2014 WHEAT CRP ANNUAL REPORT

for the Consortium and the Fund Council

CGIAR

Research Program on WHEAT

Contents

Acronyms and abbreviations

A4NH	CGIAR Research Program on Agriculture for Nutrition and Health
ACIAR	Australian Centre for International Agricultural Research
APR	Adult plant resistance
AgMIP	Agricultural Model Intercomparison and Improvement Project
AIP	Agricultural Innovation Program for Pakistan
AR4D	Agricultural research for development
ATA	Nigerian Government's Agricultural Transformation Agenda
AVRDC	World Vegetable Center
BBSRC	UK Biotechnology and Biological Sciences Research Council
BGRI	Borlaug Global Rust Initiative
BMGF	Bill & Melinda Gates Foundation
BMZ	Federal Ministry for Economic Cooperation and Development, Germany
CA	Conservation agriculture
CAAS	Chinese Academy of Agricultural Sciences
CCAFS	CGIAR research program on Climate Change, Agriculture and Food Security
CCAP	Center for Chinese Agricultural Policy
CIAT	International Center for Tropical Agriculture
CPG	WHEAT competitive partner grant
CSIRO	Australia's Commonwealth Scientific and Industrial Research Organization
CSISA	Cereal Systems Initiative for South Asia
DArTseq	Diversity Arrays Technology
DRRW	Durable Rust Resistance in Wheat Project
EIAR	Ethiopian Institute of Agricultural Research
FACASI	Farm Mechanization and Conservation Agriculture for Sustainable Intensification project
FARA	Forum for Agricultural Research in Africa
FP	Flagship Projects
Fe	Iron
GBS	Genotyping-by-sequencing
GMO	Genetically modified organism
GRiSP	Global Rice Science Partnership
GS	Genomic selection
ha	hectares
HeDWIC	Heat and Drought Wheat Improvement Consortium (HeDWIC)
ICAR	Indian Council of Agricultural Research
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IDOs	Intermediate development outcomes
ILRI	International Livestock Research Institute
IRRI	International Rice Research Institute
IWIN	International wheat improvement network
IWWIP	International Winter Wheat Improvement Program
IWYP	International Wheat Yield Partnership
JIRCAS	Japan International Research Center for Agricultural Sciences
MasAgro	Modernización Sustentable de la Agricultura Tradicional
MC	Management committee
MEXPLAT	Mexican Phenotyping Platform
MNFSR	Pakistan Ministry of National Food Security and Research
MoA	Ministry of Agriculture
Mt	Million tons
N	Nitrogen
NARS	National agricultural research systems
PARC	Pakistan Agricultural Research Council
PLL	Precision laser land leveling
QTL	Quantitative trait loci
R&D	Research and development
RWC	Rice Wheat Consortium for Indo-Gangetic Plains
RSs	WHEAT Research Strategies
SARD-SC	Support to Agricultural Research for Development on Strategic Commodities of the African Development Bank
SeeD	Seeds of Discovery
SIAP	Mexico's Servicio de Información Agroalimentaria y Pesquera
SLO	System level outcomes
t	tons
UC-Davis	University of California, Davis
USAID	U.S. Agency for International Development
W4A	Wheat for Africa
WIT	Jeanie Borlaug Laube Women in Triticum Early Career Award
W-ISC	WHEAT-Independent Steering Committee
WYC	Wheat Yield Consortium
WYCYT	International Wheat Yield Consortium Yield Trial
YR	Yellow rust
Zn	Zinc
ZT	Zero tillag

Part I – Technical report

A. Key messages

A.1 Progress and challenges in 2014

In the spring of 2014, India, Pakistan, CIMMYT and WHEAT celebrated the 100th birthday of Dr. Norman Borlaug, drawing attention to present and future challenges to wheat production. High on the list are expanding demand and rising temperatures: A study by WHEAT scientists published in *Nature Climate Change* has shown that, globally, for every 1° C increase in growing season mean temperatures, wheat production decreases by 6% — a worldwide loss of 42 million tons of grain — and rising temperatures are already reducing global wheat production (see p.3). Regionally, another WHEAT study has documented a slowdown in average wheat cultivar turnover rates in India from 9 years (1997) to 12 years (2009; see p.3), increasing risks and highlighting the challenge that WHEAT and its national partners face in many world regions. Later in the year, the World Food Prize was awarded to distinguished wheat breeder Dr. Sanjaya Rajaram, who warned that "future crop production is bound to decline unless we fully factor in the issues related to climate change, soil fertility and water deficits. It will require all the resources of international research centers, national governments, foundations, NGOs and farmer groups together to synergize future agricultural technologies and food production," underlining the importance of partnerships.

As wheat agriculture and food security challenges loom large, research funded by the WHEAT Partner Budget documented the past impact of germplasm and training in China, the world's largest wheat producer and, together with India, home to half of the world's poor (See: Where Do the World's Poor Live? A New Update, Andy Sumner, IDS Working Paper 393, Institute of Development Studies, 2012, ISBN: 978-1-78118-061-7). WHEAT researchers documented the long-term productivity impacts of agronomic technology adoption by farmers in the Indo-Ganges Plain, guiding future investments in that region. The WHEAT Global Variety Release and Adoption study will near completion in mid-2015.

With regard to outputs, sustainable intensification successes were achieved in Mexico, South Asia and Ethiopia, whilst improved wheat varieties development, distribution and adoption saw progress Afghanistan, Central Asia, South Asia and Sub-Saharan Africa (p.6), partly in collaboration with other CRPs (A4NH, p.6).

Bilateral and Windows 1&2 investments supported expanded capacity for gender research and mainstreaming (p.7), with greater gender equity achieved in capacity development (p.9). Last but not least, WHEAT developed an excellent Extension Period Proposal, which guided the reorganization of WHEAT research domains (five Flagship Projects) and changes to CRP Governance and Management initiated in 2014.

A.2 Synthesis of two most significant achievements

Impacts in China of international wheat partnerships. A 2014 study[1] led by the Director of the Center for Chinese Agricultural Policy (CCAP) of the Chinese Academy of Sciences shows that Chinese breeders' use of CIMMYT germplasm increased the country's wheat total factor productivity as much as 14% in the past three decades (annual TFP growth rate of between 0.17% and 0.45%), representing as much as 10.7 million tons of added grain worth US $3.4 billion, based on 2011 prices. Results also showed that breeders' use of CIMMYT germplasm has been increasing: CIMMYT contributions are present in more than 26% of all major wheat varieties released in China after 2000 and have added valuable diversity for

[1] J. Huang, C. Xiang and Y. Wang. 2015. The Impact of CIMMYT Wheat Germplasm on Wheat Productivity in China. Mexico, D.F.: CGIAR Research Program on Wheat.

important traits, including yield, protein content, disease resistance and earlier maturity. A separate, three-year field experiment in the Sichuan Basin[2] showed that cultivars developed from CIMMYT synthetic hexaploid wheats yielded on average 11.5% more than local, elite non-synthetic-derived cultivars. Another study by CCAP showed that 350 Chinese researchers (15% female during 1980-1990; rising to 35% female during 2000-2012 and since the 1990's increasingly focused on younger scientists) had taken part in CIMMYT wheat training programs since 1970. Of those, 170 benefited from visiting scientist appointments at CIMMYT; many of the alumni now hold important positions in China's wheat research system. The annual in-kind contribution of China to CAAS-CIMMYT wheat research currently stands at over US$ 700,000, not counting one-time investments in labs of US$ 3 million. The impact study shows that returns have been well worth such bilateral investments for the period studied and imply that further Chinese investments would offer a good return on investment.[3]

Water-saving impacts in the Indo-Gangetic Plain: Long-term investments pay off. A 2014 overview paper[4] extensively evaluated leading agronomic recommendations for South Asia. Precision laser land leveling (PLL) is the most effective innovation for reduced and equitable usage of inputs like water and maximum production, especially in coarse- and medium-textured soils. Study and promotion of the technique expanded through the Rice-Wheat Consortium during 1994-2008. It is now practiced on over 1.5 million hectares in South Asia and allows farmers to save 15-30% irrigation water and benefit from up to 6% higher yields in rice, wheat and other crops, compared to traditionally-leveled fields. Reports from India have documented wheat yields as much as 16.6% higher, with nearly 50% less irrigation water use and 132% higher water productivity with PLL and raised bed planting, compared to traditional practices. Use of laser leveling in Pakistan started in 1985 through an on-farm water management program in Punjab; in a 2013 report the technology was shown to save 31% irrigation water, raise water productivity to 1.58 kg/m^3 and increase fertilizer use efficiency by nearly 4%.[5]

A.3 Financial summary

$M	As per PIA	Budget	Actual Spend	of which on Gender
W1&2*	14.327	19.54	18.19	4.92; of total 2014 spend
W3	Part of bilateral figure below	13.7	9.43	See above
Bilateral	25.505	17.46	13.57	See above

The 2014 budget and spending aggregates WHEAT budget and ICARDA decentralization funding. The actual Consortium Board approved budget was US $ 13.9 M; by late Nov 2014 it was 16.6 M., due to increased W2 income, now half of WHEAT's combined W1&2 income. See the *Financial Report* (p.12).

Decentralization expenditure in 2014 on items identified in the original budget included commitments of US$ 404k, due to late receipt of funds and purchasing lag times (see Annex 5). Note that ICARDA Decentralization funding is not considered in the PIA signed in 2011.

[2] https://www.agronomy.org/publications/cs/abstracts/55/1/98 .
[3] Salaries of 10 scientific staff, 9 support staff, 3 postdoctoral fellows and 18 postgraduate students, plus the operational budget of breeding stations, quality and molecular labs. Source: Zhongu He, CIMMYT country director China.
[4] http://www.sciencedirect.com/science/article/pii/B9780128001318000042.
[55] http://www.uet.edu.pk/research/researchinfo/13-RJ-JUL-2013/2-ART-7.pdf.

A.4 Gender

Gender performance self-assessment as per Annex 2, p.20, is "approaching requirements."

In 2014 WHEAT has increased investments in strategic gender research, in-house gender capacity building and making a growing number of projects gender responsive. The main thrust of strategic gender research is the cross-CRP "Global Study on Gender Norms, Agency and Innovation Study in Agriculture and Natural Resource Management" (Gennovate). This is particularly important for WHEAT, as Gennovate will improve on the very limited evidence base regarding gender and wheat. WHEAT gender experts co-lead this work with colleagues from 12 other CRPs. The CIMMYT-led CRPs WHEAT and MAIZE have already completed data collection for more than 19 of the 70+ case studies planned. WHEAT is also working with gender experts across other CRPs to secure funding for Gennovate's critical analysis and write-up phase.

A.5 CRP governance and management improvements

WHEAT-Independent Steering Committee (W-ISC) members elected an Independent Chair. W-ISC membership expanded to eight voting members, as well as ex-officio, non-voting members CIMMYT and ICARDA DGs and Chairs of their Boards' Program Committee. A CRP Director has been appointed, starting 1st January 2015. For details, see this note on WHEAT management and governance changes.

B. Impact pathway and intermediate development outcomes (IDOs)

Following a standardization of CRP structures, the WHEAT strategy was reorganized around 5 Flagship Projects (FPs) in 2014, encompassing the 10 Strategic Initiatives of the original WHEAT proposal (see Annex 3, Figure 2). The FPs implement the two WHEAT Research Strategies (RSs) and contribute to a number of Intermediate Development Outcomes (IDOs) and, as part of the CRP Portfolio, to the three System Level Outcomes (SLOs) (see Annex 3, Figure 3). Each FP comprises from three to six Clusters of Activities (CoAs), which represent aggregations of projects and work packages within a research thrust. WHEAT contributes to the following IDOs: IDO 1-Productivity, IDO 2-Food Security, IDO 4-Income, IDO 5 – Gender and Empowerment, IDO 6-Capacity to Innovate and IDO 9-Environment. The CRP also contributes to the other IDOs through joint efforts with other CRPs.

The completion rate on 2014 deliverables for projects under WHEAT ranges from 83 to 100%, with an overall output achievement above 97%, as documented in WHEAT reporting templates (for W1&2) and bilateral progress reporting (see Annex 1, p. 16 for details and method). An overview of FP outputs delivering towards sub-IDOs and SLOs is provided at Annex 3, p. 21. A list of impact studies published during 2004-2014 and their key findings appears in Annex 4, p. 22. WHEAT 2014 publications are listed here: http://wheat.org/documents-about-wheat/.

Progress along the impact pathway

C.1 Progress towards outputs

Rising Temperatures, Falling Wheat Yields. FP 1. A 2014 paper[6] published in *Nature Climate Change*, discusses the work of 50 scientists (including 2 WHEAT) from 15 countries who used data from 30 crop models and widely distributed field experiments to prove that, for every 1° C increase in growing season mean temperatures, wheat production decreases by 6% — equivalent to a worldwide loss of 42 million tons of grain — and that rising temperatures are already reducing global wheat production. The results

[6] Rising temperatures reduce global wheat production. (If you have trouble, right-click on the title, copy the link, and paste it into your browser.)

link to other ex-ante research under WHEAT and CCAFS and drive work like that of the Heat and Drought Wheat Improvement Consortium (HeDWIC; see more under "partnerships").

Varietal turnover: Why do farmers grow old varieties? FP 1. A 2014 study[7], led by a professor at the University of Göttingen, Germany and former CIMMYT socioeconomist working in the Cereal Systems Initiative for South Asia (CSISA) program, explains how and why cultivar depreciation accentuates the vulnerability of resource-poor farmers to production risks, showing that average wheat cultivar turnover rates in India slowed from 9 years in 1997 to 12 years in 2009.

More and better markers for key traits and genotypic analysis of genetic diversity. FP 2. We are switching technologies, trying to move from gel electrophoresis to fluorescence-based genotyping systems to reduce the time and cost. So instead of running SSRs we will run KASP assays and promote the KASP system, which works well for wheat, especially for the gene-based markers. It will take two-to-three years to move completely to this system; right now about 50-60% of our data are KASP SNPs The technology is being used both in CIMMYT and ICARDA labs, in collaboration with service providers.

Pre-Breeding for yield potential: Data from 2nd WYCYT and performance of pipeline material. FP 2. Using information on photosynthetic and partitioning traits, hybridization schemes were designed to combine physiological traits and achieve cumulative gene action for yield potential. The resulting germplasm has produced superior yields and biomass in global, multi-location trials (the International Wheat Yield Consortium Yield Trial – WYCYT; and preliminary results from the Stress Adaptive Trait Yield Nursery -- SATYN). The top-yielding WYCYT line has a Mexican landrace in its pedigree and pipeline materials are dominated by synthetic derivatives and landraces in their pedigrees.[8]

Precision phenotyping takes off. FP 3. Indices derived from airborne imagery (drone- or blimp-mounted multi-spectral cameras or other sensors) of breeding plots were validated against equivalent ground-based indices (correlations between 0.58 and 0.91) for thousands of breeding lines, and provided significant, better-than-equivalent correlations with yield. The approach will be refined for field-based screening of large collections of genetic resources to identify new sources of adaptive traits, in gene discovery and in mainstream breeding for quantitative traits.

Global partnerships for phenotyping. FP 3. The Izmir, Turkey, phenotyping platform for yellow rust was initiated in 2012 and field facilities are operating; the aim is to complete the laboratory and containment facilities in 2015. The Mexican Phenotyping Platform (MEXPLAT) was established and is running as core infrastructure, with collaborative research and training and a focus on understanding yield potential and related processes. An agreement was signed with national partners in Sudan (early, terminal heat stress), Tunisia (Septoria, leaf rust) and Uruguay (multiple biotic stresses) to set up three additional precision phenotyping platforms (total target: 15 platforms in Phase II) across the globe, with NARS partner co-investment in each case. WHEAT will establish more phenotyping platforms, depending on W1&2 income, bilateral commitments (e.g. BGRI/DRRW Phase 3 for Kenya and Ethiopia precision phenotyping platforms) and NARS co-investment, to expand the precision and predictive value of phenotyping data for new germplasm from WHEAT and partners' breeding pipelines. The 19% W1&2 budget reduction in 2015 will reduce the number of new platforms to three, from the planned seven (see Extension Period Proposal), during 2015-16.

More durable resistance to wheat diseases. FP 3. CIMMYT and ICARDA are deploying varieties that possess adult plant resistance (APR) based on combinations of minor, slow rusting genes that provide high levels of more durable resistance. Four characterized genes have pleiotropic effects, conferring

[7] In press with the *Journal of Agricultural Science*, and available as an IFPRI discussion paper.
[8] Reynolds et al. (eds.) 2015, pp. 17-18.

partial APR to all three rusts and powdery mildew. High-yielding, rust resistant lines generated through Mexico-Kenya shuttle breeding are being distributed in CIMMYT international yield trials and screening nurseries. Gene cloning and gene function descriptions and other work were done at Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO) the University of Zurich, Agriculture and Agri-Food Canada, Iowa State University, the Plant and Food Research-New Zealand.[9] Results from discovery (upstream) research under FP2 are moving to breeding in FP3, guided by ex-ante impact studies under FP1. Investments in upstream R&D aim to assure future success in past and current downstream R4D on rust. W1&2 funded research complements a bilaterally-funded project (DRRW/Cornell) and bilaterally-funded impact studies by a US partner (USAID Linkage/University of Minnesota)[10] to guide targeting of WHEAT investments under FP2&3. ICARDA is combining 2-3 major genes in minor gene background, using molecular markers and inter-country shuttle followed by yield testing at key locations, shuttling of the segregating generation between Lebanon and Ethiopia, followed by key location testing in Lebanon, Morocco, Egypt, Sudan and Ethiopia.

Conservation agriculture for wheat in Asia, North Africa, and the Middle East. FP 4. Conservation agriculture wheat research was pursued in Jordan, Tunisia, Algeria, Palestine and Tajikistan, through trials on-farm and on station to design, implement and demonstrate site-specific conservation agriculture packages. In Tajikistan such packages did not involve livestock whereas, in North Africa, crop-livestock integrated systems were the focus. Work in North Africa addressed alley-cropping systems, with the integration of multipurpose forage species such as *Medicago arborea*, *Atriplex* spp., vetch, and forage pea.

FP 5. See Sections C.2. and F.

C.2 Progress towards the achievement of outcomes

Global wheat impacts study. FP 1. To document the use of CGIAR-related and other improved wheat germplasm and its farm-level adoption, a survey was sent to 90 countries that produce at least 5,000 tons of wheat. 64 countries responded from the survey, representing 80% of the world's wheat production; responses came from 42 developing countries, covering 99% of wheat production in those regions. A full report will be published in 2015, but preliminary findings show that (1) since 1994, more than 4,600 improved wheat varieties have been released in the world and (2) there is continued and significant use of CGIAR-derived wheat germplasm in the developing world. CIMMYT-derived varieties cover 30-80% of the national wheat area in South Asian countries and, in sub-Saharan Africa, 57% of the area in Kenya and nearly 90% in Ethiopia. This study updates results of Lantican et al. (2005).

Genomic selection to speed genetic improvement in wheat breeding. FP 2. Genomic selection offers new opportunities for increasing the efficiency of plant breeding programs. In 2014, a significant body of reports in important science journals documented WHEAT scientists' substantive progress toward applying the approach.[11] Topics covered included (i) genomic selection for quantitative adult plant stem rust resistance in wheat; (ii) simulations to evaluate the effectiveness of different genotyping and phenotyping strategies to enable genomic selection in early generation individuals; (iii) the results of genomic prediction in CIMMYT maize and wheat breeding programs; and (iv) use of classification algorithms for genomic-enabled prediction.

[9] See doi: 10.3389/fpls.2014.00641 and doi: 10.1007/s00122 -014-2390-z.
[10] See doi: 10.1126/science.1229707.
[11] (i) doi: 10.3835/plantgenome2014.02.0006; (ii) doi: 10.2135/cropsci2013.03.0195; (iii) doi:10.1038/hdy.2013.16; (iv) doi:10.1038/hdy.2013.144.

Molecular analytics to unlock new traits in massive seed collections. FP 2. As part of Seeds of Discovery (SeeD), more than 40,000 CIMMYT wheat gene bank accessions have been characterized through the DArTseq genotyping-by-sequencing (GBS) platform.[12] A high-density GBS consensus map developed in 2014 is an essential prerequisite for analyzing the GBS data of a large diversity panel and will facilitate the genetic dissection of important quantitative traits either by linkage mapping or by genome-wide association mapping.

South Asian wheat improvement with NARS partners is gaining speed (FP 3, South Asia). Twenty-one superior, resistant varieties were released in South Asia; two in Bhutan. More than 1,100 new lines qualified for inclusion in national and state trials in Bangladesh, India and Nepal. Molecular markers were identified for heat tolerance and for enhanced Zn/Fe concentrations in grain. Lines with tolerance to spot blotch were identified. Seed produced (5,639 tons) was disseminated among farmers though linkages with public and private sector institutions and also using participatory approaches.

Conservation agriculture in Ethiopia. FP 4. In June 2014, CIMMYT-Ethiopia joined the Ethiopian Highlands project of Africa RISING (see 'Africa Research in Sustainable Intensification for the Next Generation'; http://africa-rising.net/where-we-work/ethiopian-highlands/). Using a strong participatory research methodology, the Ethiopian Highlands project will identify technologies and management practices for the sustainable intensification of crop-livestock systems in the Ethiopian Highlands. CIMMYT is providing expertise on soil and water conservation (conservation agriculture and raised bed systems), small-scale mechanization (seeding, threshing and water pumping using two-wheel tractors), participatory variety selection (wheat, food barley, malt barley, potato and fababean) and community seed production.

Continued investment in seed systems (FP 5, Afghanistan, Ethiopia, Kenya). Farmer access to high quality seed remains essential in translating research into on-farm yield gains. Several donors continue to invest in NARS (adapt & test germplasm, seed multiplication, extension) and CIMMYT (germplasm provision, capacity development, project management), to make the seed system work better. In **Afghanistan**, the ACIAR-funded wheat improvement and seed systems project supported the production of 24,000 tons of certified seed derived from high-yielding, disease resistant CGIAR germplasm - enough to sow 190,000 hectares.[13] More information about Phase 1 impact is described in Section C.3. In **Kenya**, 165 tons of seed of 10 improved varieties was supplied to 2,194 smallholder farmers; improved rust resistant varieties were demonstrated and early-generation seed multiplication done.

C.3 Progress towards impact

An overview of impact studies published 2005-2014 is shown in Annex 4, p.22.
With regard to zero-till impact in Kazakhstan (see WHEAT Annual Report 2013), this technology is now practiced on 2.15 million hectares, driven by implementation of the 'CONCEPT for transition of the Republic of Kazakhstan to Green Economy' policy (since 2013), though scaling-out challenges remain: A 2015 World Bank study on agricultural risks recommends "to broaden and strengthen the use of conservation agriculture … on … farms in northern Kazakhstan … for more sustainable management of

[12] http://www.diversityarrays.com/dart-application-dartseq
[13] A second phase of this project was granted also based on the donor-funded impact assessment: http://aciar.gov.au/files/ias85-afghanistan-web-final.pdf

drought risk".[14] A 2014 national assessment of climate change adaptation technologies rated no-till technology among the top three to pursue.[15]

Speeding seed production and deployment. In **Afghanistan,** seed systems research has increased supply productivity by between 65% and 79%. In **Pakistan**, through the Wheat Production Enhancement Program (WPEP) involving the Pakistan Ministry of Agriculture and USDA and CIMMYT, 48 tons of seed of Ug99 resistant varieties and 509 tons of seed of other rust-resistant varieties were produced and distributed to other national programs, seed suppliers and farmers. In **Ethiopia,** 165 tons of seed of 10 improved, disease-resistant bread and durum wheat varieties, along with wheat production manuals, was distributed to more than 2,000 resource-poor farmers in rust-hit areas of Arsi and Bale.

Turkey-CIMMYT-ICARDA International Winter Wheat Improvement Program (IWWIP). Four new IWWIP varieties were released in 2014 in Azerbaijan, Iran, Turkmenistan and Turkey. Varieties released by IWWIP now total 63 and are sown on 2 million hectares. CRP WHEAT is providing much needed improved wheat lines tolerant to frost and salinity for the Dryland Systems CRP Aral Sea Action Site and yellow rust resistant varieties for the Dryland Systems CRP Fergana Valley Action Site.

Yields of current vs historical varieties. In a two-year study of genetic yield potential with Windows 1&2 support comparing historical and current bread wheat and durum varieties under environments including heat and drought and covering 48 years. The 2014 release Borlaug 100 shows an 18% grain yield advantage over Seri 82 under optimal conditions. The new Indian variety DPW621-50 showed a 14% yield advantage over PBW343 and there have been significant increases in durum wheat yields.

Sustainable intensification feasible for in South Asia. Through its research platforms, the Cereal Systems Initiative for South Asia (CSISA) has conclusively demonstrated sustainable intensification pathways for enhanced crop productivity (11%), increased profitability (32%), reduced energy investments (-46%) and markedly reduced irrigation requirements (-71%).[16]

C. Gender research achievements

D.1 Selected gender research achievements

Understanding gender in wheat-based livelihoods for enhanced WHEAT R4D impact in Afghanistan, Pakistan and Ethiopia, an ambitious new project accepted for funding by Germany's Federal Ministry for Economic Cooperation and Development in 2014, aims to contribute to reduction in rural poverty and increased food security by shaping and targeting research and development activities related to wheat, in ways that increase the empowerment of disadvantaged groups, in particular poor women and youth in wheat-based systems, and help unleash their potential. The purpose of the project is to make WHEAT research and development partners appreciate gender integration and social inclusion as an opportunity to enhance impact, and use the project's outputs to strengthen the integration of gender and social inclusion in wheat technology development, adaptation and diffusion.

Under the **Global Study on Gender Norms, Agency and Innovation** in Agriculture and Natural Resource Management (Gennovate), WHEAT completed data collection for seven case-studies in 2014, three in Morocco and four in Uzbekistan. In addition, under the WHEAT Competitive Partner Grant scheme, a

[14] For World Bank Agricultural Risks Study on Kazakhstan and Central Asia, see: http://www.worldbank.org/en/news/press-release/2015/06/03/world-bank-helps-identify-agricultural-risks-for-kazakhstan

[15] Republic of Kazakhstan – Technology Needs Assessment for Adaptation to Climate Change, 2014: http://unfccc.int/ttclear/misc_/StaticFiles/gnwoerk_static/TNR_CRE/e9067c6e3b97459989b2196f12155ad5/de33bfc9b4aa487f9ca0a88210f48bc3.pdf

[16] See p. 8 of this CSISA report.

grant to undertake a comprehensive diagnosis of gender relations in key wheat target regions of South Asia and development of guidelines for gender-responsive wheat-based systems development was established. Implementation of the project is led by Glasgow Caledonian University in collaboration with local partners in Bangladesh, India, Nepal and Pakistan, and involves the organization and operationalization of 30 case studies under Gennovate.

D.2 Success and challenges in mainstreaming gender research

A revised version of the WHEAT gender strategy was endorsed by the WHEAT management committee in December. Other successes related to gender mainstreaming include increased demand from scientists and research teams for gender inputs for wheat research-for-development (R4D), as well as increased efforts to integrate gender considerations into technical wheat R4D. Numerous challenges to mainstream gender in WHEAT remain, in particular related to bilateral funding and insecurity in W1&2 funding, which significantly limits the capacity to increase CRP gender staffing for mainstreaming efforts.

Gender performance self-assessment as per Annex 2, p.20: Approaching requirements.

E. Partnership building achievements

E. 1. Selected partnership-building achievements

Global Partnership Meeting. In a two-day meeting in Istanbul, Turkey, in December 2014, more than 100 participants from various sectors and institutions around the globe helped shape the beginnings of a proposal for WHEAT's second phase (2017-21), including the scope and outcomes of Flagship Projects, partnerships needed, and next steps for project designs and leadership.

Boosting wheat production in Africa to stem costly imports. Through the SARD-SC wheat project, during 2014 ICARDA operationalized 3 hubs and 15 innovation platforms in Ethiopia, Nigeria and Sudan. The impressive performance of new heat-tolerant wheat varieties in Nigeria and Sudan with yields of 4-6 t/ha– significantly more than 1-2 t/ha average of traditional varieties – generated a key policy shift in both countries. Accordingly, wheat has been included as a priority in the Nigerian Government's Agricultural Transformation Agenda (ATA) and domestic production is targeted as a solution for curbing ever growing import dependence and for ensuring food security. The Government of Nigeria has launched a national target to scale-up best practices, expand wheat area from the existing 70,000 ha to 340,000 ha, and reduce the wheat importation by 45% in the coming five years. Likewise, based on the high yield realized by wheat farmers participating in the six project IP sites in Sudan, the Sudan Government formally announced intentions to scale up the IP approach through the national extension program, expanding the country's wheat area from the present 137,000 ha to 340,000 ha in 2015/16 and boosting domestic production to reduce costly imports.

Bundling wheat improvement resources in Central Asia. The Kazakhstan-Siberian Network on Wheat Improvement (KASIB) established and coordinated by CIMMYT currently unites 19 breeding programs in Eurasia (Kazakhstan, Western Siberia, Ural, Altai and Volga), covering more than 20 million ha of wheat. KASIB activities over 14 years have generated more than 15,000 wheat lines and tested 469 advanced spring bread wheat varieties and 136 advanced spring durum wheat varieties. More than 10 varieties are presently submitted to State Testing Committees.

Partnership for climate change modeling. Successful collaboration with the wheat modeling group of the Agricultural Model Intercomparison and Improvement Project (AgMIP--Senthold Asseng, University of Florida, USA) has (1) assessed the state of the science on modeling climate change impacts for wheat, (2) generated constructive methods and novel algorithms for representing wheat's response to high

temperatures and other stresses, and (3) leveraged a relatively small budget to conduct global research documented in a high-impact journal (see *Nature Climate Change* article cited on p.3).

E.2 Strategic partnerships

IWYP(International Wheat Yield Partnership) Launched (USAID funded). A key WHEAT contribution to this BBSRC/USAID-led project to increase genetic potential by 50% by 2030 is MEXPLAT (more detail about that platform in section C1).

JIRCAS-funded FP 2 - Genetically modified (GM) wheat field trial in Mexico. Evaluation of 5 gene-promoter combinations for drought tolerance in wheat and rice has been conducted using an integrated, multidisciplinary approach spanning plant molecular biology, physiology, and breeding collaborations JIRCAS- RIKEN, CIAT, IRRI and CIMMYT. (To read CIMMYT's policy statement on genetically modified crops, click here and scroll down.)

E.3 Collaborations with other CRPs

Agriculture Innovation in Pakistan: Multi-Partner, including multi-CRP. Under the Agricultural Innovation Program (AIP) for Pakistan, WHEAT interacts with the A4NH, MAIZE and Livestock and Fish CRPs on feed quality of wheat and maize varieties. AIP also works with WHEAT, MAIZE and GRiSP on rice-wheat-based systems; with the Policies, Institutions and Markets to establish research boards in Pakistan; and with Dryland Systems and ICARDA in wheat agronomy. Through AIP also works through competitive grants with Legumes. AIP partners with the World Vegetable Center (AVRDC) on vegetables and with UC Davis in research on fruit crops. Supported by CIMMYT efforts, ILRI, IRRI, AVRDC, and UC Davis opened offices in Pakistan and CIAT is signing an MoA with CIMMYT. Finally, AIP has created a new innovation platform with Pakistan's National Rural Support Program (NRSP) for wheat varietal evaluation, popularization and deployment, on-farm agronomic interventions and community-based seed production enterprises, thereby opening a key avenue to reach large numbers of smallholders, tenants, women headed households and vulnerable people in food-deficit areas not served by mainstream public or private sector organizations.

HarvestPlus (A4NH) and WHEAT: A two-way street. Research under FP3 is making use of A4NH/HarvestPlus outputs directly and indirectly, an excellent example of the benefits a CRP portfolio can achieve. Breeding for enhanced micronutrients involves landraces and other wild ancestors. Selected novel alleles identified for traits such as yield and stress tolerance are mobilized into WHEAT breeding programs. Some of the high-zinc lines developed under HarvestPlus (A4NH) are good performers under drought and late sown heat conditions and have become part of the global breeding platform (FP3.3). Breeding for high Zn and for yield is handled as in the main breeding program under WHEAT, up to the F_5 stage. Thus have HarvestPlus-funded cross derivatives entered the Elite Selection Wheat Yield Trials, shared with national breeding programs globally.

A major progress reported under A4NH: After nearly 10 years of intensive breeding and selection for Zn and Fe traits, trials have been released in over 10,000 farmers' fields in India and are expected to be released to farmers in Pakistan in early 2015. Recent evidence shows that grain zinc and/or iron is controlled by a few major QTLs and a few minor QTLs, with moderate to high heritability. WHEAT will continue to integrate breeding for high Zn and Fe into regular breeding programs.

The **Generation Challenge Program's** Integrated Breeding Platform (IBP) will become the standard tool for CIMMYT and ICARDA researchers in 2015.

F. Capacity building

Gender equality on the rise in training. In 2014, with funding from WHEAT, **CIMMYT Global Wheat Program (GWP)** training courses involved 89 junior and mid-career scientists from all over the world; nearly 50% were women. The courses ranged from the basic wheat improvement course in Mexico (15 countries represented) to the regional statistics course on biotechnology and molecular breeding in Tunisia (6 countries represented) with ICARDA and IRESA (the Ministry of Agriculture) Wheat training courses have encouraged female participation by adjusting courses and accommodating for those who are unable to stay for extended periods. **The Jeanie Borlaug Award Program for Women in Triticum** (WIT) was established by GWP and Cornell University as part of the Durable Rust Resistance in Wheat Project (DRRW). **ICARDA** hosted 279 trainees in 2014; 14% female. Courses ranged from quality seed production to molecular breeding, crop improvement and supplemental irrigation and were held in Sudan, Nigeria, Morocco, Ethiopia, Tunisia and Iraq. In addition to group courses, ICARDA held on-site farm workshops and study missions for students. A total of 13 newly enrolled PhD and MSc students participated in courses in 2014; 77% were female.

First phase of the Arab Food Security Project (2011-14). 25,700 farmers have benefited from field days, farmer schools and travelling workshops, with an average 28% increase in wheat yield across all countries from large-scale on-farm demonstrations of improved wheat varieties and agronomic practices. Mechanized raised-bed planting for smallholders provided an average 25% savings in irrigation water, a 30% increase in wheat yield and a 74% improvement in water-use efficiency on farmers' fields in Egypt. Substantial improvements in rainfed systems included a 45% gain in yields in Yemen and gains of 24% in Jordan and Tunisia. No-till systems increased wheat yields 16% in Syria, 20% in Jordan and 50% in Morocco. The project's Young Scientist Training Program mentored and trained 34 young scientists. Work was funded by the Arab Fund for Economic and Social Development, Kuwait Fund for Arab Economic Development, Islamic Development Bank and OPEC Fund for International Development, and is now set to scale out the successes. Full story here.

G. Risk management

In 2014, a risk management matrix was created to regularly assess and manage risks related to the delivery of results by the CRP. This matrix identifies a number of risks related to asset management, compliance, general management, change management, finance and technology. Based on the risk assessment, specific mitigation measures were identified to manage these risks.

The three major risks for the CRP are: (1) delayed transfer of W1&2 funds, which directly affects CRP research and development operations; (2) non-fulfilled obligations by the partners for commissioned and competitive grants; (3) lack of a systematic and integrated approach for monitoring and evaluation at the outcome level.

To mitigate risk (1), the WHEAT-Management Committee agreed to prioritize CGIAR-led research over partner and management budgets, and to maintain the WHEAT partner budget as the most flexible component of the budget. WHEAT continues to sign only one-year partner grant contracts, to manage partner expectations and minimize any delays of payments to them. As for risk (2), WHEAT has hired a Senior Monitoring, Evaluation and Learning Specialist, shared with the MAIZE, to strengthen the CRP monitoring and evaluation system. Other CIMMYT initiatives also contribute to minimizing this risk, including the implementation of a documentation and monitoring system.

H. Lessons learned (including monitoring CRP progress)

Notwithstanding the positive outcomes achieved, additional efforts are needed to increase the quality of project management and of monitoring and evaluation at both project and program levels.

To respond to this need, both CIMMYT-led CRPS improved the standardized process and associated tools for project planning and design, including clear roles and responsibilities for each step and decision. It has also identified key steps where specialists (e.g., gender, monitoring and evaluation, communications) should be involved to provide advice. At the institutional level, CIMMYT has launched a new component of its Research Management System to support project planning and to record key documentation and decisions.

The CRP foresees a number of future efforts to support this need, including building capacity in the development of theories of change, impact pathways and monitoring and evaluation plans, and the development of a monitoring, evaluation and learning strategy.

H.1 Level of confidence of the response to the key performance indicators

The information reported in Table 1 is obtained from detailed data found in a variety of sources, including project technical reports and institutional databases. WHEAT is confident in the quality of the indicator information supplied. However, the program will continue to improve the systematic approach to collecting the quantitative evidence and other types of performance or progress data, across the WHEAT project portfolio, to improve the process and time required to collect and analyze the information.

WHEAT has reorganized its strategy around five Flagship Projects in 2014 encompassing the Strategic Initiatives of the original proposal following a standardization of CRP structure. These changes have been reflected in Table 1, under indicators 1, 2 and 3.

The program also endorses other CRPs' positions on the importance of clarifying the definitions of some of the SLO- and IDO-level indicators to support consistent and reliable reporting across CRPs.

H.2 Unintended results and innovative initiatives

There were no unintended results.

Part II: Financial report

Figure 1. Total WHEAT budget vs. expenditures, 2014 (US $ millions): L111 and L136

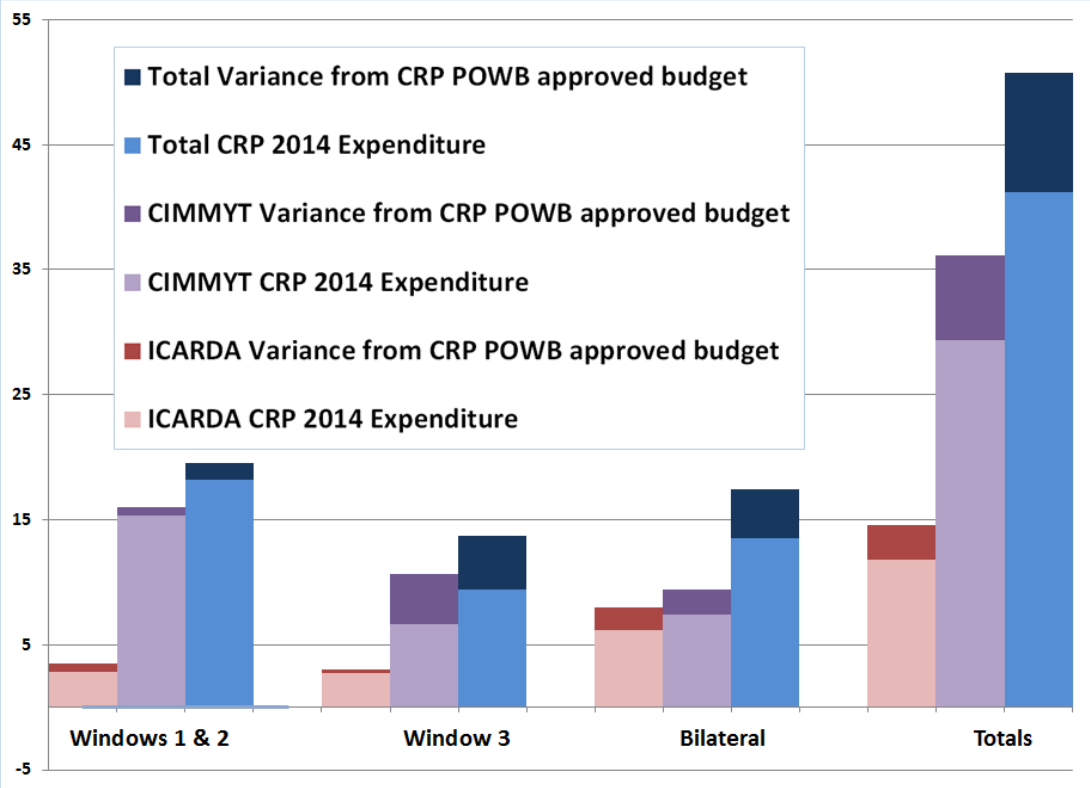


Figure 2. POWB approved by Flagship Project, 2014.

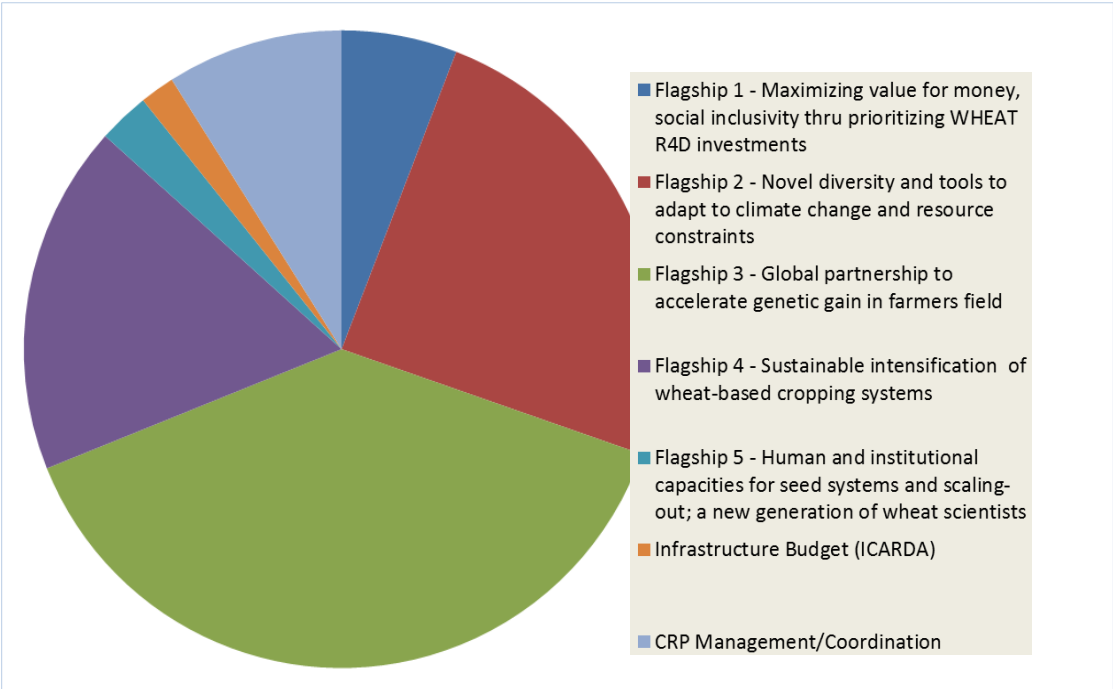


Figure 3. Actual expenditures by Flagship Project, 2014.

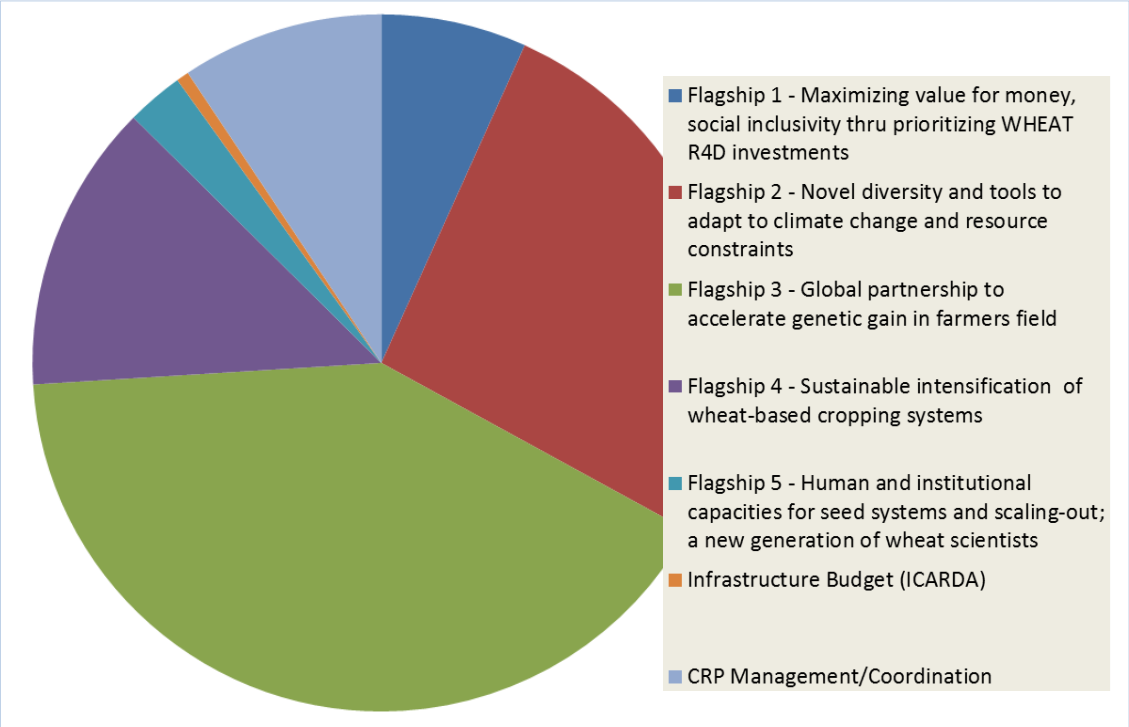


Figure 4. Gender Summary by Flagship Project, 2014 (US $ millions).

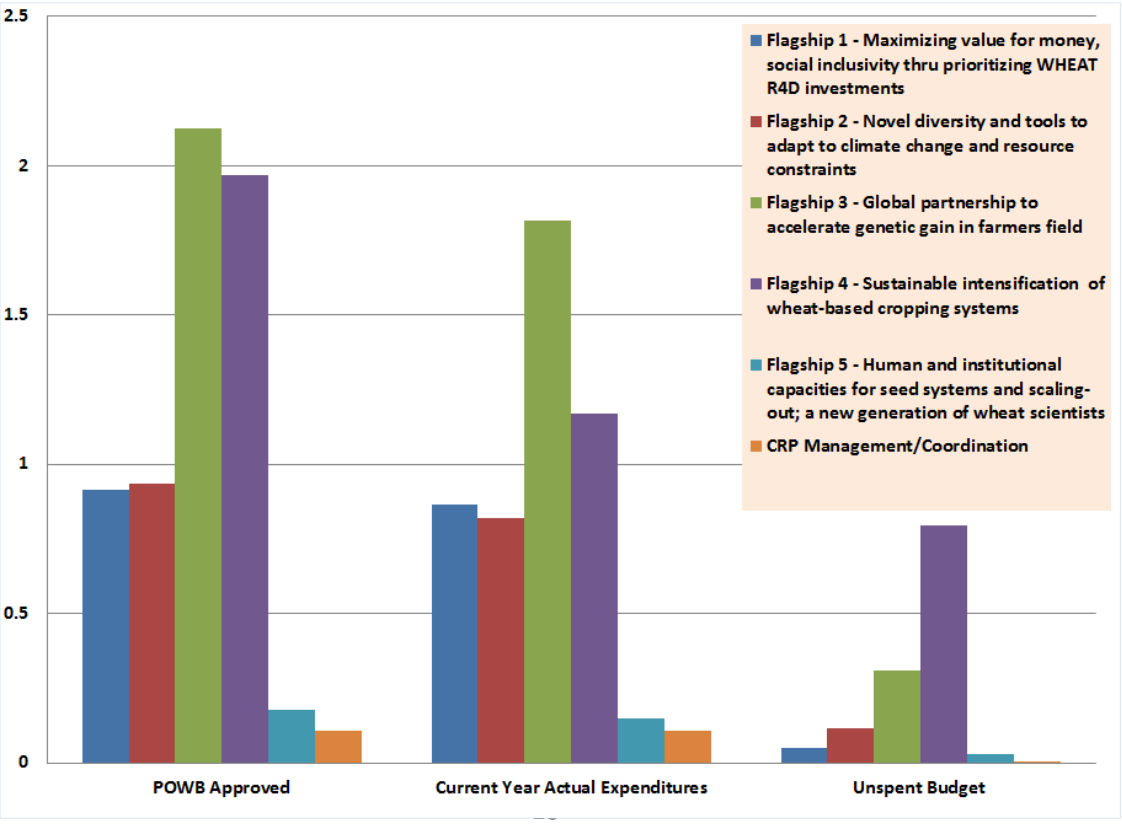


Table 1. Annual Funding Summary (Totals for Windows 1 and 2 combined): L106

		Windows 1&2	Window 3	Bilateral Funding	Total Funding
	CIMMYT :				
1	CGIAR	15,340	-	-	15,340
2	ACIAR	-	230	-	230
3	Arcadia	-	-	648	648
4	Barcel, S.A. de C.V.	-	-	50	50
5	BMGF	-	2,103	-	2,103
6	Cornell	-	-	2,905	2,905
7	GIZ	-	-	346	346
8	ICAR, India	-	403	-	403
9	ICARDA	-	-	96	96
10	Japan	-	160	69	228
11	Kansas	-	-	317	317
12	OFID	-	-	54	54
13	SAGARPA	-	-	2,805	2,805
14	Turkey	-	226	-	226
15	UOT	-	-	58	58
16	USAID	-	3,456	-	3,456
17	Other <50k	-	70	79	149
	ICARDA:				
18	International Maize and Wheat Improvement	2,854		291	3,145
19	Germany			386	386
20	Kuwait Fund			498	498
21	Swedish University of Agricultural Sciences (via the Swedish Research Council)			79	79
22	African Development Bank (AfDB) through IITA			2,027	2,027
23	Agricultural Research Center- Egypt (ARC)			50	50
24	Arab Fund for Economic and Social Development (AFESD)			752	752
25	Cornell University			501	501
26	European Commission		872		872
27	Grains Research & Development Corporation (GRDC)			281	281
28	Islamic Development Bank (ISDB)			98	98
29	Japan		66		66
30	NSW Department of Primary Industries (DPI)			80	80
31	The Japan International Cooperation Agency (JICA)			204	204
32	Turkey		239		239
33	United States Agency for International Development (USAID)		1,607		1,607
34	United States Department of Agriculture (USDA)			810	810
35	Other <50k			87	87
Total for CRP 3.1: WHEAT		**18,194**	**9,431**	**13,571**	**41,196**

Table 2. Annual financial summary by natural classification (US $ 000s): L121

Total CRP 3.1: WHEAT	Windows 1 & 2	Window 3	Bilateral Funding	Center Funds	Total Funding	Windows 1 & 2	Window 3	Bilateral Funding	Center Funds	Total Funding
	POWB Approved Budget					Actual				
Personnel	5,221	2,853	6,566	-	14,640	5,558	1,969	3,583	-	11,110
Collaborators Costs - CGIAR Centers	3,044	2,789	-	-	5,833	4,497	1,567	-	-	6,064
Collaborator Costs - Partners	178	2,210	1,372	-	3,760	256	1,498	1,812	-	3,566
Supplies and services	7,701	3,472	5,289	-	16,462	3,006	2,408	5,345	-	10,759
Operational Travel	579	399	1,256	-	2,234	606	356	815	-	1,777
Depreciation	1,019	396	1,168	-	2,583	2,118	511	635	-	3,265
Sub-total of Direct Costs	**17,742**	**12,119**	**15,651**	-	**45,511**	**16,042**	**8,309**	**12,189**	-	**36,540**
Indirect Costs	1,802	1,585	1,807	-	5,194	2,152	1,123	1,381	-	4,656
Total - All Costs	**19,544**	**13,704**	**17,457**	-	**50,705**	**18,194**	**9,431**	**13,571**	-	**41,196**
LESS Coll Costs CGIAR Centers	(3,044)	(2,789)	-	-	(5,833)	(4,497)	(1,567)	-	-	(6,064)
Total Net Costs	**16,500**	**10,915**	**17,457**	-	**44,872**	**13,697**	**7,865**	**13,571**	-	**35,133**

Total CRP 3.1: WHEAT	Windows 1 & 2	Window 3	Bilateral Funding	Center Funds	Total Funding
	Unspent/Variance				
Personnel	(338)	884	2,983	-	3,529
Collaborators Costs - CGIAR Centers	(1,453)	1,223	-	-	(231)
Collaborator Costs - Partners	(78)	712	(440)	-	194
Supplies and services	4,695	1,064	(56)	-	5,703
Operational Travel	(27)	43	441	-	458
Depreciation	(1,100)	(115)	533	-	(682)
Sub-total of Direct Costs	**1,699**	**3,810**	**3,462**	-	**8,971**
Indirect Costs	(350)	463	425	-	538
Total - All Costs	**1,349**	**4,273**	**3,887**	-	**9,509**
LESS Coll Costs CGIAR Centers	1,453	(1,223)	-	-	231
Total Net Costs	**2,803**	**3,050**	**3,887**	-	**9,740**

Table 3. WHEAT partnership report, 2014 (US $ 000s): L211

TOTAL FOR CRP "X.X"				Actual Expenses - This Year				
	Institute Acronym	Institute Name	Country	Windows 1 & 2	Window 3	Bilateral	Center Funds	TOTAL
	CIMMYT :							
1	ASARECA	Association for streng	UGANDA	100	-	-	-	100
2	BARI	Bangladesh Agricultur	BANGLADESH	-	238	(2)	-	236
3	BIU	BANARAS HINDU UNIVI	INDIA	184	14	-	-	198
4	CAS	CREATIVE AGRI SOLUTI	CHINA	94	-	-	-	94
5	CU	CORNELL UNIVERSITY	USA	-	-	74	-	74
6	DATECH	DIVERSITY ARRAYS TEC	AUSTRALIA	90	-	25	-	115
7	DWR	INIDIAN INSTITUTE OF	INDIA	118	-	-	-	118
8	ICAR	Indian Council of Agric	INDIA	-	39	235	-	274
9	ICARDA	INTERNATIONAL CENTE	ARAB REPUBLIC	986	-	-	-	986
10	IDE	INTERNATIONAL DEVEL	BANGLADESH	-	271	-	-	271
11	IFPRI	INTERNATIONAL FOOD	USA	-	80	-	-	80
12	IISERK	INDIAN INSTITUTE OF S	INDIA	263	-	-	-	263
13	IITA	INTERNATIONAL INSTIT	NIGERIA	-	81	-	-	81
14	ILRI	INTERNATIONAL LIVEST	KENYA	-	141	-	-	141
15	INIA	INSTITUTO NACIONAL D	URUGUAY	673	-	-	-	673
16	INIFAP	INSTITUTO NACIONAL D	MEXICO	-	-	168	-	168
17	IRRI	INTERNATIONAL RICE R	PHILIPPINES	-	1,227	-	-	1,227
18	IWWIP	INTERNATIONAL WINTE	TURKEY	36	69	-	-	105
19	KRIGBSPK	KASHKADARYA RESEAR	UZBEKISTAN	120	-	-	-	120
20	LAU	LANCASTER UNIVERSITY	UK	466	-	-	-	466
21	RRL	ROTHAMSTED RESEARC	UK	374	-	-	-	374
22	RUM	REGENTS OF THE UNIVE	USA	200	104	-	-	304
23	TARI	TIGRAY AGRICULTURAL	ETHIOPIA	-	-	53	-	53
24	TG	TRAIT GENETICS GmbH	GERMANY	187	-	-	-	187
25	UACHL	UNIVERSIDAD AUSTRAL	CHILE	-	-	55	-	55
26	UCGC	THE UNIVERSITY COUR	UK	473	-	-	-	473
27	WAUR	WAGENINGEN UR	NETHERLANDS	307	-	-	-	307
28	Others les than 50k			67	178	96	-	341
	ICARDA:							-
29	EIAR	Ethiopian Institute of	Ethiopia		335	41		376
30	CIMMYT	The International Maize and Wheat Improvement Center				300		300
31	University of Bonn	University of Bonn	Gemany			283		283
32	ARC	Agricultural Research	Sudan		13	79		92
33	INRA	Institut National de la	Morocco		53	33		87
34	ARC	Agricultural Research	Egypt		21	60		81
35	IWWIP	International Winter \	Turkey		71			71
36	NIBGE	National Institute of E	Pakistan			56		56
37	Others les than 50k			15	128	255		398
								-
								-
	Total for CRP			4,753	3,064	1,811	-	9,629

Annex 1. Indicator of progress in 2014.

CRP all-FP completion rate	**97.1%**
CRP all-FP reporting completion	**91.3%**

	Flagship 1			Flagship 2				Flagship 3					Flagship 4			Flagship 5			Flagship 2&3	
	CoA 1.1	CoA 1.2	CoA 1.3	CoA 2.1	CoA 2.2	CoA 2.3	CoA 2.4	CoA 3.1	CoA 3.2	CoA 3.3	CoA 3.4	CoA 3.5	CoA 4.1	CoA 4.2	CoA 4.3	CoA 5.1	CoA 5.2	CoA 5.3	*CoA 2./3.6 (acc. 50/50)*	*CoA 2./3.7 (acc. 50/50)*
Completion per CoA	92.5%	83.8%	100%	100%	100%	97.2%	91.8%	95.8%	96.4%	100%	91.9%	99.5%	100%	100%	100%	99.8%	100%	100%	91.4%	100%
Completion per FP	92.1%			96.9%				96.6%					100.0%			99.9%			95.7%	
Reporting completion	*84.6%*			*90.6%*				*89.7%*					*97.4%*			*94.1%*			*90.0%*	

Note on methodology: For 2012-14, all WHEAT scientists, including non-CGIAR delivering on competitive or commissioned grants, report on annual progress using a reporting template, against WHEAT workplan annual deliverables or milestones. Project leaders and principal investigators determine completion rates and describe hurdles to achieving annual milestones, as appropriate. The CRP Team aggregates completion rates per CoA and FP. A very small number of incomplete W1&2-funded activities reports are not considered. Progress on bilaterally funded projects is in some cases estimated, because annual progress reports, as per donor requirements, were not yet available.

CRP indicators of progress, with glossary and targets.

WHEAT									
CRPs concerned by this indicator	Indicators	Glossary & Comments	Deviation narrative (if actual is more than 10% away from target)	2013		2014		2015	
				Target	Actual	Target	TOTAL	Target	Actual
KNOWLEDGE, TOOLS, DATA									
All	1. Number of flagship "products" produced by CRP	Glossary: These are frameworks and concepts .. they should be likely to change the way stakeholders along the impact pathway allocate resources and/or implement activities .. change the way these stakeholders think and act. For the CRP MAIZE, each Flagship Project is a flagship "product.	Following a standardization of CRP structures, the MAIZE strategy was reorganized around five Flagship Projects (FPs) in 2014, encompassing the nine Strategic Initiatives of the original MAIZE proposal	10	10	5	5	5	
All	2. % of flagship products produced that have explicit target of women farmers/NRM managers	Included in FPs: FP1 – Maximizing value for money, social inclusivity through prioritizing WHEAT R4D FP3 – Partnership to accelerate genetic gain in farmers field FP4 – Sustainable intensification FP5 – Human and institutional capacities, scaling out and up	Following a standardization of CRP structures, the MAIZE strategy was reorganized around five Flagship Projects (FPs) in 2014, encompassing the nine Strategic Initiatives of the original MAIZE proposal	3	4	4	4	4	
All	3. % of flagship products produced that have been assessed for likely gender-disaggregated impact	Included in FPs: FP1 – Maximizing value for money, social inclusivity through prioritizing WHEAT R4D FP3 – Partnership to accelerate genetic gain in farmers field FP4 – Sustainable intensification FP5 – Human and institutional capacities, scaling out and up	Following a standardization of CRP structures, the MAIZE strategy was reorganized around five Flagship Projects (FPs) in 2014, encompassing the nine Strategic Initiatives of the original MAIZE proposal	10	10 of which 2 more in-depth	4	4	4	
All	4. Number of "tools" produced by CRP	Glossary: These are significant decision-support tools, guidelines, training manuals, software, and/or videos that are significant in that they should be likely to change the way stakeholders along the impact pathway allocate resources and/or implement activities		522 changed to 25	23 (17 co-developed with other CRPs)	26	39	25	
All	5. % of tools with explicit target of women farmers	Tools target men and women users equally							
All	6. % of tools assessed for likely gender-disaggregated impact	Tools are not assessed individually but at flagship product level							
All	7. Number of open access databases maintained by CRP	IWIS, GRIS (wheatpedigree.net), IWIP.org, rusttracker.org, Wheat Atlas and Wheat Doctor (taken off the web Dec 2013) **Not included**: Cereal Knowledge Bank, http://www.knowledgebank.irri.org/wheat.ht, maintained by IRRI (with 118,671 unique pageviews)		5	6	To be reviewed	11	5	
All	8. Total number of users of these open access databases	Unique visitors (**not included**: Cereal Knowledge Bank)			124,450	54,767	119,832	125,000	
All	9. Number of publications in ISI journals produced by CRP			121	121 (23 jointly with other CRPs)		107	120	
1,2,3, 4, 6	10. Number of strategic value chains analyzed by CRP	Ethiopia: addition 2013; 3 for India/CSISA (wheat value chains in states Bihar, Haryana and Madhya Pradesh)		5	4	2	10	5	
1,5,6,7	11. Number of targeted agro-ecosystems analysed/characterised by CRP								
1,5,6,7	12. Estimated population of above-mentioned agro-ecosystems								

CRP indicators of progress, with glossary and targets (cont'd).

WHEAT									
CRPs concerned by this indicator	Indicators	Glossary & Comments	Deviation narrative (if actual is more than 10% away from target)	2013		2014		2015	
				Target	Actual	Target	TOTAL	Target	Actual
TECHNOLOGIES/PRACTICES IN VARIOUS STAGES OF DEVELOPMENT									
All	18. Number of technologies/NRM practices under research in the CRP (Phase I)	Germplasm: 184,633 Agronomy: 372 From KPI database		260,000	124,517		200,005	120,000	
All	19. % of technologies under research that have an explicit target of women farmers								
All	20. % of technologies under research that have been assessed for likely gender-disaggregated								
1,5,6,7	21 Number of agro-ecosystems for which CRP has identified feasible approaches for improving ecosystem services and for establishing positive incentives for farmers to improve ecosystem functions as per CRP's recommends								
1,5,6,7	22. Number of people who will potentially benefit from plans, once finalised, for the scaling up of strategies								
All, except 2	23. Number of technologies /NRM practices field tested (phase II)	Germplasm: 1325 Agronomy: 76 From KPI database		2,600	2600		2,151	1,000	
1,5,6,7	24. Number of agro-ecosystems for which innovations (technologies, policies, practices, integrative approaches) and options for improvement at system level have been developed and are being field tested (Phase II)								
1,5,6,7	25. % of above innovations/approaches/ options targeted at decreasing inequality between men and women								
1,5,6,7	26. Number of published research outputs from CRP utilised in targeted agro-ecosystems								
All, except 2	27.Number of technologies/NRM practices released by public and private sector partners globally (phase III)	Agronomy: 14 From KPI database		50	46	50	24	50	

CRP indicators of progress, with glossary and targets (cont'd).

WHEAT										
CRPs concerned by this indicator	Indicators	Glossary & Comments	Deviation narrative (if actual is more than 10% away from target)	2013		2014		2015	
				Target	Actual	Target	TOTAL	Target	Actual
CAPACITY ENHANCEMENT AND INNOVATION PLATFORMS									
All	13. Number of trainees in short-term programs facilitated by CRP (male)	From CIMMYT Training database, plus Competitive Partner Grants and ICARDA Short-term = < 90 days		16,415	14,232 (171 with other CRPs)	17,000	4,088	3,000	
All	14. Number of trainees in short-term programs facilitated by CRP (female)	From CIMMYT Training database, plus Competitive Partner Grants and ICARDA Short-term = < 90 days		5,226	3,068 (73 with other CRPs)	To be reviewed	1,069	1,000	
All	15. Number of trainees in long-term programs facilitated by CRP (male)	From CIMMYT Training database, plus Competitive Partner Grants and ICARDA Long-term = > 90 days		40	121 (7 with other CRPs)	To be reviewed	44	24	
All	16. Number of trainees in long-term programs facilitated by CRP (female)	From CIMMYT Training database, plus Competitive Partner Grants and ICARDA Long-term = >90 days		23	65 (4 with other CRPs)	To be reviewed	36	24	
1,5,6,7	17. Number of multi-stakeholder R4D innovation platforms established for the targeted agro-ecosystems by the CRPs			43	45	50	50	45	
POLICIES IN VARIOUS STAGES OF DEVELOPMENT									
All	28. Numbers of Policies/ Regulations/ Administrative Procedures Analyzed (Stage 1)			2	6	2	8	2	
All	29. Number of policies / regulations / administrative procedures drafted and presented for public/stakeholder consultation (Stage 2)			1			3	1	
All	30. Number of policies / regulations / administrative procedures presented for legislation (Stage 3)			0	1	1	1	1	
All	31. Number of policies / regulations / administrative procedures prepared passed/approved (Stage 4)						1	1	
All	32. Number of policies / regulations / administrative procedures passed for which implementation has begun (Stage 5)						0	1	
OUTCOMES ON THE GROUND									
All	33. Number of hectares under improved technologies or management practices as a result of CRP research	Based on impact studies for select geographies: RWC-CSISA/Laser Land Levelling (2014 study): 1.5M ha, 1.2M farmers (1988-2013); Ethiopia 90% national wheat area covered w/ CGIAR-derived varieties (2014 study, 2015 global impact study): 1.53M ha, 3.06M farmers; China impact study (2015): CGIAR-derived varieties sown 1.815M ha, 6.05M farmers (1982-2012)		1,650,000	1,650,000		4,845,000	1,815,000	
All	34. Number of farmers and others who have applied new technologies or management practices as a result of CRP research	see above		2,802,000	2,802,000		10,310,000	3,082,200	

Annex 2. Performance indicators for gender mainstreaming with targets defined.

Performance Indicator	CRP performance approaches requirements	CRP performance meets requirements	CRP performance exceeds requirements
1. Gender inequality targets defined	Sex-disaggregated social data is being collected and used to diagnose important gender-related constraints in at least one of the CRP's main target populations	Sex-disaggregated social data collected and used to diagnose important gender-related constraints in at least one of the CRP's main target populations And The CRP has defined and collected baseline data on the main dimensions of gender inequality in the CRP's main target populations relevant to its expected outcomes (IDOs)	Sex-disaggregated social data collected and used to diagnose important gender-related constraints in at least one of the CRP's main target populations And The CRP has defined and collected baseline data on the main dimensions of gender inequality in the CRP's main target populations relevant to its expected outcomes (IDOs) And CRP targets changes in levels of gender inequality to which the CRP is or plans to contribute, with related numbers of men and women beneficiaries in main target populations
2. Institutional architecture for integration of gender is in place	- CRP scientists and managers with responsibility for gender in the CRP's outputs are appointed**,** have written TORS. - Procedures defined to report use of available diagnostic or baseline knowledge on gender routinely for assessment of the gender equality implications of the CRP's flagship research products as per the Gender Strategy -CRP M&E system has protocol for tracking progress on integration of gender in research	- CRP scientists and managers with responsibility for gender in the CRP's outputs are appointed, have written TORS and funds allocated to support their interaction. - Procedures defined to report use of available diagnostic or baseline knowledge on gender routinely for assessment of the gender equality implications of the CRP's flagship research products as per the Gender Strategy -CRP M&E system has protocol for tracking progress on integration of gender in research And A CRP plan approved for capacity development in gender analysis	CRP scientists and managers with responsibility for gender in the CRP's outputs are appointed, have written TORS and funds allocated to support their interaction. - Procedures defined to report use of available diagnostic or baseline knowledge on gender routinely for assessment of the gender equality implications of the CRP's flagship research products as per the Gender Strategy -CRP M&E system has protocol for tracking progress on integration of gender in research And A CRP plan approved for capacity development in gender analysis And The CRP uses feedback provided by its M&E system to improve its integration of gender into research

Annex 3. How WHEAT delivers towards impacts (CGIAR System Level Outcomes).

Figure A3-1. Overview of FP outputs delivering towards sub-IDOs and SLOs.

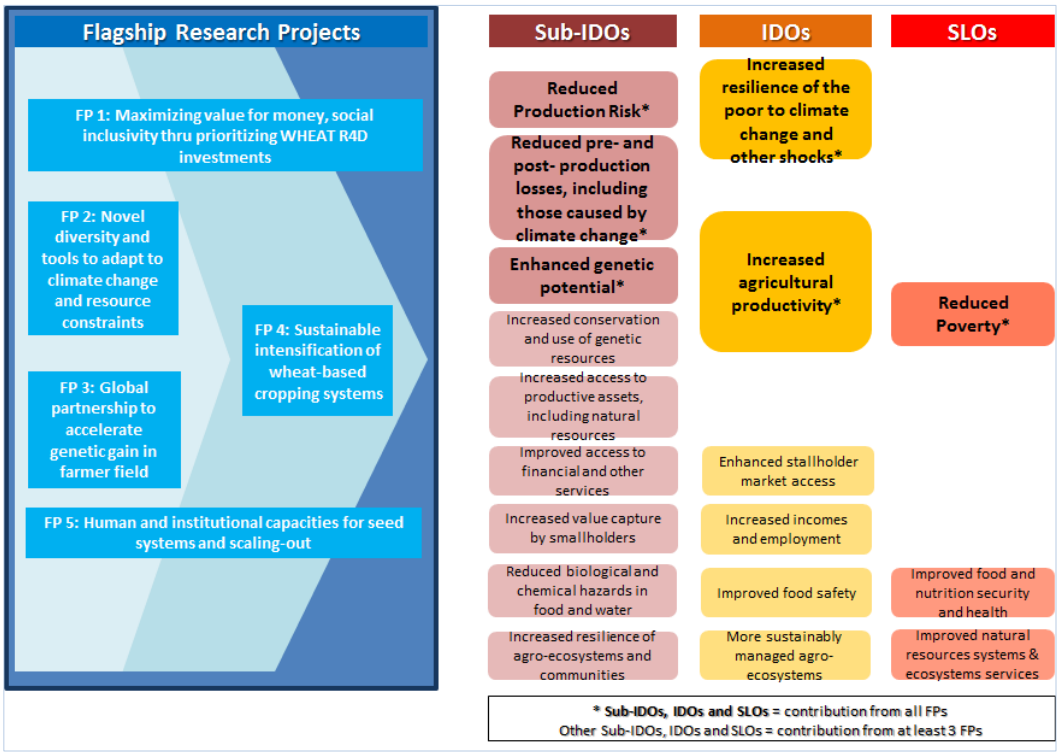
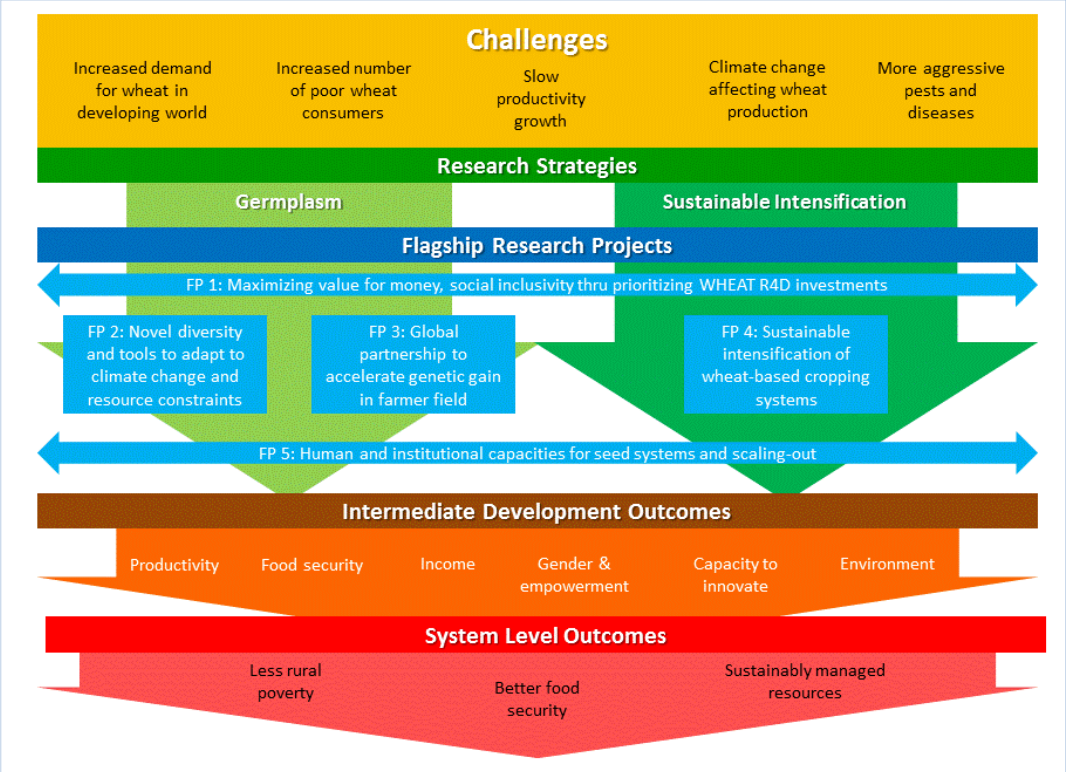


Figure A3-2. Wheat CRP impact pathways.



Annex 4. WHEAT-related impact studies published during 2004-2014.

A 2014 study identified total of 105 relevant reports for 2004-14, including 74 with a focus on CRP-Wheat and 31 studies across-CRPs. Most directly involved CIMMYT and/or ICARDA scientists as (co-) authors. A few were fully external, published and available in the public domain, examples including ACIAR's commissioned external impact assessment of CIMMYT implemented projects in Afghanistan (Jilani et al., 2013) and an independent journal paper evaluating CIMMYT achievements in NW Mexico – the cradle of the green revolution (Nalley et al., 2010). There are also hybrid publications – published by a CGIAR center but led by external scholars (e.g. Gollin, 2006).

Most relate to adoption and impacts of technological interventions associated with CIMMYT, ICARDA and/or CRP-Wheat for farmers and, to a more limited extent, consumers. The 105 studies amount to an average of 9.5 publications per year. About half were peer reviewed and a third (32%, 3.1 p.a.) were published in recognized journals (Table 1). Contrasting the pre-CRP years (2004-11) to the CRP-years (2012-14), the total number of annual publications increased from 9.1 to 10.7 p.a (17%). The number of peer reviewed publications doubled from 3.5 to 7.0 p.a., representing respectively 38% and 66% of the period's publications, although the number of recognized journals increased more modestly. For fuller details of this report and the publications listed, click here.

Annex 5: ICARDA Decentralisation funding through WHEAT Budget & Expenditure 2014

List of Approved ICARDA Decentralization Infrastructure and Equipment under CRP 3.1 - Wheat

Location of Infrastructure or Equipment	Description of Approved Items	Amount	Amount Used as of 2014	Balance Available as of End 2014 (Carried Over to 2015)	Amount Used from 1-Jan to 15-Jun-2015	Balance Available as of 15-Jun-2015
Egypt	Personal Computers	2,000	-	2,000	-	2,000
Egypt	Electrophoresis (Agarose)	10,000	14,703	(4,703)	-	(4,703)
Egypt	Elchrom ORIGINS Electrophoresis system	15,000	-	15,000	-	15,000
Egypt	Multichannel pipette set	8,000	-	8,000	-	8,000
Egypt	Hydroponic system	25,000	-	25,000	-	25,000
Egypt	Pick-ups	50,000	-	50,000	-	50,000
Egypt	Isolation cages	70,000	-	70,000	-	70,000
Egypt	Seed counter	18,000	-	18,000	-	18,000
Egypt	Plot Tractor (row group tractor, 75hp)	40,000	-	40,000	-	40,000
	Sub-Total Egypt	**238,000**	**14,703**	**223,297**	**-**	**223,297**
Ethiopia	Pick up	25,000	-	25,000	31,815	(6,815)
Ethiopia	Plot combine	130,000	-	130,000	145,485	(15,485)
Ethiopia	Seed treater	6,000	6,779	(779)	-	(779)
	Sub-Total Ethiopia	**161,000**	**6,779**	**154,221**	**177,300**	**(23,079)**
Turkey	Vehicles	30,000	-	30,000	36,475	(6,475)
Turkey	Pick-ups	37,000	22,723	14,277	27,083	(12,807)
Turkey	Plot combine	120,000	-	120,000	145,440	(25,440)
Turkey	Plotseed TC Plot seeder	36,000	-	36,000	-	36,000
Turkey	Seed treator Hege 11	15,000	-	15,000	-	15,000
Turkey	Thressher LD 350	38,000	-	38,000	-	38,000
Turkey	LD 350 Laboratory thresher.	10,000	-	10,000	-	10,000
Turkey	Hege 11 Liquid seed treater.	13,000	-	13,000	-	13,000
Turkey	Storage room	30,000	-	30,000	-	30,000
Turkey	Plastic houses	50,000	-	50,000	29,399	20,601
Turkey	Seed Store (5 C)	12,000	19,461	(7,461)	-	(7,461)
Turkey	Desktop computer	10,000	-	10,000	-	10,000
Turkey	MLN Sample cleaner	20,000	7,270	12,730	-	12,730
Turkey	Labe pert label printer N3000-1001	2,000	8,226	(6,226)	-	(6,226)
Turkey	Oven	3,000	-	3,000	-	3,000
Turkey	Liquid Nitrogen tank	13,000	-	13,000	-	13,000
Turkey	Field facilities	50,000	58,666	(8,666)	8,977	(17,642)
Turkey	Computers	6,000	-	6,000	-	6,000
Turkey	Cars	25,000	-	25,000	-	25,000
	Sub-Total Turkey	**520,000**	**116,345**	**403,655**	**247,374**	**156,281**
Morocco	Renovation of an office and laboratory building in Rabat and in Merchouch	71,000	-	71,000	-	71,000
Morocco	Generator 450 kva for Rabat	41,000	-	41,000	-	41,000
Morocco	Double cabine pick-ups to transport seeds	80,000	-	80,000	-	80,000
Morocco	Roller, 500 kg/m, 6 m working width	8,000	-	8,000	-	8,000
Morocco	***Special Additional Allocation:*** Equipments for 6 Laboratories (pathology, entomology, virology, physiology, cereal quality, biotechnology at 200,000 each)	150,000	-	150,000	180,392	(30,392)
	Sub-Total Morocco	**350,000**	**-**	**350,000**	**180,392**	**169,608**
	Grand Total	**1,269,000**	**137,828**	**1,131,172**	**605,065**	**526,107**