

# Chapter V

## Promoting Rust-resistant Wheat Varieties and Technologies

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### 5.1 Introduction

In Ethiopia the agricultural extension service went through several radical policy shifts during the last 50 years (Kassa, 2009). However, its core objective remained to be the improvement of agricultural production and productivity based largely on application of science, technology, and information provided through the national agricultural research and development system and various extension advisory services. Within this context, the success of agricultural development projects and programs has been shown to depend largely on direct stakeholder involvement in planning, implementation and evaluation. Within this context, the USAID supported ICARDA-EIAR project on ‘Deployment of Rust-resistant Wheat Varieties implemented an innovative technology promotion and dissemination approach that comprises multiple processes and involve several stakeholders.

As one of the components of the project planned technology promotion through demonstration, popularization and on-farm seed production was implemented. This chapter documents the approaches, activities, achievements and lessons learned in promoting new rust-resistant varieties and associated technologies.

## 5.2 Approaches in Technology Promotion

Demonstration and popularization of new rust-resistant varieties was undertaken at farmer training centers (FTCs) and at the fields of selected model farmers in the target districts selected for the project implementation.

In parallel with demonstration and popularization activities on-farm seed production was implemented in collaboration with Office of Agriculture at district level in the target areas. On-farm seed production considered small seed pack distribution and organizing, clustering and training farmer groups to ensure the availability and access to seed of rust-resistant varieties for rapid adoption and dissemination. Farmers and development agents were trained on varietal options and quality seed production. Access to source seed through small seed pack was implemented through revolving seed scheme. Field days were organized by involving all relevant stakeholders to create awareness of wheat rust problems, improved varieties and demand for seed.

The key features of the approach followed include:

**Use of technology as a package:** Instead of promoting variety alone, as a piecemeal approach, the variety is used as a driving force and promoted along with integrated crop management packages including agronomy, use of inputs, etc

**Integration of demonstration, popularization and seed multiplication:** The integration of the three activities enhanced awareness creation and availability of technologies shortening the time lag of adoption compared to the conventional sequential technology generation followed by demonstration, popularization and seed production. The demonstrations were conducted on plots of at least a quarter of a hectare compared to conventional demonstration of 100 m<sup>2</sup>. The popularization activities were linked to on-farm seed production and small seed pack distribution. This considered the involvement of both formal and informal seed actors.

Farmer seed production may also help non participant farmers to get access to seed at their farm gate with less transaction costs. It also

facilitates seed exchange among farmers, share experiences and helps to incubate seed business.

**Clustering of farmers' fields:** To ensure group action and ensure community mobilization, clustering of farmers' fields was promoted on voluntary basis that consider interest in seed production and business and proximity to potential seed users. In each *kebele* (lowest administrative unit) about 100 farmers each with a minimum of quarter of hectare were organized as a group. Farmers clustered their fields to maintain the varietal purity and quality of seed produced.

**Coordinated multi-stakeholders partnership:** An all-inclusive and participatory collaborative partnership was established among all stakeholders involved in agriculture and rural development in the target areas. The stakeholders include multi-disciplinary team of the following members:

- Federal and regional agricultural research centers;
- Zonal and district bureau of agricultural development;
- Development agents in target *kebele* administration;
- District administration office;
- Farmers' primary cooperatives and cooperative unions;
- Farmers' representatives;
- Public and private seed producers;
- Agro-processors; and
- Non-governmental organizations.

All stakeholders are involved right from the planning stage through to the implementation of planned extension activities. The new partnership has a broad range of stakeholders with shared and clearly defined roles and responsibilities which proved highly effective in rapid dissemination and adoption of the improved technologies. The coordination of partnerships and regular follow-ups and supervision of the planned activities are vested upon the BoA and the project coordinators from respective research centers.

**Revolving seed loan:** Participating farmers were given source seeds for planting as seed loans to be paid back in equivalent amounts in kind after harvest. The approach is important particularly in addressing the wider

distribution in subsequent years where the revolving seed was distributed to other communities in target areas.

**Regular training of SMS, DAs and farmers:** In addition to coordination and technical backstopping, the project provided training of trainers to SMS and DAs which in turn trains participant farmers and development agents of the target districts and other relevant stakeholders. The training includes awareness about wheat rusts, wheat varieties and associated technologies and seed production and marketing.

**Provision of inputs and marketing options:** In addition to seed of new rust-resistant wheat varieties provided by the project, the farmers' cooperatives and their unions played a vital role in the provision of required inputs (mainly fertilizers and pesticides) and market information, purchase of seed/grain from the participating farmers.

**Field days and exchange visits:** Field days have been organized by inviting all stakeholders including policy makers, researchers, extensionists, development practitioners and farmers to create awareness of available technologies and their performance and to discuss and address emerging policy and development issues. The event provides opportunities to share ideas and information and facilitates the awareness of relevant technologies among farmers, researchers and extensionists. It also empower farmers and thereby increasing their influence over other stakeholders. In addition exchange visits were organized for farmers for experience sharing and learning visiting each other's farms where good practices are demonstrated. This has enhanced peer influence among farmers.

**Monitoring and evaluation:** The M&E involves regular follow-up and supervision through field visits, workshops and reports. Field visits were made to provide technical backstopping at field level along with addressing emerging issues. Regular reporting was made through quarterly and annual progress reports using pre-designed format that show the performance against the plan. In addition, workshops were organized targeting different stakeholders to address emerging research, development and extension issues for enhanced promotion of wheat rust related technologies and information.

Regular follow-up and supervision of the on-farm performances and activities was performed by a team of researchers from the project in cooperation with the district BoA experts, focal persons and development agents. This has been crucial to the success for technology promotion.

## 5.3 Achievements of Technology Promotion

### 5.3.1 Demonstration and Popularization

Variety demonstration and popularization was a critical component of the project to create awareness of improved technologies and create demand. Rust-resistant wheat varieties were used as a driving force where all other integrated agronomic management practices were included as a package to demonstrate the superiority of improved technologies. Linked with demonstration activities seed of preferred and rust-resistant wheat varieties were further distributed as part of popularization (scaling up).

**Demonstrations:** Farmers Training Centers (FTCs) and farmers' fields were used to demonstrate high yielding rust-resistant wheat varieties. Demonstrations were conducted across 45 target districts. Each variety was demonstrated on plot sizes of 400 m<sup>2</sup> (20 m x 20 m) where four farmers per *woreda* were provided with seed of rust-resistant varieties. During the four years newly released rust-resistant bread wheat (*Kakaba, Danda'a, Gambo, Shorima, Hulluka, Hidase, Hoggana, Ogolcho, Biqa, Honqolo, Mandoyou and Sanate*) and durum (*Mangudo and Mukiye*) wheat varieties were demonstrated at FTCs in 51 districts and farmers' fields including irrigated areas in the lowlands.

**Popularization:** Linked with demonstration activities, the project has supported the popularization (pre-scaling out) of rust wheat technologies in four major regions. About 261 tons of seed was directly supplied to 12,500 farmers (8.2% women) and produced 7758 tons seed/grain sufficient to plant an estimated 67,238 ha (Table 5.1). About 65,610 household members benefitted.

Table 5.1 Demonstration and popularization of rust-resistant wheat varieties

Year	Seed distributed (t)	Area planted (ha)	Seed produced (t)	Area planted with seed available (ha)	No of farmers	No of HH members benefitted
2012/13	43.0	312.2	936.6	6,244	1,179	7,074
2013/14	72.4	482.6	1,689.3	11,262	1,931	11,586
2014/15	145.8	1,387.0	5,131.9	49,732	9,390	46,950
Total	261.2	2,181.8	7,757.8	67,238	12,500	65,610

**Emergency seed supply:** In 2010, with the outbreak of yellow rust epidemics, four non AGP districts (Ambo, Dendi, GedebAsasa and Hitosa) were considered for emergency seed relief because of severe rust epidemic occurrence and crop loss. About 5 tons seed of rust-resistant wheat varieties was distributed to the emergency districts. During the two project years, a total of 3452 farmers (306 female) farmers benefitted i.e. 1639 male and 37 female farmers in Ambo district and 1507 male and 269 female farmers in Gedeb Asasa directly participated in rust-resistant wheat seed production. A total of 8,404 and 17,469 household members have been benefitted from the project in Ambo and Gedeb Asasa districts, respectively.

In 2014, an outbreak of new strain of stem rust caused serious damage in wheat growing areas of southeastern Ethiopia. A bread wheat variety *Digalu* was severely damaged by the stem rust attack with substantial yield loss. The project availed seed of rust-resistant varieties for farmers who lost most of their produce. A total of 19.5 tons of seed was distributed and 328 farmers (1968 HH members) benefitted from the intervention. The seed is sufficient to plant 135 ha and produce 405 tons of seed.

**Field days:** During the project life several field days were organized in target districts using FTCs and on-farm seed production fields. Annually, the project supported one mega field day in each region (four in total) attended by key stakeholders from farmers including those from neighboring districts to technical staff and policy makers from district, zonal, regional, and federal offices. In these events over 35,000 (2500 female) farmers, experts, and development agents from BoA, community seed producers, public and private seed enterprises, zonal and *woreda* administrators and other stakeholders were participated.

Apart from the field days organized by the project, every year each target district organized field days under the umbrella of BoA. The field days are aimed at promoting rust-resistant varieties and in creating awareness of good practice in agricultural production. This has created tremendous interest and surge in demand for quality seed. In most of the events there was good interaction among participant and non-participant farmers, development agents, researchers and policy makers. The project presented varietal choices but a home take message for the research system is to come up with diverse set of varieties not only with durable resistance but also comparable high yield to replace popular varieties like *Kubsa*.

#### **5.4.2 On-farm seed production**

The Ethiopian national seed policy recognizes farmers' role in local seed production and distribution with view of complimenting the formal sector. The project used small seed-pack distribution-cum-on-farm seed production as one of the strategy for quick dissemination of rust-resistant varieties to reach substantial number of farmers. In each target district an agreement was reached with BoA where select group of interested farmers are identified, organized into groups, provided with training and with seed to engage in local seed production of rust-resistant wheat varieties. The seed is provided on revolving seed scheme where farmers return the equivalent in kind at the harvest time.

In each district a group of farmers clustered their fields and provided each with 25 kg seed to plant a quarter of ha. Clustering was meant to minimize contamination to ensure quality seed production and ease of management of seed production fields. Apart from the practical training imparted to farmers, the development agents provide the regular technical support required during planting, crop growth and harvesting to ensure quality seed production. The seed produced either purchased by public seed enterprises if it went through formal certification by the regional quality control offices or through informal farmer to farmer sales and exchanges.

On-farm seed production was supported with regular train-the trainers (ToTs) where development agents who received the training in turn train farmers involved in project activities in their respective localities. The

courses include about available wheat technologies, integrated wheat crop management practices, rust pathology and quality seed production. Besides, brochures were distributed and field days were organized to acquaint more farmers on the available wheat technologies to create awareness and demand for quality seed. Every year joint planning took place with the staff and experts from relevant stakeholders especially the regional, zonal and district BoA.

Source seed for on-farm seed multiplication scheme was supplied by the project on a revolving-seed basis where EIAR was responsible for seed purchase and distribution to the project districts and the district BoA were responsible for distributing the seed to the selected farmers; follow up the activities, collecting the revolved seed and recording all relevant data of the activities. Every year data on the seed distributed, area coverage, total production, revolved seed recovered, seed reused or recycled (including farmer to farmer exchange), number of *kebeles*, households (by gender) and total heads were recorded and summarized (Tables 5.2 to 5.5).

Farmers from 47 districts of the four regional states were participated during 2011/12-14/15 cropping seasons of which farmers from 19 districts participated throughout the project period (4 years) while the rest joined during the subsequent years. About 15 bread and 7 durum wheat varieties were distributed during the project period (Table 5.2) though the uptake varied by varieties. On-farm seed multiplication was started with a good number of improved wheat varieties (10 bread and 6 durum) and has continually declined in the subsequent years ending up with 7 varieties (5 bread and 2 durum) in the final year (2014/15). Since deploying few varieties has a risk of increased vulnerability to rust disease outbreak, diversifying and maintaining a good number of varieties in wheat production have to be accentuated. Two new and one existing bread wheat variety (*Danda'a*-21.6% and *Kakaba*-33.8% and *Digalu*-30.8%,) dominated the distribution constituting about 86.1% of the total seed made available for on-farm seed production. The proportion of the dominant varieties within the four project years was variable where the most dominant variety, *Digalu*, in the first year was declined while *Danda'a* and *Kakaba* were increased.

The dominance of the three bread wheat varieties (*Digalu*, *Danda'a* and *Kakaba*) might have resulted from limited varietal options of new released varieties, the inherent nature of the alternative varieties like low yield potential, susceptibility to rust diseases, and narrow adaptability. To stabilize the wheat production of the country and avoid crop failures in case of rust disease outbreak, deployment of more varieties is vital. There is some uncertainty in future too as the two dominant bread wheat varieties (*Digalu* and *Kakaba*) promoted by the project were already under severe stem rust threat particularly in Arsi, West Arsi and Bale zones during 2014/15 cropping season.

The relevance of the informal sector in providing seed of specifically adapted varieties so long as they are well promoted and their niches are well identified is immense. Moreover, the lag in generating widely adapted new varieties to cope with the recurring new rust strains in short intervals is obvious. Therefore, generation/adaptation of new and efficient use of the less utilized available varieties requires a concerted effort of the research and other stakeholders' to stabilize and boost the country's wheat production, thereby to realize the intended food self-sufficiency.

The diffusion of durum wheat varieties was unsatisfactory mainly due to problems associated with marketing rather than rust disease incidences. However, some efforts were initiated at the final year of the project where all relevant stakeholders in durum wheat value chain involved to improve its production and marketing as reported elsewhere in the document.

Table 5.2. Amount of seed distributed (t) for on-farm seed multiplication

Variety	Amount of see distributed (t)					Proportion (%)
	2011/12	2012/13	2013/14	2014/15	Total	
<b>Bread wheat</b>						
Galema	2.00	2.00	.	.	4.00	0.45
Tusie	0.80	3.00	.	.	3.80	0.43
Madaa Walabu	4.10	2.00	.	.	6.10	0.68
Sofumar	4.20	.	.	.	4.20	0.47
Dure	0.30	.	.	.	0.30	0.03
Digalu	56.88	67.70	66.45	84.05	275.08	30.78
Danda'a	5.98	42.70	65.80	78.20	192.68	21.56

Kakaba	54.27	59.60	65.60	122.43	301.90	33.78
Mekele-1	0.50	.	.	.	0.50	0.06
Mekele-2	0.50	.	.	.	0.50	0.06
Pavon 76	.	7.50	1.20	.	8.70	0.97
Shorima	.	0.05	2.00	.	2.05	0.23
Hulluka	.	0.58	1.60	.	2.18	0.24
Hidase	.	.	1.00	5.50	6.50	0.73
Ogolcho	.	.	.	0.04	0.04	0.004
Sub-total	129.52	185.13	203.65	290.21	808.52	90.46
<b>Durum wheat</b>						
Ude	6.75	34.00	4.50	0.30	45.55	5.10
Yerer	3.68	6.10	1.60	.	11.38	1.27
Ellani	1.20	3.50	.	.	4.70	0.53
Obsa	8.80	.	3.00	.	11.80	1.32
Tate	1.00	1.90	2.50	.	5.40	0.60
Toltu	1.40	3.00	.	.	4.40	0.49
Mangudo	.	.	.	2.00	2.00	0.22
Sub-total	22.83	48.50	11.60	2.30	85.23	9.54
Total	152.35	233.63	215.25	292.51	893.74	100

The amount of seed distributed each year for an informal on-farm seed multiplication ranged from 152.35 tons to 292.51 tons of which 68.4% to 99.2% were recovered as a revolving-seed, the average being 83.5% (Table 5.3). Of the total seed produced with the source seeds provided by the project, about 50.3% to 67.7% (on average 59.2%) was reused as seed through farmer-to-farmer seed exchange either by cash or other means for planting the next season crop each year (Table 5.3). About 3097 to 6588 households were directly participated in on-farm seed multiplication with source seed provided by the project of which female households ranged from 10.2% to 13.5% (on average 11.6%). The total number of individuals directly benefited ranged from 15,962 to 33,777.

The effect of the informal on-farm seed production scheme had a multiplicative effect where the area coverage with the improved varieties and the number of participant farmers has substantially increased considering the first round of revolving seed fund and farmer to farmer seed exchange in the subsequent years (Table 5.4). Though not tracked by the project, there were also some second round of revolved and reused seeds (Table 5.4) and the second cycle reused seed from the total produce through farmer-to-farmer seed exchange which ranged from 10.1 to 18.7% (an average 12.7%) each year.

From the first project year onwards, three categories of seeds (newly distributed source seed, revolved seed and farmer to farmer exchanged seed) originating from the project were tracked each year. The seed supply which has been started with 152.4 tons in the first year has reached 3695.9 tons; including revolved and farmer to farmer exchanged seed and covered about 30,291.3 ha by involving 86,533 households (HHs) in 2014/2015 cropping season (Table 5.5). Moreover, for planting the 2015/16 cropping season 7,642.8 tons of wheat seeds (1<sup>st</sup> cycle revolved and farmer to farmer exchanged seeds) were retained and planted on about 51,564 ha and that gave 185,130 tons of produce accounting for 3.2% of the nation's annual wheat area and 4.6% of the total wheat production by involving 98,411 farmers and benefiting 502,672 HH members.

Table 5.3. Amount of seed distributed and area planted to rust-resistant wheat varieties in target districts of four regions

Year	Region	Number of districts	Number of PAs	Number of varieties	Amount of seed distributed (t)	Area planted (ha)	Total seed produced (t)	Used as seed (t)	Recovered as revolving seed (t)	Participating farmers (HHs)		No of direct beneficiaries	Productivity (t/ha)		
										Male	Female		Lower	Higher	Mean
2011/12	Amhara	5	22	3	38.36	255.74	937.25	913.7	15.8	713	46	3795	1.8	5	3.66
	Oromia	16	131	13	69.96	489.54	1573.14	904.06	61.61	1266	96	7345	0.9	5.4	3.21
	SNNP	4	19	4	25.03	166.86	793.14	297.05	8	486	173	3336	2.5	6	4.75
	Tigray	3	16	4	19.01	125.95	480.9	195.9	18.72	295	22	1486	2	5.2	3.82
	Total	28	188	16	152.35	1038.09	3784.43	2310.71	104.13	2760	337	15962	0.9	6	3.65
2012/13	Amhara	8	49	6	51.5	346.69	1321	499.37	37.26	1679	179	8968	0.95	6	3.81
	Oromia	22	268	13	123.83	852.26	2851.56	1814.73	107.46	2192	250	13708	0.7	8.7	3.35
	SNNP	6	46	6	32.1	214.5	870.7	458.7	27	652	84	4508	0.5	5.8	4.06
	Tigray	6	25	3	26.2	184.65	642.05	141.5	18.5	505	95	2547	2	5.2	3.48
	Total	42	388	14	233.63	1598.1	5685.3	2914.3	190.27	5028	608	29731	0.5	8.7	3.56
2013/14	Amhara	10	86	6	81.45	681.53	2523.69	1059.55	66	1692	170	8863	0.4	6	3.7
	Oromia	19	292	7	94.8	670.92	2625.59	1429.74	66.85	1455	165	8254	1	7.5	3.91
	SNNP	3	22	5	19.5	144.94	581.7	500.8	14.6	324	75	1936	2	5.5	4.01
	Tigray	6	24	3	19.5	135.1	550.6	251.4	14.4	383	46	2228	2	6	4.08
	Total	38	424	11	215.25	1632.49	6281.58	3241.49	161.85	3854	456	21281	0.4	7.5	3.85
2014/15	Amhara	10	69	4	67.01	650.92	2483.7	1762.6	66.95	1358	162	6892	2	6.6	3.82
	Oromia	19	229	5	112	1103	3697.2	2395.2	112	2763	208	15824	2	6.2	3.35
	SNNP	7	61	3	82.5	803	3662.5	2454.3	82.5	1089	347	8103	2	6.8	4.56
	Tigray	8	54	4	31	269.63	1020.5	735.15	28.74	486	175	2958	2	7	3.78
	Total	44	413	7	292.51	2826.55	10863.9	7347.25	290.19	5696	892	33777	2	7	3.84
	G. total	47*	1413	22**	893.74	7095.23	26615.21	15813.74	746.39	17338	2293	100751	0.40	8.70	3.75

\*Some districts were added/dropped each year; \*\*Similar varieties are usually grown in different regions

Table 5.4. Amount of revolved seed and reused seed and area planted in districts of four regions through 2012/13-15/16 cropping seasons

Year	Region	No of varieties	Revolved seed (t)	Reused or exchanged seed (t)	Area planted (ha)	Total seed production (t)	Amount reused for 2 <sup>nd</sup> cycle as seed (t)	Recovered as revolving seed for 2 <sup>nd</sup> cycle (t)	Participating farmers (HHs)		No of beneficiaries	Productivity t/ha		
									Male	Female		Lower	Higher	Mean
2012/13	Amhara	3	15.80	913.70	6197.00	23305.10	1817.85	10.5	5129	442	27855	2.80	5.00	3.76
	Oromia	13	61.62	904.06	6426.32	22819.93	6677.90	37.70	22852	1397	130060	1.50	7.00	3.55
	SNNP	4	8.00	297.05	2032.50	9288.35	979.58	-	6950	636	45380	2.40	7.80	4.57
	Tigray	4	18.72	195.90	1445.00	4497.90	352.70	-	2167	242	12045	1.70	4.10	3.11
	Total	16	104.13	2310.71	16100.82	59911.28	9828.03	48.20	37098	2717	215340	1.50	7.80	3.72
2013/14	Amhara	6	37.26	414.07	3786.56	15951.78	4402.50	13.80	13031	745	68160	1.70	5.50	4.21
	Oromia	13	107.46	1815.48	13302.12	44911.90	7026.90	42.28	31601	2182	152914	0.80	6.50	3.38
	SNNP	5	27.00	458.70	3236.60	14405.40	2798.70	12.00	12183	1404	82321	2.00	7.80	4.45
	Tigray	3	18.50	170.40	1301.65	5178.90	803.40	11.4	1074	256	6310	2.00	5.44	3.98
	Total	14	190.22	2858.65	21626.93	80447.98	15031.50	79.48	57889	4587	309705	0.80	7.80	3.72
2014/15	Amhara	4	66.00	1059.55	9271.30	38729.40	4022.70	-	31299	958	153231	2.20	5.70	4.18
	Oromia	7	66.85	1429.74	11837.10	49278.80	4919.00	-	26500	1824	139681	1.70	6.50	4.16
	SNNP	5	14.60	500.80	4584.70	18397.30	1839.60	-	10673	1594	60829	3.00	5.50	4.01
	Tigray	3	14.40	251.40	1771.60	7906.50	793.50	-	6782	315	32629	2.50	6.00	4.46
	Total	8	161.85	3241.49	27464.70	114312.00	11574.80	-	75254	4691	386370	1.70	6.50	4.16
2015/16	Amhara	4	66.95	1762.60	12154.00	44486.10	6278.00	-	19415	1911	98958	2.20	5.20	3.66
	Oromia	5	112.00	2395.20	16673.00	54038.80	4440.00	-	25238	4179	151842	1.70	5.00	3.24
	SNNP	3	82.50	2454.30	16888.00	65635.50	6555.00	-	28208	3466	183371	2.00	5.30	3.89
	Tigray	4	28.74	740.55	5849.00	20969.50	1978.40	-	14272	1722	68501	2.20	5.20	3.59
	Total	7	290.19	7352.65	51564.00	185129.90	19251.40	-	87133	11278	502672	1.70	5.30	3.59
Grand total		22	746.39	15763.49	116756.45	439801.16	55685.73	127.68	257374	23273	1414087	0.80	7.80	3.77

Table 5.5. Amount of seed distributed, recovered, farmer-to-farmer exchanged and area covered in target districts of four regions,

	Issued/distributed	Cropping season				
		2011/12	2012/13	2013/14	2014/15	2015/16
Seed (t)	Recovered *	152.35	233.63	215.25	292.51	290.19
	Farmer to farmer exchanged**		2310.71	2858.65	3241.49	7352.65
	Total	152.35	2648.47	3264.12	3695.85	7642.84
Area (ha)	Issued/distributed	1038.09	1598.1	1632.49	2826.55	
	Recovered		694.28	1349.31	1306.12	1957.83
	Farmer to farmer exchanged		15406.54	20277.62	26158.58	49606.17
	Total	1038.09	17698.92	23259.42	30291.25	51564
Production (t)	Issued/distributed	3784.43	5685.3	6281.58	10863.9	
	Recovered		2583.42	5019.17	5436.26	7029.18
	Farmer to farmer exchanged		57327.86	75428.81	108875.74	178100.72
	Total	3784.43	65596.58	86729.56	125175.9	185129.9
Participants (HHs)	Issued/distributed	3097	5636	4470	6588	
	Recovered		1717	3898	3802	3737
	Farmer to farmer exchanged		38098	58578	76143	94674
	Total	3097	45451	66946	86533	98411

Note: \*About 68.35%, 81.42%, 75.19% and 99.21% of the seed issued were recovered from the each year the average being 83.51%; \*\*From the total seed produced by farmers from the issued seed every year, 61.1%, 50.3%, 51.6% and 67.7% were reused as seed the average being 59.2%

### **5.4.3 Capacity development**

Strengthening the human resources capacity and infrastructure of key stakeholders facilitated project implementation particularly for formal and on-farm seed production.

#### **a) Strengthening capacity of human resources through trainings and workshops**

The project designed the training of trainers' courses where technical staff receive basic knowledge and in turn organize hands-on practical training for farmers and development agents. To this effect, both in-country and international courses of different levels were given for stakeholders. Regular training of trainers of research technicians and agricultural experts at various levels including development agents played an important role in the success of the innovation process. The training was given every year in order to create awareness and understanding and to share experiences.

Accordingly, 1490 subject matter specialists and development agents, 87 research technicians, 75 researchers, 157 farm managers from agricultural research centers; and 106 experts from farmers' cooperative unions and other stakeholders from target districts, zones and regions were given training on wheat production technology from 2011 to 2015 (Table 5.6). The trainers in turn trained farmers and development agents in the target districts.

About three staff (one female) from NARS participated in a regional seed course organized by ICARDA on variety identification, maintenance, quality seed production and certification held in Cairo, Egypt. Moreover, six staff from inputs departments of regional bureaus of agriculture attended a regional course on seed enterprise development and management and seed marketing held in Cairo, Egypt.

Apart from training courses, two national workshops were organized to create awareness of wheat rusts and 137 participants attended including project staff, partners and stakeholders. Project staff also attended an international yellow rust conference to share the experiences and successes of the project with international community (international wheat rust conference in 2014).

Table 5.6. Training of trainers' courses organized and staff trained during 2011/12- 2014/15 cropping season

Trainees	Number of personnel trained				Total
	2011/12	2012/13	2013/14	2014/15	
Subject matter specialists and development agents	270 (35 F)	410 (45 F)	370 (75 F)	440 (67 F)	1490 (222 F)
Farm managers	50	45	35	40	157
Research Technicians		24	36	27	87
Researchers	25	15	10	25	75
Seed producers and cooperatives		30	36	40	106
Total	320 (35 F)	509 (45 F)	477 (75 F)	547 (67 F)	1911 (222 F)

*Note: Figures in parenthesis are female participants*

### **b) Strengthening capacity of stakeholders through provision of facilities**

NARS and farmer seed producers are the major beneficiaries in provision of machineries and facilities. To strengthen the early generation seed production EIAR was provided with farm machinery, vehicles, laboratory equipment and storage facilities. The project provided one each station wagon and mini bus, five pick-ups, two automobiles, two heavy duty 180 HP tractors with necessary implements (levelers (2), ridgers (2), planters (2) and spare parts) to EIAR to facilitate project implementation and strengthen its early generation seed multiplication. Moreover, irrigation facilities, equipment for seed laboratory, seed storage and sewing machines and polypropylene bags were provided to EIAR.

In addition, one mobile seed cleaner each was provided to farmer seed producer associations in Amhara, Oromia and Tigray regions. This includes Dil Betigil, Haqo Sado and Birhan Ayiba farmer seed producers associations from Amhara, Oromia and Tigray region, respectively. Members of the cooperatives and technical staff from regional bureaus of agricultural received the training during the assembling and commissioning of the mobile seed cleaners.

## 5.4 Lessons Learnt

**Empowering female farmers:** In Ethiopia, more than fifty percent of the farm related works are accomplished by the womenfolk. Unfortunately, their role in agricultural and horticultural crops and livestock production, post- harvest handling, etc., has not been recognized in the right perspective and as a result much effort has not been made in improving their positions in these areas. Moreover, experiences indicate that extension programs are increasingly proving to be gender biased unduly in favor of male section of the society. In cognizant of the above facts the project in collaboration with district BoA mobilized women farmers to form seed producers group at Endegagn district (Gurage Zone), believing that group approach is the cornerstone for the empowerment of women farmers. The 22 women members cultivate a four hectares land allotted to them by the *woreda* BoA and engaged in seed production by the project. The project provided source seed for 4 hectares. In 2012/13 they produced about 20 tons of seed and sold all to the Southern Seed Enterprise with a 15% premium price. During the off-season they mostly grow vegetables like onion and cabbages by harnessing the river adjacent to their farm land.

Women groups become self-reliant after starting the entrepreneurial activities. They learned to read and write and start savings. The group, by mobilizing their own physical and intellectual resources, has increased their family income, ensured their food security and able to pay for their children's education. The members of the group become stronger by day as the group dynamics got strengthened and the group bond get cemented and learned the benefits of group action and realized the importance of group strength. This is the first step towards independence.

**Empowerment of farmers:** telling adults what to do provokes reaction, but showing them triggers imagination, involving them improves understanding, and empowering those leads to commitment and action.

**Community organization:** Extension workers need to learn the principles of community organizing, skills in conflict resolution, negotiation and persuasive communication.

**Capacity building:** combine technical capacity with management capacity

**Problem solving and education:** help farmers identify problems and seek solutions by combining indigenous knowledge with improved knowledge and using their resources properly (learning by doing).

**Knowledge of DAs:** Most DAs have the basic technical expertise, but are deficient in specific skills which farmers demand. Hence DAs require training in key areas such as intensification and diversification of farming, agricultural marketing and communication skills.

## **5.5 Conclusion and Way Forward**

The GoE seeks to double agricultural production during the Growth Transformation Plan (GTP) period by scaling up best bet technologies. The USAID supported ICARDA-EIAR project implemented an innovative technology promotion approach for deployment of rust-resistant varieties that comprises multiple processes where several key stakeholders with relevant expertise contributed towards its successful implementation. The forum includes a wide range of stakeholders including researchers, seed suppliers and policy makers from federal and regional offices as well as administrators and development agents and farmers from target districts.

The overall management and orientation of the promotion of best practices is driven by the farmers' expressed needs and priorities. A farmer-driven orientation ensures that the extension system is serving farmers in their areas of highest need and allows for flexibility at regional, national and district and even at kebele levels. An important factor to be considered in extension priorities is the role of women in increasing farm household income. In most cultures, including Ethiopia, rural women are primarily responsible for almost all agricultural activities carried out.

Historically the main thrust of extension has been to increase agricultural production. A shift in emphasis is needed to link farmers to markets in response to the current priorities and emerging realities. This new thrust requires additional knowledge or expertise in processing, market information and marketing. Extension needs to shift some of its focus from food security to increasing farm income and rural employment.

Indeed, knowledge and information systems had to come to be recognized as a fourth pillar alongside those of land, labor and capital.

The number of Development Agents (DAs) has expanded rapidly in recent years. However, at least as important as the number of DAs, their capabilities and their mind-sets are critical which determine their behavior at work. As observed over the four years of the project life, the vast majority of the extension workers (DAs) have the basic technical expertise and theoretical knowledge. But farmers were demanding specific skills. They need training and technical backstopping as they rapidly move into the production of high value crops and livestock enterprises as well as climate change. Some farmers noted that DAs lack the necessary practical experience and business skills and expertise to help farmers. There are serious constraints in the capabilities and mind-sets of DAs. Technical skills are rather limited, and business skills and entrepreneurial mind-sets are lacking. Furthermore, a technology-push mind-set dominates while knowledge of participatory methods and approaches are lacking as well. The supply driven approach could be appropriate to start with in a subsistence farming system, but to have a sustainable rural transformation demand side constraints should be addressed. Moreover, DAs are attempting to carry out the extension program from their own particular perspectives while farmers are seeking to diversify their farming system within specific agro-ecological areas. Due to their age, lack of on-farm experience, and their narrow subject matter focus, most DAs lack the practical, hands on skills and knowledge needed to gain the confidence of farmers. To improve the above mentioned constraints DAs need training in key areas such as intensifying or diversifying farming systems, agricultural marketing and other communication and soft skills and how to organize producer groups.

In a nut shell a collaborative arrangement that brings together several organizations working towards technical and social change or organizations that are involved in the generating, diffusing and adapting new knowledge in agriculture is a way out to improve and build the capacity of the conventional extension system. In Extension “no one size fits all. It is tailor made.”

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