

Progress Report

2016

**Project Title: Enhancing Smallholder Wheat Productivity through Sustainable
Intensification in Wheat-based Farming Systems of Rwanda and Zambia (SWPSI)**

Grant Number: 2000001095

Reporting period: 23rd May 2016 – 31st December 2016

**Submitted By: The International Maize and Wheat Improvement
Centre (CIMMYT)**

to

The International Fund for Agricultural Development



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Funding for the research work in this report was provided by the International Fund for Agricultural Development, Rome Italy (IFAD). The project is implemented by the International Maize and Wheat Improvement Center (CIMMYT) in collaboration with national and regional partners, namely; the Rwanda Agriculture Board (RAB), Zambia Agriculture Research Institute (ZARI), and Centre for Coordination of Agricultural Research and Development for Southern Africa (CCARDESA).

Disclaimer

The authors accept full responsibility for the contents of this report. The report does not necessarily reflect the views of IFAD.

Summary

In most sub-Saharan African (SSA) countries, domestic wheat production is by far less than its consumption level. The disparity between growth in wheat consumption and domestic production is increasing over years. As wheat consumption outweighs domestic production, the only mechanism to fill the gap is through wheat imports that costs the region Billions of Dollar every year. On average, wheat import of the SSA constitutes up to 42% of the imports on agricultural products. Some of the countries in the region have a good potential for wheat production both in terms of suitable agro-ecology and land area. However, wheat production is not catching up to the level it has been expected.

These days, there are some initiatives in wheat research and development to support smallholder based domestic wheat production to enhance food security and reduce wheat import bills. The **"Enhancing Smallholder Wheat Productivity through Sustainable Intensification in Wheat-based Farming Systems of Rwanda and Zambia (SWPSI)"** project is one of these initiatives supporting research on smallholder wheat production in Africa. The project is financed by the International Fund for Agricultural Development (IFAD) and implemented by the International Maize and Wheat Improvement Center (CIMMYT) in collaboration with three other partners, namely: Rwanda Agriculture Board (RAB), Zambia Agriculture Research Institute (ZARI), and Centre for Co-ordination of Agricultural Research and Development in Southern Africa (CCARDESA).

The main focus of this research project is to develop a proof of concept that smallholder farmers in sub-Saharan Africa could competitively produce wheat and support their domestic consumption and eventually help their nation in reducing wheat import bills. The project assesses the wheat value chain to identify major production and marketing costs and associated constraints along the value chain that potentially impede the growth in domestic wheat production and productivity. In addition, the project also undertakes wheat yield gap assessment under smallholder farming to figure-out key constraints in attaining the productivity potential in smallholder wheat production system. Breeding proper wheat varieties that could perform best in the identified agroecologies in both target countries are also conducted. The breeding work includes both the introduction of new germplasm for adaptability test and also do selection on disease resistant traits.

The SWPSI project agreement was signed between IFAD and CIMMYT on 23rd May 2016 and subsequent sub-grant agreements between CIMMYT and the national and regional project implementing partners (RAB, ZARI and CCARDESA) were also signed in August 2016. Project launching workshop was conducted on the 17th June 2016 in Kigali at the presence of delegates from the implementing partners (RAB, ZARI and CCARDESA). Site selection for the agronomic experiments and socioeconomic research were done in both target countries in close collaboration between staffs from CIMMYT and national implementing partners (RAB and ZARI). In Rwanda, the first season on-farm agronomic trial was established and baseline household and plot level production and marketing survey was also conducted. As the wheat cropping season in Zambia starts at early January, there was not much field activities done in Zambia during this reporting period.

This technical report covers the period from 23rd May 2016 to 31st December 2016 (the first six months of the project). Highlights of activities implemented during this period and planned activities for the months to come are presented in the report.

Programme goals and objectives

The overall goal of this project is to contribute to food security and nutrition and, rural incomes. The objective is to establish the potential of smallholder wheat production to increase food security and reduce wheat import bills in Rwanda and Zambia, draw lessons to inform wheat sector development and subsequent for scaling-up of initiatives to increase wheat farm productivity. The project has four specific objectives:

- a) Establish the technical and socio-economic success factors for profitable wheat production by smallholder farmers in the core countries (Rwanda and Zambia) and spill-over countries (Tanzania, Mozambique and Madagascar).
- b) Adapt appropriate wheat technologies and management practices to smallholder wheat producers in the two core countries.
- c) Build the capacity and effectiveness of key actors in the wheat value chains in the two core countries.
- d) Establish the business case for investment in wheat production and markets by generating wheat-related knowledge and learning packages, and sharing them widely with stakeholders.

Programme components/outputs

The project has four core outputs. Under these outputs, there are a number of sub-outputs as well. These core outputs and sub-outputs are presented below.

- a) Technical and socio-economic success factors for profitable wheat production by smallholder farmers in Rwanda and Zambia (core countries) and spill-over countries (Tanzania, Mozambique and Madagascar) established.
- b) Proven appropriate wheat technologies and management practices for smallholder wheat producers in relation to the core countries identified.
- c) Capacity and effectiveness of key actors in the wheat value chains built in the two core countries.
- d) Business case for investment in wheat production and markets established.

Key achievements against targets (output or outcome levels) under component/outputs as presented in the approved proposal (refer to the logframe). Summary of Progress from the previous report (not *applicable for Year 1 progress report*)

The project implementation started on 23rd May 2016. Thus, this report is for the first six months where not many achievements against targets could be reported.

Innovations (if applicable) and scaling up/adoption

Field experiments to grow wheat on semi-permanent raised beds (for which planting could be mechanized using two-wheel tractor) are under way. Semi-permanent raised beds are expected to reduce tillage, facilitate weeding, reduce the quantity of seeds used, improve water management (draining, harvesting) and allow intercropping in wheat field. These results are not yet ready to report in here.

Other field experiments to link wheat canopy NDVI to nitrogen demand at critical stages (first node, booting) are also under way.

Knowledge Products (*if applicable*)

Too early to report on knowledge products generated during this first six months of the project implementation period.

Gender

Women farmers were incorporated in the agronomic field experiments both in Rwanda and Zambia. In addition, good number of women headed households (45 out of the total 160 HHs) were interviewed during the baseline survey in Rwanda to document both the production and marketing cost structures of smallholder wheat in Busogo area. With some additional information at a plot level, the collected data will also be used for yield gap analysis. This helps to assess any difference between male and female headed households in terms of wheat productivity gap and other gender related factors contributed towards the disparity (if any).

Partnerships

So far the partnership has been strengthened among the project implementing collaborators (CIMMYT, RAB, ZARI and CCARDESA). In the future, more partnership will be developed with wheat millers, wheat seed producers and dealers, and other relevant stakeholders along the wheat value chain to establish or strengthen market linkages for a reliable and sustainable wheat production and marketing both in Rwanda and Zambia.

IFAD visibility activities (*if Applicable*)

The project is still at its early stage and not yet developed knowledge products that could be shared with other relevant bodies where donor visibility activities could be carried out.

Conclusions (including priorities for next reporting period)

During this reporting period (23rd May 2016 to 31st December 2016), the main activities implemented were conducting project inception workshop at Kigali where all the implementing partners were represented by their delegates. During this workshop, the importance of smallholder wheat production in both countries were presented. In addition, the portfolio of wheat research conducted by the national research institutes (RAB and ZARI) were also highlighted with a special focus on agronomic practices and varietal development and adaptation to different agro-ecologies and biotic stresses. Rust in Rwanda and pests in Zambia are the main challenges in rain-fed wheat production. Varietal selection and adaptation trials done towards responding to these challenges in both countries were presented. The project goal, objectives, detailed activities and the role of each implementing partner in this specific project were identified and discussed on.

Sub-grant agreements between CIMMYT and the other three project implementing partners (ZARI, RAB and CCARDESA) were signed and the first transfer of fund to each of them were made according to the signed agreement.

On-farm experiments of wheat planted on semi-permanent raised bed and nitrogen trials to establish a relation between wheat canopy NDVI and nitrogen demand at critical stages (first node, booting) were established in Rwanda. The wheat crop from this first season trial will be harvested in February 2017.

Wheat nurseries sent from CIMMYT Head-Quarter (Mexico) to RAB were also grown at Rwerere and Kinigi research stations for evaluation against rust resistance and grain yield performance compared to the well established 'check' varieties like Njoro, Maroko, and Musama. Harvest results will be reported in year two (2017).

In the next reporting period:

In the next reporting period (January –December 2017), the following activities will be implemented in the target and spill-over countries (as explicitly stated below).

- Analysis of the base-line survey data collected in Rwanda will be done. In doing so, we will document the major technical and socio-economic factors contributing to the profitable production and marketing of wheat under smallholder farmers in Rwanda (with specific reference to Busogo area).
- Same agronomic experiments and variety adaptation trials will be established at Mpika in Zambia.
- Season 2 agronomic and varietal adaptation trials will continue in Rwanda as well.
- Innovation platforms will be strengthened at community and district level for better information exchange on wheat and also look for potential solutions to the identified major constraints in wheat value chain with a special focus on wheat produced and marketed by the smallholder farmers.
- A project review and planning meeting will be conducted around the end of year 2 to assess key results and knowledge products generated during the first two years and revise the project activity plans in such a way that the remaining expected outputs could be achieved by the end of the project period.
- A scoping study on smallholder wheat production and marketing, value chain assessment and the profitability and competitiveness of smallholder wheat production in the three spill-over countries (Tanzania, Mozambique, and Madagascar) will be conducted through hiring local consultants with good knowledge of wheat value chain in the respective countries. Results from these analysis will be presented on the mid-term project review and planning meeting for validation. Results will also be published using appropriate outlet based on the analysis quality.
- How smallholder wheat production could be enhancing using proper machineries that could fit to the soil nature and practices in both target countries will be tested.
- At different stages of wheat growth, farmers will be invited to visit the on-farm agronomic and varietal trials (demonstrations) to evaluate the performance of different wheat varieties and wheat under different agronomic practices (bed-type and, rate and timing of nitrogen application).

MAIN REPORT: (20 Pages excluding Annexes and Appendices).

Project Title: Enhancing Smallholder Wheat Productivity through Sustainable Intensification in Wheat-based Farming Systems of Rwanda and Zambia

I. BACKGROUND

Project goals:

The overall goal of this project is to contribute to food and nutrition security and rural incomes of smallholder farmers in wheat-based farming systems of Rwanda and Zambia.

Project objectives:

The main objective of the project is to establish the potential of smallholder wheat production to increase food security and reduce wheat import bills in Rwanda and Zambia, draw lessons to inform wheat sector development and subsequent for scaling-up of initiatives to increase wheat farm productivity.

The specific objectives

The project has four specific objectives:

- i. Establish the technical and socio-economic success factors for profitable wheat production by smallholder farmers in the core countries (Rwanda and Zambia) and spill-over countries (Tanzania, Mozambique and Madagascar).
- ii. Adapt appropriate wheat technologies and management practices to smallholder wheat producers in the two core countries.
- iii. Build the capacity and effectiveness of key actors in the wheat value chains in the two core countries.
- iv. Establish the business case for investment in wheat production and markets by generating wheat-related knowledge and learning packages, and sharing them widely with stakeholders.

Project Components/Output:

The project has four core outputs, each with a number of sub-outputs. These are:

a. *Technical and socio-economic success factors for profitable wheat production by smallholder farmers in Rwanda and Zambia (core countries) and spill-over countries (Tanzania, Mozambique and Madagascar) established.*

- Value chain actors and their linkages along the whole wheat value chain in the targeted areas of Rwanda and Zambia (Year 1) and spill-over countries (Year 2) are identified through review of literature supported by focus group discussions and key informants' interviews.
- Innovation Platforms (IP) are established at District/Community level consisting key stakeholders to strengthen wheat value chain in the two core countries.
- Production and marketing cost structures of wheat is assessed to examine the competitiveness of smallholder wheat production in both the core

(Rwanda and Zambia) and spill-over countries (Tanzania, Mozambique and Madagascar).

- Yield gap in smallholder wheat production and the critical factors for increased wheat productivity both in the core and spill-over countries are identified.
- Market linkages between smallholder wheat producers and wheat millers in the targeted communities of both core countries are established and/or strengthened.

b. *Proven appropriate wheat technologies and management practices for smallholder wheat producers in relation to the core countries identified.*

- Based on the identification of critical factors currently limiting the productivity and profitability of smallholder wheat production in these countries, inventory of improved wheat technologies available for a direct up-scaling to smallholders in the targeted wheat potential areas of Rwanda and Zambia are taken.
- Suitability of the selected packages of improved wheat technologies at farm level in each target community are adapted and validated through the establishment of farmer-managed demonstration and adaptation trials.
- Farmers' access to pre-and postharvest machineries/technologies reducing drudgery for different social groups and gender categories in wheat production are facilitated. Cost-saving technologies (for direct seeding, precise application of fertilizer, efficient irrigation, etc.) will also be considered.
- Dissemination of improved wheat seed and other complementary inputs to the target communities are facilitated.

c. *Capacity and effectiveness of key actors in the wheat value chains built in the two core countries*

- Capacity gaps in technology utilization and management practices in wheat production systems and value chains are identified.
- Farmers and extension agents are trained on wheat seed and grain production and management practices.
- Stakeholders are trained on how to establish/strengthen and effectively utilize innovation platforms
- Stakeholders are trained in wheat post-harvest handling and marketing

d. *Business case for investment in wheat production and markets established.*

- New knowledge and information generated on sustainable and competitive smallholder wheat production and marketing, including seed systems and the farm-to-fork value chain are documented to strengthen the business case for investment in wheat production and markets
- Documented knowledge and information are shared with potential stakeholders through different means such as IPs, publications, community radio, etc.
- In country farmer-to farmer exchange visits are organized in Rwanda and Zambia to observe and share performance on wheat technologies and market linkages.
- Organize inception (Year 1), mid-term review (end of Year 2 or beginning of year 3), and end of project (Year 4) workshops. Policy makers from the spill-over countries are invited to the last two workshops to get updated and reflect on the research findings from the core and spill-over countries.

II. IMPLEMENTATION PROGRESS:

A. Project expenditure by year (in USD)

Total Project Budget	Year: 1	Year 2	Year 3	Total Expenditure
Funds received	0			
Expenditure	105,327			
Balance	(105,327)			

B. Brief comments on expenditure

Till this report was finally compiled, the expected initial transfer of fund from IFAD to CIMMYT has not reached CIMMYT's Account. Thus, CIMMYT is pre-financing the project implementation activities with the expectation that the fund will arrive the soonest possible. The above indicated expenditure till the end of 2016 is 25% of year 1 funding. As field activities mainly follow the cropping season, not much field expenses were incurred in Zambia compared to Rwanda. More activities are being going on in 2017 as the cropping season started in Zambia and the second season in Rwanda will also start in few weeks.

C. Physical progress by component/output against targets

During this reporting period, field agronomic and varietal test experiments were done only in Rwanda as the season for wheat in Zambia starts early January. Thus, the physical progress reports are focussing more on Rwanda for this reporting period.

Project Launching Workshop

The project launching workshop was conducted on 17th June 2016 in Kigali where staffs from CIMMYT, RAB, ZARI and CCARDESA attended this one-day workshop that highlighted the project objectives and activities. The overview of wheat research and production in both target countries were also presented. The project launching event was featured on CIMMYT Newsletter: <http://www.cimmyt.org/smallholders-in-rwanda-and-zambia-to-enhance-wheat-productivity-through-new-project/>



Figure 1. Project launching workshop participants (Kigali, June 17, 2016)

Project site identification visits in Rwanda and Zambia

A team from CIMMYT and the respective national partners in Rwanda and Zambia participated in project site identification to establish on-farm trials to assess major constraints in smallholder wheat production and productivity.

Site identification in Rwanda

During 16-20 August 2016, a team of Socio-economist, Systems Agronomist, and Breeder from CIMMYT and RAB travelled to four distinct sites in Northern Province to identify a proper site to experiment on agronomic practices, yield enhancing and disease resistant varieties, linking wheat producers with better paying and reliable markets. Locations visited were Nyamicuc in Butaro sector, a village in Gahunga sector, Busogo/Rubaka in Gataraga sector and Rebero/ Ntarabana in Rusiga sector. Among these, the team evaluated and decided to establish the experiments at Busogo/Rubaka. The area has good potential for wheat, good soil for mechanization, wheat is grown in both seasons.

Project site selection in Mpika Zambia

Like the site selection exercise in Rwanda, a team from CIMMYT and ZARI also travelled to Mpika area in Zambia during the first week of November 2016 to do the on-farm experimental site selection. Accordingly, two sites were identified for the experiment: Muchinga in Mpika District and Mufubushi in Mpika Main camp. Five volunteer farmers (one female farmer) were also registered to establish the agronomic trials when the wheat cropping season starts during the first week of January 2017.



Figure 2. Experimental site selection at Mpika (Zambia)

First season agronomic experiment in Rwanda

In Rwanda, during the 2017A season (September 2016 - February 2017) on-farm agronomic experiments were established at Busogo area. The agronomic trials established were semi-permanent raised bed for wheat planting and Nitrogen fertilization. Yield from wheat planted on the semi-permanent raised bed will be compared with the conventional raised bed farmers are preparing each season. The N-application experiment has six different N levels: 0 Kg/ha, 10 Kg/ha, 20 Kg/ha, 50 Kg/h, 100 Kg/ha, and 150 Kg/ha and this helps in establishing wheat yield relationship with level of N-application for the specific location.



Figure 3. Planting wheat on flat and raised-based system (*Busogo, Rwanda*)



Figure 4. Wheat experimental plot at germination stage (*Busogo, Rwanda*)



Figure 5. Wheat Nitrogen application experiment at grain filling stage (*Busogo, Rwanda*)

Rwanda Household and Plot level survey

During December 2016, a total of 160 farmers (45 female headed and 115 male headed households) and their main wheat plots were surveyed to document their input use in wheat production (including varieties grown), and how the wheat produced during the previous season was utilized. Data was entered and some preliminary analyses were done.

Accordingly, Maroko and Njoro wheat varieties are what farmers in Busogo area grow most commonly.



Figure 6. Enumerators' training at RAB-Musanze (Rwanda)

D. Progress by Components/Outputs realized since the submission of previous report (*not applicable for Year 1 progress report*)

Output 1: Technical and socio-economic success factors for profitable wheat production by smallholder farmers in Rwanda and Zambia (core countries) and spill-over countries (Tanzania, Mozambique and Madagascar) established.

Plot and household survey conducted in Rwanda and data analysis will follow.

Output 2: Proven appropriate wheat technologies and management practices for smallholder wheat producers in relation to the core countries identified.

On-going agronomy experiments and varietal test

Output 3: Capacity and effectiveness of key actors in the wheat value chains built in the two core countries

Not yet started.

Output 4: Business case for investment in wheat production and markets established.

Not yet started.

E. Difficulties encountered and measures taken to resolve problems

Not many difficulties were encountered during this reporting period except some delays in processing sub-grant agreement with national and regional partners.

III. INNOVATIONS (If applicable) and their up/adoption

This is just the first six months of the project implementation period. So, no new innovation was identified for up-scaling or adoption purpose.

IV. GENDER ISSUES

Women farmers were included in the agronomic on-farm experiments. Women headed households were also got surveyed in documenting the plot and household level information on wheat production and marketing. Results from these experiments and survey data will help us to assess the gender related challenges in smallholder wheat production and marketing.

V. PARTNERSHIPS

The existing partnership among CIMMYT, RAB, ZARI and CCARDESA on the project implementation is getting stronger through regular communications and joint field activities in both target countries (Rwanda and Zambia).

In Rwanda, Bakhresa Grain Milling Ltd., wheat processor (miller) based at Kigali, was invited to the project launching workshop. During this meeting, it was learned that the miller is getting only 1% of its wheat supply from domestic producers. The rest is coming from Europe and Argentina as import. Thus, the collaboration with this miller will be enhanced to link it with wheat assemblers at the project site in Busogo so that quality wheat grain produced by local smallholder farmers could be supplied to the miller and help in securing sustainable wheat market at a better market price for all actors along the value chain.

VI. CONCLUSIONS (including outline work plan for next reporting period if applicable).

During this reporting period (23rd May 2016 to 31st December 2016), the main activities implemented were conducting project inception workshop at Kigali where all the implementing partners were represented by their delegates. During this workshop, the importance of smallholder wheat production in both countries was presented. In addition, the portfolio of wheat research conducted by the national research institutes (RAB and ZARI) were also highlighted with a special focus on agronomic practices and varietal development and adaptation to different agro-ecologies and biotic stresses. Rust in Rwanda and spot blotch and pests in Zambia are the main challenges in rain-fed wheat production. Varietal selection and adaptation trials done towards responding to these challenges in both countries were presented. The project goal, objectives, detailed activities and the role of each implementing partner in this specific project were identified and discussed on.

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- A project review and planning meeting will be conducted around the end of year 2 to assess key results and knowledge products generated during the first two years and revise the project activity plans in such a way that the remaining expected outputs could be achieved by the end of the project period.
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- How smallholder wheat production could be enhancing using proper machineries that could fit to the soil nature and practices in both target countries will be tested.
- At different stages of wheat growth, farmers will be invited to visit the on-farm agronomic and varietal trials (demonstrations) to evaluate the performance of different wheat varieties and wheat under different agronomic practices (planting bed-type and, rate and timing of nitrogen application).

Annexes

Annex 1: Cumulative achievements

Targets in Logframe of the approved proposal	Achieved so far	100% achieved against target in proposal
4,000 men and women smallholder farmers adopted improved wheat technologies in the target countries.	Not yet	
80 farmer-managed trials established.	12.5% (5 farmers each both in Rwanda and Zambia)	
4,000 individuals participate (disaggregated by gender) in any of the capacity building activities undertaken.	Not yet	
At least three key technical and socio-economic success factors for profitable smallholder wheat production in Rwanda and Zambia identified.	Not yet	
At least three proven wheat technologies identified	Not Yet	
20 actors in four wheat value chains trained on basics of functional and inclusive value chains.	Not Yet	
At least six business cases for investment documented.	Not yet	
Five location and gender specific profitability analysis on smallholder wheat production (i.e., two for the core and three for the spill-over countries)	Not yet	
At least three major constraints and opportunities identified in smallholder wheat production and marketing (along the value chain)	Not yet	
At least three improved wheat varieties and agronomic practices tested	100%	Nitrogen application rate and timing, raised- vs. flat-bed wheat planting, and new wheat nurseries

		resistant to rust are under experiment in both Rwanda and Zambia.
Four training manuals/protocols developed	Not yet	
At least five publications are developed and shared with relevant stakeholders	Not yet	

Annex 2: Farmers participating in Project Activities

Activity	Women	Men	Total
On-farm agronomic experiment	3	7	10
Plot and household level wheat production and marketing data collected (Rwanda)	45	115	160
Total	48	122	170

Annex 3: Knowledge Products

As the project implementation is at its initial stage, no knowledge product has been developed yet.