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**Scaling Technology Transfer through Private Seed Channels:
Experience from East Africa**

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Scaling Technology Transfer through Private Seed Channels: Experience from East Africa

Background

The goal of the breeding programs of the International Agricultural Research Centers (IARCS), including those of the CGIAR, is ultimately to see improved germplasm become widely available to smallholder farmers as seed or planting material of improved varieties. This improved material carries with it important pro-poor traits such as higher yield potential, disease resistance, improved nutrition, and resistance to abiotic stresses, among other aspects. Seed systems or seed channels serve to deliver seed of improved varieties to smallholder farmers who may also benefit from planting quality material free of seed-borne disease, better germination rates and seed treatment (if applied). Seed systems can also be important in rehabilitating agriculture following civil unrest or natural disasters where seed can be lost.

Historically, IARC breeding programs have disseminated advanced parental lines to national research programs who took on the task of variety development and diffusion. In the case of sub-Saharan Africa, national programs and government parastatal bodies also often take on the role of foundation and certified seed production. Resource limitations have resulted in amounts of quality seed of improved varieties (of particularly open and self-pollinated varieties and clonally propagated crops) falling a long way short of national requirements in many African countries. This gap is sometimes exacerbated by any mismatch between public breeding targets and actual farmer and market needs. The distribution of seed of hybrid varieties offers a clearer business model and has seen more private sector participation, including national and international companies, in seed production and distribution in many developing countries. Thus whilst more than 70% of maize seed planted in Kenya is quality seed of improved varieties, typically less than 10% of rice seed planted in many West African and less than 1% of potato seed in East African countries is quality seed. The yield gap seen for most crops grown by African small-holder farmers is striking when compared with farming elsewhere in the developing world, and is in large part due to poor functioning seed systems.

The question raised in this brief paper is to what extent the private sector can be expected to invest in the dissemination of seed of improved varieties for a wider range of crops and what partnerships need to be put in place for this to begin to happen.

SFSA and a scalable private sector approach

The Syngenta Foundation is a long-term supporter of R&D programs within the CGIAR. It has invested in the system for over ten years. In 2012, USD 3.79 million or 25% of the Foundation's investment budget of USD 15.2 million was allocated to projects hosted by individual centers. The approach in recent years has been to develop public-private partnerships that bring the skills of the respective organizations closer together, realize the impact potential of CGIAR research, and build trust and longer-term links between public and private organizations in international agricultural research. All along, the goals motivating the collaborative relationship have included the delivery of research goods to farmers and therefore the creation of conditions enabling farmers to adopt the improved technologies that emerge from research.

Delivering technology on a large scale requires commercial solutions. Where government and market failures abound, these solutions may need to be nudged into existence by measures in the public interest that mitigate risk and might include funding and other catalytic support. The SFSA's Seed Systems Development Thrust provides for this, as this paper shows. The Thrust's purpose is to support private, local seed companies so they can acquire new varieties from both public and private sector breeders and multiply and distribute quality seeds of a growing range of crops. Private seed channels are seen as a necessary addition to informal seed systems, complementing public sector seed providers. The Foundation currently demonstrates the feasibility of its approach through model projects for key selected crops in a limited number of countries and for which the demand for seed is clear. In some instances, the projects work with CGIAR centers to accelerate the progression of the products of their breeding programs to seed companies and into farmers' fields.

The basic idea is to identify seed supply needs and suitable seed companies or seed multipliers interested in meeting farmers' (and thus the market's) needs. Then the Foundation acts as an intermediary to link these seed companies to both potential purchasers of seed (through connections to credit, savings or market linked input purchases) and public or private breeders who can supply commercial licenses to permit seed multiplication of proprietary new varieties. These partnerships are clearly not happening by themselves and hence the need for an intermediary.

Evidence of adoption of new varieties by small-holder farmers is supplied to International public breeders such as the CGIAR centers (in lieu of royalties). Fair and equitable royalty bearing models are being developed to respond to market opportunities and needs, while respecting national legislation and the policies of public plant breeding institutions. Licensing models that are compatible with relevant mandates and international obligations are being developed with CGIAR centers. The Foundation's role is as a facilitator and incubator that stands aside from any bilateral arrangements between breeders and seed purchasers or seed companies. The Foundation's *Seeds2B* program identifies partners and market needs, invests in adaptation trials and assists in fast-track variety registration and any required licensing arrangements. Additional technical and risk mitigation support for seed companies (such as advanced market commitments) and support for government regulatory authorities is provided as needed.

The project also works closely with the SFSA's Kilimo Salama micro-insurance thrust, recognizing that we need to manage the risk of asking small-holder farmers to invest in inputs such as improved seeds. In all cases evidence is collected of improved access and uptake of improved seeds by small-holder farmers.

The potato case studies below illustrates this approach and is discussed along with current plans to scale both bean varieties in East Africa and dryland cereals in West Africa.

Potato seed in Kenya and Tanzania

An estimated 2.5 million smallholder farmers depend on potato as both a cash and subsistence crop in the highlands of East Africa. Average yields persist around 7-8 tonnes per ha when the potential of the crop is above 30 tonnes per ha. The lack of provision of quality disease-free seed of improved varieties is the principle cause of this yield gap.

The international Potato Center (CIP) implemented a USAID and GIZ funded initiative (known as the "3G" initiative) between 2009 and 2011 which saw the successful entry of the private sector into potato seed production in Kenya working in partnership with the relevant Kenyan

government agencies. This project resulted in a new seed capacity which has continued to grow beyond the life of the project through private sector investment. The activity now supplies some 30,000 smallholders with quality seed of CIP/KARI - bred disease resistant varieties (see growth path in Fig. 3 below).

In Kenya, a single private sector potato seed multiplier (Kisima Farm) produced a record 900 tons of certified seed from 40 ha planted in the long rain 2012 season and harvested in January 2013 (and likely to achieve nearly 2000t for the whole of 2013). This private production matches the total output of the Kenyan public sector capacity (ADC plus KARI). Plans for the next two seasons amount to expansion to about 50ha per season (100ha per year) with the potential to produce some 2000- 2500t per year. A survey of 170 local small-holder farmers revealed that the supply of quality potato seed was cited by 41% of respondents as having increased their yields by between 2 and 10-fold. Kisima Farm estimate that some 14,000 local beneficiaries (3000 direct and 11,000 indirect) could be generating up to an additional 2235 usd per year per grower per acre amounting to a total direct benefit of some 6 million usd per year (these figures will be verified in the coming season). SFSA also brokered a successful alliance between a Dutch private breeder (HZPC) and Kisima Farm which permits the latter to commercially produce seed of modern processing varieties in Kenya in return for a royalty payment -the first of its kind in SSA. The draft agreement includes novel mechanisms to promote small-holder uptake of the new varieties and even to put them in an advantageous position over larger producers through waiving the right to collect seed multiplication royalties and ware-replant fees. It is interesting to see that private sector breeders are also willing to enter this smallholder market with germplasm (advanced processing traits) that complements the existing public supplied varieties (disease resistance and abiotic stress traits). Additional investment from the Africa Enterprise Challenge Fund (AECF) and SFSA of 1.1 million usd will now permit the construction of a badly needed seed cold store and additional facilities (Fig.1.) The funding (which includes 50% matching private funding from) will permit planned expansion to supply an additional 30,000 small-holders with seed.

In a parallel exercise other private partners, with Syngenta Foundation support, have consolidated the story and repeated it in neighboring Tanzania, including assisting with the registration of CIP/KARI varieties in that country. Mtanga Farms limited in Iringa, Tanzania have now constructed two screen-houses with their own funds and successfully completed a third cycle of mini-tuber production, reaching 120,000 mini-tubers in 2013, without any further assistance from SFSA technical consultants. Field multiplication of seed in 2013 reached 1.2 ha of G1/G2, 2 ha of G2/G3 and 5 ha G4/G5 sufficient to supply approximately 125t of certified seed to 500 small-holder farmers (assuming 0.5 acre holdings). The farm also made the first sales of locally grown certified potato seed in 2012 -- the first quality seed produced in Tanzania in perhaps more than 30 years. SFSA successfully introduced Mtanga Farm to the Norwegian social capital fund Voxtra in 2012, who subsequently concluded a 1 million USD investment in the enterprise. SFSA are also signatories to a small NORAD technical assistance grant to support this investment. This follows the successful SFSA supported AECF proposal in 2011 and brings additional total private funding of more than 2 million USD to support expansion of the enterprise for a total SFSA investment of 120K USD cash plus technical support. SFSA funded training of the Tanzanian regulatory agency TOSCI by their Kenyan counterparts (KEPHIS) in potato seed testing and certification has resulted in a working protocol for potato seed certification now in place for Tanzania.

Fig.1. Private sector investment in a 1000t seed cold store in Timau, Kenya (Kisima Farm)



Bean seed in Kenya and Rwanda

CIAT report that beans are the most important food legume crop in both Rwanda and Kenya (Buruchara *et al.* 2011). Beans are cultivated by approximately 95% of Rwandan farmers, and occupy about 30% of all cultivated land (FAO, 2011) while in Kenya; beans are second to maize in cultivated land area. Beans are a primary and the cheapest source of protein for over 40 million people in the two countries. Rwanda and some of parts of Kenya including western regions have the highest per capita bean consumption in the world (between 50 - 60 kg per person per year). Beans are not only a superior source of proteins (>20%) but is one of the best sources of iron and zinc; two of the most common nutritional deficiencies affecting the nutritionally sensitive groups (pregnant and lactating mothers and under-fives). In these two countries, beans are also a significant source of income for rural households with sales exceeding US\$ 500 million annually and having an export value of about 110 million USD (FAO, 2011). Fifty percent of the production is normally retained for domestic consumption in rural areas (except for snap bean for which more than 95% is sold). Beans are also becoming a specialized niche product (navy beans for canning and snap beans for domestic and foreign markets). Beans therefore play a crucial and unique role as a source of cash and food for the majority of farmers. The crop is mainly grown by resource poor farmers, particularly women, giving it the name “a woman’s crop”. Opportunities for growing beans are wide. Breeding effort has produced a wide range of bean varieties that tolerate various biotic (pest and diseases) and abiotic (drought, heat, low fertility) stresses making this crop versatile and adapted for cultivation across a wide range of agro ecologies.

Breeding programs funded by the public purse, such as the International Centre for Tropical Agriculture (CIAT), national breeding programs and universities have bred and are currently developing high-performing bean varieties. However, there are no incentives to market these

varieties as commercially attractive seed input for farmers. This situation results in varieties that often languish on the shelves without reaching the farmers. In Kenya, for instance, there are more than 70 registered seed companies, but only four are involved in dry bean seed business and these four only supply seed of the already popular/well known varieties and not the new varieties. In Rwanda, the formal seed industry is at infant stage, requiring more support to establish and will require innovative ways on how to include beans in the companies' portfolios. Efforts to encourage and stimulate private companies to embark on bean seed business have yielded promising results in Zimbabwe, Malawi, as well as Uganda and Kenya. For instance, in Kenya, the use of certified bean seed increased from 2 % to 5 % between 2008 to 2012 (PABRA, 2012). Building on this promising experience will push higher the growth of bean seed market by private companies.

A partnership between the innovative NGO *One Acre Fund* and local seed companies has successfully generated private sector investment in bean seed production through explicitly linking seed sales to the availability of credit. One private producer in Kenya (Fig. 2) is currently producing more than 50 ha of certified bean seed (enough to supply 15,000 smallholders) of a CIAT/ KARI bred variety and planning to expand. *One Acre Fund* serves more than 160,000 farm families in Kenya. SFSA is currently working to expand this partnership, working with CIAT and the respective NARS, to include a wider range of varieties and to include seed production in Rwanda. The provision of adequate amounts of foundation seed remains a key issue to resolve before further private sector engagement can be expected.

Conclusions

We conclude that a demand-led, commercial approach coupled with new methods of fair and equitable variety licensing can attract significant private sector investment and business talent, which in this case resulted in the scaling of the dissemination of CGIAR germplasm to 10,000s of small-holder farmers. The particularly interesting aspect of the potato case in Kenya and Tanzania is that significant private sector investment (more than 3 million usd) was leveraged to support seed multiplication, dissemination, and even variety registration, of CGIAR technology. There is every indication that further private sector investment will further develop potato seed capacity in the region once others see it as profitable. With beans in Kenya, the partnership between an innovative NGO (*One Acre Fund*) and a private seed company has permitted private sector investment in a self-pollinated crop which should have result in a more sustainable approach to inject new genetics into a predominantly informal seed sector at scale. The injection of private sector resources and expertise is also seen as important. Considering that resources are also often limiting for variety development and public breeding it could also be argued that there is a place for the private sector to also participate in variety development, particularly registration, for the so-called "orphan" crops in SSA. This might warrant re-examining policies and strategies in regard to managing access to proprietary varieties arising from public breeding programs within the context of international treaties- at least on an experimental basis. A system of nonexclusive commercial licensing both incentivize further private sector investment as well as providing much needed royalty benefits to public breeding programs. Any such strategy would need to be shown to materially benefit small-holder farmers through increased access to quality seed of improved varieties at an affordable price.

Discussions are underway with a view to spreading this private sector-led approach in partnership with additional centers and crops, including the possible dissemination of ICRISAT/NARS sorghum and millet varieties in both East and West Africa with key NGOs as well as commercial partners.

Fig. 2. Large-scale private certified seed multiplication of CIP/ KARI potato variety Tigoni (Timau, Kenya) and CIAT/ KARI bean variety KK8 (Kitale, Kenya)



Fig 3. Scaling of CIP/KARI potato varieties through private sector seed channels in Kenya and 10 year projected impact.

