

Appendix F

Impact Metrics

Breeding and seed delivery

Bread wheat: 274 new high yielding lines that carry near-immune to moderately resistant APR responses included in CIMMYT international replicated yield trials and non-replicated screening nurseries for distribution in 2013 and 2014.

Durum: 17 resistant and 44 moderately resistant high yielding lines distributed globally. Genetic basis of resistance is not known but is likely to be based on to a large extent on non- single major gene.

More than 21,000 tons of seed of rust resistant wheat varieties are available for planting:

9,059 tons of seed are available in Ethiopia for distribution. (980 tons of pre-basic seed, 6,208 tons of basic seed, and 1,235 tons of certified seed through the public sector and 380 tons of pre-basic seed, and 3,256 tons of certified seed through the private sector.

12,070 tons of seed of rust resistant varieties are being produced in Kenya on more than 50,000 hectares for distribution to farmers.

100 tons of seed of rust resistant wheat candidate varieties are available for planting in Nepal and Bhutan. 17 seed companies now are selling seed in Nepal, contributing to the adoption of new varieties, and to local economies in the region.

Women accounted for 15-22% of participants in all village-level field days in Ethiopia. In Nepal, 100 women participated field activities under the project.

Pre-breeding (Year 3: Oct 2012–Sep 2013)

>40 plant genes identified as sources of resistance to TTKSK (Ug99) *Sr2, Sr12, Sr13, Sr15, Sr21, Sr22, Sr25, Sr26, Sr28, Sr32, Sr33, Sr35, Sr37, Sr39, Sr40, Sr42, Sr43, Sr44, Sr45, Sr46, Sr47, Sr50, Sr51, Sr52, Sr53, Sr55, Sr56, Sr57, Sr58, SrWeb/Gabo56, Sr1662, SrTr129, SrTm4, SrTA10187, SrTA10171, SrSha7, SrC, SrNiini, SrND643, SrHuw234, SrYanac*; consistent QTL on chromosomes 1A, 1B, 2B, 3D, 4A, 5B, 6B, 7A, 7B; *Sr55, Sr56, Sr57* and *Sr58* were validated to confer APR to Ug99 and other stem rust populations, joining *Sr2* for APR resistance.

27 resistance genes in wheat breeders' toolbox: *Sr2, Sr13, Sr15, Sr22, Sr25, Sr26, Sr28, Sr32, Sr33, Sr35, Sr39, Sr40, Sr42, Sr45, Sr47, Sr50, Sr53, Sr55, Sr56, Sr57, Sr58 SrWeb/Gabo56, Sr1662, SrTA10187, SrTA10171, SrND643, SrNiini*

Sr58 was designated as the pleiotropic APR gene component of the *Lr46/Y29/Pm39* locus. *SrND643* mapped to 4AL and identified as a new gene. Temporarily designated genes *SrSha7, SrNinii*, and *SrTmp* mapped to same position on 6DS as *Sr42* and *SrCad*, indicated that they are the same genes.

Diagnostic SNP markers were trialed at the GRRC, Australia, and University of the Free State.

43 leaf, stripe and stem rust resistance genes (16 leaf rust, 9 stripe rust and 18 stem rust) were protocoled and posted on MASWheat by October 2013.

1,792 visits/month and 5,168 page-views/month, on average, to MASWheat—an increase of 29% and 17% respectively compared to the previous period. About 51% of the visitors have visited the site before, suggesting that the site functions as a source of reference information.

Surveillance

20 national focal points regularly contribute surveillance data to international focal point (including 4 new contributing countries). From South Asia, four national focal points (India, Nepal, Bhutan and Bangladesh) have been contributing surveillance data to the International Focal Point over the last two years.

33 samples were race-typed in a timely manner by UMN-CDL. In addition more than 1,500 rust disease samples were race typed in other regions.

25 institutions used seed distributed by ICARDA for trap nurseries (including 3 institutions in South Asia).

3 institutions received seed for differential sets: Directorate for Wheat Research, India, EIAR, Ethiopia, and CIMMYT (Nepal and Bhutan).

Early warning of a rust threat and coordinated national response was implemented for first time in Ethiopia.

Aecia from 141 barberry plants were analyzed using sequence information, and were identified as belonging to the *Puccinia graminis* species complex, *P. arrhenatheri* and *P. striiformoides* (syn. *P. striiformis* f.sp. *dactylis*).

East African screening facilities

58,000 accessions were screened in international screening nurseries in Kenya and Ethiopia (48,000 in Kenya and 10,000 in Ethiopia) during the off and main-seasons 2013.

80,000 lines over three seasons evaluated from more than 25 countries and research institutions at KARI, Njoro, yielded reliable phenotypic data.

15,000 lines over three seasons at were evaluated at Debre-Zeit, Kulumsa, and Melkasa research centers.

8 seasons of international screenings from India have yielded reliable data, differentiating resistant and susceptible cultivars and **2 seasons** of reliable data was obtained from Nepal for international screenings.

Programs from 28 countries are screening cereal germplasm in the East African rust nurseries:

USA: USDA, NDSU, Cornell University

Canada: Agriculture and Agri-Food Canada, University of Alberta

Mexico: CIMMYT (irrigated bread wheat and rain-fed programs)

Australia: University of Sydney, CSIRO

South America: Argentina, Uruguay, Paraguay,

Africa: Kenya, Ethiopia, South Africa, Uganda, Egypt, Morocco

Asia: India, China, Nepal, Bangladesh, Pakistan, Afghanistan, Bhutan

Middle East: ICARDA, Iran

EU countries: Sweden,

Others: Tajikistan, Kazakhstan, Uzbekistan, Turkey, Israel

283 lines with nine different *Sr* genes (known) and few unknown genes are distributed in CIMMYT international trials.

200 lines with genes/genetic basis of resistance were postulated in collaboration with national programs and the international screening nursery at the Directorate of Wheat Research, India.

Advocacy

Approximately \$87 million Co-funding raised by partners engaged in the Borlaug Global Rust Initiative: See Appendix E: Other Funding to Subcontractors for Wheat and Rust Research.

Human capacity

62 scientists (including 17 students) from Kenya and Ethiopia participated in international training and applied skills learned to their own research programs.

86 scientists from the SAARC region participated in international training.