Songotra and Asetenapa) were evaluated on farmers field with local checks. IP field fora were organized during pod formation and at harvest when the promising dual-purpose varieties could be clearly distinguished from non-dual purpose through drying of leaves and leaf fall at maturity. Members selected the varieties they preferred.

Generally, value chain actors appreciated better biomass and grain qualities and yield of the improved cowpea and groundnut varieties. Pod, seed and fodder yield of cowpea and groundnut varied across locations.

Field days were organized at the time of harvest. Farmers were impressed about the pod and fodder yields of two groundnut varieties, *Nkosour* and *Adepa*. They observed that not only do their varieties produce less seed and biomass but also lack fresh seed dormancy, which results in seeds sprouting on the field when harvesting was delayed. IP members also selected *Padi-tuya* and *Songotra* as the preferred cowpea varieties.

The project introduced seed production as a business for the IPs. Six farmers (3 women and 3 men) were trained to produce seed and were duly registered as certified seed growers. Five of the 6 seed growers produced certified seeds of cowpea, groundnut and maize in the minor cropping season of 2014 at Amantin. The other three IPs at Wungu, Wulugu and Atebubu also produced improved seeds through community seed production. Through the innovative platforms, farmers now have access to improved dual-purpose groundnut and cowpea varieties and therefore the districts will not only have sustainable access to high quality seeds of improved varieties at affordable prices but will also improve their productivity and incomes. The certify seed growers at Amantin produce more than 15 MT of seed every year. Out of the quantity produced, about 50% are sold to farmers in the district and the other 50% sold to other districts and even regions through other seed companies who source their seed from them.

Community Seed Depots – Achieving Dual Objectives of Sustainable Bean Seed Access and Nutritional Security in Guatemalan Highlands

Irvin Widders, Luis Flores, and Salvador Castellanos[27]

MASFRIJOL, a USAID Feed the Future project in the Western Highlands of Guatemala, is seeking to achieve the dual objectives of increasing the productivity of common bean by smallholder resource-poor farmers and of improving the nutritional quality of diets through increased household bean consumption, a traditional nutrient-rich staple food.

The Feed the Future Innovation Lab for Collaborative Research on Grain Legumes (Legume Innovation Lab, LIL) at Michigan State University (lead institution) in partnership with the Instituto de Ciencia y Tecnologia Agricola (ICTA) and the Ministerio de Salud Publica y Asistencia Social (MSPAS) in Guatemala have be contracted to implement MASFRIJOL.

The Feed the Future target area in the Guatemalan highlands includes the Departments of Totonicapán, San Marcos, Huehuetenango, Quetzaltenango and Quiche, where the incidence of child stunting among indigenous Mayan communities exceeds 60% due to poor food diversity in the maize-based diets.

An estimated 390,000 smallholder farmers (2002-03 census) produce beans within this region, each household planting on average from 0.1 to 0.5 ha. Following the traditional practice with bean landraces, a minimum of 90% of the smallholder farmers retain seed for planting from one season to another. When a farmer does need to acquire seed for planting purposes, majority of farmers will purchase bean grain from local markets, selecting grain that is uniformly large and of the preferred color (opaque black). The consensus is the less than 15% of bean farmers are familiar with the names of specific varieties and thus rarely seek to purchase seed of improved varieties.

Approximately 62% of the bean production in the Guatemalan highlands is inter- or relay cropped with maize following the traditional milpa system. Landraces of climbing beans of three distinct species (*Phaseolus vulgaris, P. coccineus* and *P. polyanthus*) plus a couple of improved varieties of "bolonillo" beans (P. vulgaris) are planted by smallholder farmers primarily for household bean consumption. Because of the low yields obtained, harvested beans are rarely sufficient to meet highland household bean consumption needs throughout the year.

Alternatively, monoculture (38% of bean production area) of early maturing bush-type varieties adapted to higher altitudes are gaining attention by smallholder farmers in the "altiplano" region. ICTA small black seed-type varieties such as ICTA Hunapu and ICTA Altense have shown significantly higher yield potential when cultivated under appropriate agronomic conditions, thus enabling farmers to achieve their household food security needs with less area planted.

Access to quality seed at an affordable price and in adequate quantities of these high-altitude bush-type varieties is a significant constraint. Since higher plant densities are required by the determinant bush-type varieties to achieve high yields, farmers need to acquire and plant relatively copious amounts of seed (recommended seeding rate of 50 Kg per ha) to establish a monoculture planting. Seed therefore

---

[27] *Feed the Future Legume Innovation Lab, Michigan State University, East Lansing, MI*

represents the primary input investment for the farmer. This translates into 4.5 to 22 kg for a typical farmer to plant 2 – 10 cuerdas (Guat.), 0.09 to 0.44 ha, in contrast to only 1.6 to 6.5 kg, respectively, for intercropped beans with maize.

Smallholder farmers in the highlands recognize the importance of quality bean seed for planting. Farmer interviews indicate that they value quality seed because of high germination percentage and thus improved stand, lower incidence of certain diseases (seed-borne diseases), uniformity in maturation and harvest, and uniformity of grain type, all of which translate into higher yields.

Although willingness to pay for quality seed varies from farmer to farmer (i.e., commercial versus subsistence), smallholder farmers on average are thought to be willing to pay approximately 33% higher than bean grain prices in local markets. Market class, color and size of seed are primary factors used in selecting grain for planting purposes. When good community networks exist, and farmers learn of a positive experience with the production of a specific variety, other farmers in a community may also seek to acquire seed of that bean variety or landrace.

A fundamental premise of the MASFRIJOL strategy is that the planting of "quality" bean seed is critically important to increasing productivity, perhaps even more important that the variety. In addition, the program decided to promote monoculture production of either bush or climbing bean varieties because maize is the priority crop for farmers in the "milpa" system. Under an intercropped system, inputs and integrated crop management practices focus on maximizing maize productivity at the expense of bean productivity. Monoculture affords the opportunity for farmers to achieve high bean yields on a small fraction of their arable land area while concurrently not compromising on maize production.

To achieve MASFRIJOL's dual objectives of increasing bean productivity and consumption for improved child and family nutrition, the project sought to:

1. Enhance smallholder farmer access to quality seed of improved disease resistant bush and climbing bean varieties adapted to the agro-ecologies of the Guatemalan highlands through sustainable community-based seed production, and
2. Increase household dietary decision maker's knowledge of the nutritional value of beans in local diets and of alternative bean cooking methods and recipes for nutritious bean-based foods for young children.

To achieve sustainable smallholder farmer access to quality bean seed, MASFRIJOL has established 75 community seed depots ("almacenes comunitarios") in remote rural communities in selected bean production areas in the Feed the Future target departments in the Guatemalan highlands. Each community seed depot (CSD) is led by a selected, progressive and trusted smallholder farmer in the community who produces quality declared ("apta") seed for sale to farmers in his/her local area. Presently, this model is not intending to provide for all the bean seed requirements of a community, since each CSD farmer only has capacity to plant up to 0.25 ha with a total harvest of approximately 450 kg of quality declared seed. The limitation in seed production capacity of CSDs is not considered, however, to be a constraint, since ICTA recommends that resource-poor non-commercial farmers only purchase quality declared seed (QDC) once every three growing seasons and to save conditioned grain for the intervening seasons.

The bean varieties being promoted and disseminated through the Community Seed Depots includes two bush-type black bean varieties adapted to high altitudes (up to 2,700 meters), *ICTA Hunapu* and *ICTA*

Altense, an Fe bio-fortified bush-type black bean variety (*Super Chiva*), plus two climbing "bolonillo" grain type bean varieties (*ICTA Labor Ovalle* and *ICAT Utatlan*). These are improved bean varieties bred by ICTA over the last three decades in collaboration with Bean/Cowpea CRSP, Legume Innovation Lab (North Dakota State) and CIAT scientists.

The "community seed depot" model under MASFRIJOL involves a series of actions considered critical to its success in producing QDS bean seed.

1. Selection of leader farmers committed to the production of QDS bean seed, have an entrepreneurial spirit, and are willing to sign a one-year agreement with MASFRIJOL
2. Selection of appropriate sites for been seed production; land that has not been planted to beans for at least one year and preferably has access to irrigation
3. Training of the CSD farmers in artisanal seed production by ICTA
4. Provision of inputs for the first season (registered seed of the appropriate variety for the region, *rhizobium* inoculant, fertilizer, plastic for drying, etc.)
5. Training in Environmental Mitigation and Monitoring relative to safe pesticide and rhizobium inoculant procurement, handling and application
6. Technical assistance and monitoring provided by ICTA and MASFRIJOL agronomists at critical stages of crop development; planting, application of pesticides, flowering, harvest, and seed drying, conditioning and storage

CSD farmers have shared that the opportunity to start a new profit-generating enterprise was their primary incentive for committing to produce bean seed. Some farmers, however, acknowledged that they were attracted to the opportunity to receive production inputs and technical assistance, to experience growing new bean varieties, and to be involved in a project that contributes to improvements in agriculture and nutrition within their community.

The question of whether the CSD model is profitable, which is critical for sustainability, remains to be answered. The fact that CSD seed growers were able to achieve yields substantially higher than average bean grain yields in the region, 1,850 kg/ha versus 543 kg/ha, and to sell the QDS at reasonably good prices ($1.46 to 2.38 per kg depending upon the location and time of sale) is encouraging and suggests that seed production may be profitable. More rigorous cost-of-production analyses, however, must be conducted to fully assess the profit potential of smallholder seed production and to determine whether it can be a viable enterprise in the long term considering the additional input and management requirements.

Consultations with MASFRIJOL technicians working with the CSDs and USAID FtF Western Highland Implementing Partners (WHIP) in Guatemala have revealed professional opinions regarding the strengths of the community seed depot model that should contribute to their sustainability.

1. There is likely to be an increasing demand for QDS bean seed produced by CSDs as farmers gain more experience in planting "quality" seed and observe the benefits to crop stand, vigor, health and ultimate grain yields. A recent report by AGEXPORT on smallholder farmer experience with QDS seed from MASFRIJOL revealed that farmers in the Departments of Quiche, Totonicapán and Quetzaltenango achieved bean yields of 717 kg/ha (averaged over 2,500 ha). This represents a yield increase of 175 kg per ha which is significant for a low input smallholder farmer. It is unclear from this data however how much of the yield increase can be attributed to planting different or improved varieties.

2. The price of QDS bean seed produced by smallholder CSD farmers is substantially lower that certified bean seed in Guatemala markets and thus more affordable to many resource-poor farmers. Certified bean seed prices are consistently 200 to 300% higher than bean grain prices, putting it out of the reach of most farmers. A primary reason for the lower cost of CSD produced QDS is attributable to the lack of transportation costs and more economical seed handling and packaging.

It must be acknowledged that the community seed depots being promoted by MASFRIJOL have not yet been proven sustainable for providing rural bean farmers with access to quality bean seed. The program has gained only two years of experience with the model and consultations indicate that improvements are likely needed. Recommendations to strengthen the CSD model include:

1. Farmers managing CSDs must have access each year to foundation or registered seed of improved bean varieties to be able to ensure that seed of the multiplied varieties are disease free and genetically pure. In Guatemala, this should not be a constraint since the bean improvement program of ICTA has committed to provide CSDs with registered seed of their improved bean varieties each year. The total foundation/registered seed requirements of the CSDs each year is not overwhelming; maximum of 2.5 MT to provide for national CSD requirements (100 CSDs x 0.5 ha each x 50 kg/ha).
2. CDSs should produce and market multiple varieties of QDS bean seed. Smallholder farmers like options. Experiences in Nicaragua and Honduras have shown that farmers vary in their bean market class and varietal preferences depending upon agro-climatic conditions of their farm site, season of planting, culinary preferences, and market demand. In addition, smallholder farmers recognize the value of planting more than one variety as a risk reduction strategy.
3. Networks of artisanal bean seed producers (owners of CSDs) would facilitate the governance of seed production within a region or country. Functions of such organizations of artisanal seed producers would include assessment of demand in terms of both specific varieties and quantities of seed, arranging to produce foundation/registered seed by the NARO, and the coordination of seed marketing across a region to communities and farmer associations. Such networks would also provide opportunities for sharing experiences, accessing technical assistance, receiving capacitation in small business management and seed marketing, and the coordination of self-monitoring of seed quality.
4. Cost effective accountability mechanisms should be established to monitor the quality of QDS seed being produced by CSDs to protect consumer farmer interests. Monitoring mechanisms would also be valuable for the identification of seed quality problems, including the emergence of new diseases to mobilize appropriate responses for resolving these problems. The question of who would assume the burden for this cost needs to be addressed.

Experience to date indicates that the community seed depot model being promoted by MASFRIJOL has the potential to sustainably provide smallholder bean farmers in remote communities in the Guatemalan highlands with access to quality bean seed. The planting of quality bean seed by smallholder resource-poor farmers is critically important to achieve nutritional security for food insecure households. The Feed the Future Legume Innovation Lab at Michigan State University views MASFRIJOL has a “field laboratory” to improve bean seed systems in Central America and is committed to testing modifications that might improve the profitability of the CSDs, the quality of the multiplied seed, access for marginalized farmers to QDS seed, and the sustainability of the bean seed value-chain.

A Business Model for Mungbean Promotion under Rice-Wheat System in Nepal

Narayan P Khanal, Sabin Basi, Madan Bhatta, Arun K Joshi, Mina Devkota, Anil Khadka, Lokendra Khadka, Himalaya Subedi and Andrew McDonald[28]

Abstract

International Maize and Wheat Improvement Centre (CIMMYT International) through the project Cereal System Initiative for South Asia (CSISA) has been strengthening mungbean business model since 2014. In this model, the Seed Company was put in the centre and strengthened its forward and backward linkages with mungbean value chain actors and service providers. It resulted to 173 contracts between traders and mungbean grain growers, and 11 contracts between Seed Company and seed producer groups/cooperatives in 2016. Therefore, volume of seed sold in the seed enterprises was increased by 10 times (i.e. 10t in 2016 against 1t in 2014) and is projected to be 35t (35ha) in 2017. Similarly, one mungbean variety (Panta Mung 5) has been introduced in Nepal by the Seed Company and is planned to register at Seed Quality Control Centre in 2018. A survey of 173 grain producers in 2016 shows that 47.5% of the total produce was sold to local market as seed, 7.4% given to relatives for seed, 36% consumed as grain at home and 8.5% saved for seed. Considering this, traders are making contracts with producers in block, in partnership with government's pocket program and CSISA. It is estimated mungbean area would be increased by 2,500ha in 2017 as an outcome of this business model.

Introduction

A substantial land (about 0.4 million hectares) remains fallow for three months (Mid-March to mid-June), in Nepal's Terai (70 to 550m above sea level), after wheat harvest, due to limited irrigation facility, free grazing and improper technological options and institutional mechanisms (Subbarao *et al*. 2001). Some short duration (60 to 70-day maturity), bold seeded and disease resistant mungbean varieties are available but source seed, irrigation facility, market networks remain the major production constraints (Khanal *et al*., 2005). It is estimated that mungbean is grown in 12000ha with its average yield of 500kg/ha (Joshi et. al., 1997).

This crop has been traditionally growing in Eastern and Central *Terai* in subsistence scale after wheat harvest, especially in higher water table areas where residual moisture is sufficient for its production. Rest of the demand is fulfilled through imports from foreign countries. There is no reliable official statistics about the mungbean imports in Nepal. Mungbean traders estimate that at least 50t of mungbean is consumed each day in the Nepalese market (personal communication with Pathak Dalmot Udyog, Butwal). It means about 18,000t of mungbean with the value of US$ 270 million is imported in Nepal annually, and two-third of this comes from India. Mungbean is consumed as whole grain, splited grain (dal), and the ingredient for dalmot. The largest sized grain is used for dalmot. Traders estimated that over 60% of the mungbean traded in Nepal is used for dalmot, and the dalmot companies normally import dehusked, splitted and graded mungbean from India. Considering the opportunities and challenges for mungbean promotion under rice-wheat system, in 2014 CSISA project started participatory research and development activities in Mungbean. In the initial two years, the project focused on testing the available varieties in participatory trials, and from 2015 it started strengthening the business model. This paper discusses the modality, achievements, and lessons while implementing the mungbean business model.

[28] CIMMYT South Asia, Regional Office, Kathmandu, Nepal Email: n.khanal@cgiar.org

Business Model and its Implementation

A **business model** is the way by which a business creates and captures value within a market network of producers, suppliers and consumers *(*Weill et al., 2005*).* It means creating value to actors associated to mungbean business/promotion is the central theme of the model. In Nepalese context, these actors are farmers, millers, traders and seed companies, and research & development organizations. They realize value once mungbean farming, processing and marketing become profitable and sustainable. As mungbean is the new introduction in the project area, this raises the question of innovation, entrepreneurship, marketing and strategic management. CSISA implemented this business model putting Seed Company in the centre (Figure 1) and strengthening its backward and forward linkages through capacity building and networking. Actors in the forward side are the agrovets grain producers, agrovets (local traders) and millers, and those in the backward side include farmers' groups/cooperatives, NGOs, agrovets, National Grain Legume Research Program and District Agriculture Development Offices. CSISA organized participatory market chain analysis (PMCA) workshop convening seed companies, millers, traders, agrovets and research & development agencies. This workshop gave clear picture about the mungbean supply and demand, quality and nature of demand, mungbean varieties to de developed to address the demand, etc. Following the workshop CSISA facilitated contractual arrangements between seed producer groups/cooperatives, especially those experienced in mungbean production, and Seed Company (GATE Nepal). It was followed by field level technical training to the leader farmers, extension workers and Agrovets, and the same module was practiced in grain production side. Moreover, this project organized joint monitoring visits, community-level video campaign and distributed 3000 mungbean production tips through different networks.

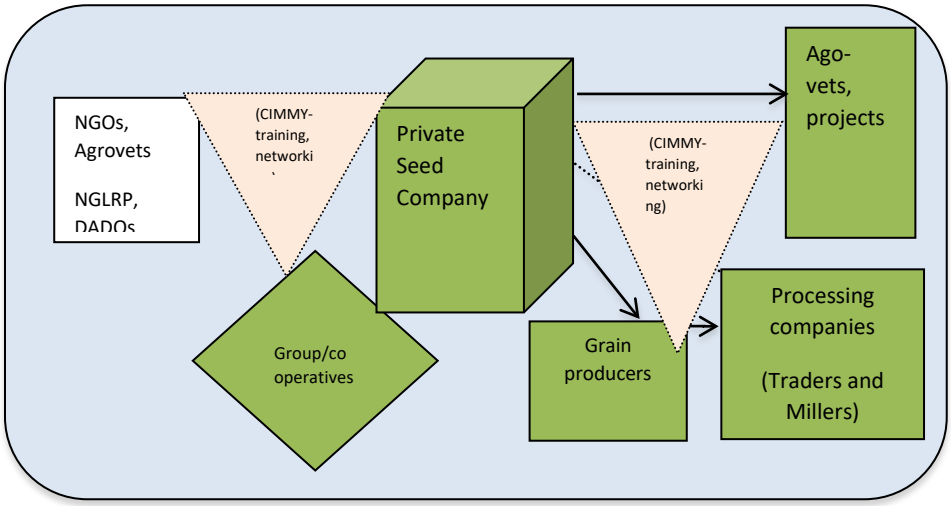


Figure 1. A sketch of mungbean business model

Achievements and lessons

Grain production in contractual arrangement between traders and producers

A total of 173 contract agreement was signed between two millers (Debbhar Rice Mill, Nepalgunj, and Pathak Khadya Udhyog, Mahendranagar) in mungbean grain in Banke, Bardiya, Kailali and Kanchanpur districts. In this arrangement, mungbean was planted in 500ha, and average land used in mungbean production was 0.3ha. A survey carried out in this area (n = 173) shows that mungbean productivity was 0.8t/ha but it ranged from 0.4t to 2t/ha. Moreover, all farmers were found to have seed at home for next year production, and the % saved seed was 8.5. It shows the farmers' behaviour to be more self-secure on seed which may be due to subsistence nature of farming. Even though all farmers made contract with traders only 60% of those were able to sell about 45% of the total produce in the local market (Figure 2).

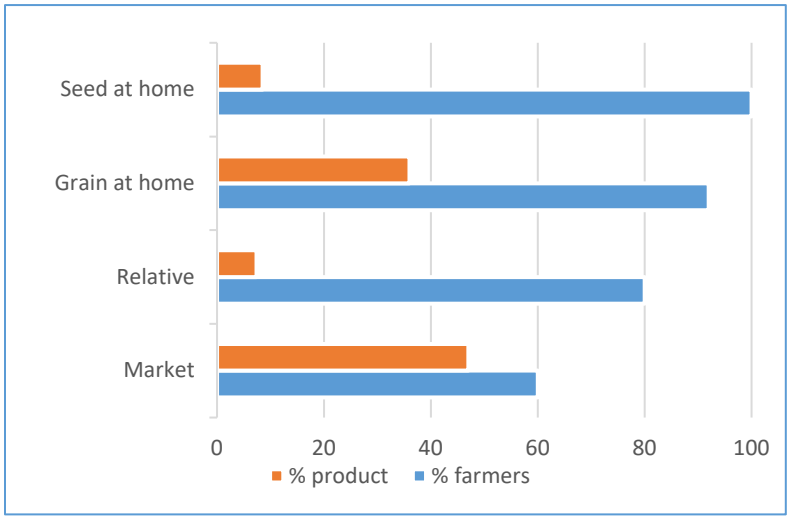


Figure 2. Utilization of mungbean by farmers in 2017, n = 273

The poor market participation was due to its consumption at home and distribution of produce to relatives and neighbours. It is also clear from the figure that those engaged in mungbean farming would increase its area by three times in 2017. Despite the contract, millers received 10% of the total produce which is due to the scattered production and less price offered by traders as compared to the price farmers got while selling produce directly to the local hotels and retail shops.

Increased seed production and number of varieties at Seed Company

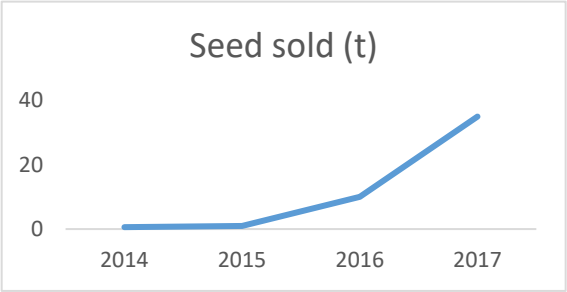


Figure 3. Seed sold trend of GATE Nepal

Table 1. Result of participatory varietal selection (2016, n = 7)

Varieties	First picking (No. of days)	Yield (Kg/ha)	100 seed weight (gm)
Panta Mung 5	61 ± 1.5a[1]	1179.8 ± 68.1b	6.3 ± 0.1b
VC6173(B-10)	61.7 ± 0.3ab	1011.2 ± 59.4ab	6.3 ± 0.1b
Bari mung	63 ± 0b	988.5 ± 85.1ab	5.5 ± 0.4a
SML 668	60.3 ± 0.3a	848.8 ± 108.3a	6.0 ± 0.2ab
Hum16	60.3 ± 0.7ab	822.2 ± 113.8a	5.9 ± 0.2ab
Partiksha	63 ± 0b	760.5 ± 89.5a	5.8 ± 0.3ab

[1]values with same letter in the column do not differ significantly at p = 0.05

GATE Nepal made contractual arrangement with 5 agricultural cooperatives and 2 private firms for mungbean seed production in 11ha land from which the company was able to purchase 10t seed of six mungbean varieties (Kalyan, Prateeksha, Hum 10, Bari Mung, SML 668 and Panta Mung 5). For this, the company received breeder seed from NGRP in case of former four varieties whereas latter two varieties were introduced from India. This company has a plan to sell 35t seed in 2017 (Figure 3). It has also extended its partnership with Indian companies, and cooperatives working in mungbean in Eastern Terai of Nepal. As a strategy for new product development, GATE Nepal has also started testing mungbean varieties in participatory variety testing module. Out of the six varieties tested across 7 farmers' field in 2016, Panta Mung 5 was ranked in number one considering yield and grain size (Table 1). This company is planning to test this variety again in 2017 spring season to complement the last year's data.

Changed behaviour of government station towards mung

Crop Development Directorate under the Department of Agricultural Development has integrated mungbean as the prioritized green manure crop. Because of this policy, District Agricultural Development Officers have focused this crop under pocket program. The coverage of each pocket will be 10ha, and farmers would receive subsidy on seed (50%), machinery (50%) and irrigation (85%). DADOs records show that this covers 2500ha across the 10 Terai districts. Similarly, as a response of increased seed demand, source seed production at NGLRP has doubled in 2017 (415kg) compared to 2016 (200kg).

Discussion and Way Forward

Farmers could get substantial benefit (revenue $900 (USD)/ha, benefit cost ratio- 1.6) in a brief period (70-80 days) where most of the land remains fallow during its production season. The benefit will go up while considering its biomass, and nitrogen fixation (60kg/ha) which saves the costs of nitrogenous fertilizer (e.g. Urea) in the subsequent rice crop and enhances soil quality. Despite this, farmers grew mungbean in small parcel of land, some of the reasons behind it include limited irrigation facility and intensive labour requirement for mungbean harvesting. Field survey shows that it costs $330 (USD) for mungbean production in a hectare, and labour cost accounts 60% of the total cost. Due to multiple pickings, existing varieties require 3 pickings to harvest 90% of the production, and these pickings cover 70% of the total labour cost. This requires the development of varieties that could be harvested in a single picking. Another lesson learnt from this initiative is that mungbean production should be carried out in block to attract the trader in fields as it reduces their transportation cost. Suitable pod drying measures should be validated in mungbean production domains as the crop maturity coincides with the monsoon onset. Similarly, efforts should be made to establish mungbean processing facility (peeling, splitting and grading) at local level as such facility does not exist for mungbean in Nepal.

References

Khanal, N.P; Khanal, N.N., Gurung, G.B., Thapa, S., Gupta, K.P., Sherpa, L.T., Joshi, K.D., Harris, D., Rao, JVDK Kumar, Darai, R. (2005). Mungbean (*Vigna radiata* (L.) Wilczek) in cereal fallows: Experience of farmers' participatory research and development activities in foothills and terai of Nepal. Proceedings of 4th International Food Legumes Research Conference, 18-22 October 2005, New Delhi (ed. M. C. Kharkwal), vol. 2: 67-76.

Subbarao, G.V., Kumar Rao, JVDK., Johansen, C., Deb, UK., Ahmed, I., Rao, K., Venkataratnam, M.V., Hebbar, L, Harris, D. (2001). Spatial distribution and quantification of rice-fallows in South Asia-potential for legumes. Patencheru 502324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics. 316 pp. ISBN 92-9066-436-3.

Weill, P., Malone, T.W., Urso, T.D., Herman, G., Woerner, S. (2005). Do some business models perform better than others? A study of the 1000 largest US firms. http://ccs.mit.edu/papers/pdf/wp226.pdf

Community-Based Approach for the sustainable supply of commercial seeds in Timor-Leste

Buddhi Kunwar[29], John Dalton[30] and Simao Belo[31]

Ministry of Agriculture and Fisheries (MAF) produced limited quantities of certified seeds of the MAF-released crop varieties and distributed to farmers through its extension officers until 2011. Since MAF's certified seed production from the contract growers was low in quantity in relation to the national seed demand, seed replacement ratio was only 3% in 2011. MAF imported seed every year from abroad to meet its seed requirements for major food crops (maize, rice and peanut). MAF's certified seeds were expensive to produce as it required many contract growers, and major effort and expenditure in seed processing and storage facilities at MAF research stations. Moreover, seed imported from abroad was very costly, often arrived and was distributed late and the seeds were of poor quality - not suitable to the local agro-ecological conditions. Huge costs and inefficiencies incurred in distribution of seeds from the capital city to the farmers in distant municipalities and villages. To solve these problems, and produce seeds in a decentralised and cost-effective manner, the MAF-Seeds of Life Program Phase III (2011-2016) initiated a community-based approach to the production of commercial seeds through establishment and strengthening of commercial seed producers' groups in all municipalities.

From 2103 to 2015 a total of 69 commercial seed producers' groups have been registered. These groups produce high quality commercial seeds of locally researched improved varieties under MAF supervision. In just a few years, there has been a significant achievement in supplying commercial seeds locally. The seed replacement ratio has increased seven-fold from 3% in 2011 to 21% in 2016. With the increased quantity of seeds supplied by commercial seed producers' groups, MAF has ceased importing seeds from abroad.

For the past three years, MAF has been the sole buyer for the seed produced by commercial seed producers. The seed is then distributed free of cost to the farmers through agricultural extension workers. With the emergence of agro-input retailers in the country, engagement of private sector would strengthen seed marketing systems in future. The community-based approach for commercial seed production has proved to be cost-effective and a sustainable method of achieving local seed security and national seed sovereignty.

Keywords: Timor-Leste, community-based approach, commercial seed, seed security, food security, sustainability

Corresponding author:
buddhibkunwar@gmail.com

---

[29] Buddhi Kunwar is a former Community and Commercial Seed Development Advisor at Seeds of Life Program of MAF and is now the Director at Independent Advisory Services, Timor-Leste.

[30] John Dalton is a former Australian Team Leader at Seeds of Life Program of MAF and is now the Chief Executive Officer at Independent Advisory Services, Timor-Leste.

[31] Simao Belo is a former Source Seed Production and Quality Control Coordinator at Seeds of Life Program of MAF and is now a Source Seed Production and Quality Control including Seed System Advisor at Seed Department, MAF.

INTRODUCTION

Timor-Leste is the newest nation in Asia independent from Indonesia in 2002. It has 1.1 million population with over 130,000 farming households most of whom earn their livelihood from agriculture sector (SoL 2016). Timor-Leste is progressing towards a better future. It is one of the fastest growing economies in Asia. The Government has undertaken various programs to raise the productivity of agriculture and to lessen the country's dependence on imports of food and seed. While these programs are producing results, many people in Timor-Leste continue to suffer periodic food shortages in the lean season.

Maize, paddy, cassava, sweet potato and legumes are the main staple crops grown by farming households in Timor-Leste. Moreover, these crops - except paddy, are grown by the poor majority living on marginal lands, rain-fed uplands, hills and mountains. Paddy is normally grown by smallholders in irrigated lands in limited number of districts determined by extent of access to irrigation or/and availability of rain-fed flat land. Productivity of all the staple crops is low. Various factors contribute to low agriculture production such as low soil fertility, lack of fertilizer use, low level of mechanization and inadequate support for post-harvest storage. However, insufficient availability of high yielding improved variety seeds is considered a critical factor.

Experiences of the Seeds of Life Program within the Ministry of Agriculture and Fisheries (MAF) indicate there is significant yield advantage of MAF-released crop varieties over local varieties under farmer management practices. According to the Seeds of Life Research Report 2013, the yield advantage of the MAF recommended 'Sele' maize variety is 50%, Suwan-5 maize 54%, Noi Mutin maize 46%, Nakroma paddy 24%, Hohrae 1 sweet potato 102%, Hohrae 2 sweet potato 91%, Hohrae 3 sweet potato 131%, Utamua peanut 47%, Ailuka-2 cassava 46%, Ailuka-4 cassava 15% higher than the traditional varieties (SoL 2013). This potential to increase crop production is dependent on the availability of quality seeds of improved variety at planting time.

To service Timor-Leste's approximately 77,081 ha of maize, paddy and peanuts cultivation Timor-Leste's annual seed requirement is 2,080 t of quality seed per year. In 2010-11, the quality seed supply from the MAF for the three major crops was 3% (i.e. 85 t) of the total requirement (i.e. 2,877 t in 2011). This indicates the very limited outreach of improved seed and the large annual gap between annual seed requirement and supply. This seed gap is largely met using low quality seeds saved by farmers from their previous year's harvest and partly from seed imports. When certified seeds are produced by the MAF contracted growers and processed in MAF owned facilities, the cost of seed become 2.3 times expensive than the seed produced by commercial seed producers' groups spread in different communities covering all the districts (Nesbitt et al 2016).

When seeds are imported from abroad, there are concerns about the suitability of such seeds as they have not been tested in Timor-Leste's diverse agro-ecological conditions. There have been problems with imported seeds in the past. Imported seeds often result in late delivery to the farmers due to difficulty of timely distribution from the national capital to the district offices and then on to the distant Suco (lowest administrative unit of local administration) and Aldeias (Suco is further divided into 3-10 Aldeias) is always a challenge. Moreover, it is necessary to distribute seed just before the rainy season when road conditions are poor and deteriorating, particularly in remote areas. The imported seeds are also expensive (average of US$3.50/kg) hence most farmers cannot afford to purchase them. So, they are distributed through MAF Extension Staff to farmers as free goods (Planicka 2012). Since MAF has limited funds to procure seeds of maize, rice and peanuts it cannot afford to buy the quantities the nation requires. Moreover, purchasing seeds every year from abroad is not sustainable.

This paper documents the efforts and experiences of Timor-Leste's Ministry of Agriculture & Fisheries to achieve seed security using community-based approach of commercial seed production through commercial seed producers' groups. The evidence presented and discussed here reflects experience of the Ministry and the Seeds of Life (hereafter MAF-SoL) for the period from February 2011 to June 2016.

1. SOURCES OF DATA

Authors relied on several data sources. Ministry of Agriculture and Fisheries Seeds of Life program provided data on crops and varieties released, importation of seed, seed production, number of commercial seed groups and concept behind the community-based approach to commercial seed production through commercial seed producers' groups. Data on cost of MAF producing seeds were sourced from a report compiled by an intern from Columbia University (Planicka 2012). Information on seed classes and certified seed production were sourced from Seed Department and National Directorate of Agriculture and Horticulture within Ministry of Agriculture and Fisheries.

2. WHAT IS COMMUNITY-BASED APPROACH FOR SEED PRODUCTION?

Community-based approach for seed production is defined as a production, quality control, storage and marketing of seeds by organized groups of farmers operating close to their homes as commercial seed producers' groups. At the initial stage, these commercial groups receive training on seed production, quality control, storage, processing and marketing from extension staff of MAF. As experience develops these groups continue seed production activities on their own with periodic monitoring support from MAF extension staff as well as Municipal Seed Officer. The groups follow basic seed production procedures and produce a quality commercial seed and sell most of the produce to seed companies or any other seed buyers such as NGOs and individuals. Community-based approach for seed production is a community owned, community controlled and community managed approach to local quality seed production and storage (Kunwar and Guterres 2010).

3. SEED MULTIPLICATION AND DISTRIBUTION APPROACHES IN TIMOR-LESTE

Timor-Leste Ministry of Agriculture and Fisheries adopted two approaches of seed multiplication and distribution during 2010-2015. These include: a) a centralised approach of certified seed multiplication and distribution; and b) a decentralised community-based approach of 'commercial seed' multiplication and distribution. Until 2011, MAF focused on 'formal seed production' distributing - certified seed, while 2012 onwards MAF focused on seed multiplication and distribution of 'commercial seed'. The pros and cons of each of these approaches are discussed below:

Seed Multiplication and Distribution of Certified Seed

"Certified" seed production is defined as the production, storage and distribution of seeds under conditions of stringent MAF quality control procedures. This approach involves a contract agreement between MAF and specialized seed growers before the planting season and multiple supervision and inspection visits by government seed technicians during the growing season and at harvest. Trained MAF staffs inspect the crop at least four times during the growing season and select potential seed at harvest using a buy-back guaranteed price for the seed produced provided it meets seed production standards. When all seed production and quality control criteria are fulfilled by the seed growers and seeds are procured by MAF they are then taken to MAF seed processing centres for further drying cleaning, grading, storage and subsequent packing, labelling and distribution as certified seed.

Table 1: Area cultivation of major food crops and seed replacement rate (SRR) in 2011

SN	Crop	Area cultivated (ha)	Seed Rate kg/ha	Seed Requirement (t)	Seed supply of improved variety 'Certified Seed' (t)	Seed replacement rate (SRR)
1	Maize	75,804	20	1,516	32	2%
2	Paddy	38,069	20	761	50	7%
3	Peanut	4,000	150	600	3	0.5
		117,873		2,877	85	3%

Source: MAF 2011, Seeds of Life 2013

In 2010/11, Timor-Leste required 2,877 t of seeds of three main crops (maize, paddy and peanut) annually to meet the national requirement for quality seeds (see *Table 1*). Since commercial seed was not produced in that year, certified seed multiplication and distribution was the only option to MAF to support farmers. The supply of MAF released variety of certified seed of maize and paddy was 85 t in 2010/11 which was 3% to the total seed requirement. In other words, SRR was achieved 3%.

Table 2: Estimated annual cost to produce Timor-Leste's total seed requirement in 2011 using certified seed

Crop	Amount seed required at 35% SRR for maize and 25% SRR for paddy and peanut (t)	Total area required to produce seed ha)*	# Growers required @0.6 ha land/grower	Seed cost to Grower US$/kg	Seed price US$/kg**	Total cost of supplying national seed requirement (US$)
Maize	531	531	885	$1.25	$ 3.50	1,858,500
Paddy	190	127	211	$1.25	$ 3.50	570,000
Peanut	150	214	357	$1.50	$ 4.00	600,000
	871	872	1,453			3,028,500

Note: * area required to produce seed is calculated @1 t seed produced/ha for maize, 1.5 t seed produced/ha for paddy and 0.7 t seed produced/ha for peanut; **total cost of one kilo of certified seed including cost of processing, storage and transport to municipal office.

Table 2 above shows the cost of seed production for three major staple crops: maize, paddy and peanut to meet the total national seed requirement of 871 t a year based on seed replacement principle, the last column providing two scenarios depending on the cost of seed production. The first uses a seed cost or the cost incurred by contract growers in simply producing each kilogram of quality seed. This cost does not include processing, storage and transport which totals another US$2.25/kg based on (one third cost to grower and two third cost to the processing and storage). The second scenario uses this total cost at US$ 3.50/kg including cost of production plus processing, storage and transportation to the municipal headquarters (Planicka, 2012, Young, 2013).

Timor-Leste incurs a cost of more than US$3 million annually to service its national seed requirement for three major crops maize, paddy and peanut, a large expense for a small nation. Major portion of expense on producing certified seed using MAF seed processing and storage facilities is on seed processing, storage and transport of seed to municipal headquarters. Other issues must also be considered if certified seed production and supply are alone used to meet the annual maize seed requirement of Timor-Leste. These include the following:

Development of specialized seed growers: From Table 2 it is evident that Timor-Leste requires at least 1,453 individual seed growers with at least 4-5 years of experience in quality seed production. Developing such professional seed growers poses a challenge in terms of cost, capacity building and in providing the buy back guarantee for the seeds they produce.

The cost for seed processing facilities: The real cost of producing seeds is very high (it is two third cost incurred on seed processing and storage). In addition to the more than US$ 3 million annual cost for source seed production there is also infrastructure and equipment procurement, operation and maintenance costs required to support seed processing, testing and storage as well as training and supervision of staff and farmers.

Transportation, storage and handling of seeds: There is also an issue of seed transportation from the production centres to the processing centres in seed warehouses and then distributing the seed out again to farming families living in distant villages and hamlets. This will long remain a challenge considering the poor transport network, unreliable transport facilities and the very poor roads in mountainous rural areas, particularly in the rainy season.

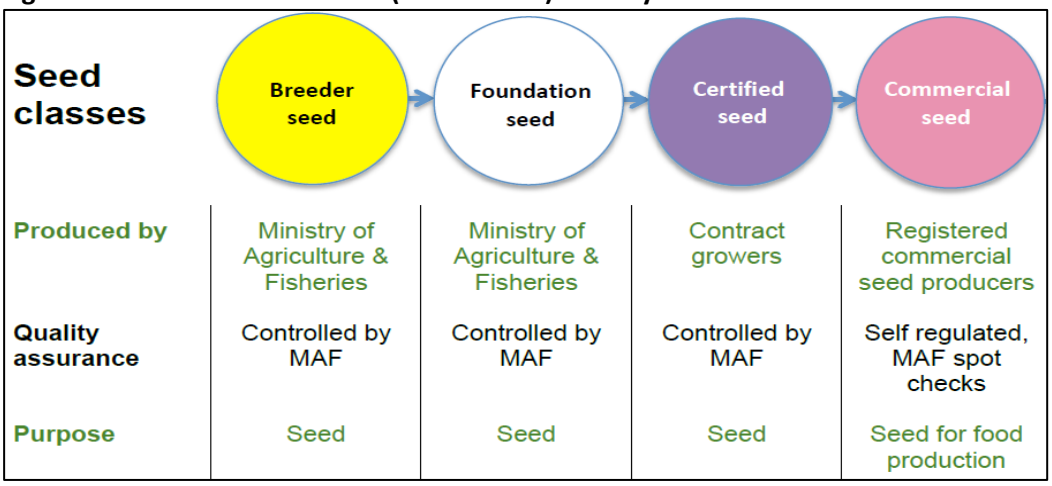
Financial implication of seed if distributed free: If MAF decide to distribute free seed to farmers, it must spend more than US$ 3 million a year to support the maize, paddy and peanut crops. Similarly, if MAF were to cover the cost for producing and distributing seeds of other staple crops such as planting materials of improved varieties of cassava and sweet potato, the total cost would be prohibitively high. Moreover, distribution of free seeds to farming families tends to nurture a culture of dependency. MAF policy is to encourage farmers to become more commercial by reducing subsidies on agriculture inputs and distribution of free seeds is not sustainable.

The cost of producing certified seed is certainly higher than producing 'truthfully labelled commercial seed'. Since majority of subsistence farming families in Timor-Leste have low purchasing power, even if "certified" quality seed were available for sale in the market farmers could not afford to purchase them. If price of seed is expensive, availability of seed become a problem and diffusion of seed will remain low. Producing only certified seed is not only costly but also difficult to implement from the logistic and management perspective, whereas, the production of quality seeds through organized community-based seed producer groups using decentralized production, storage and distribution is an effective alternative. Community-based approach to commercial seed production not only ensures a secure supply of quality seeds is locally available to farming families at planting time, it also improves farm family autonomy and independence.

Community-based approach to Seed Multiplication of Commercial Seed:

MAF has followed four generation model of seed multiplication: breeder seed, foundation seed, certified seed and commercial seed under the national seed system of released varieties (*Figure 1*). In addition, there is also a 'community seed' produced by informal community seed group which is not discussed here.

Figure 1: Seed classes in Formal (Commercial) Seed System in Timor-Leste



Unlike certified seeds, commercial seeds are multiplied by MAF registered Commercial Seed Producers (CSP formerly known as farmer association or a former contract growers' group). The CSPs request authorisation in the form of 'annual crop permit' from MAF Seed Department to multiply Certified Seed to produce Commercial Seed normally three months before the planting season. CSPs harvest, process and test their Commercial Seed for physical purity, germination and moisture content at MAF Seed Laboratory, which are recorded on a pink commercial seed label prior to packaging.

CSPs market the seed using their own name under ***'Fini ba Moris (*Seeds of Life)'*** brand that assures of quality seed (Kunwar et al 2013). CSPs seed plots and seed can be spot checked by Municipal Seed Officers or others from MAF-Seed Department. All CSPs must follow basic seed production procedures set by MAF Seed Department and produce a commercial seed.

MAF begun with establishment of 19 CSPs since 2013 following the spirit of National Seed Policy. Within three years, number of CSPs has increased to 69 in 2015. There is a CSP in each Municipality including the special region Oecussi (see *Table 3*), averaging 5 per Municipality. A CSP has average of 25-member households.

Table 3: Number of Commercial Seed Producers by Municipal in 2015-16

SN	Municipal/Region	Number of CSPs	Crop grown for seed
1	Aileu	5	Maize, Paddy, Peanut
2	Ainaro	3	Maize and Paddy
3	Baucau	12	Maize, Paddy, Peanut
4	Bobonaro	7	Maize, Paddy, Peanut
5	Covalima	4	Maize, Paddy, Peanut
6	Dili	1	Peanut
7	Ermera	3	Maize and Paddy
8	Lautem	6	Maize, Paddy, Peanut
9	Liquica	4	Maize, Paddy, Peanut
10	Manatuto	5	Maize, Paddy, Peanut
11	Manufahi	6	Maize, Paddy, Peanut
12	Viqueque	8	Maize and Paddy
13	Oecussi Special Region	5	Maize and Peanut
	TOTAL CSPs	69	

Table 4 below shows 441 t of commercial seed has been produced by CSPs in 2015-16. These seeds distributed to at least 45,000 farmers by MAF and development agencies. Figures on Tables 1 and 4 reveal that there is seven-fold increase in SRR in the past five years from a mere 3% in 2011 to 21% in 2016. By crop, there is eleven-fold increase of SRR in maize, five-fold increase in paddy and six-fold increase in peanuts between 2011 and 2016.

Table 4: Area of major food crops and seed replacement rate in 2015-16

SN	Crop	Area cultivated (ha)	Seed Rate kg/ha	Seed Requirement (t)	Seed supply of improved variety 'commercial seed' (t)	Seed replacement rate (SRR)
1	Maize	44,812	20	896	198	22%
2	Paddy	28,128	20	563	227	40%
3	Peanut	4141	150	621	16	3%
		77,081		2,080	441	21%

Source: MAF NDAH 2016

Using a community-based approach to commercial seed production, Timor-Leste incurs a cost of nearly US$ 0.93 million annually to service its national seed requirement for three major crops maize, paddy and peanuts, which is 70% cheaper than the centralised certified seed production approach using MAF seed processing facilities (*Table 5*).

Table 5: Estimated annual cost to produce Timor-Leste's total seed requirement in 2015-16 using 'Commercial Seed'

Crop	Amount seed required at 35% SRR for maize and 25% SRR for paddy and peanut (t)	Total area required to produce seed ha)*	# CSP required @5 ha/CSP for maize and paddy and peanut	Cost to grower US$/kg	Farm gate seed price US$/kg	Total cost of supplying national seed requirement (US$)
Maize	314	314	63	$0.22	$ 1.50	471,000
Paddy	140	88	18	$0.32	$ 1.50	210,000
Peanut	155	221	44	$0.60	$ 1.50	232,500
	609	402	81			913,500**

*Area required to produce seed @1 t seed/ha for maize, 0.7 t seed/ha for peanut and 1.5 t seed/ha for paddy, 2015-16

** Based on a similar cultivated area to 2010-2011, the total cost was approximately $1,295,500.

In other words, certified seed production is 2.3 times costlier than the community-based commercial seed production. This reveals a huge savings for MAF when chosen community-based approach to commercial seed production. Main reason of incurring low cost of production by CSP is due to use of their own seed facilities (equipment, seed warehouse), their labour for seed processing and storage and proximity to MAF Municipality to transport and distribute seeds within the Municipality. *Table 6* reveals that there is significant reduction in certified seed multiplication in 2015/16 compared to 2011 in maize and paddy, however in peanuts there is a growing interest from CSPs for seed production, therefore there is more than five-fold increase in source seed production to supply to CSPs for next season.

Table 6: Amount of certified seed production by MAF in 2011 and 2015-16

SN	Crop	2010-11	2015-16	% change
1	Maize	32	21	-59%
2	Paddy	50	5	-86%
3	Peanut	3	16	433%
		82	**42**	

Source: MAF NDAH 2016

Currently, MAF produces small quantities of certified seed to supply to CSPs as a 'source seed' for commercial seed production. Unlike in the past, MAF has completely stopped distribution of certified seed directly to farmers for food production or sale of certified seed to NGOs for distribution to farmers has been completely stopped. Moreover, from 2016, it has been very good news for the community-based commercial seed producers and to the farmers of Timor-Leste that MAF ceased importing seeds of maize, paddy and peanuts from abroad because of increased Supply of commercial seeds from commercial seed production groups.

4. SEED MARKETING

Seed Markets

Markets for open pollinated seeds are not well developed in Timor-Leste. There are approximately 30 agro-input retailers in the country. Majority of them are new with experience of less than three years. Most of them sell seeds of seasonal vegetables and pesticides. A few of them also sell hybrid seeds of rice and maize. For the past few years, open pollinated seeds of MAF released crop varieties produced by registered CSPs are purchased by MAF contracted buyers. The buyers are selected by MAF through a competitive bidding process, following stringent government procurement procedures. Thus, there is no guarantee that same buyer is selected every year. Normally, at least one buyer for one crop is awarded with contract. After the selection of the contractor as a seed buyer, they coordinate with MAF Seed Department and contact the commercial seed producers and inquire the seed stock each of CSPs they have. According to the MAF Commercial Seed Production Guidelines, the seed contractors can purchase seeds from the CSP whose seeds are passed through Seed Department laboratory test in terms of physical purity, germination percentage and moisture content. MAF Seed Department and National Directorate of Extension Services keep the record of seed production of maize, paddy and peanuts. Based on the contracted amount of seed by the seed contractor from the MAF, the contractor purchases seed from CSPs. As of 2016, MAF is the largest seed buyer in the country. For the past three years, farm-gate price for seeds purchased by Seed Contractor from the CSP remain the same which was USD 1.50/kg for maize and paddy and USD 2 for peanut. The CSPs are happy to receive this price as it is almost three times higher than the price of the food grain of same crops. There are a few NGOs such as World Vision, CARE and CRS who also purchase small quantities of seeds from CSPs and distribute the seeds of MAF varieties to poor and vulnerable men and women farmers in their program municipalities and Sucos (villages).

Seed customers

There are two segments of seed customers in Timor-Leste.

First segment includes the poor farmers who are interested in growing new crop varieties. They are supported with seed free of cost by MAF agricultural extension workers. Agricultural extension workers collect the list of interested farmers from each Aldeia (hamlet) and distribute the seed to those households who are registered on the distribution list.

Second segment includes neighbouring community members living close to CSPs who purchase seeds from CSPs. The neighbouring households of CSPs value the seeds produced by CSPs are of high quality.

Moreover, they also had chance of observing performance of crops in the village in terms of growth, tolerance to drought, disease and yield. Normally neighbouring households pay USD 1/kg for maize and paddy and USD 1.50/kg for peanut. This is a concessional price for seed compared the price of seed CSPs sell to MAF hired Seed Contractors and NGOs which was USD 1.50/kg for maize and paddy and USD 2 for peanut.

5. DISCUSSION

Between the centralised approach of certified seed production and the decentralised community-based approach to commercial seed production implemented by MAF for seed multiplications and distribution in Timor-Leste, community-based approach to commercial seed production and distribution found to be the successful, cost effective and viable option. Seed multiplications through centralised certified seed (formal) production approach showed a high cost of producing certified seeds and poor access and availability of seeds to needy farmers at right planting time. This option of seed multiplication is not only expensive but also difficult to implement from the logistic and management perspective. In contrary, community-based approach to commercial seed production and distribution is easy to implement and cost effective. Unlike centralised approach of certified seed production, community-based approach to commercial seed production through commercial seed producers groups is a decentralised approach which nurtures local ownership and leadership on seed multiplication, quality control, storage, processing and distribution.

Seed production and marketing of open pollinated crops maize, paddy and peanuts in Timor-Leste is a heavily subsidized business model. Most of the quality seeds produced by CSPs are purchased by MAF through its Seed Contractors who are selected just before the planting season. MAF seems to be the sole seed buyer at present. The seeds purchased by MAF are then distributed to farmers free of cost through agricultural extension workers. Since quantity of seed purchase from MAF differs year to year as it depends on budget approval on seed purchase heading from Ministry of Finance, farmers are uncertain about what quantity of seeds that could be sold to the Seed Contractor. Hence a forward contract system is required between seed buyer and seed producers in future for providing guarantee for both the parties (Seed Contractor and Seed Producers) regarding what quantity of seed to be produced, what quality standards of seeds to be supplied and agreed delivery time of seed supply.

Although there are 30 Agro-Input retailers, most of them are not selling seeds of open pollinated varieties. Normally, they sell vegetable seeds (mostly hybrids) to the farmers. Since there is huge amount of seeds of maize, paddy and peanuts distributed freely to farmers there is no incentive for these privately run agro-input retailers to stock the seeds and sell to the farmers. More engagement of private sectors in seed marketing and reduced involvement of MAF in procuring seeds would address seed marketing problem.

6. CONCLUSION

The five years' experience with implementing MAF-Seeds of Life program (2011-2016) indicates that the community-based approach for commercial seed production has proved to be cost-effective and a sustainable method of achieving local seed security and national seed sovereignty. MAF-Seeds of Life program has institutionalised a national seed system that will provide policy and practice support to production and distribution of quality seeds for many years to come.

The seed production and marketing of open pollinated seeds is still subsidised largely by MAF, as it purchases most of the seeds produced by CSPs and distribute freely to farmers through agricultural extension workers. Since MAF has been able to raise awareness on benefits of using improved varieties of seeds, there is opportunity for private sector to engage in seed business and supply the seed in the

market through agro-input retailers in near future. MAF is required to engage private sector to supply quality seeds of MAF released open pollinated varieties. In addition, MAF can also strengthen capacity of agro-input retailers to encourage practising forward contract system with CSPs and sell quality seeds to farmers.

ACKNOWLEDGEMENTS

The Authors acknowledge the support of Australian Government through the Australian Agency for International Development and the Australian Centre for International Agricultural Research to the Seeds of Life Program within the Ministry of Agriculture and Fisheries.

The Authors like to thank the Director General (Agriculture) at Ministry of Agriculture and Fisheries, Mr. Deolindo da Silva for providing overall support to Seeds of Life community-based approach to commercial seed production.

The Authors also like to extend our appreciation to Dr. Harry Nesbitt, Australian Program Coordinator, Centre for Plant Genetics and Breeding within the University of Western Australia for his overall guidance to the community seed production program in Seeds of Life.

Finally, the Authors like to thank all staff of MAF for their support and cooperation to implement the community-based commercial seed production program in their program municipalities and provide feedback related to practice and policy.

REFERENCES

Kunwar, B., Januario Marcal, Francisco Gama, Rui Amaral, Asep Setiawan and John Dalton. 2013. Timor-Leste's efforts to achieve maize seed security using 'community seed production'. Proceedings of World Maize Conference, Ministry of Agriculture, Indonesia

Kunwar B. and T. Guterres. (2010). Community based seed production and storage of improved maize: CARE's Experience, *in* Food Security Timor-Leste, July Volume 1, Issue 1, Ministry of Agriculture and Fisheries, Dili, www.foodsecuritytl.org. pp. 5-6

MAF 2011. An Introduction of Informal Seed Production. Ministry of Agriculture and Fisheries, Seeds of Life. Dili. Timor-Leste.

MAF-NDAH 2016. Crop and their areas under cultivation. Ministry of Agriculture and Fisheries, National Directorate of Agriculture and Horticulture, Seeds of Life. Dili. Timor-Leste.

Nesbitt H., Erskine W., da Cruz C.J. and Moorhead A. (eds) 2016. Food security in Timor-Leste through Crop Production. Proceedings of TimorAg2016, an international conference held in Dili, Timor-Leste, 13-15 April 2016. ACIAR Proceedings No. 146. Australian Centre for International Agricultural Research: Canberra. 187 pp.

Planicka, Chris. 2012. Formal Seed Production Costs and Value Chain Analysis: Maize, -Columbia Intern at Seeds of Life, Dili, Timor-Leste

Seeds of Life 2013. Annual Research Report 2013. Seeds of Life, Ministry of Agriculture and Fisheries, Dili, Timor-Leste.

Seeds of Life 2016. Annual Research Report 2016. Seeds of Life, Ministry of Agriculture and Fisheries, Dili, Timor-Leste.

Young, Phillip 2013. Effects of Importing Maize and Rice Seed on Agricultural Production in Timor-Leste, Seeds of Life, Dili, Timor-Leste.

WORKING GROUP SUMMARIES

Seed Systems for Nutrition

This group focused on development of partnership models that satisfy joint objectives of achieving nutrition outcomes, meeting consumer needs, and generating income for the enterprises involved.
Seed must have traits that add value beyond nutrition – such as yield, income, superior taste, early maturing etc.

What is the seed system delivering towards improving nutrition outcomes?

- Needed seed/ genetic material
- Reduced on-farm storage losses
- Enhanced information
- Biofortified vs all grain legumes (nutrient rich, high in protein, gut health)

However, issues that limit availability of legumes for nutrition include - pests, seed diseases, abiotic stresses. Other issues may include:

- Limited access to improved bean varieties
- Limited access to micronutrient-rich bean products
- Seed companies not being available in locations that grow certain crops
- Legumes being primarily a rotation crop – driver for legumes in Ethiopia
- Institutional buyers (that decide where supplies will be destined).

There is a need to define nutrition for seed systems: caloric needs, dietary diversity or micronutrient.

Integrated nutrition / marketing campaign:

- Market analysis – understand the customers (farmer for seed, consumer as end user of produce). More focus on the customer/ farmer (why they buy, what they buy, why pay premium)
- Existing variety versus new variety: risks and opportunities of focusing on the 'biofortified' or 'nutritionally enhanced'
- Tailor nutrition messages within a seed system intervention and the impact on nutrition-related outcomes based on different sets of clients (such as children under 5, lactating mothers etc.) for different players within the seed system such as – ag extension agents, end-user of seed, customers
- Nutrition education to different players within the seed system:
    - Agriculture extension agents
    - End user of seed
    - End user of final product (consumers)
    - Traders
    - End user market – raw versus processed final product
    - Food crops of the poor vs healthy food for all
- Traders can understand value of the nutrients attached to a variety and give it a different or higher value. They can use this knowledge in marketing.

Nutrition Education:

- Seed labeling (include nutrition information)
- Marketing on nutrition, yield, and disease resistance
- Nutrition education for market demand
- Multiple varieties to address home consumption and marketing needs

- How much do we want to integrate nutritional issues within the seed system?
  -Nutrition education to seed system players (breeders, traders, seed buyers)
- How much do we partner with others to support nutrition – what are the new partners (MoH/ health system, health promoters)
- Transition from home consumption to market purchase for food so private sector food retailers can influence the diet – how to engage the retailers to increase demand (food and seed systems for healthy diets)
- Who? Link public agriculture and health sector to promote
- Some successful examples from OFSP (can these serve widely for other ag/health models)?
- Awareness raising by providing nutrition information to increase demand – what is contained, why important, targeted to community…supplementation is limited so use beans to meet deficiencies
- Short duration crops – food security, smoothing hunger gap, providing nutritious food

Gender considerations:

- Who makes decisions at the farm level on legumes and how would that affect targeting and program design for grain legumes in Africa?
- Entrepreneurs self-selection bias: does it exist and why? Female and male entrepreneurs?
- QDS – females access to extension agents?

What and where is more evidence needed?

- Clinical trials on legumes on nutrition (existing literature)
- *Gaps*
  - Understanding some of the HH decision-making processes of farmers and consumers in terms of crop choice
  - Household consumption vs market: As legumes are being produce for the market what is the effect on HHs nutrition and if they are selling, what has been the impact on income
  - What are the bottleneck to production and delivery (bean yields per hectare does not meet HH food security needs; marginalize producer even less).
  - Low cost deployment mechanisms for different varieties (context)
  - How can the seed system help shape demand for nutrition?
  - Seed systems include locally preferred varieties does this effect HH consumption (culinary traits)
  - Effectiveness of nutrition education on consumption behavior at HH level. What is really making a difference?
  - Any evidence of combining nutrition with seed systems effective - is it at the seed system level

Where should we invest more?

- Customer segmentation
- When we bundle / piggy-back, we should invest in layering programs that also achieve nutrition goals

Seed Systems for Last-Mile

Seed businesses may view last mile differently from institutions that deliver emergency-to-relief seeds. The focus here on 'last mile' refers to farmers who might be geographically, politically or socially removed from access to innovations. Note also that many crops and varieties are bred specifically for 'last mile' type areas, such as drought-prone regions—so the challenge is how to deliver them where they can have higher impacts.

What and where is more evidence needed?

- Consumers' (seed buyers') evolving needs and wants
- Logistics in hard to reach geographies
- Consumers' profile (information management)
- What kinds of government/institutional structures
- Strategies in finding last mile beneficiaries
- Making seed availability in last mile profitable
- Seed availability in last mile areas
- Information about informal sources of seed--- last mile and elsewhere
- Potential output market, road networks
- Whether seed dressing add gains in bundling package?

Policy implications

- Softening the licensing procedure to sell seed in range of last mile outlets
- Regulatory frameworks that allow alternative quality control for certification –QDS/TL seed, local level seed testing mechanisms
- Better segmenting last-mile customers: subsidy or not? Smart subsidy?

What practical actions might need to be tested?

- Bundling of seed with appropriate seed treatment techniques/rhizobium application
- Defining minimum commercial threshold sales necessary for sticky adoption in different geographies (sticky meaning adoption over several years) ?
- Analyses of viability and sustainability of the existing business models in reaching the varied last mile contexts
- Gauging importance of ICT, village fairs as useful in last mile delivery?
- Testing of inclusive business models (linking companies with groups/cooperatives, high potential and low potential area)

Where should we be investing more?

- Production of alternative qualities of seed/competitive products
- Piggybacking systems (seed and non-seed) for alternative distribution mechanisms
- Customer segmentation: for seed, varieties, seed-linked products.

Enhancing seed sourced from local markets: working with potential seed traders

This working group stems from the evidence that smallholder farmers source a good deal of their planting material ('potential seed') from local markets. At present, seed sector initiatives rarely work explicitly to strengthen the quality of seed or the range of new varieties found in these routine market locales.

Who are we talking about?

1. Grain traders who need seed and may actively engage in support seed production supplies to factories and/or select value chains

These general grain traders:
May not distinguish among varieties or know the most popular
May not be aware of better technical in storage conditions
May need credit—just due to the volumes they manage
May be Looking for knowledge to improve business operations—and capture new business
Can I sell to WFP? Can I sell to processors demand high quality and uniform standards?

2. Traders who deal in potential seed

They tend to know varieties well (their traits and where they can be sourced
They know the price difference for potential seed (vs. grain)
They keep varieties separate, they clean out the junk (sand, sticks, broken and immature grains), they know the good local multipliers
They often do not have good storage conditions-

3. Small specialized traders- seed-oriented, seasonally specialized

To capture the important margins at sowing time:
make money off of potential seed
have direct feedback to consumer and can give feedback to seed producer

What evidence do we need?

1. Classification or better characterization of 'traders 'overall--- different Typologies (and how they change across contexts and for different crops and scales).

a) Classification of potential seed traders tied to different end-markets (processors)

2. Elaboration of potential seed traders' constraint and opportunities related to seed
3. Documentation of trader practices related to seed

Questions to explore:

4. What makes a lasting trader linkage to serving farmers (e.g. legacy seed fair linkages)
5. Is the potential of ICTs changing the potential of traders to link with farmer groups?

Possible roles of traders related to seeds

- Introduce new varieties
- Provide credit to farmers/producers
- Maintain and enhance quality of seed
- Diminish storage loss of seed-- take over risk from farmer
- Serve as service provider in a storage function
- Maintain local varieties and serve as source of local varieties

- Serve as information function on good seed and new varieties
- Serve as seed security function (provide seed stocks, in normal and stress periods)
- Move seed to remote areas - they may act fast, good social connections, social certification, knowledge of adaptation zones, planting times, potential seed demand, end market demand
- Traders are motivated by profit. What would be their incentives to engaging in these distinct roles.
- Note- traders may not want new varieties, they want what is known and what sells. They want 'cash cows'.

What are the first-step roles?
Actions – may differ between 'regulated seed' and other seed

1. Traders selling small packs of certified seed (legal seed- moved through wider set of outlets)
2. Traders multiplying/moving popular seed of non -released high popular varieties (e.g. yellow bean in northern Tanzania)

Why are we not investing now?
Stigma of un-deserving poor trader, oppressive middleman
General traders excluded from Seed Laws
Needs a mindset shift of seeing trader as service provider.

Next steps / Interventions
What are the fora or ways of engaging these traders… (how, where, on what terms?)
'Underexploited option within wide toolbox of seed sector development'

Precise Information to collect on actual field experience
Learn more about USAID existing work on traders in Chad (helping with seed selection and quality)
Learn more about CRS work with traders in emergency - credit incentives

Quality Declared Seed

There were three presentations addressing issues around Quality Declared Seed (QDS) during the workshop. Extensive discussion during the plenary sessions highlighted core issues shaping current and perhaps expanded use of the seed quality approach.

We list the issues-to-be-solved and reflections in no particular order. The consensus was that QDS as an option needs much more central attention by all those seeking impact-oriented seed system development.

1. Why are there not more direct comparisons Certified, QDS, market seed? Costs of production, yields, risk factors?

2. Scaling for QDS - how much does it depend on government extension absorbing the costs?

3. With what frequency should one encourage farmers to purchase and plant QDS (every season, 2 or 3 seasons, 4 seasons)?

4. QDS vs. seed/grain market - what are the cost benefits/ what is the ability to get the crop and variety of choice in each system

5. Which crops should be marketed under QDS, as priorities?

6. Implementation of QDS requires a conducive regulatory framework

7. QDS is often project- based. Is it lucrative enough to be sustainable when outside funding is removed?

8. Labelling for QDS is key

9. QDS is at least 31% cheaper than certified seed

10. Is there concern about commercial seed companies sourcing seed from trained QDS farmers? This is an interesting linkage that might be explored.

11. Should QDS systems be focused only on farmer-based organizations? Can it be included in private company organizations? What are the disadvantages/advantages?

Concluding Remarks

By Louis Sperling

This meeting focused on seed business models' systems especially for legumes, shared multiple cases of real steps forward, and was explicit about advances that still need to be made—if we are to reach last mile customers. Several general messages, repeated throughout the meeting, frame the legume seed context.

1. **Support both formal and informal systems .** It is not a choice of one or the other seed system. Both formal and informal seed systems will have to be built on strategically and systematically. Investments will be needed in both to reach the range of customers.

2. **Look beyond the maize-seed centered model to enhance impact.** The hybrid maize seed business model is not necessarily the starting point for a legume seed business, not at all. New business models are going to have to be tailored to legume seed customers—e.g for whom new variety access might be more important than recurrent purchase of quality seed season after season.

3. **Look beyond seed in setting up sustainable enterprise.** Seed systems increasingly might best be framed as ' seed systems plus other direct inputs + financial services + information systems' (etc.) In addition, seed systems might be linked in mutually beneficial ways to other (non-seed) delivery systems - which is why concepts like a) multi-product rural kiosks or b) piggybacking are essential to explore practical solutions.

4. **Partnerships as a driving factor in reaching to milllions.** Decentralization of seed multiplication and delivery needs to be planned explicitly rather performed as 'ad hoc' collaboration. Getting the right seed-linked partnerships, in and for target zones, should be considered among the first priorities.

Priority themes

In terms of moving forward, conference participants identified pressing themes for the next five years: Simply: there are big gaps in understanding; they are urgent to solve; and they demand collaborative action (i.e. they are just too big for any one organization or group to solve alone.)

Seven joint themes :

1. **Seed buyers / market segmentation**- what do customers want and need. How do those evolve over time and space? How much are they willing to pay for the diverse types of products?

2. **Data on access to agro-dealers**- what is their real reach- how far geographically, what type of farmer, what range of products ?

3. **Profitability** of small scale business models for legumes (how many different models) ?

4. **QDS vs Certified** – costs, benefits, impacts ?

5. **Typology of traders linked to seed**, and evidence from working with them (how can traders be leveraged to reach more farmers with high quality seed) ?

6. **Strategic information systems** to get variety information out - what works best, where, for whom?

7. **Bundling** seed options: which options for which crops and bundles of what?

Obviously, there is a great deal of work to do and these are exciting times. That said, the explicit commitment to designing and reinforcing new models of seed business-- for nutrition, for enhanced resilience, and to reach the last mile—-represents important steps forward.

ANNEX I

Participants: Legume Seed Meeting, March 1-2, 2017

Aga, Amsalu Ayana **Title**: **Organization**: ISSD Ethiopia **Email**: aga.amsaluyana@gmail.com **Skype**: amsalu715 **Telephone**: +251 911842210	**Cigulube, Jean Paul** **Title**: MYAP Program Manager – PICS Project Coordinator **Organization**: Catholic Relief Services **Email**: jeanpaul.cigulube@crs.org **Telephone**: +243 81 861 34 74
Amidou, TRAORE **Title**: Sr. agriculture and Livelihood Program Manager **Organization**: Catholic Relief Services **Email**: Amidou.traore@crs.org **Skype**: Amidou.traore.crs.org **Telephone**: +226 67 05 57 36	**De Young, David J.** **Title**: Specialist **Organization**: Michigan State University **Email**: deyon59@msu.edu **Skype**: deljoven **Telephone**: 517-884-8522
Asibou, James Yaw **Title**: Principal Research Scientist (Plant Breeding) **Organization**: CSIR-Crops Research Institute **Email**: jyasibou@gmail.com **Skype**: jy.asibou **Telephone**: +233-243372005	**Donovan, Cynthia** **Title**: Deputy Director (Legume Innovation Lab) and Associate Professor in Agricultural, Food, and Resource Economics **Organization**: Legume Innovation Lab and Michigan State University **Email**: donovanc@anr.msu.edu **Skype**: Cxdonovan **Telephone**: 218-290-0270 or 571-432-2664
Ayenan, Mathieu Anatole Tele **Title**: Head of Coopérative Agro-pastorale et Agro-alimentaire du Bénin (CAAG) **Organization**: Coopérative Agro-pastorale et Agro-alimentaire du Bénin (CAAG) **Email**: mathieuayenan@gmailc.com **Skype**: ayenan.mathieu **Telephone**: +229 96063461	**Ehlers, Jeff** **Title**: Program Officer **Organization**: Bill and Melinda Gates Foundation **Email**: Jeff.ehlers@gatesfoundation.org **Skype**: geneticjeff **Telephone**: 206-419-0421
Baributsa, Diedonne **Title**: Lead, PICS Program **Organization**: Purdue University **Email**: Baributs@perdue.edu **Skype**: baridido **Telephone**: +1 765 494 8713	**Fernandez, Pilar** **Title**: Consultant, Enabling the Business of Agriculture **Organization**: World Bank **Email**: pfernandez@worldbank.org **Skype**: pilar.fernandez18 **Telephone**: 202-458-5731
Beebe, Stephen **Title**: Leader, Bean Program **Organization**: International Center of Tropical Agriculture (CIAT) **Email**: S.Beebe@cgiar.com **Skype**: Sebeebe **Telephone**: 57-318-770-9968	**Ferris, Shaun** **Title**: Director Agriculture & Livelihoods **Organization**: Catholic Relief Services **Email**: Shaun.Ferris@crs.org **Telephone**: 410 350 1233
Buruchara, Robin **Title**: Director, Pan Africa Bean Research Alliance (PABRA) **Organization**: International Center for Tropical Agriculture (CIAT) **Email**: r.buruchara@cgiar.org **Skype**: buruchara **Telephone**: +254-718000986	**Forcino, Sarah** **Title**: Investment Officer **Organization**: Catholic Relief Services **Email**: sarah.forcino@crs.org **Skype**: sarah.forcino **Telephone**: 410-234-3177
Chakanda, Robert **Title**: Executive Director **Organization**: AgroVentures **Email**: chakanda@hotmail.com **Skype**: chakanda51	**Hamed, Parasto** **Title**: Field Manager **Organization**: Deloitte **Email**: phamed@deloitte.com **Skype**: parasto.hamed

Telephone: +232 780 51 704	**Telephone**: 571-882-8646
Hanif, Charity **Title**: Agribusiness and International Development Consultant **Organization**: Independent Consultant **Email**: chanifmoz@hotmail.com **Skype**: charityhanif **Telephone**: 1 301 642 3147	**Low, Jan W.** **Title**: Principal Scientist and Co-leader of the Sweetpotato for Profit and Health Initiative **Organization**: International Potato Center **Email**: j.low@cgiar.org **Skype**: janhigh3 **Telephone**: 254-20-422-3601
Hoppenjan, Troy **Title**: Agriculture and Livelihoods manager **Organization**: Catholic Relief Services **Email**: Troy.hoppenjan@crs.org **Skype**: troyhoppenjan **Telephone**: 667-228-3001	**Maereka, Enock Kuziwa** **Title**: Seed Business Development Specialist **Organization**: International Center for Tropical Agriculture **Email**: E.Maereka@cgiar.org **Skype**: enock.maereka **Telephone**: +265 999 969 964
Huisenga, Mark **Title**: Senior Program Manager **Organization**: USAID **Email**: mhuisenga@usaid.gov	**Man, Christian** **Title**: PhD Candidate **Organization**: Penn State **Email**:czm212@psu.edu **Skype**: christianrman **Telephone**: +1 901 494 1826
Isaacs, Krista **Title**: Gender & Plant Breeding Post-Doctoral Fellow **Organization**: ICRISAT **Email**: k.isaacs@cgiar.com **Skype**: imtasirk **Telephone**: 607-280-5955	**March, Julie** **Title**: Food Security and Livelihoods Team Lead **Organization**: USAID/OFDA **Email**: Jmarch@usaid.gov **Telephone**: 202-712-0398
Katabalwa, Charles **Title**: Managing Director **Organization**: Cedo Seeds **Email**: ckatabs@yahoo.co.uk **Skype**: katabalwa.charles **Telephone**: +25677259054	**Maredia, Mywish** **Title**: Professor, International Development **Organization**: Michigan State University **Email**: maredia@msu.edu **Skype**: ishwym **Telephone**: 517-353-6602
Khanal, Narayan Prasad **Title**: Innovation Manager **Organization**: CIMMYT International, South Asia Regional Office, Kathmandu **Email**: n.khanal@cgiar.org **Skype**: Narayan.khanal12 **Telephone**: +977 9851183024	**Mastenbroek, Astrid** **Title**: Chief of Party ISSD Plus Project **Organization**: Wageningen University and Research-Centre for Development Innovation **Email**: astrid.mastenbroek@wur.nl **Skype**: **Telephone**: +256 (0)787007615
Kunwar, Buddhi Bahadur **Title**: Director at Independent Advisory Services, Timor-Leste **Organization**: Independent Advisory Services, Timor-Leste **Email**: Buddhi.kunwar@seedsoflifetimor.com **Skype**: Buddhi.kunwar **Telephone**: +9779841335250	**Mcguire, Shawn** **Title**: Seed Security Officer **Organization**: Food and Agriculture Organization **Email**: Shawb.mcguire@fao.org **Skype**: shawn.mcguire_dev **Telephone**: +39 06 570 54892
Leege, David **Title**: Director, University Engagement and Research **Organization**: Catholic Relief Services **Email**: david.leege@crs.org **Skype**: **Telephone**: 410-951-7389	**Mcguire, Shawn** **Title**: Seed Security Officer **Organization**: Food and Agriculture Organization **Email**: Shawb.mcguire@fao.org **Skype**: shawn.mcguire_dev **Telephone**: +39 06 570 54892
Louwaars, Niels **Title**: **Organization**: Plantum **Email**: n.louwaars@plantum.nl **Skype**:	**McKay, Brenna** **Title**: Technology Commercialization Lead **Organization**: Feed The Future Partnering for Innovation **Email**: bmckay@fintrac.com **Skype**: brennacarmen

Telephone: +31 6 170 170 38	**Telephone**: 202 733 1185

Merchan, Rafael **Title**: Livelihood Coordinator – SEGAMIL - DFAP **Organization**: CRS - Guatemala **Email**: rafael.merchan@crs.org **Telephone**: +502 3050 1852	**Rweyendela, Vianey** **Title**: Country Coordinator SSTP/AGR **Organization**: AGRA **Email**: vrweyendela@agra.org **Skype**: vianeyjr **Telephone**: +255 685 444 273
Morris, Peter **Title**: Division Director, Preparedness, Strategic Planning and Migration **Organization**: USAID **Email**: Pmorris@usaid.gov	**Sevier, Mark** **Title**: Partnership Manager **Organization**: Fintrac **Email**: msevier@fintrac.com **Skype**: mark.sevier1 **Telephone**: 202-733-1185
Muhhuku, Fred **Title**: Program Officer **Organization**: AGRA **Email**: FMuhhuku@agra.org **Skype**: fmuhhuku **Telephone**: +254734400052	**Sperling, Louise** **Title**: Senior Technical Advisor, Agriculture and Livelihoods **Organization**: Catholic Relief Services **Email**: Louise.sperling@crs.org **Skype**: louisesperling **Telephone**: 860 350 3555
Nagarajan, Latha **Title**: Senior Economist **Organization**: IFDC **Email**: lnagarajan@ifdc.org **Skype**: l **Telephone**: 202-772-4175**Telephone**: 860 350 3555	**Waweru, Mwangi Martin** **Title**: Program Manager, Agriculture and Livelihoods **Organization**: Catholic Relief Service, Kenya Country Program **Email**: martin.waweru@crs.org **Skype**: Waweru.martin.mwangi **Telephone**: +254 734 600 6
Ogundijo, Dayo Stephen **Title**: Agriculture Team Lead **Organization**: Catholic Relief Services Nigeria County Program **Email**: dayo.ogundijo@crs.org **Skype**: dayodijo1 **Telephone**: +2348034249301	**Widders, Dr. Irvin** **Title**: Director, Feed the Future Legume Innovation Lab **Organization**: Michigan State University **Email**: widders@anr.msu.edu **Skype**: irvwidders **Telephone**: 517-355-4611
Onyango, Mercy Anyango **Title**: Graduation Research Intern Analyst **Organization**: University of Nairobi **Email**: macyonyango@yahoo.com **Skype**: macyonyango@yahoo.com **Telephone**: +254712552156	**Rubyogo, Jean Claude** **Title**: Seed System Specialist **Organization**: CIAT-Tanzania **Email**: j.c.rubyogo@cgiar.org **Skype**: rubyogo **Telephone**: +255 688 033 600
Overcamp, Katherine **Title**: Head of Programs, Eastern DRC **Organization**: Catholic Relief Services **Email**: Katherine.overcamp@crs.org **Skype**: katherineovercamp **Telephone**: +243 971-091-267	**Ngila Kimotho** **Title:** Managing Director **Organization:** Dryland Seed Ltd.
Rhoe Davis, Valerie **Title**: Senior Technical Advisor, Agriculture – Gender & Nutrition **Organization**: Catholic Relief Services **Email**: Valerie.Davis@crs.org **Skype**: Valerie.Rhoe **Telephone**: 703 568 1949	**Rubyogo, Jean Claude** **Title**: Seed System Specialist **Organization**: CIAT-Tanzania **Email**: j.c.rubyogo@cgiar.org **Skype**: rubyogo **Telephone**: +255 688 033 600
Ngila Kimotho **Title:** Managing Director **Organization:** Dryland Seed Ltd.	

ANNEX II

Program: New Models for Legume Seed Business: Resilience, Nutrition, and Reaching Farmers at the Last Mile

March 1-2, 2017 Washington, DC

Day 1, ***March 1, 2017***

8:30- 9:00	*Registration*	
WELCOME		
9:00-9:10	Welcome	P Morris/OFDA
9:10-9:30	Participant Introductions	D Leege
SESSION I:	**INTRODUCTION AND OVERVIEW TO NEW MODELS MEETING**	
9:30– 9:50	Opening Remarks and Program Overview	L Sperling
9:50-10:00	Discussion/exploration (maize vs. legumes)	S.Beebe
SESSION II:	**EXPANDING THE VISION FOR SEED SYSTEM GOALS** *(moderator: L Sperling/CRS)*	
10:00-10:20	Seed Systems for Nutrition: specific features	J Low
10:20-10:40	Seed Systems for Resilience: specific features	S McGuire
10:40-11:00	Discussion (focus on features)	
11:00-11:25	*Coffee/tea break [and posting on a) legumes/maize b) nutrition c) resilience]*	
SESSION III:	**BUIDING BLOCK FOR SEED SYSTEM: SEED QUALITY** *(Moderator: S.Beebe/CIAT)*	
11:25-11:30	*Opening remarks*	
11:30-11:50	Challenges of legumes seed supply – reduce cost of quality controls through QDS	N Louwaars
11:50-12:10	QDS: filling the gap between formal +informal seed: Uganda	A Mastenbroek
12:10-12:30	Early generation legume seed production and delivery: Tanz.	L Nagarajan
12:30-12:50	The economics of local seed entrepreneurship: A case study of the Association Song Koaadba (ASK), Burkina Faso	M. Maredia
12:50-13:00	Discussion (evidence and processes to move QDS forward)	
13:00- 13:55	*Lunch*	
SESSION IV:	**SEED COMPANIES, CUSTOMERS, AND REACH** *(Moderator: F.Muhhuku/AGRA)*	
13:55-14:00	*Opening remarks*	

14:00-14:20	Overview: Current Legume Seed Delivery and The Last Mile	C Hanif
14:20-14:40	Drylands Seed Company, Kenya	N Kimotho/J.C. Rubyogo
14:40-15:00	CEDO (Community Enterprise Development Organization): legume seed credit model,	CKatabalwa
15:00-15:20	Discussion (spurring companies to reach customers)	
15:20-15:55	*Coffee/tea break (and posting on 'Last Mile')*	
SESSION V:	**SEED COMPANY SUPPORT** *(moderator, S. Ferris/CRS)*	
15:55-16:00	*Opening remarks*	
16:00-16:20	Incentivizing Businesses to Commercialize Seeds for Smallholder Markets: Marketing and Distribution	B McKay
16:20-16:40	How AgResults is using pull mechanisms to create a legume seed market in Uganda	H. Parasto
16:40-17:00	CRS Impact Investing	S. Forcino
17:00-17:15	Discussion	
17:15-18:00	**DAY 1: Report Backs and Summary**	
	• Maize vs. legumes	Beebe
	• Seed systems and Nutrition	Low/Davis
	• Seed systems and Resilience	McGuire
	• Last Mile	Muhhuku
18:15- 19:30	*Cocktail !!*	

<u>Day 2</u>, March 2, 2017

8:45-8:55	Announcements and quick recap	
SESSION VI:	**INTEGRATED MODELS FOR SCALE/LAST MILE** *(moderator J. March /USAID/ OFDA)*	
8:55- 9:00	*Opening remarks*	
9:00- 9:20	Reaching The Last Mile: PABRA's Experience	R Buruchara
9:20- 9:40	ISSD: Ethiopia. Experience with multiple legume seed businesses	S Walsh
9:40:10:10	Discussion (features for scale)	
10:10-10:30	*Coffee/tea break*	
SESSION VII		
10:30-11:30	**Expert Groups:** Maize/legumes, Resilience, Nutrtion, Last Mile/Reach/Scale	

11:30- 12:00	Detailed feedback	
12:00- 12:55	*Lunch*	
SESSION VIII:	**INFORMATION SYSTEMS: COMPLEMENTARY TO SEED** *(moderator: D Baributsa/Purdue)*	
12:55-13:00	*Opening remarks*	
13:00-13:20	Exploiting information technology to deliver quality cowpea seeds Benin	M Ayenan
13:20-13:40	Making Bean Seed Systems Nutrition-Sensitive in Southern Africa	E Maereka
13:40-13:55	Facilitated Discussion- D. Baributsa leads/S.Ferris adds CRS experience	
SESSION IX A:	**COMMUNITY-BASED/DECENTRALIZED MODELS I (***moderator M. Onyango CCRP)*	
13:55- 14:00	*Opening remarks*	
14:00- 14:32	Community seed banks in Nicaragua	D. DeYoung
14:20- 14:40	Community-based seed systems: seed system in the hands of the community Nigeria	D. Ogundijo
14:40-15:00	Improving legumes certified seed production through breeding for pests resistence and innovation platforms: Ghana	J. Asibuo
15:00- 15:20	Clarification questions	
SESSION IX B:	**COMMUNITY-BASED/DECENTRALIZED MODELS II (***moderator C. Donovan, MSU))*	
13:55- 14:00	*Opening remarks*	
14:00- 14-20	Community Seed Depots- Achieving Dual Objectives Of Sustainable Bean Seed Access And Nutritional Security In Guatemalan Highlands	I. Widders
14:20-14:40	A Business Model for Mungbean Promotion under Rice-Wheat System in Nepal	N. Khanal
14:40-15:00	Community Based Approach for the sustainable supply of commercial seeds in Timor-Leste	B. Kunwar
15:00-15:20	Clarification questions	
SESSION IX C	**Plenary (provocative) discussion . The Future of Community-Based/ Decentralized models**	
15:20-16:00		C. Donovan M. Onyango
SESSION X:	**REVIEW AND KEY ISSUES FOR MOVING FORWARD**	
16:00-17:30	Plenary and expert review	

17:30 Final remarks and Official Closure of meeting