Planting the Seeds of a Green Revolution in Africa

Photo: AGRA
Cover photo: Neil Palmer/CIAT

Planting the Seeds of a Green Revolution in Africa

Several years ago a group of agriculture experts at the Rockefeller Foundation, frustrated by the state of agriculture development in sub-Saharan Africa, started a program with a simple mission. They wanted farmers in Africa to have something farmers elsewhere in the world take for granted: a steady supply of seed for more productive or "improved" crop varieties. This seed could help the farmers generate higher crop yields and overcome the constant barrage of plant pests, drought, and disease that are the enemies of agriculture everywhere.

For centuries, farmers in Africa have skillfully operated their own informal seed systems. They save seeds from one year's crop for planting in the next and share seeds through community networks. Many have worked like plant breeders in research laboratories, combining different varieties to obtain desirable traits and collaborating with other farmers to expand their knowledge.

Despite this impressive ingenuity, the performance of local varieties of maize, cassava, millet, and other African food staples now lags far behind the rest of the world. Harvests per hectare for major crops like maize can be as much as 80 percent below their potential. More importantly, this yield gap is a key reason farmers in Africa are not producing enough food to sustain the continent's rapidly growing population.

The desire to give African farmers a wider range of seed choices—including access to seed of highly productive crop varieties known as hybrids, which have revolutionized food production elsewhere in the world—eventually led to the creation of the Program for Africa's Seed Systems, or PASS.

Today, PASS is an integral part of the Alliance for a Green Revolution in Africa (AGRA).

AGRA was launched by the Rockefeller Foundation and the Bill & Melinda Gates Foundation in 2006. Its goal is to develop practical ways to improve production and income for the millions of smallholder farmers, who form the core of Africa's dynamic but neglected agricultural sector. And a key priority for AGRA is to upgrade Africa's seed systems.

In many ways, the work of PASS is just beginning to bear fruit in fields across the continent. Many obstacles remain to providing Africa's smallholder farmers with the seed they need and deserve. But the program is making substantial progress.

If the production from all 80 PASS-supported seed companies is added up, it constitutes the biggest seed producer working in sub-Saharan Africa today. From a mere 2,346 metric tons in 2007, annual production from PASS producers had risen, by 2014, to 80,606 metric tons of professionally certified seeds. Moreover, the companies are focusing on crop varieties endowed with traits carefully selected by local crop breeders for their compatibility with specific African agricultural environments—of which there are many.

The companies also are working with a wide range of crop types. They include improved, locally adapted varieties of maize, cassava, millet, rice, sorghum, beans, sweet potato, cowpea, groundnut, soybean, pigeon pea, sweet potato, banana, durum wheat, and bread wheat.

PASSing Along a New Seed System for Africa

AGRA's Program for Africa's Seed Systems, or PASS, has achieved several milestones. For example:

PASS collaborates with 80 small- and medium-sized seed companies across Africa that produce 80,606 metric tons of professionally certified seeds each year. PASS-supported companies are collectively the largest seed producers in sub-Saharan Africa.

PASS partnerships with national research programs have generated 464 new, improved varieties of 15 important crop species, 312 of which are now commercially produced and available for sale to African farmers.

PASS has trained and certified 15,000 rural agro-dealers in 16 countries that now provide farmers with 400,000 metric tons of seed and one million metric tons of fertilizers. They also have conducted over 7,000 technology demonstrations and held nearly 4,000 farmer field days

PASS support for training the crop breeders of tomorrow has resulted in 66 scientists earning PhDs and 135 earning master's degrees.

A farmer in Tanzania shows the benefits of hybrid maize.

Photo: AGRA

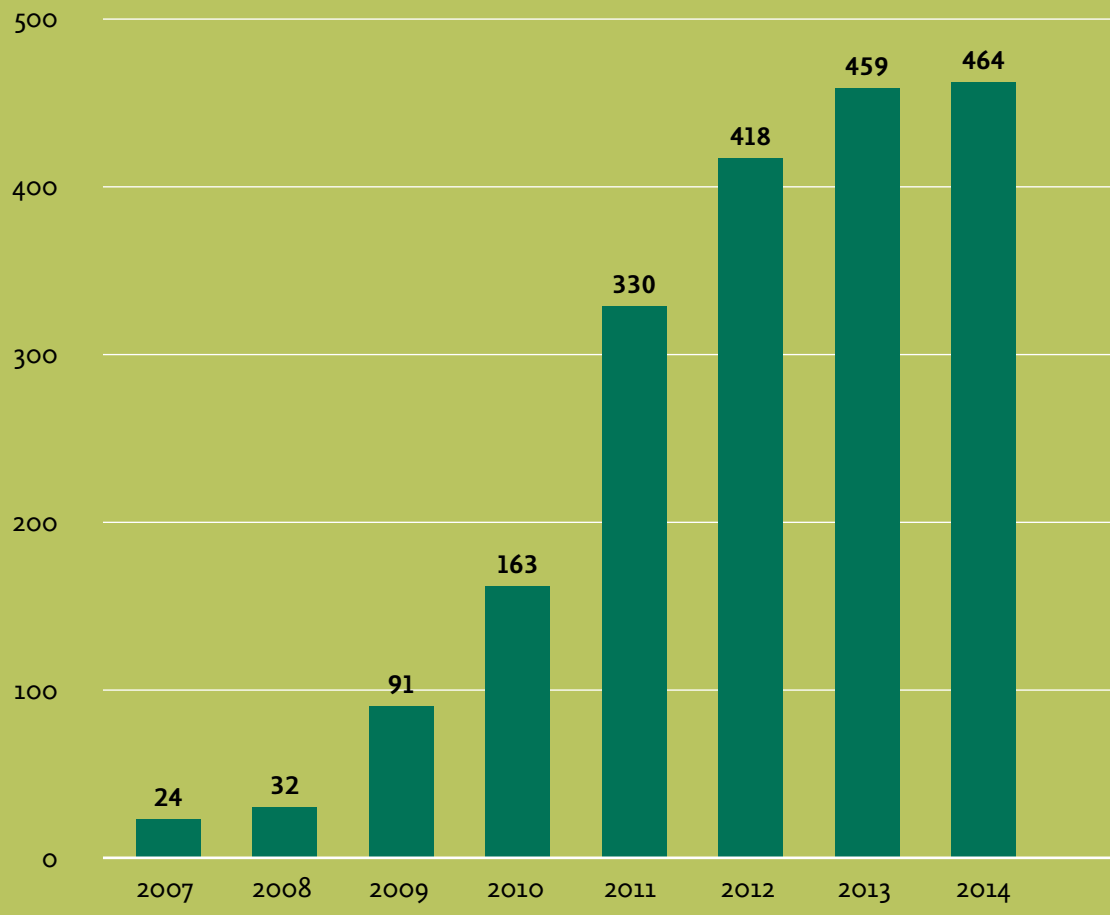
Seeking a Third Way for Seed Production

The collaboration initiated by PASS with small seed companies across Africa represents a new way of building a sustainable seed production sector in Africa.

In the past, there have been two approaches to expanding seed choices for Africa's smallholder farmers, and both of them have failed. First, there was the conventional development approach, which collapsed because it either failed to account for local farmer preferences or donor funding dried up. Second, farmers could purchase improved crop varieties from big multinational seed companies, but these companies typically focused only on maize, and not the broad spectrum of crops cultivated in Africa.

PASS is seeking a third way: nurturing small- to medium-sized seed businesses located in close proximity to the farmers they serve. These companies collaborate with farmers and with crop breeders working in public research programs to produce a steady supply of affordable, locally adapted, improved varieties of a wide range of crops. The goal is to establish resilient and responsive African-owned seed production capacity that can be self-sustaining and not reliant on donor financing to survive.

Seed Varieties Released, 2007–2014*



* Numbers as of April 2014

Strengthening Weak Links Across the "Value Chain"

An important lesson from the many failed efforts to improve agriculture production in Africa is that a successful seed program must strengthen multiple links of what AGRA calls the seed value chain. This means that PASS works in multiple areas simultaneously, from the breeding programs that develop new crop varieties to the companies that produce seeds to the agro-dealers who make them available to farmers.

For example, PASS works upstream of seed production to support national crop breeding programs, which are staffed by experienced crop breeders. The scientists are intimately familiar with local growing conditions, but their efforts have been starved for investments in recent years.

Since 2007, PASS has awarded more than 100 grants to allow scientists in national research institutes to develop improved varieties of a wide range of crops. The payback has been substantial. These partnerships have released 464 new, improved varieties of 15 important crop species, 312 of which are now commercially produced and available for sale to African farmers.

PASS also is supporting efforts to train a new generation of African crop scientists.

By the end of 2013, 66 PASS-supported scientists had earned PhDs and 135 had earned master's degrees. Given that the majority of African farmers are women, PASS also has focused on bringing more women into the world of crop breeding,

Meanwhile, PASS is working with a rapidly growing network of small, community-based agriculture supply retailers, sometimes referred to as "agro-dealers." PASS started in 2007 working with just 331 agro-dealers to expand their offerings and improve their expertise. The number of PASS-trained and certified agro-dealers now stands at more than 15,000.

This agro-dealer network has provided farmers in 16 countries with 400,000 metric tons of seed and one million metric tons of fertilizers. They also have conducted over 7,000 technology demonstrations and held nearly 4,000 farmer field days, where local farmers can examine test plots to see first-hand how the new varieties perform.

"PASS works in multiple areas simultaneously, from the breeding programs that develop new crop varieties to the companies that produce seeds to the agro-dealers who make them available to farmers."

The overall result is that farmers across Africa have much greater access to improved crop varieties—both those produced by PASS-supported companies and by other firms as well— along with the inputs required to realize their yield potential. A 2013 survey of farmers in nine countries found that the majority who invested in improved crop varieties achieved yields 50 to 100 percent above local varieties.

For example, 69 percent of farmers in Kenya, 74 percent in Nigeria, and 79 percent in Mozambique said improved maize varieties had doubled harvests per hectare. Meanwhile, 79 percent of farmers in Ghana reported doubling rice yields, and 85 percent of farmers surveyed in Uganda reporting doubling yields from cowpea.

Improving All Aspects of African Seed Production

PASS is organized to simultaneously address multiple weaknesses in different links of what it calls the seed value chain.

Education

Through the Education for African Crop Improvement (EACI) program, PASS identifies strong educational institutions and provides grant support to train scientists and link them with crop breeding programs.

Breeding

Through PASS' Fund for the Improvement and Adoption of African Crops (FIACC), it identifies crop-breeding teams and develops breeding strategies that include collaborations with local farmers. It also provides grants, links breeders with seed companies, and assists in commercializing their products.

Production

PASS' Seed Production for Africa (SEPA) program serves as its business incubator, identifying seed enterprises and providing grant support to help them acquire equipment and develop marketing strategies. It also connects them with potential investors.

Distribution

The Agro-Dealer Development Program (ADP) works with farm supply sellers or "agro-dealers," with particular focus on small, rural operations that are in close proximity to farmers. The ADP offers training, on such things as the proper use of fertilizers and other inputs, and it oversees credit guarantees.

464 Varieties | Seed varieties released by crop

Photo: Neil Palmer/CIAT

A New Adventure Begins: Scaling Seeds and Technologies Partnership

PASS has achieved many important milestones. It helped build a new foundation for developing, producing, and distributing improved crop varieties that are intended for African farmers, African climates, African soils, and African dinner tables. Now, with support from Feed the Future through the United States Agency for International Development (USAID), AGRA is accelerating efforts to give smallholder farmers access to high-yield crop varieties and other innovations that can help them fight hunger and poverty. This work is aligned with the New Alliance for Food Security and Nutrition, a shared commitment by African leaders, private sector partners, and donor governments to lift millions out of poverty over the next decade.

The initiative is called the Scaling Seeds and Technologies Partnership, or SSTP. The goal of the Partnership is to coordinate a variety of country-specific initiatives that increase the use of improved seeds, fertilizers, farming techniques, and farming technologies on smallholder farms in Africa.

One objective is to encourage more players in the private sector, including local businesses and non-profit organizations, to play a role in seed production. Meanwhile, the Partnership will help governments craft policies and build regulatory capabilities to ensure new crop varieties developed by national research organizations and other breeding endeavors are quickly made available to farmers. Governments also will be encouraged to expand efforts to monitor seed quality and police the market for counterfeit seeds.

Specifically, the program provides USD $47 million for AGRA and PASS to work over the next four years in six countries—Ethiopia, Ghana, Malawi, Mozambique, Senegal, and Tanzania—to:

- attract USD $40 to $50 million in additional investments to improve private sector seed production at the national level;
- spur the development of 12 seed technology or supply enterprises led by women;
- commercialize at least 50 technologies for improving farm production;
- reduce the average distance between rural farmers and agro-dealers from 20 to six kilometers;
- achieve a 45 percent increase in use of improved seed, fertilizers, and other production technologies;
- increase grain production by 4.5 million tons; and
- boost food security for 7.6 million people.

Lessons Learned on the Frontlines of African Farms

PASS and SSTP will embark on the next phase of work endowed with hard-earned knowledge about what it will take to achieve a self-sustaining seed development, production, and distribution enterprise to serve the needs of millions of African smallholder farmers. Here are a few of the many lessons AGRA has absorbed in its ongoing journey.

It's Not Just the Seeds, it's Also the Fertilizers

There are many parts of Africa where crop production could quickly rival what farmers achieve in the world's great breadbaskets. But missing are not just seeds for high-yield crop varieties. Fertilizers—mineral and organic—are in short supply as well.

Fertilizers have a negative image in many parts of the world. In places like the United States, their over-use—both on farms and on residential lawns—has contributed to environmental harms, like waterways choked with algae. Yet Africa's breadbaskets remain largely untapped in part because farmers do not use nearly *enough* fertilizers. According to the World Bank, in sub-Saharan Africa, farmers use, on average, 10 kilos or less per hectare. Compare that to South Asia, where the average is 123 kilos, or to high-income countries, where the average is 143 kilos.

Even with the improved high-yield varieties being developed for African growing conditions, the addition of a modest amount of fertilizer can dramatically increase yields.

For example, in Western Kenya, over the last 10 years, the combination of improved maize hybrids and better access to fertilizers has allowed yields to more than double, from 838 kilos per hectare for a local variety produced with no fertilizer to 1,935 kilos per hectare for improved hybrids grown with fertilizer. The addition of fertilizer alone to the improved hybrids generated an additional 700 kilos per hectare.

Smallholder farmers elsewhere in Africa have achieved significant increases in yield by "micro-dosing" each plant with a mere bottle cap full of fertilizer. PASS is working through its agro-dealer program to greatly increase the availability and affordability of fertilizers in Africa and provide farmers with advice on how to safely and efficiently apply them.

Photo: Neil Palmer/CIAT

Dispatches from a Seed Revolution

The PASS journey to transform seed development and production in Africa began with numerous trips and many intense conversations in rural communities across the continent. Meetings were held with a wide array of local business people who expressed confidence that, with proper support and a favorable business climate, they could make a living selling certified seed to the smallholder farmers who dominate agriculture in Africa.

It became clear that if this plan was to work, a few things had to be established. For one, the crop varieties offered needed to be suitable for local growing conditions and clearly superior to varieties farmers were currently planting. And farmers would need to see evidence that these new seeds would perform as advertised, preferably by observing them in action on small plots they could visit and examine for themselves.

Consultations with local communities also revealed that seeds needed to be available in packages of 2 kilograms or less, because most smallholder farmers in Africa are tending plots less than one hectare in size. In addition, there needed to be a strategy to ensure seeds and farm inputs were available closer to the farmers themselves. Farmers did not want to travel great distances just to get a bag of seed or a sack of fertilizers, though many did and many still do.

But one thing that stood out above all: the notion that African farmers are backward traditionalists resistant to change and uninterested in new agriculture technologies is absolutely false. They want what any other consumer wants: a quality product sold in a manageable quantity at an affordable price and available at a nearby retailer.

"African farmers want what any other consumer wants: a quality product sold in a manageable quantity at an affordable price and available at a nearby retailer."

Why PASS Promotes Private Sector Seed Production

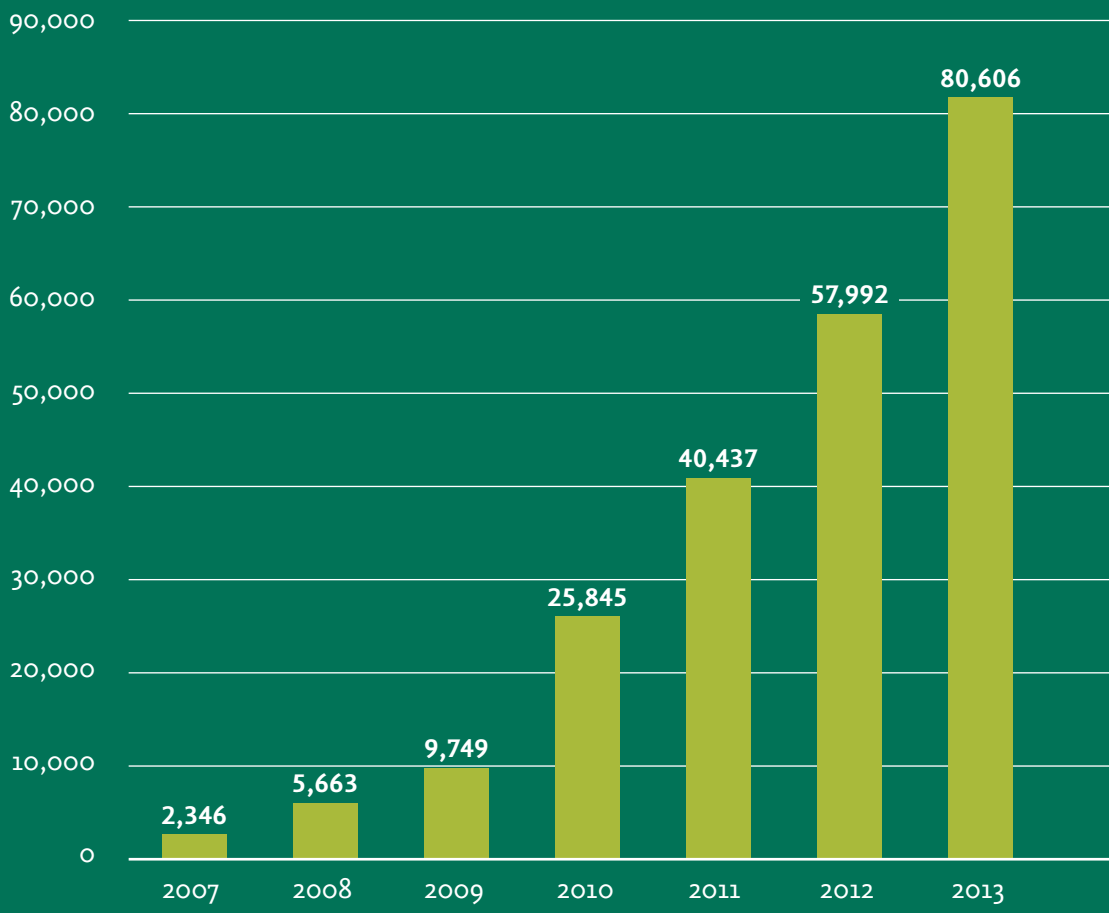
Crop seed is a living technology, unforgiving of neglect or late delivery. Also, crop varieties are in need of regular renewal to help farmers overcome constantly evolving threats from pests and disease, adapt to new growing conditions caused by climate change, and take advantage of new agricultural innovations.

PASS believes that locally owned, private-sector enterprises that live or die based on their ability to provide smallholder farmers with high-quality seeds when and where they need them offer an opportunity to build a sustainable seed supply infrastructure in Africa.

The last few decades have seen many failed attempts by governments or donor agencies to establish effective systems for providing African farmers with quality seed. The PASS approach of employing public breeders to develop new varieties and private seed producers and suppliers to deliver them to farmers is working.

Photo: AGRA

Seed Production, Metric Tons, 2007–2013



Policies Must be Cultivated Along with Crops

It is important to work closely with government officials to develop a policy environment that encourages innovation in seed production. In particular, PASS has found that, in many countries, there are policies in place that make it difficult for seed production enterprises to obtain "foundation seed" for new, high-yielding varieties developed by national crop breeding programs.

Essentially, when a breeder develops a new crop variety, the next step is to produce foundation seed that manufacturers require to generate the large quantities necessary to meet farmer demand. A lack of foundation seed has long been viewed as a significant barrier to giving African smallholder farmers greater access to locally adapted, high-yield crop varieties. The benefits of improved varieties developed by scientists can only be achieved if there is steady flow of foundation seed moving through the seed production system.

PASS is seeking ways to improve the quantity and quality of foundation seed available to all types of seed producers—including public sector seed producers and seed production initiatives organized by farmers and community groups. For example, PASS is encouraging governments to consider contracting out foundation seed production or allowing companies to work directly with plant breeders to produce their own foundation seed.

Already, PASS has helped organize public-private seed production partnerships in several countries, including Uganda, Zambia, Kenya, and Malawi. These alliances are proving beneficial to all: seed companies get the foundation seed they need and governments realize the benefits that accrue as the improved varieties boost food security and incomes in rural farming communities.

PASS also works with national governments to improve seed inspection and certification systems. In some countries, problems with seed quality and sales of counterfeit seeds have made some farmers reluctant to invest in improved crop varieties.


Photo: Neil Palmer/CIAT

The Importance of Collaborating with Smallholder Farmers

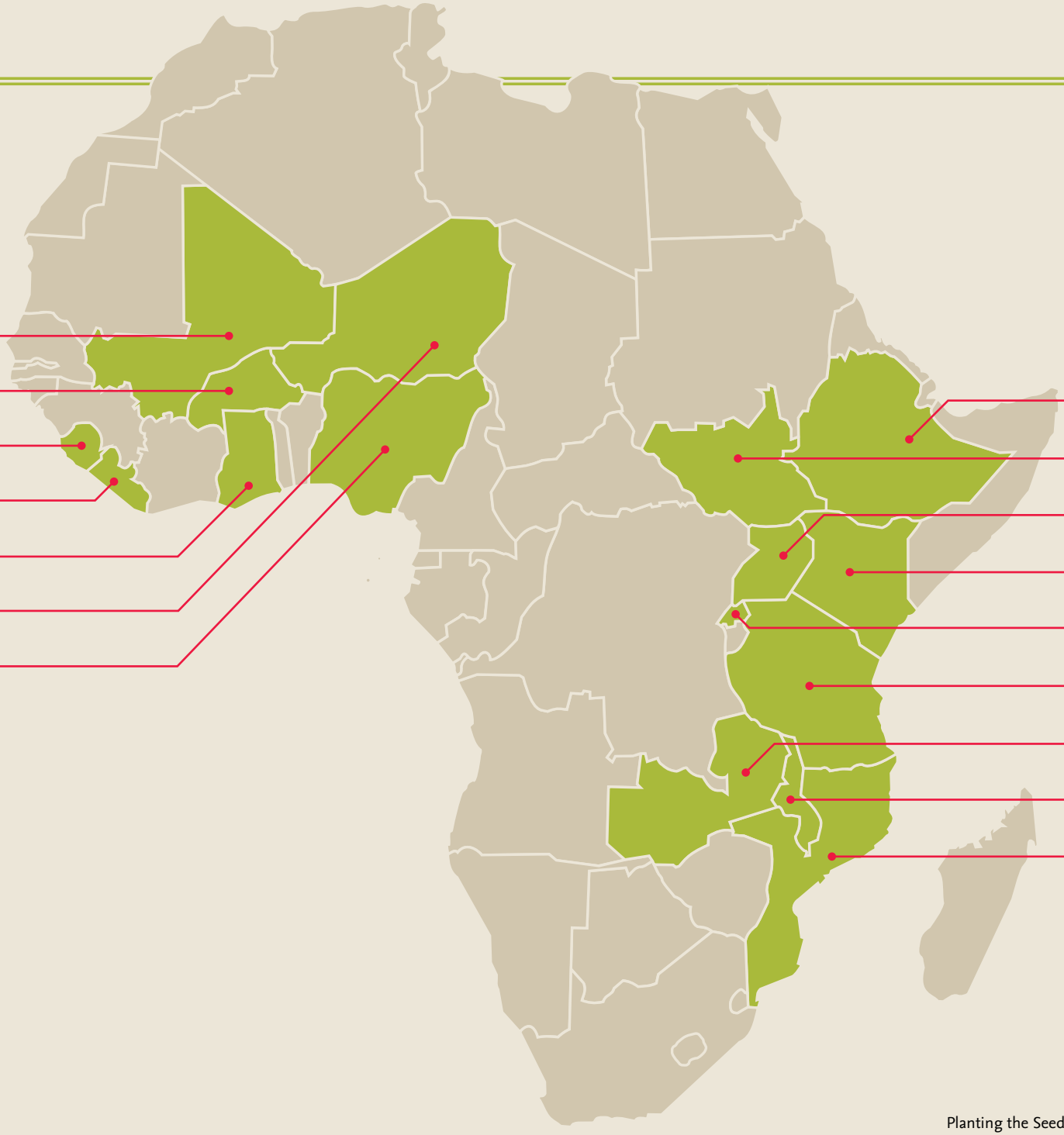
PASS works with thousands of smallholder farmers across Africa and they have proven critical to facilitating more widespread use of improved seeds and farm inputs.

Farmers, particularly women farmers, say they look primarily to other farmers for advice and information on improving their production practices. For example, they are more likely to purchase seeds for a new variety—and the inputs to go along with them— if they have an opportunity to observe the results on a neighbor's farm. This practical approach shows the need to get local farmers more involved with testing new varieties.

Smallholder farmers also can help seed producers deal with challenges of scaling up production. PASS has addressed constraints affecting local seed producers by offering grants to help companies negotiate contracts with local farmers to multiply seeds. Initially, PASS-supported companies were handling all of their own seed multiplication. Now, 20 to 50 percent of production is handled by contract farmers, which has allowed overall seed production to double.

Seed Production by Country, 2013

Metric Tons



Mali **1,112.4**

Burkina Faso **3,543.1**

Sierra Leone **25.8**

Liberia **159.0**

Ghana **1,356.5**

Niger **1,340.1**

Nigeria **22,684.7**

Ethiopia **15,833.0**

South Sudan **244.7**

Uganda **14,600.8**

Kenya **2,654.4**

Rwanda **690.5**

Tanzania **8,283.6**

Zambia **762.9**

Malawi **4,156.0**

Mozambique **3,158.6**

Snapshots of Success in African Seed Production

Generating Bumper Crops in Ethiopia

PASS grantee Alemayehu Makonnen and his company, Alemayehu Makonnen Farm Limited, are producing seed for hybrid maize, bean, and teff for farmers in Ethiopia's Southern Nations, Nationalities, and Peoples' (SNNP) Region. Now, more than 16,000 smallholder farmers in the region are cultivating the company's hybrid maize varieties and achieving bumper harvests of between four and six tons per hectare. One farmer, Wulchafo Surage, decided to plant hybrid maize after seeing it growing in Makonnen's fields. Surage subsequently harvested 18 tons of maize, *six times more* than his normal harvest.

Rice is Nice for Nigeria

In Nigeria, PASS grantee Andrew Efisue and his team of researchers at the University of Port Harcourt worked for six years to produce three new varieties of disease-resistant, drought-tolerant rice. The new varieties offer local farmers an opportunity to boost harvests by 20 to 35 percent. AGRA hopes the new varieties can help increase rice production in Nigeria and across West Africa, where surging demand requires many countries to rely heavily on imports. Nigeria alone is one of the world's largest importers of rice, but has embarked on an ambitious plan to become self-sufficient in rice production.

Photo: AGRA

For Africa's Drylands, a Wellspring of Drought-Tolerant Seed

In 2002, Ngila Kimotho used his savings to start a small business selling supplies to local farmers working the arid and semi-arid lands around Machakos, Kenya. He quickly became convinced that there was an underserved market of smallholder farmers in East Africa eager for crop varieties that could provide consistent yields even in relatively dry conditions. In 2004, Kimotho started Dryland Seed Limited and, in 2007, AGRA provided a grant to help expand his fledgling operation. Dryland Seed now has agreements with numerous research organizations to produce seeds for drought-tolerant maize, pigeon pea, sorghum, and green grams (mung beans). Each year, its products sell out. Dryland Seed is now working with AGRA and the Africa Enterprise Challenge Fund to rapidly expand capacity to meet farmer demand.

Photo: SABMiller

Brewing Up Better Cassava in Mozambique

PASS-supported scientists at Mozambique's Institute of Agricultural Research developed a new variety of cassava that offers improved starch qualities and disease resistance. But it faced a challenge: would there be enough seed to allow farmers to meet demand for raw cassava to be used in a new brand of cassava beer? So the International Fertilizer Development Center (IFDC) consulted with the Mozambique brewing company Cervejas de Moçambique (CDM) and its cassava processing partner, the Dutch Agricultural Development and Trading Company (DADTCO). They decided to send the seeds to Corredor Agro Ltd (CAL), a company that works with smallholder farmers in the region, for rapid duplication, and then on to farmers trained and organized by IFDC for further seed and cassava root production. By using local farmers to expedite seed production, CDM was able to rely on smallholder growers to produce enough cassava to help it launch Impala, the world's first commercially-made cassava beer.

Photo: SABMiller

Conclusion: Facing Future Challenges on a Foundation of Success

The effort to upgrade African seed systems to the level needed to power a Green Revolution and elevate food production across the continent still faces a number of challenges. A key advantage of working in several countries and with multiple aspects of agriculture production simultaneously is that AGRA is keenly aware of the many barriers that still prevent millions of smallholder farmers in Africa from cultivating high-yield crop varieties.

The following are examples of challenges PASS is working to resolve:

Africa still needs more seed companies. The increased volumes of improved seed reaching farmers now is encouraging, but far from adequate. Young seed companies grow slowly and it will take many such ventures to meet farmer demand for improved crop varieties. To help companies increase capacity, PASS assembled a team of seed experts with many years of industry experience to advise them on the do and don'ts of seed production, while at the same time imparting important skills.

Local seed company owners need to become better managers. As their companies grow, these young business people will benefit greatly from expertise imparted by others who have traveled the same path, expertise that can be incorporated into management training courses designed with seed companies in mind. PASS has established a "Seed Enterprise Management Institute" at the University of Nairobi in Kenya where seed company staff come for short, specialized courses that are provided in partnership with the Seed Science Center of Iowa State University.

Government policies need to support building seed production capacity in Africa's private sector. Governments can play an important role by freeing up the supply of foundation seed developed by public-sector breeding programs and offering tax incentives to encourage investments in processing equipment, irrigation technology, and other seed production infrastructure.

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Farmers need to learn more about how improved seeds—particularly for hybrid varieties—can rapidly increase food security and incomes. Seed companies do some of this education via farmer field days and on-farm demonstrations, but education initiatives are expensive. One alternative is to plant thousands more crop demonstration plots, which in many ways allow seeds to sell themselves.

Fueling the growth of small- and medium-sized seed companies requires better access to investment capital. Banks have proven to be too risk-averse to be effective partners for seed companies. This is an area where venture capital can really make a difference for poor, smallholder farmers in Africa. PASS has established two social impact funds to support seed production but more are needed.

Despite the many challenges that remain for Africa's seed systems, PASS has managed to achieve substantial progress. Its simultaneous focus on supporting breeding work, scientific training, seed production, and agro-dealer networks has significantly increased the number of improved crop varieties available to farmers across Africa.

Several countries have made particularly important progress. In Uganda, Zambia, Kenya, and Malawi, there is a healthy pipeline of new crop varieties flowing efficiently from breeding programs to local seed companies. There also is strong interest from investors in supporting local seed production and balanced policies from governments that facilitate access to foundation seed. In addition, farmers in these countries are highly aware of the benefits offered by the new varieties now available and have greater access to them through their local agro-dealers.

Many more countries also are showing substantial improvement. AGRA and PASS are committed to working with them in the coming years as they continue to develop a uniquely African seed production and farm input supply system to power a uniquely African Green Revolution.

Alliance for a Green Revolution in Africa

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