

Validating and scaling of crop technologies: Lessons from Africa RISING in Ethiopian Highlands

Background

Cereals (wheat and barley), food legumes and oil crops play vital roles in the Ethiopian Highlands for food security, nutrition, incomes, and animal feed. Temperate food legumes (faba bean, field pea, chickpea and lentil) and edible oil crops (Brassica, Noug and linseed) are also an important component in the diversification and sustainability in the cereal-based cropping system particularly wheat. Since the productivity and production of wheat (bread and durum), malt barley and oilseed crops could not meet the demands of the increasing human population and agro-industries, the Government of Ethiopia (GoE) is importing million tons of wheat, malt barley, durum wheat and edible oil. To narrow the gaps, the GoE has developed a strategy that gives the road map to increase production and productivity of rain fed bread and durum wheat in the four major wheat-growing regions of Africa RISING project sites. Although there are improved crop technologies developed by the national agricultural research systems (NARS), still there are high yield gaps in wheat, barley, food legumes and oil crops in the highlands. Major factors are weak extension and seed systems, wheat mono-cropping, expansion of acid soil, and biotic factors. To support the government efforts in crop production, Africa RISING project carried out adaptive research and implemented development activities with local and international partners.

Approaches

Participatory variety selection (PVS): Africa RISING project mandated by ICARDA used PVS approach to evaluate newly released varieties by NARS in many locations and capture the socio-cultural and ecological variability and address priorities accordingly. Africa RISING project with ICARDA has initiated PVS since 2013 cropping season to evaluate the performance of improved faba bean, field pea, chickpea, durum wheat, bread wheat, malt barely and food barely varieties together with different groups of male and female farmers. Farmer vari-

etal selections were conducted in four regions (Tigray, Amhara, Oromia and SNNPR) in Africa RISING project intervention sites. This approach entails male and female farmers to evaluate the varieties during mid-season (maturity). Each crop variety in the PVS was evaluated in a plot size of 25m² and hosted by 16 farmers (4 farmers per intervention district) following standard procedures. Seed rates, spacing and other agronomic practices were followed based on recommendations made for each agro-ecology. Crop grain yield was measured for each plot for final decision together with farmer's evaluations. The final selection was made based on weighted mean ranking of farmers and productivity. For rapid adoption of crop technologies, training of farmers and development partners were conducted to narrow their knowledge and skill gaps.



Photo 1. Farmers visited malt barley variety during a field day Africa RISING site in Tigray (photo credit: ILRI/Apollo Habtamu)

Community seed multiplication and partner scaling: This approach was used to increase availability and accessibility of quality seed of cereal and food legume varieties that was selected through PVS for wider adoption and diffusion of improved crop technologies. Besides, multiplying early generations seeds with NARS, community seed multiplication plots were used to demonstrate improved varieties

and management practices both for farmers and extension experts. They are used to create awareness and demand for new improved technologies. Scaling of crop technologies was implemented in partnership mode with a development agencies partnership where Africa RISING engaged in capacity building schemes and development partners played a key role in scaling to reach more farmers and benefit them with Africa RISING validated crop varieties and management practices. In some cases, Africa RISING provided pre-basic, basic or certified seeds of farmer preferred cultivars to community seed growers on revolving seed scheme in areas where there is limited access for specific crop varieties. In a revolving seed system, farmers return equal or more amount of seed that they received at the end of the growing season. The Office of Agriculture (OoA) in each Africa RISING operational areas facilitates further uses of revolving seeds for subsequent growing season as part of its scaling activities. Once enough seeds were produced by community seed growers, OoA and other farmers buy the seeds for further scaling. Africa RISING and the extension offices in Amhara, Tigray, Oromia and SNNP regions support farmers to follow a cluster crop production approach.

Table 1. Lists of cultivars selected through farmers' participation at Africa RISING intervention sites, 2017-2019

year	Crop	Sinana	Lemo	Basonaworana	Endamehoni
2017	Faba bean	Gebelcho	Tumsa	Gebelcho	Gora
		Didea	Didea	Didea	Didea
		Gora	Gebelcho	Gora	Gebelcho
	Kabuli chickpea	-	Habru	-	Arerti Hora
		Malt barley	HB1963 HB1964	HB1963	-
	Bread wheat	Deka	Deka	Deka	Kingbird
		Wane	Lemu	Wane	Wane
		Durum wheat	Bullaallaa	Bullaallaa	Bullaallaa
	2018	Fetan	Fetan	Fetan	Fetan
		Linseed	Biltstar	Biltstar	Biltstar
	Bakalcha		Bakalcha	Bakalcha	Bakalcha
2019	Food barley	Adoshe	Agegnehu	IAR(H)485	Adoshe
		Hagere	Hagere	Hagere	Hagere

Achievements

Africa RISING with the collaboration of ICARDA introduced and evaluated several crop varieties during 2017, 2018, 2019 and 2020 cropping seasons in the project implemented regions. As a result, many farmers were able to obtain better crops yield. Capacities of farmers and extension agents enhanced through the interactive process along with the PVS, community seed production and scaling process. Crop diversification helps to reduce risks associated with weather and diseases. Integrated research for development approach, social capital development and innovative capacity-building pathways were an essential part of the project. Various stakeholders in each intervention site engaged in regular multi-stakeholder platforms and identified challenges and solutions together with validated technologies and scale up the selected crop technologies through the informal seed system. Innovation capacity developments supported the project implementation process and narrow the knowledge and skill gaps among research for development partners. These approaches helped the project to successfully validate and scale up crop technologies described in Table 1 and reach a great number of beneficiaries indicated in Table 4. In the last four years, the project started working with farmer cooperatives and cooperative unions, producing seed through semi-formal and formal seeds approaches which are crucial for wider scaling up of validated technologies. Africa RISING project outputs and outcomes need to scale out and up in similar production systems in the four regions to bring the desired impact on food security, nutrition, income, cropping system diversification and gender equality. Africa RISING experiences in Ethiopia show the importance of working in multi-stakeholder engagement platforms and farmer organizations to build social capital and improve the capacity of local actors.



Photo 2. Field pea farm in Africa RISING site in Tigray (photo credit: ILRI/Kindu Mekonnen)

Zone	Crops and selected cultivars	Range	Average	Regional average
South Tigray	Bread wheat (Kingbird & Wane)	0.5-7.3	3.7	2.1
	Malt barley (IBON174/03 & HBI964)	1.2-5.2	3.3	1.8
	Food barley (Adoshe & Hagere)	1.8-3.0	2.4	1.8
	Faba bean (Gebelcho, Didea, & Gora)	1.1-6.1	3.6	1.7
	Linseed (Blitstar & Bakalcha)	0.6-1.0	0.8	1.0
	Kabuli chickpea (Arerti & Hora)	0.2-2.6	1.7	NA
North Shoa	Bread wheat (Deka & wane)	3.5-7.9	5.3	2.6
	Durum wheat (Bullaallaa & Fetan)	1-5	3.5	NA
	Food barley (Hagere & IAR(H)485)	0.7-4.7	2.2	2
	Faba bean (Gora, Didea & Gebelcho)	1.3-4.1	2.5	1.9
	Linseed (Blitstar & Bakalcha)	0.5-1.2	0.8	0.7
	Bale Zone	Bread wheat (Deka & Wane)	1.6-4.6	3.0
Durum wheat (Bullaallaa & Fetan)		0.8-3.1	1.9	NA
Malt barley (HBI963 & HBI964)		0.8-5	2.4	2.4
Food barley (Adoshe & Hagere)		1.6-4.4	2.6	2.4
Faba bean (Gebelcho, Didea & Gora)		0.7-4.8	2.6	2.4
Linseed (Blitstar & Bakalcha)		1.2-2.1	1.5	1.4
Hadya Zone	Durum wheat (Bullaallaa & Fetan)	0.8-2.8	1.8	NA
	Bread wheat (Deka & Lemu)	1.2-2.4	1.8	2.7
	Malt barley (HBI963)	0.5-2.0	1.3	NA
	Food barley (Hagere & Agegnehu)	0.2-2.6	1.5	1.9
	Kabuli chickpea (Habru)	0.4-2.4	1.4	NA
	Faba bean (Gebelcho, Tumsa & Didea)	2.5-4.5	3.4	1.9
	Linseed (Blitstar & Bakalcha)	0.6-1.2	0.9	0.6

NA= Not available

Table 2. Yield (t/ha) of selected cultivars through farmers' participation at AR intervention sites

Year	Oromia	Amhara	Tigray	South	Total
2017	284.33	112.14	62.34	31.5	490.3
2018	51.1	71.72	73.4	19.5	215.7
2019	71	101.22	25.7	159.2	357.1
2020	2681.6	3764.8	581	755.9	7783.4
Total	3,088	4,049.8	742.4	966.1	8,846.6

Table 3. Amount of seed produced (ton) by Africa RISING supported community seed growers

Year	Amhara		South		Oromia		Tigray	
	Women	Total	Women	Total	Women	Total	Women	Total
2017	1,092	12,772	62	318	1,734	12,117	1,240	6,455
2018	1,402	9,660	1,457	9,998	5,805	32,790	317	1,242
2019	610	20,274	30	169	4,147	22,588	342	1,562
2020	4,161	30,820	672	7,074	3,970	20,463	2,599	11,299
Total	9,611	73,526	2,391	17,559	15,466	87,958	13,198	14,357

Table 4. Total households participated in scaling of selected technologies through partners (2017-2020)

The way forward: the project aims to improve the livelihood of smallholder farmers through validation of high yielding crops cultivars through partnerships to narrow the yield gaps through seeds accessibility for farmers as well as increasing crop diversity to reduce risks due to weather and/or diseases. The Africa RISING project together with ICARDA works closely with the extension system, research institutions, private sectors, and other partners to bring the desired impact on food security, nutrition, income diversification and gender equality.



Photo 3. Faba bean field visit in Africa RISING site in Oromia (photo credit: ICARDA/Seid Ahmed)



Photo 4. Bread wheat seed production in Oromia Africa RISING site (photo credit: ICARDA/Zewdie Bishaw)



photo 6. Farmer briefs about field pea in Tigray Africa RISING site (photo credit: ILRI/Apollo Habtamu)



Photo 5. Farmers visiting bread wheat variety during a field day Africa RISING site in Oromia (photo credit: ICARDA/Zewdie Bishaw)



photo 7. The collaboration between Raya Beer factory and Africa RISING is encouraging farmers to grow more malt barley through contract farming (photo credit: Apollo Habtamu/ILRI).



The Africa Research in Sustainable Intensification for the Next Generation (Africa RISING) program comprises three research for development projects supported by the United States Agency for International Development as part of the U.S. government's Feed the Future initiative.

Through action research and development partnerships, Africa RISING will create opportunities for smallholder farm households to move out of hunger and poverty through sustainably intensified farming systems that improve food, nutrition and income security, particularly for women and children, and conserve or enhance the natural resource base.

The three projects are led by the International Institute of Tropical Agriculture (in West Africa and East and Southern Africa) and the International Livestock Research Institute (in the Ethiopian Highlands). The International Food Policy Research Institute leads an associated project on monitoring, evaluation, and impact assessment.

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