

SEED

SYSTEMS

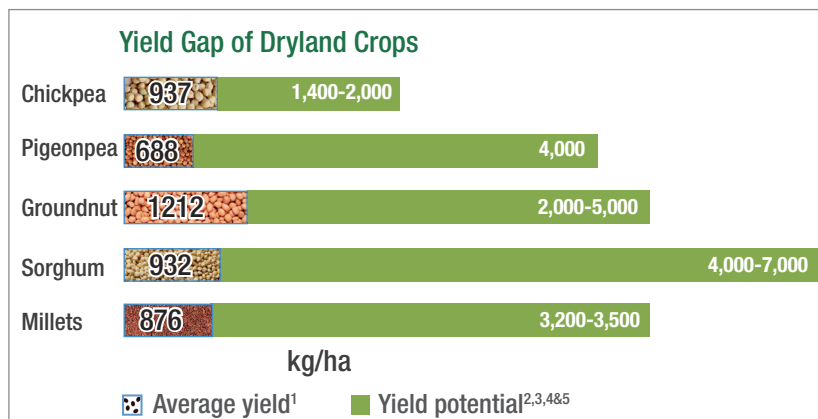
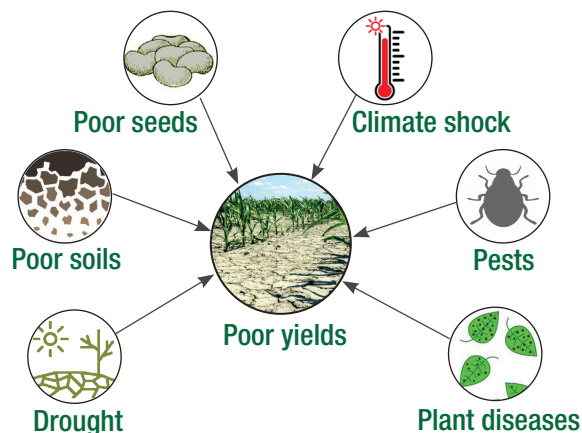
MODELS & LESSONS LEARNED



Better seeds, better lives for dryland smallholder farmers

Better seeds will fill the yield gap

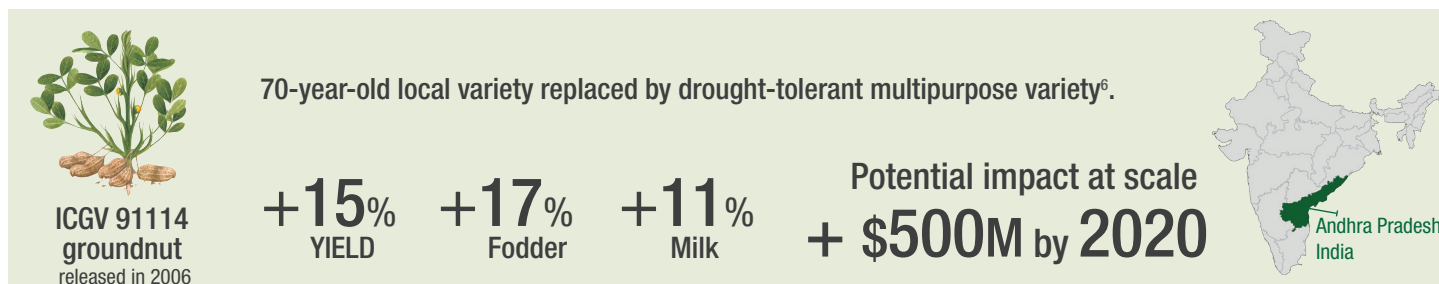
Smallholder farmers have relatively low crop yields in sub-Saharan Africa and South Asia, as they face multiple challenges from poor soils, numerous pests and plant diseases, drought and other climate shocks. A major issue often cited by farmers is the poor quality of seeds.



For the millions of smallholder dryland farmers who rely on rainfed farming, improved seeds are one of the most cost-effective ways to enhance their yields, food security and livelihoods.

ICRISAT research has developed many improved varieties that can provide higher and more stable yields, drought tolerance, pest resistance and other traits preferred by farmers and markets (color, grain size).

If farmers can get the right improved seeds, associated with the right farming practices, the impact could be huge.



The seed dilemma: How to reach smallholder farmers

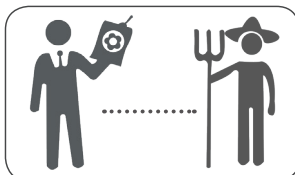
Low adoption for dryland cereals and grain legumes



<20% land in Africa planted with improved varieties⁷



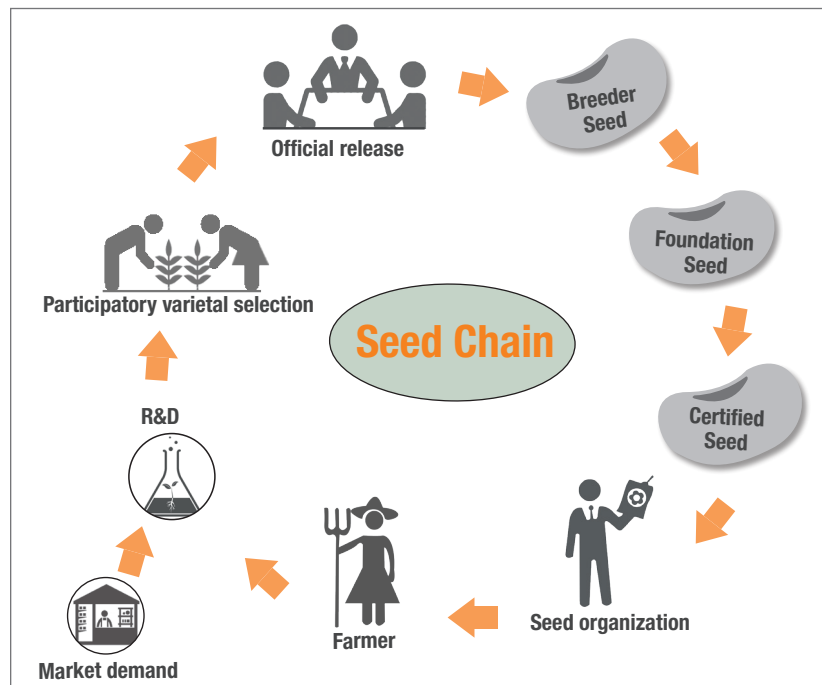
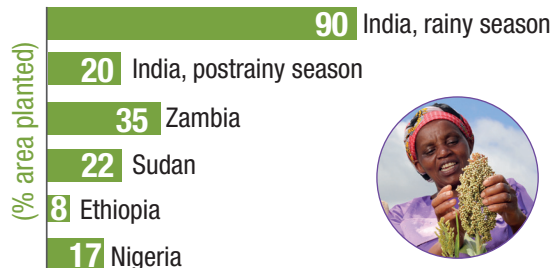
Low seed replacement ratio⁸



Low attraction for commercial seed sector

Contrasted situation

Adoption levels of improved sorghum varieties⁹



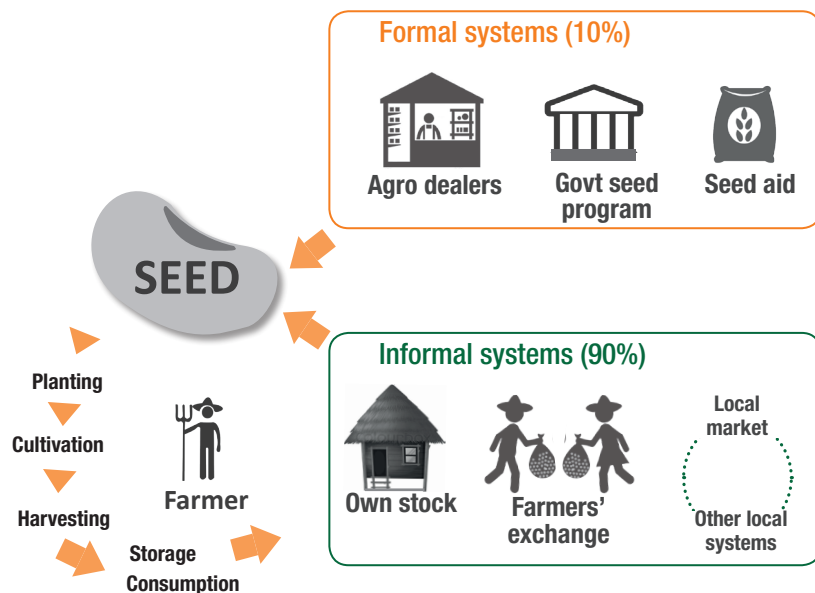
From lab to plate: demand-driven seed roadmap

Developing improved seeds is a complex research-and-development process. Seeds should be accessible in time, affordable and meet the true needs of farmers and markets.

ICRISAT works with national research partners, farmers, public and private organizations and non-governmental organizations along the seed value chain to develop and produce seeds from breeder to quality controlled seeds.

Timing is key. A year can be lost if farmers get seeds too late for sowing. Mobile technologies help plan and track seed production at all stages, along the seed supply chain.

Seed systems are diverse but most smallholder farmers get seeds from local, informal channels



>30% farmers
access new varieties in last 5 years¹¹

Yet, with the right policies, investments and incentives in place, things can move quickly so that farmers can get access to better seeds.



Adapting seed demand to smallholders' needs: Small seed packets

Providing affordable small seed packets (SSP) for as little as the cost of a cup of tea motivates thousands of farmers to experiment with new varieties at minimal risk. Improved seeds are packed in 100 to 500 g bags, which allows testing of the variety over a 100 m² plot. SSP have informative labels in local languages and contact information of the seed producer.

Reaching the last mile: SSP have high transaction costs for farmer organizations or seed ventures. In remote, difficult to access areas, alternative marketing channels should be explored – mobile seed shops, seed fairs, schools, farmer field schools, partnerships with retail networks, etc. The closer the input source (<5 km) to the farm the better, especially for women farmers.

Seed watersheds: Mapping farmers' access to seed outlets using GIS and mobile applications will improve marketing strategies of agro dealers and development practitioners.



[Small seed packets could play big role in Africa's battle against drought¹²](#)

the guardian

IMPACT



Tropical Legumes II project 2007-2014¹³



Total distributed
2.16 million SSP
(50 g - 25 kg)

281,000 farmers
undertook improved
variety trials

Malawi (groundnut)
839,500 SSP

Potential outreach via SSP
44.5 million farmers

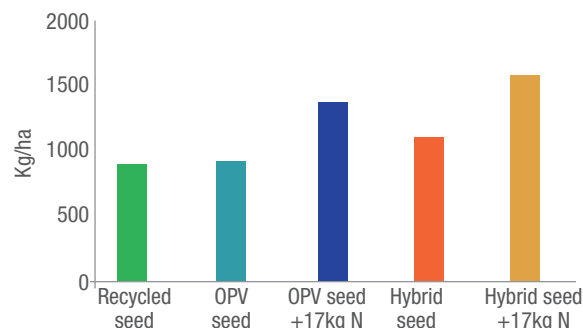
\$9 return per **\$** invested



Linking seed and inputs systems

Better seeds alone are not necessarily the shortest route to impact

Soil fertility is often the biggest constraint for drylands farmers, especially in sub-Saharan Africa. Impact is greater when seed access is paired with appropriate fertilization. Farmers need seed and inputs systems.



Comparison of maize field trials in Zimbabwe (x1,000 paired plots)¹⁴.

The [warrantage system](#)¹⁵ tested in Mali, Niger and Burkina Faso helps farmers sell their produce at better prices and access credit to buy better seeds and fertilizer to practise microdosing.

Yields ↑ **44–120%** **Incomes** ↑ **19–113%**

Supporting small seed organizations to become viable

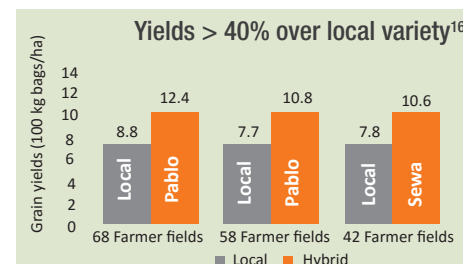
ICRISAT assists farmer organizations in sub-Saharan Africa and South Asia to manage complex seed production and gradually become successful seed ventures.

Jigi Seme cooperative in Mali now produces sorghum hybrid seeds with yields 40% higher than the farmers' best local variety.



"If you have good seeds, you will be ahead of the game"

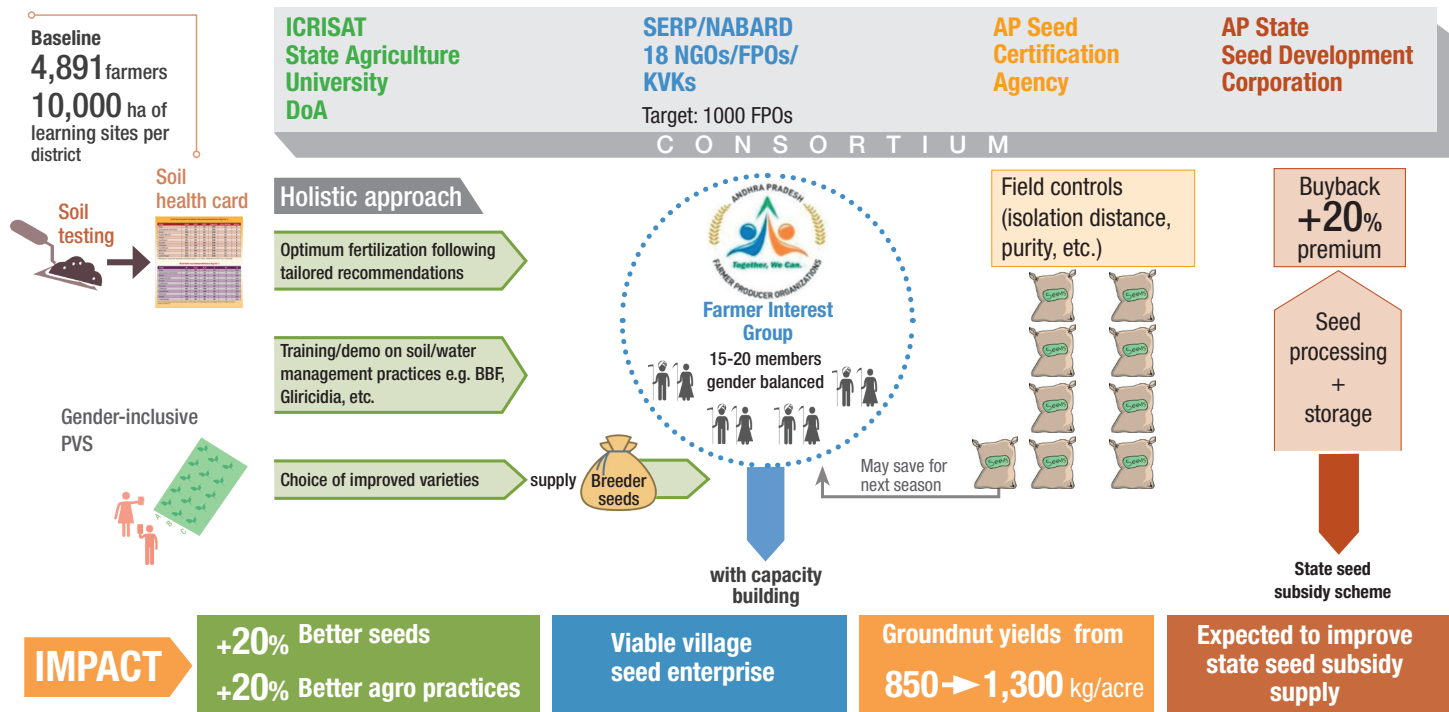
– Souleman Ballo, President of Jigi Seme (Mali)



\$1 invested ➡ \$39 net benefits¹⁷

Transforming farmer groups into village seed enterprises in Andhra Pradesh, India

In Andhra Pradesh, India, under the Rythu Kosam initiative, a consortium aims to set up 1,000 village seed enterprises that could supply the state seed sector with quality seeds for crops and regions where private seed companies are not present. Already, impact is huge on the ground¹⁸.



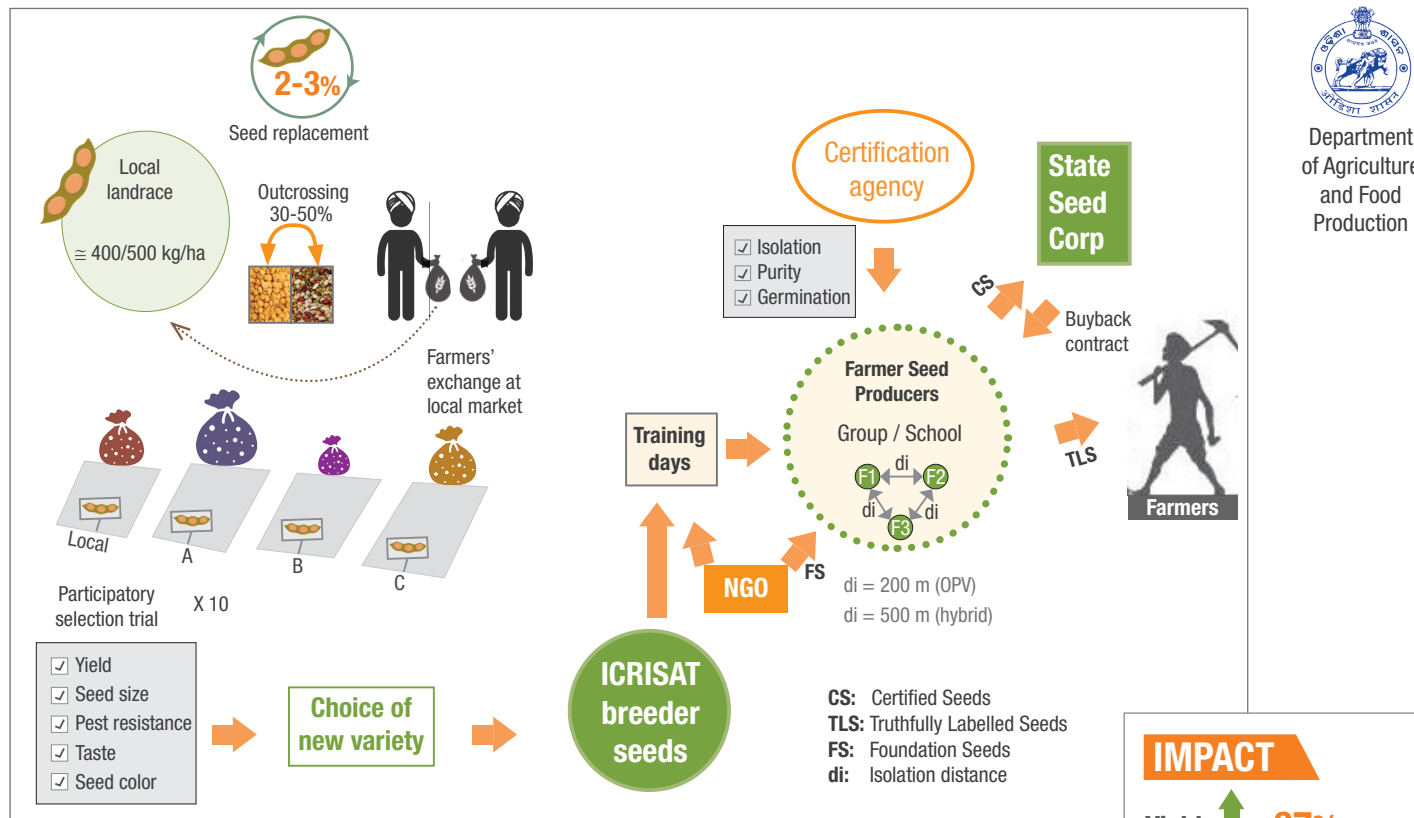
FPO - Farmer Producer Organization; PVS - Participatory Variety Selection; BBF - Broad Bed and Furrow; KVK - Krishi Vigyan Kendras (Extension Services); DoA - Dept of Agriculture; SERP - Society for Elimination of Rural Poverty; NABARD - National Bank for Agriculture and Rural Development



Government of Andhra Pradesh

Community-based seed organizations spread seed impact fast

One village-one variety: Pigeonpea in Odisha rainfed dryland systems¹⁹



Department of Agriculture and Food Production

In rainfed pigeonpea farming systems like in the Odisha uplands in India, farmers rarely have access to improved seeds. Due to pigeonpea's high outcrossing pollination, ICRISAT encourages seed producers within the same community to grow the same improved variety. Women self-help groups were trained to produce quality seeds, which were sold as truthfully labelled seeds to other women farmers, at affordable prices. As well as generating incomes, impact on yields was rapid.

IMPACT

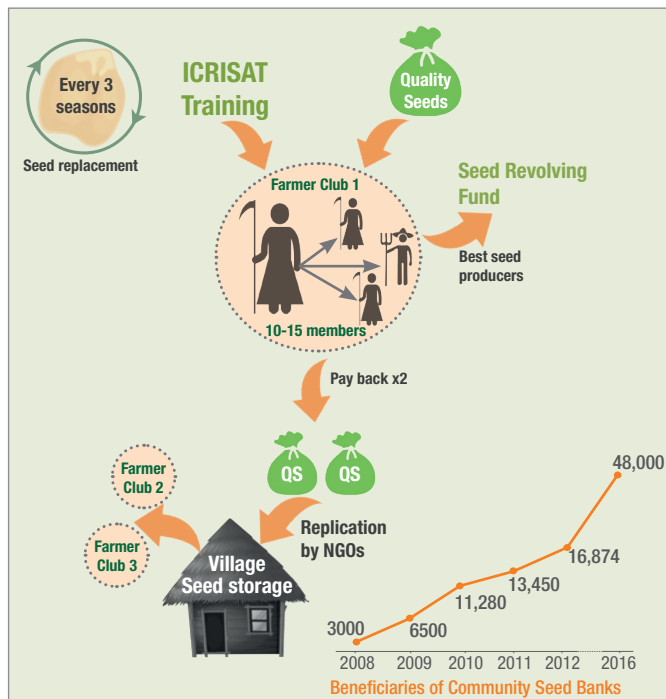
Yields $\uparrow >37\%$

Incomes $\uparrow \times 2$

43,354 Farmers benefited

Net ROI: \$1: \$7

Village seed banks in Malawi²⁰



IMPACT

120 ton QDS
produced per year

48,000 farmers
benefited

174
seed banks

47% of them
women

How access to better chickpea seeds transformed the fate of some Ethiopian farmers

Chickpea production in Ethiopia is dominated by the informal seed sector, as public seed enterprises mainly focus on cereals, despite a vibrant pulses market. ICRISAT trained six community seed producer associations to become major national suppliers of chickpea and lentil seeds of improved varieties selected for their pest resistance (*Ascochyta blight*) and yield potential. Chickpea productivity was boosted from 890 kg/ha in 1999 to 1,930 kg/ha in 2016¹³.



[Ethiopian farmers test chickpeas in pictures²¹](#)

theguardian

Groundnut Seed Revolving Fund in Malawi^{22&23}

IMPACT

No of seed producers:
235 (2008) → **1736** (2012)



45% are female

Projected return for
next 5 years – **\$14** for
each **\$** invested

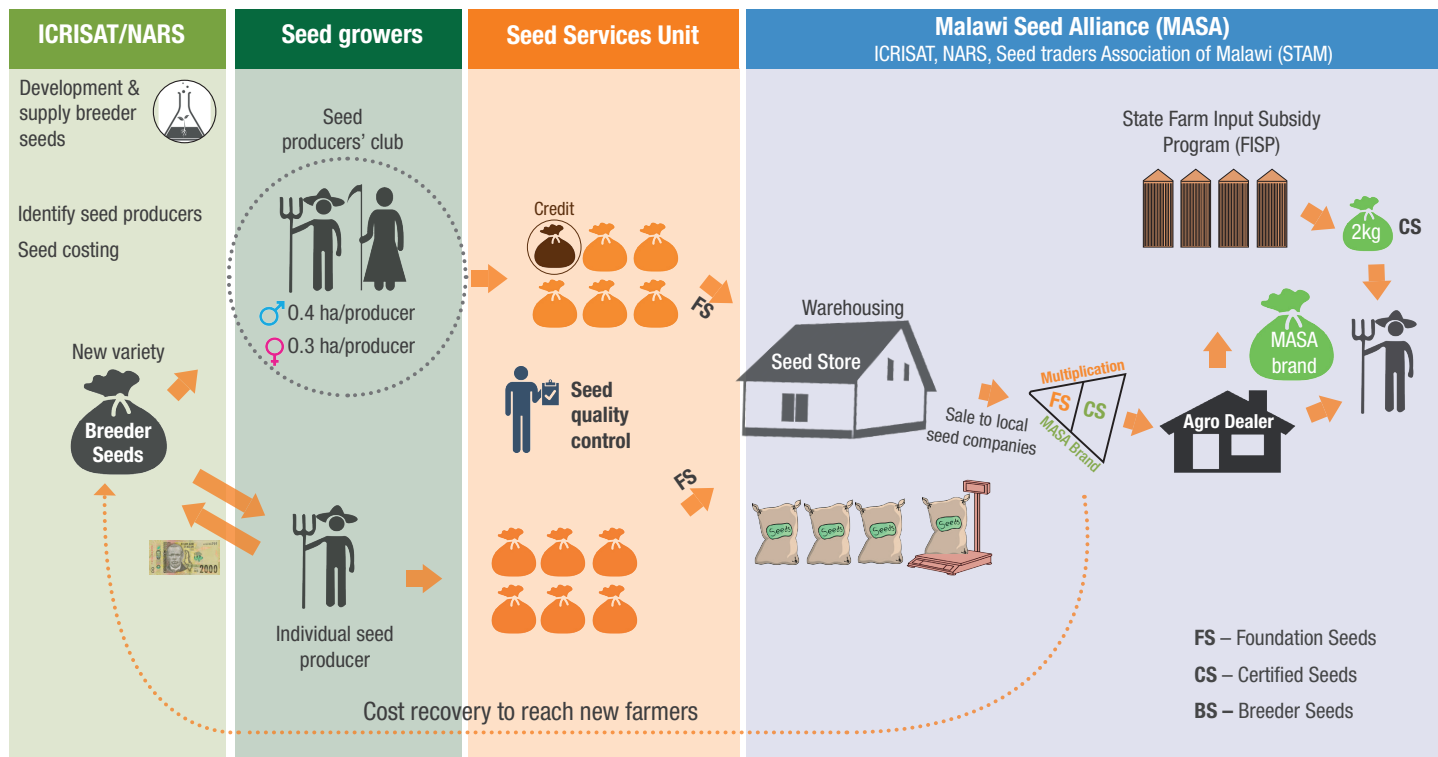
The Seed Revolving Fund (SRF) was established in 1999 initially to provide high-quality foundation seeds of improved varieties in a sustainable manner and at a reasonable cost, starting with groundnut. From 2008, SRF moved into certified seed production to supply to the Malawi Farm Inputs Subsidy Program (FISP).

How it works: Central to the SRF are the seed-producing clubs of 10-15 smallholder farmers trained in seed production, management and group dynamics. These clubs are contracted by the SRF to produce foundation seeds which are bought back at agreed prices. Individual larger farmers can also become seed suppliers of SRF. Foundation seeds are then sold to local seed ventures for multiplication. Their seeds, which are certified by the Seed Services Unit, are sold under the **Malawi Seed Alliance (MASA)** brand, through private input shops or tenders from the State Seed Agency to supply FISP.

The MASA consortium makes the key decisions on variety choice based on market needs, seed quantity, coverage strategy, seed quality assurance system, and seed pricing for SRF sustainability. This seed system is now able to cover warehouse worker wages, packaging and seed transportation, and engages more smallholder farmers every year.

As it scales up, the seed fund is diversifying into other crops (pigeonpea, rice) and SRF management is gradually shifting to MASA as local seed ventures get more involved, seeing the value for money in producing quality legume seeds.





Helping local seed ventures grow

Local private seed ventures like Maïmouna Coulibaly's Faso Kaba company in Mali can play a big role in scaling up adoption of improved varieties by dryland farmers. ICRISAT helps local seed ventures grow through seed management training, supply of foundation seeds, linkages with smallholder seed growers or marketing research testing alternative retail strategies like small seed packets.

[In her own words: a Malian seed entrepreneur is given the tools to grow](#)²⁴



Ms Coulibaly, Founder of Faso Kaba, the first woman seed entrepreneur in Mali in one of her shops. Laureate of the African Food Prize, 2017.

ICRISAT's [Agri-Business Incubation program](#) has supported many rural entrepreneurs in India and Africa to establish successful seed ventures.

In Tamil Nadu, for instance, 25 farmers formed the Kazhi Kadaimadai Farmers' Federation Thiruvengadu (KKFF) and were trained by ICRISAT in seed production. Now they have registered their own Pudhan brand of seeds. Additional income for each member is about ₹5,000–7,000 (about \$100) per acre and the number of seed producers has grown from 25 to 900.

KKFF'S GROWTH LINE²⁵

2006

▶ **Post-tsunami rehabilitation program**
Nagapattinam area

2008

▶ **Seed business program**
Collaborated with ICRISAT

2009

▶ **PUDHAN**
seed processing plant
Mullayapattinam village
in Nagapattinam

2014

▶ **Seed production area (ha)**
increased from 15 to 100

▶ **300 tonnes of seed**
produced and sold annually

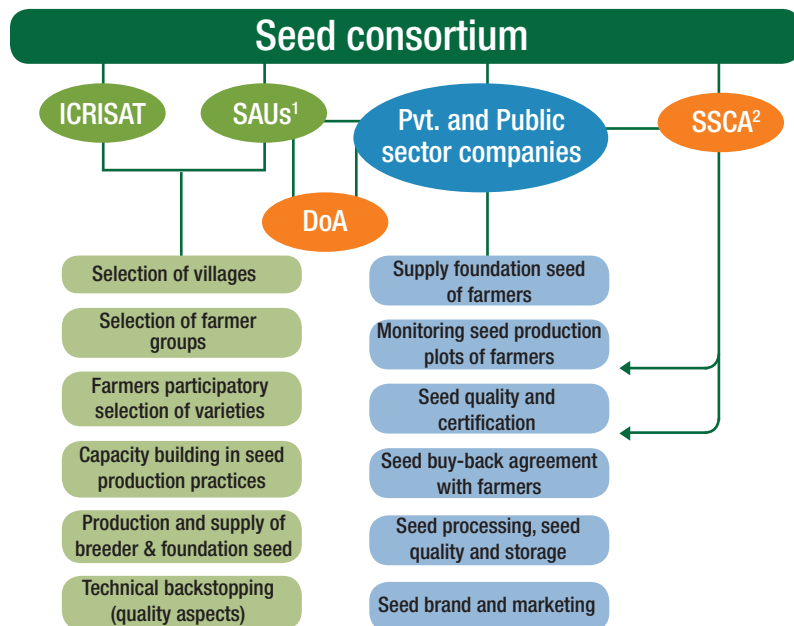
▶ **₹ 12,500 – 17,500/ha**
additional income/farmer

▶ **900 KKFF members**
increased from 25 to 900

▶ **Seed business incubation**
net revenue *annual turnover*
₹ 0.6 million ₹ 12 million
(US\$ 9,826) (US\$ 200,000)

Bridging public and private seed sectors

Postrainy (Rabi) sorghum consortium in Maharashtra, India²⁶

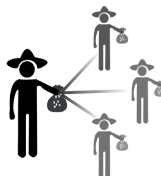


¹ State Agricultural University; ² State Seed Certification Agency

IMPACT

5 years
>41,000 farmers
benefited directly

300,000 farms
benefited via
secondary diffusion



↑ 39%
Higher yield over
local varieties



↑ 29%
Stover yield

↑ 36-41%
Milk production

Pearl Millet Hybrid Parents Research Consortium (2000 onwards)²⁷

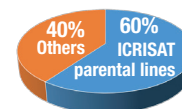
A way for private sector to invest more in dryland cereals

Each private seed company member of the consortium provides an annual grant for a 5-year period for public pearl millet research. Any outcome like a new parental line is international public goods, freely accessible to the public sector and any consortium member. Non-members can access it in exchange for an agreed one-time fee. A similar public-private partnership exists for sorghum hybrid research, which is now extended to Eastern and Southern Africa.

IMPACT

1st public-private
partnership within CGIAR ➔ **24** private
seed companies

5 million ha
planted with
improved hybrids ➔



6 million households reached

1980 → 2007: **67%** ↑ in pearl millet yield

Integrated seed sector development for faster, sustainable impact

Private and public, informal and formal seed systems should cohabit if we want to reach out to millions of small farmers in the drylands.

A conducive seed policy environment has to facilitate the development of complementary seed channels both local, community based, and more formal seed organizations so that the seed industry is inclusive and responds to the needs of small farmers too.

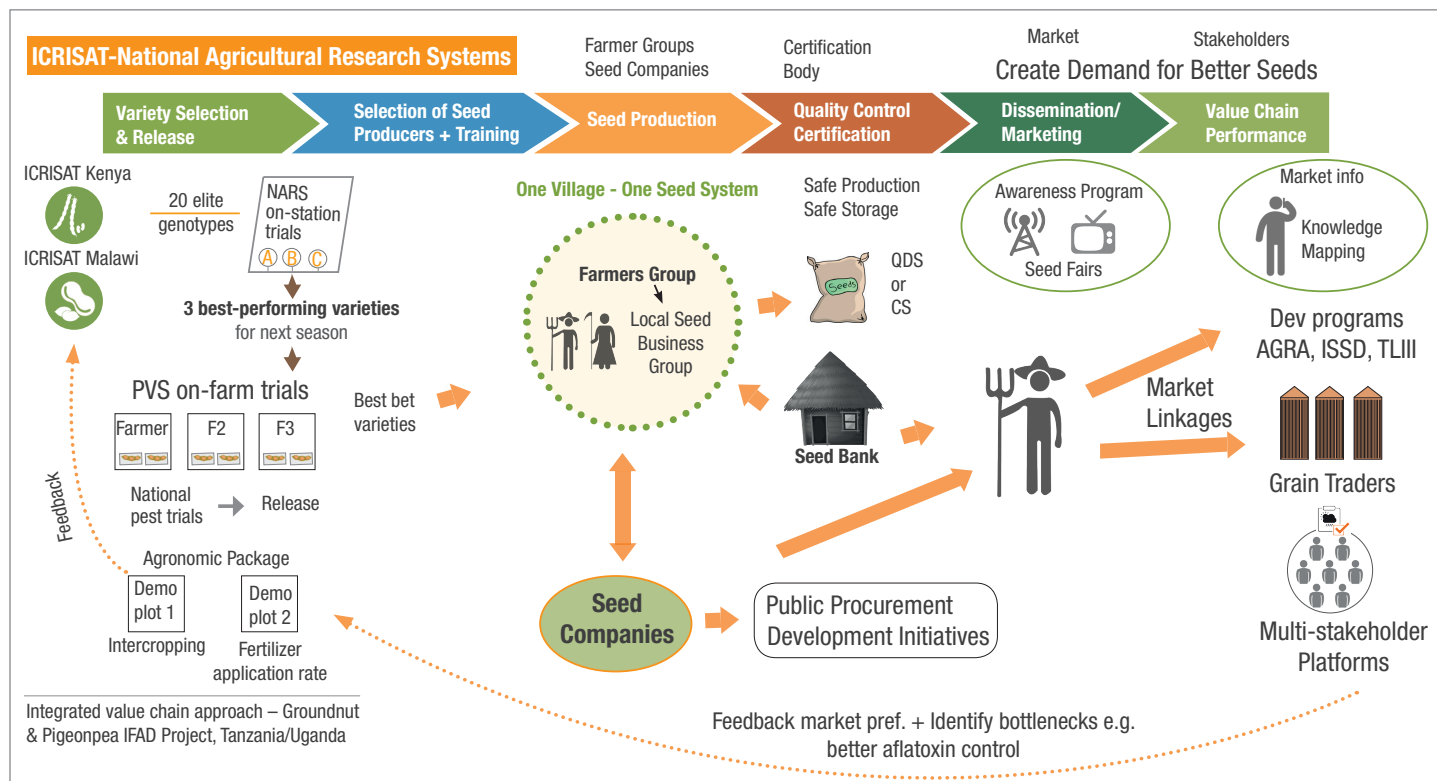
IMPACT²⁸

Lake Zone, Southern Tanzania:

1232-1493 kg/ha

yield compared to national average

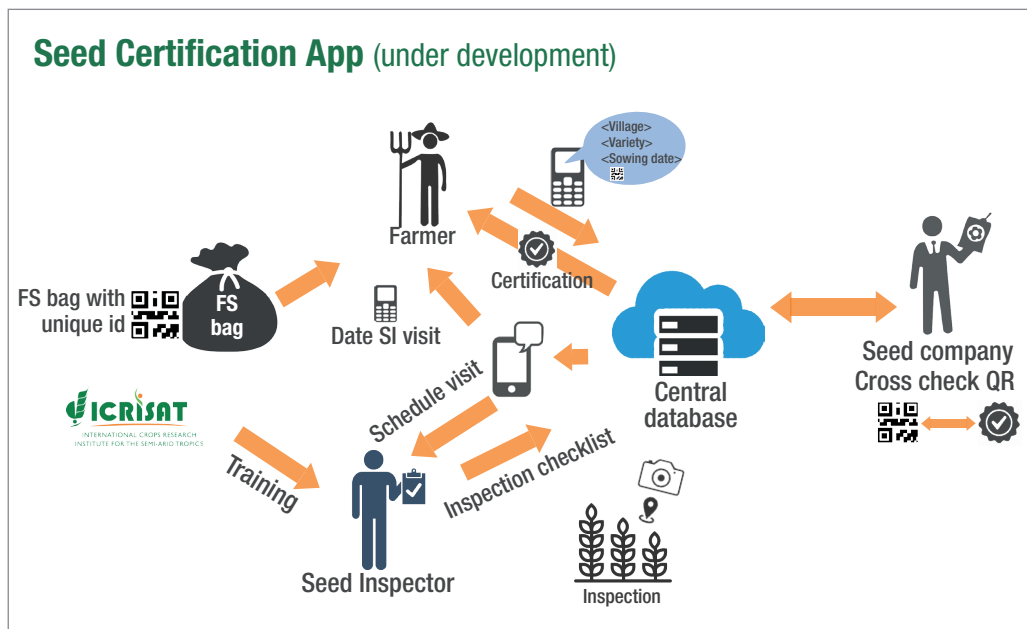
45-70% ↑
880 kg/ha



Seed quality control: Building seed trust in a cost-effective way

Quality control is key to ensure seeds will be of certain quality standards (purity, germination) and deliver what farmers pay for, in terms of yield, grain quality and other traits. Quality control has a cost and a formal certification scheme may impede the development of local seed organizations. ICRISAT advises farmers and seed organizations on the most appropriate quality insurance system depending on crops, country and maturity of seed markets. Community-based seed systems may follow less stringent rules, more adapted to smallholder seed growers like the Quality Declared Seed system in Tanzania, or Truthfully Labelled Seeds in India.

In Malawi, to support the seed certification agency, ICRISAT has trained barefoot seed inspectors. A mobile application for seed quality control is being developed to improve transparency and lower the cost of seed certification²⁹.



Capacity-building

166 seed
para inspectors trained

6000 ha inspected
(40% seed prod area in 2016/17)

Women at the center of improved legumes and cereals seed systems

Gender-sensitive seed systems³¹

Women have a traditional role as the household 'seed security' guardian, especially for grain legumes and millets, saving own seeds each season.

Women's social networks are important to maintain biodiversity and introduce new varieties.

They buy seeds, mostly from local markets where grain is converted into seeds. Only 7-9% of seed is obtained from the formal systems that supply improved legumes and cereals seeds.

More equitable access of both men and women to resources, information and decision-making is critical for the success of any seed system. ICRISAT is particular that seed systems are gender-sensitive in many ways; e.g. by ensuring women's participation in farmers' variety selection of all ICRISAT breeding programs, so that they learn the benefits of using improved legume and dryland cereal seeds.

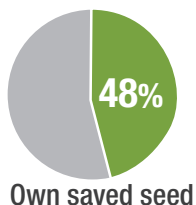
 **47%** women in seed producer clubs in Malawi



 Local markets
27-64%

 Formal systems
7-9%

Seed purchase



Changing women's lives with groundnut seeds: Mary Kumwenda's story in Malawi³²

Farm laborer and mother of three, Mary joined Madede seed growers club in Mzimba District of Malawi in 2012, where she was trained in groundnut seed production and she got 20 kg groundnut breeder seeds for multiplication. She harvested 222 kg of basic seed and made a profit of MK 78,000 (about US\$107). The next year, she doubled the area and tripled the seed production thanks to good rains.

She made a profit of MK 321,000 – 1.5 times the national average income. The proceeds from her seed activity helped Mary rethink her farming system to be more profitable. She now feels more food secure for herself and her children and has gained a sense of entrepreneurship.



"With the seed sales I was able to start a small fritter business. I also bought some fertilizer for my maize field. The seed incomes kept my family food secure throughout the year, and we will soon move from our small thatch hut to my dream house, with concrete floor and solid iron sheet roof."

Ms Mary Kumwenda, 2017.

 **Irish Aid**
Government of Ireland
Rialtas na hÉireann

Project: Malawi Seed Industry Development Project³⁰

Shaping the future of seeds

Nutrition-focused seed systems

To [improve children's nutrition in Bangladesh](#)³³,

nutritive peanut-based bars, spreads and cookies were distributed in schools. This followed discussions with food companies leading to the selection of desirable traits like bold kernel and high oleic acid content for better shelf life.



Contract farming, where the processing industry arranges the supply of the improved variety seeds to the farmers, and later buys their groundnut production at agreed prices, ensures sustainable quality along the value chain, with rapid positive nutrition impact.

Novel (molecular, digital) tools for more effective seed systems



Track adoption of improved varieties using DNA tracers to assess precisely the impact of crop improvement programs at farmgate.



Mobile App to better inform farmers: What to sow? ([Sowing App](#)), where to buy?

Transparent, cost-effective quality control: Traceability App

Planning and tracking seed production: Digital Seed Roadmap

Build sustainable and impactful seed partnerships

ICRISAT works along the value chain, as farmers will only grow seeds that are in demand by farmers and the food industry. In Kenya, we collaborate with millet processors to create new finger millet products.

We ensure that dryland cereals and grain legumes are taken into account in major seed development initiatives.



Access to Seeds
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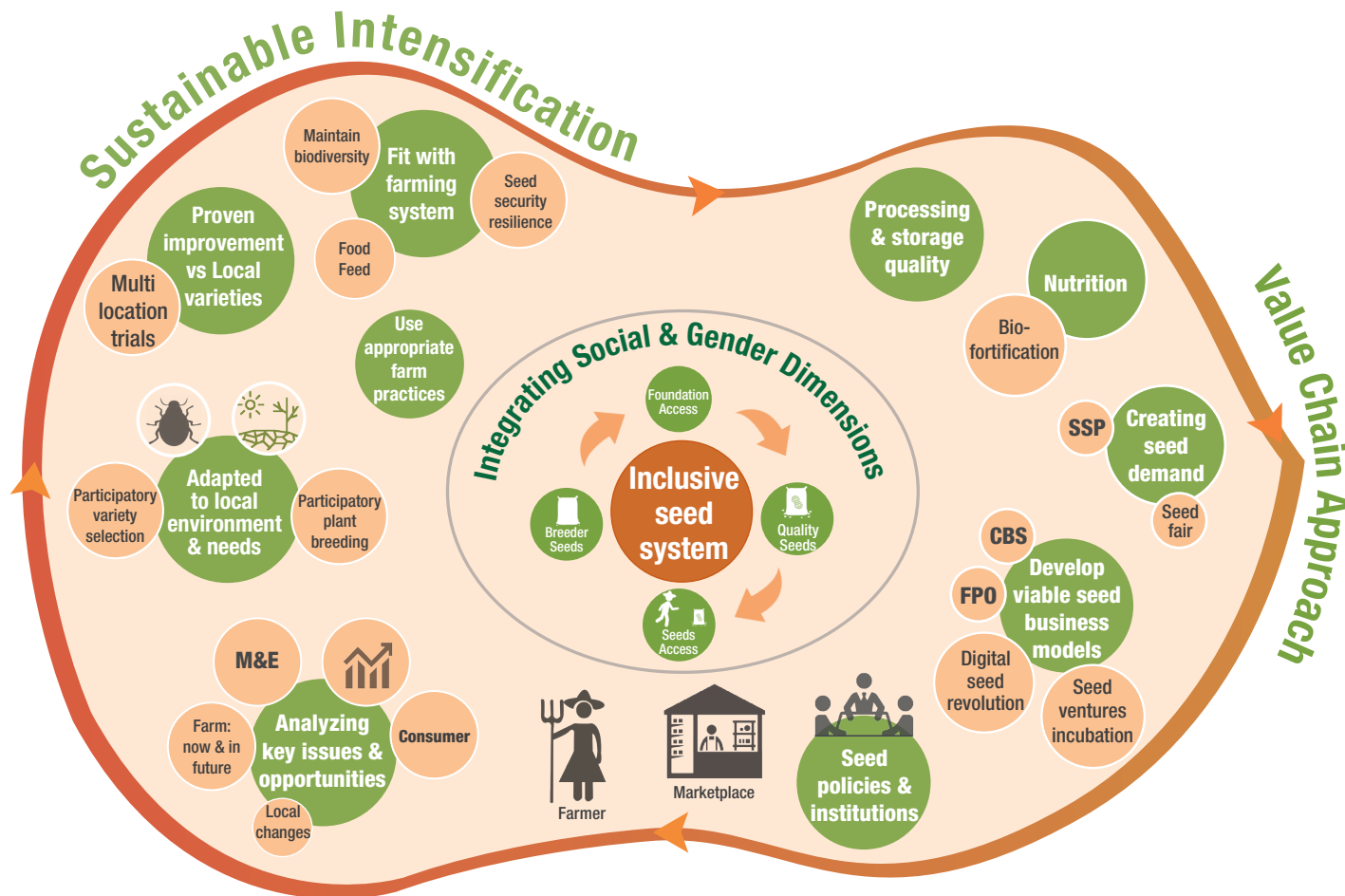


AGRA PASS Program for
Africa's Seed Systems



ICRISAT's vision on seed systems: demand-driven, holistic and in partnership

ICRISAT aims at building, with partners across crop value chains, inclusive and sustainable seed systems that provide dryland small farmers with sufficient quantity of high quality seeds, at the right time and right place, at reasonable costs.



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We believe all **people** have a **right** to **nutritious food** and a **better livelihood**.

ICRISAT works in agricultural research for development across the drylands of Africa and Asia, making farming profitable for smallholder farmers while reducing malnutrition and environmental degradation.

We work across the entire value chain from developing new varieties to agri-business and linking farmers to markets.

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