Understanding rice farming practices through SRP (Sustainable Rice Platform) survey in Burundi

Transforming Agri-Food Systems in West and Central Africa

Work Package 1: Sustainable production intensification and diversification in Rwanda, Burundi and Democratic Republic of the Congo

Report

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Introduction

Rice is one of the main staple foods in Burundi, along with beans, banana, and maize. It is consumed in a variety of ways including as an accompaniment with stews and sauces, as a main course, and in soups and porridges. It is primarily grown in the lowlands by smallholder farmers who cultivate on small plots of land, often using traditional practices.

Despite its importance, rice production in Burundi faces various challenges, including low productivity, biotic and abiotic stresses, limited access to modern technology and inputs (IRRI, 2018). Rice imports are also high in Burundi, with the country relying on imports to meet the demand for rice. However, the Burundian government has been implementing policies and programs to increase rice production and reduce imports, such as providing farmers with improved seeds and inputs and investing in irrigation infrastructure (MINISTERE DE L'AGRICULTURE ET DE L'ELEVAGE, 2014).

As part of the CGIAR Regional Initiative Transforming African Food Systems - West and Central Africa (TAFS-WCA), surveys with rice farmers in Burundi was conducted in three rice-growing areas of Burundi: Imbo plain, Moso and high elevation marshland. The survey aimed to assess the SRP (Sustainable Rice Platform) standards and performance indicators for rice farmers in order to understand current rice farming practices and production constraints and then propose appropriate technologies to improve their production in a sustainable manner.

The Sustainable Rice Platform (SRP) is a global multi-stakeholder partnership that was established in 2011 by the United Nations Environment Program (UNEP), Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ), the International Rice Research Institute (IRRI) and private sector partners to promote sustainable rice farming (SRP, 2020b). The objective of the platform is to promote sustainability in the rice sector, which is a critical source of food for millions of people around the world. SRP has developed a set of standards and performance indicators that are designed to help rice farmers improve their sustainability and their performance. These standards and indicators cover a range of issues, including water use, greenhouse gas emissions, and social and economic sustainability. This report represents the methodology and the preliminary results of the SRP survey conducted in Burundi**.**

Methodology and data collection

This study was conducted in collaboration with IRRI Burundi, thus nine IRRI researchers were trained as interviewers. Prior to the field survey, these interviewers received online training on the understanding of the content of the questionnaire by AfricaRice agronomy team based in Madagascar. Physical training was held a day before the survey to train them for data collection with the tablets. The platform "Survey solutions" was used to create the survey in numerical format and manage the data. Interviewers and supervisor accounts were created for piloting the field survey. Each enumerator has an interviewer account. Android application "Interviewer" was used for data collection on the tablet. After synchronization via the Internet, the data was automatically transmitted to a server. The role of the supervisor was assigned to the AfricaRice agronomist research Assistant, to control the quality of submitted data.

The questionnaire is interactive and has two interdependent parts. The first part is about standards which include 41 requirements on farm management, pre-planting, water use management, nutrient management, integrated pest management, harvest and post-harvest management, health and safety of chemical applications, labor rights. At the end of the first part, a final score is given for applicable standards and presented on a 0-100 scale. This score defines the level of sustainability of rice production. The second part concerns performance indicators which includes rice profitability and productivity, water, nutrient and pesticide use efficiency, youth inclusion and women's empowerment. Each requirement in the standard is designed to address one or more SRP performance indicators.

The survey was carried out in three rice-producing areas of the country: Imbo Plain, Moso lowland and High elevation marshland from 18th to 23rd October 2022. A week before the survey, a preliminary field visit was made by an IRRI agronomist researcher to select the communes per region and ensure the smooth running of the survey. For data collection, 27 communes in 11 provinces of the three areas were selected (Figure1). The agronomist based in each commune was in charge of farmer selection for the interview.

As the questionnaire was quite long, the farmers selected for the interview per commune were gathered in the same place in order to save time and reach the targeted number of farmers (at least 150 in Burundi). The team of interviewers was split into 2 groups to ensure the coverage of the area in a week time. The interview was done individually per farmer.

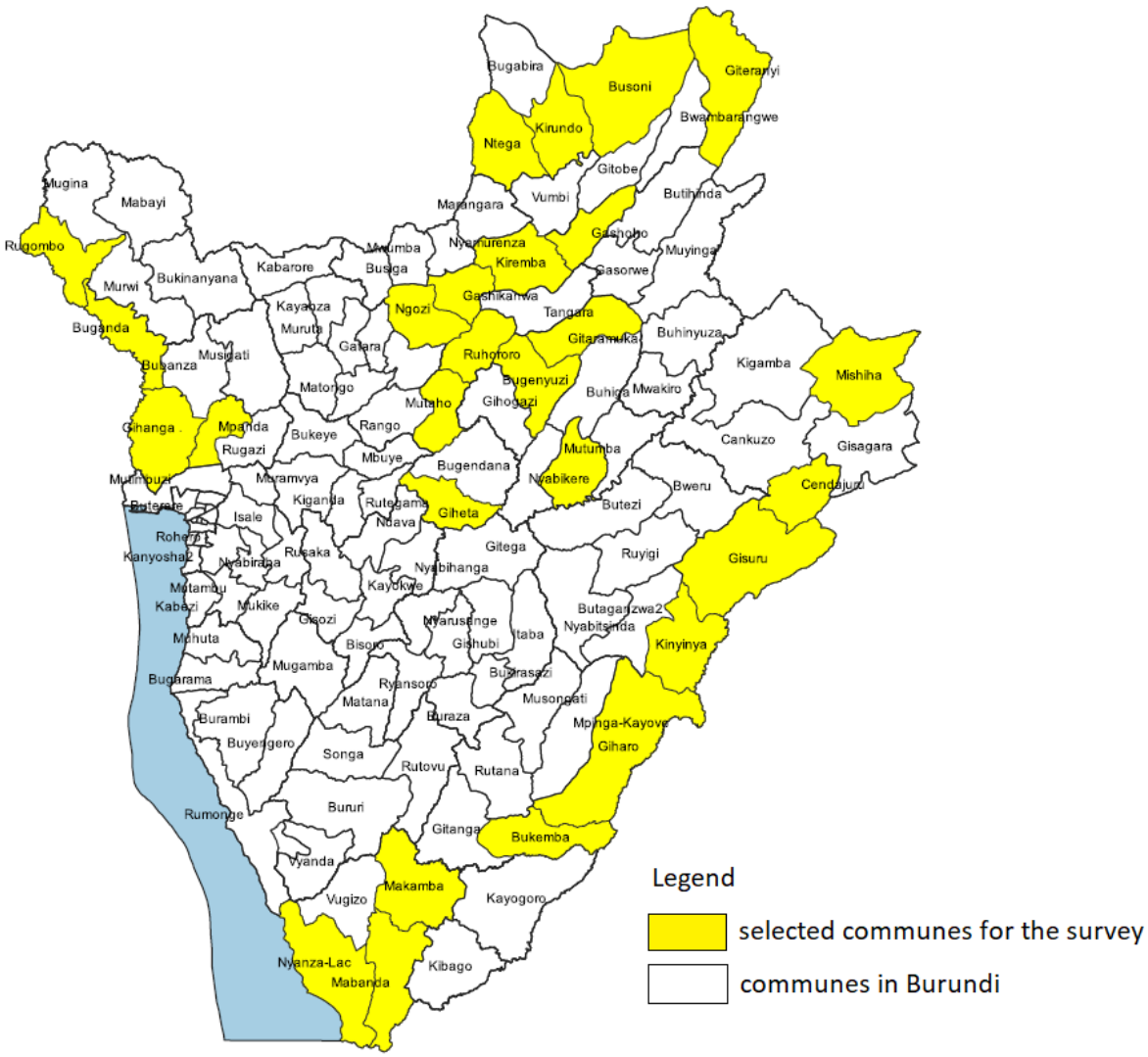

Figure 1: Selected communes for the survey in Burundi

Field challenge and limitation

One of the major challenges was to achieve the objective of covering the rice production areas with the required number of surveyed farmers while ensuring quality data. The average interview time per farmer was 1.5 hours.

However, the reliability of some of the data collected is not fully assured, even though the enumerators did their best to obtain such exact information from the farmers. These concerns especially the numerical data on productivity and profitability. Some farmers are not sure of the size of their plot, the quantity of agricultural inputs used, the amount of production obtained, or the total cost of each activity during the season. However, the data collected allowed us to see the gaps in their production system and how to technically improve rice farmers' productivity.

Data analysis

Descriptive statistics and multiple correspondence analysis (MCA) were used for the analysis.

Results

1) General characteristics of rice farms: farm size, farming system and rice varieties

A total of 151 rice farmers comprising 102 males and 49 females participated in the survey. The table below represents the distribution of the surveyed farmers by rice-growing areas.

Table 1: Number of farmers interviewed per region by gender

Rice growing area	Imbo	Moso	High elevation
Male	18	37	47
Female	16	12	21
Total	34	49	68

The result presented that 60% of interviewed farmers hold a land between 1 and 4 ha, 34% has less than 1 ha and 6% more than 4 ha. Figure 2 represents the percentage of farmers in each region who fall under each farm size category. These farms size includes areas for all crops, not just rice. The actual rice field cultivated per farmers ranged from 0.01 to 3 ha with an average of 0.37 ha. Regarding farm management, 96 % of farmers indicate they manage their farm by themselves. For the remaining 4%, hired labor or farm management service are the responsible for decision-making in rice farming. To perform the main farming activities, the majority of farmers (96%) used hired labor. For the 4%, family labor is organized for all activities.

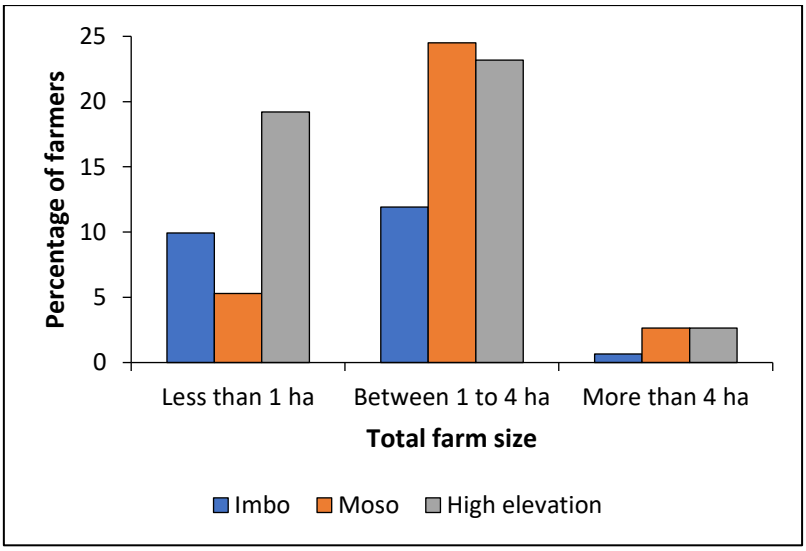

Figure 2: Distribution of farmers across different farm size categories in each rice growing areas in Burundi

Rice is cultivated during two main seasons in Burundi: the first season from January to June and the second season from July to December. The farming system used by farmers is represented in the figure 3 below.

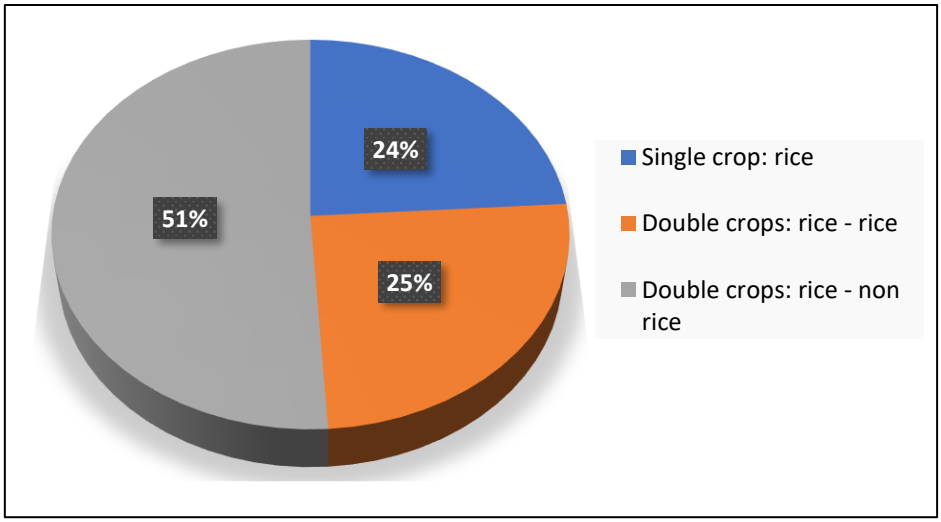

Figure 3: Farming system used by farmers

The popular rice varieties used by farmers are different from a location to another. Table 2 presents the list of most grown rice varieties cited by interviewed farmers per region. Majority of farmers do not know the official name given to the variety; they gave a local name for the rice variety.

Only 12% of farmers are members of a farmer cooperatives or seed producers' group.

Table 2: Most grown rice cultivars cited by farmers per rice-growing area in Burundi

Imbo	Moso	High elevation
1. Gwizumwimbu	1. Mugwiza	1. Kigori
2. Mugwiza	2. Gwizumwimbu	2. Yunyin
3. Kazosi	3. Fashingabo	3. Rubabi
4. Nyagatwenzi	4. SUPA	4. Musomati
5. Fashingabo	5. Kalamata	5. Gikokora
	6. V18	6. Kirundo
		7. Kigingi or L662-3-9

The results indicate that three out of the five most widely cultivated rice varieties in Imbo, and two out of six in Moso are from IRRI. However, none of the most commonly cultivated varieties in the High Elevation region are from IRRI. This suggests that IRRI may need to focus on developing rice varieties that are better suited to the High Elevation region to increase their adoption by farmers in that area. Therefore, it can be recommended that IRRI invest more resources in developing and promoting rice varieties that are well adapted to the climatic conditions of the High Elevation region.

2) Farm management

Majority of farmers (81%) has a written crop calendar which includes the expected date for major-field activities for the season. However, data record kept by farmers are minimal or even none. The data that is recorded, if any, is basic and may include information such as field size, seed variety, fertilizer and pesticide applied, quantity of paddy harvested. Intermediate data (more precise data with international unit) are collected by external partners if there are a collaboration with farmers.

In the last 5 years, farmer training, information, and support needs are almost assessed. Fifty five percent of them received training on rice production and applied what they learned from the training.

No training from SRP authorized training provider was not yet done in the region at the time of the study.

3) Pre-planting: heavy metal and soil salinity assessment, invasive species, land leveling and seed quality

No risk assessment on milled grain rice or soil contamination from heavy metals such as arsenic, cadmium, chromium was conducted within 5 years.

About soil salinity, few farmers growing rice from Imbo plain mentioned that there is a risk of soil salinity evaluated within 3 years and mitigation/ adaptation measures are taken. In other areas, no assessment of risk of soil salinity was done.

Farmers indicate that no invasive species have been introduced intentionally since 2009.

Majority of land under cultivation are flat land or terraces and 80% of farmers indicate that their land has been leveled.

Regarding seed quality, among the interviewed farmers, 56 % use certified and pure quality seeds while 44 % relies on self-saved seeds from the previous season (Figure 4). The percentage of farmers using certified and pure quality seeds varies from one region to another: it is 91% in the Imbo plain, 49% in Moso and 44% in the high elevation ecology, which indicates that the Imbo plain farmers are the most advanced in the adoption of rice production technologies.

Among the 44% who do not use certified seed, 13 % use seeds with quality control, 8 % use own saved seeds without quality control but not exceed three crop cycles and the remaining 23 % farmers use self-saved seeds for more than three crop cycles. Seed with quality control must meet the criteria of varietal purity including rogueing in the field (removal of off-type plants), free of weed seeds, high germination rate, safe storage, fungal and pest control.

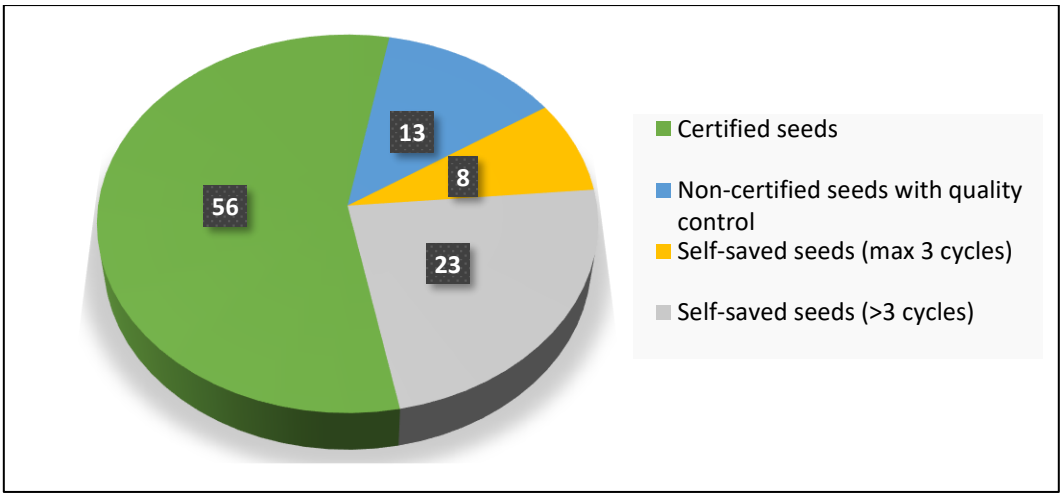

Figure 4: Percentage of farmers using different seed sources

Due to the non-use of certified seed, certain rice farmers have to use high seed rates to avoid low germination rate. The multiple correspondence analysis showed a strong correlation with the seed source, the seed rate and the rice-growing conditions (Figure 5). Variables that are close together are highly correlated, while variables that are far apart are poorly correlated. The figure below shows that

farmers use certified seed with normal seed rate (12 to 30 kg/ha) under irrigated lowland conditions than under rainfed lowland conditions. Those who do not use certified seed like self-saved seeds for more than three cycles use high seed rate more than 30 kg/ha. The recommended seed rate by the Ministry of Environment, Agriculture and Livestock in Burundi for transplanted rice is 12-15 kg/ha.

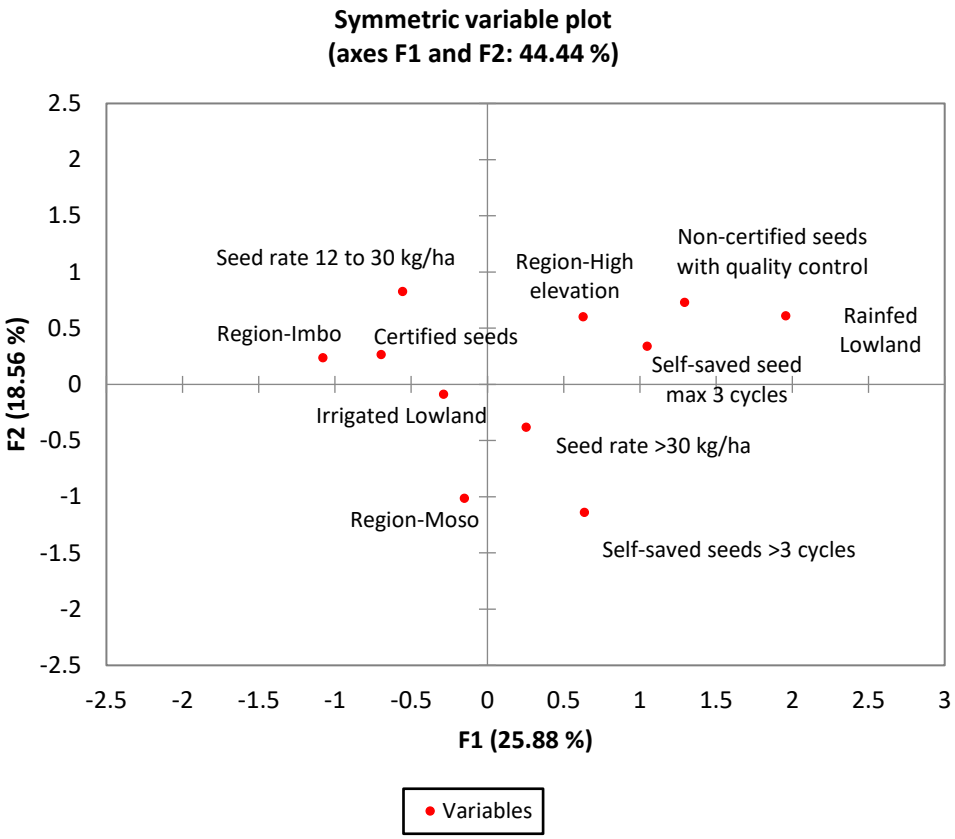

Figure 5: Relationship between the seed source and the seed rate used

4) Water use and drainage

The results showed that 13% of farmers cultivate their rice field under rainfed conditions, 87% irrigated their field including 22% area flood prone and 65% not flood prone. For rainfed production, to enhance water use efficiency, farmers tried to plant in time according to the local climate, establish the crop on direct seeding and use suitable varieties for local conditions. For flood prone irrigated production system, measures to enhance water use efficiency is not fully followed by farmers. These measures include timely crop establishment to avoid crop submergence during expected floods, one mid-season drainage event at least, and use of flood-tolerant varieties.

For irrigated production system not flood prone, techniques to improve water use efficiency such as a dry tillage before flooding, leveling and strong bunds and drainage of field two weeks before harvesting are mostly applied by rice farmers. However, the technique of alternate wetting and drying and the use of short or medium-duration varieties with similar yield potential as long duration varieties are not common to them. Maybe it is because of the lack of knowledge of the technique and/or the non-availability of the short and medium duration varieties.

The irrigation system under command of the farmer or farmer group is more or less in conformity with the following criteria:

- The availability of internal canals for adequate supply and drainage in the command area.
- The absence of leaks in dikes.
- Proper functioning of sluices (if applicable).
- Involvement of stakeholders in decision-making related to the irrigation system.

Regarding inbound water quality, the majority of farmers (92%) do not have knowledge about cleanness of inbound water and no recent analysis was done about it. The period of surface drainage is different according to the farmer's practices and the chemical types (fertilizers or pesticides). There is no intentional surface (sideways) drainage for 23%, due to having good practices in place. Fifty eight percent of farmers mentioned that surface drainage is delayed after surface application of agrochemicals, fewer days to 14 days according to the product.

5) Nutrient Management

For nutrient management (inorganic and/or organic fertilizers), 54% achieved the minimum score required for effective nutrient management: appropriate rate of fertilizer applications at the right time, use of cropping systems of soil fertility enhancements such as crop rotation, intercropping, and cover cropping.

Among the interviewed farmers, 17% do not apply any kind of fertilizers (either organic or mineral), 56% reported using organic fertilizer such as farmyard manure, compost or straw incorporated before cultivation. Of those who used organic fertilizer, 61% score for appropriate use. Conditions favorable to its use include: application in non-flooded fields in composted or de-composted state, sufficient time for its decomposition prior to flooding, and physical availability. Regarding inorganic fertilizer choice, 70% indicated that they used mineral (Urea, DAP, MoP) or organo-mineral fertilizers locally available such as Fomi Imbura and Fomi Totahaza from a non-counterfeit source. The recommended rate N-P-K for the region is 75-30-30 kg/ha, respectively, while majority of farmers apply less than this rate.

6) Integrated pest management (IPM) and pesticide use

IPM combines preventive and curative methods of pest control. Preventive pest management methods manage conditions to prevent pest proliferation and may include: resistant varieties, crop rotation, intercropping, sanitation, ecological engineering and others. Curative pest control methods treat pests that have developed and can include: mechanical control (e.g., hand weeding), biological control (e.g., biological control agents), and chemical control (e.g., synthetic pesticides). The SRP standard is intended to encourage preventive actions to prevent pest outbreaks and spot curative actions when preventive methods are not effective on their own. Pesticides are used only as a last resort and actions should be as targeted as possible to avoid unwanted negative effects to the environment (SRP, 2020b).

Most farmers try to protect their crops from pests as much as possible by preventive methods, according to their knowledge. For curative methods, its use depends on the type of pest (Table 3). For weed control, mechanical control is the common practices mainly hand weeding. However, for insect and disease controls, majority of farmers are using pesticides. For mollusks control, 92% do not have knowledge about snails and only 6% use curative methods. The use of molluscicide is not common among farmers. For rodent control, 48% use curative method but rodenticides are used only by 19%.

Regarding bird control, 81% mentioned the need to control birds by non-lethal method like bird-scaring.

Table 3: Percentage of farmers using curative method and chemical methods against pests

	Percentage of farmers	
Pest control	Use of curative method	Use of chemical method (pesticides)
Weed control	75	3
Insect control	73	72
Disease control	56	48
Snail control	6	2
Rodent control	48	19

Among the interviewed farmers, 72% use pesticides. Broad-spectrum insecticides and strong systemic fungicide are the most pesticides used: Dursban (68%), Kitazin (43%), Dudu Fenos (17%), Rocket (11%).

7) Harvest and Post-harvest

For majority of farmers (92%), the indication of timing of harvest is when 80% to 85% of the grains per panicle are straw- or yellow-colored. Rice is harvested manually but only 50% of farmers clean equipment to avoid contamination and mixing of varieties. After harvesting, farmer transports rice to a drying or processing facility within 12 hours after the harvest. Eighty-seven per cent of farmers indicate drying their rice by themselves. The drying technique used is sun drying and farmers are trying to follow the sustainable technique such as maintaining a layer thickness of 2 to 4 cm, periodically turning the grains, protection from rain, mycotoxins and animals.

For rice storage, 63% indicate storing their rice by themselves in a safe place and method to maintain its quality. Rice stubble and straw are not burnt but managed in a sustainable way to mitigate greenhouse gas emissions, minimize environmental impacts, and retain or improve soil quality. However, some farmers are still continuing burning stubble (13%) and/or straw (25%).

8) Level of Mechanization

For all regions, the majority of agricultural activities from land preparation to harvesting and post-harvesting are done manually. The Table 5 below represents the percentage of farmers using different methods to perform each activity.

Table 4 : Percentage of farmers using different methods (manual, animal and mechanical) for performing cropping activities

Activities	Method used	Percentage of farmers (%)
Land preparation	Manual	98.6
	Animal	0.7
	Tractor	0.7
Direct seeding/Transplanting	Manual	100
Irrigation	Pump	19.2
	No energy required	80.8
Fertilizer application	Manual	100
Pest control	Back pack Knapsac spray	82.1
	No	17.9
Weeding	Manual	98.7
	Mechanical weeder	1.3
Harvesting	Manual	100
Threshing	Manual	100
Drying	Sun drying	100
Transportation	Manual	74.8
	Animal	1.3
	2-wheel tractor	22.5
	4-wheel tractor	1.3

9) Health and safety

Workers, including working household members, had never received safety instructions on how to prevent work-related accidents or diseases, where to access first aid kits, and how to contact health workers. As the majority of operations are done manually, tools and equipment used do not require a big maintenance or calibration. Farmer just has to make sure that they are functional and working well.

Among the interviewed farmers, 24% do not use any kind of pesticide. From the 76% using it, only 41% receive training on safe handling and application. Backpack sprayers are used for pesticide application, but pesticide applicators do not use all the required personal protective equipment (PPE) during mixing and application, including chemical-resistant gloves, masks, dermal protection, boots, and eye protection. However, they do use gloves and masks and pregnant or lactating women, persons below 18 years, and those with respiratory diseases do not apply pesticides.

The areas designated for washing PPE, bathing, and changing for pesticide applicators are distinct from those used for household laundry. In the field, re-entry time after the use of pesticides does not always follow the recommendation and are not well communicated. At home, there is no specific place to store pesticides and chemicals because most farmers who use them buy only the amount they need for their fields and use it immediately afterwards. If it is necessary to store them, farmers place them in a locked area, separate from fuel, food products, and out of reach of children. In Burundi, there is no collection, return or disposal service for pesticides and good practices for the disposal of empty pesticide containers are not enforced.

10) Labor rights

When it comes to hired labor, their rights are respected and they are not subjected to discrimination or disrespectful treatment. Workers are free to establish or join any association of their choice without interference and take part in collective bargaining concerning working conditions. However, farmers demonstrate less than full compliance regarding wages and may not fulfill one or more of the following criteria:

- Compliance with local or national laws and regulations regarding minimum wages.
- Payment of wages on a regular and timely basis.
- Payment of wages in a legal currency or acceptable form that does not create dependency.
- Voluntary overtime and payment of overtime wages in compliance with local or national laws and regulations, or collective bargaining agreements.

11) Child labor and youth inclusion

This measure assesses the prevalence of child labor, adherence to children's right to education, and initiatives to make farming activities attractive to people aged 15 to 30 (SRP, 2020a).

Among the interviewed farmers, 46% indicates using young labor (<18 years of age) and 87% have children living on the farm at school age. For children below 15 years, 61% indicates not engaging them as workers. For others, they are using them in some farming activities that are not harmful to their health and development. With regard to dangerous work, farmers try not to use children (<18 years of age) for work that is likely to harm their physical, mental or moral well-being. For example, carrying heavy loads that are not adapted to their physique and age. Children living on the farm at the age of compulsory schooling go to school but some of them do not go all year long.

Youth inclusion is measured based on their access to agricultural knowledge, modern agricultural technologies, capital and training. Farmers' responses on whether or not youth have access to these elements are presented in the figure below. The result shows that youth is not prioritized for access to new technologies on agriculture and for training on agribusiness.

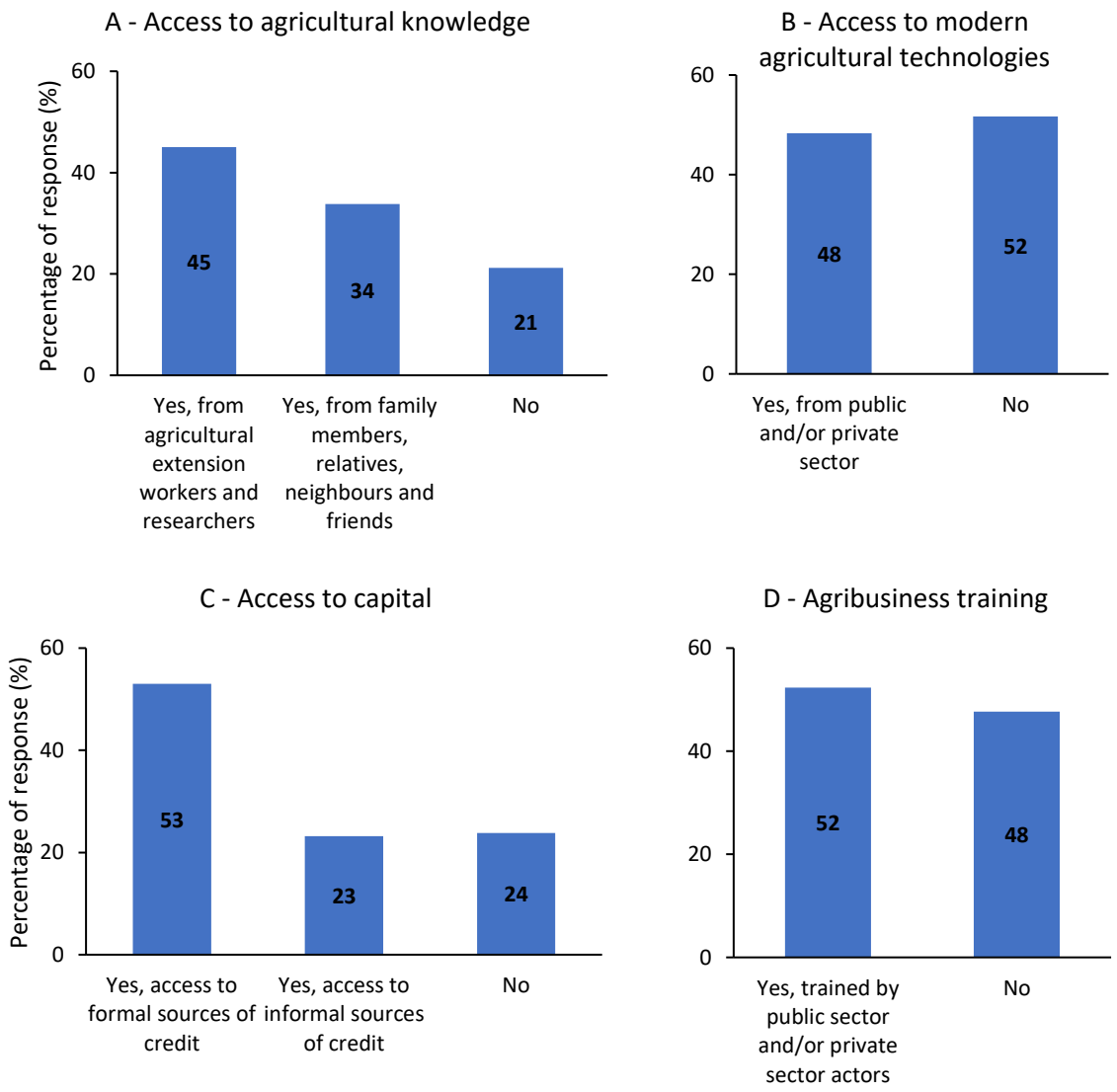

Figure 6: Farmers' response to youth access to agricultural knowledge (A), modern agricultural technologies (B), capital (C) and agribusiness training (D), expressed in percentage

12) Women empowerment

The indicator assesses women's power to make decisions relevant to their well-being. The following topics are evaluated to measure women empowerment (SRP, 2020a):

- Women's control over decisions regarding household agricultural production
- Women's control over decisions regarding their own labor input
- Women's satisfaction regarding their labor input
- Women's access to information and capacity building
- Women's access to seasonal resources for farm activities
- Women's control over long-term resources for farm activities
- Women's control over decisions regarding household income
- Women's control over their personal income
- Women's participation in collective-decision making
- Violence against women

Each theme is given a score out of 10, set by SRP to measure the place of women in decision-making, their place in society and the respect of their rights.

For example, for decision making power, the score is given as follows:

- Women have at least equivalent decision-making power: 10/10
- Someone else makes the decision, but women have a significant say in the decision: 6/10
- Somebody else makes the decision, but the women are consulted: 3/10
- Women are not involved in decision-making: 0/10

For yes/no questions: a score of 10 is given if yes, otherwise zero.

We want to see how men and women evaluated women's place on the decision making and the result is represented in the following table 5. Women and men assessment are almost the same. However, score given by women is numerically higher to score given by men except for access to facilities for breastfeeding, use of loans and being leaders of organizations. Average score greater than 6 except for domestic violence, that means women have a significant say in the decision to take even if someone else takes the decision. Regarding domestic violence, farmers stated the presence of at least one case of violence in the community.

Table 5: Average score of women empowerment by gender

Themes	Average score out of 10		
	Female	Male	Average
1a. The choice of crops/varieties to be planted	7.7	7.4	7.5
1b. The choice of technology/management practices	7.8	7.2	7.5
1c. The use of inputs in rice cultivation	8.0	7.5	7.7
1d. The use of rice produced	8.2	7.6	7.9
2a. The use of income from rice	8.3	7.5	7.9
2b. The use of off-farm income	7.8	7.3	7.5
3a. The use/allocation of her own time for income-generating activities, unpaid tasks and leisure	8.4	8.0	8.2
3b. Their contribution of labor in rice value chain related activities-both amount and activities.	8.4	7.9	8.2
3c. The use of drudgery- or labor-reducing technologies	7.8	6.9	7.4
3d. Access to facilities and being able to nurse their children	9.2	9.6	9.4
4a. The use of farmland, including decisions around purchase, sale or leasing in and out	8.3	7.7	8.0
4b. The use of farm machinery and tools, including decisions around purchase, sale, or hiring in and out	8.1	7.0	7.5
4c. Agricultural knowledge, information and capacity building	7.3	7.3	7.3
4d. Formal and informal sources of credit/microfinance	8.4	7.7	8.0
4e. The use of loans	7.8	8.2	8.0
4f. Access to markets	8.6	8.4	8.5
5a. Their movements in public places	8.4	8.9	8.6
5b. Participation in formal and informal village and community organizations	9.8	9.8	9.8
5c. Leaders of village/community organizations	9.3	9.9	9.6
5d. Domestic violence	4.1	3.5	3.8
6. Women do not experience wage gap in the rice value chain	9.8	9.5	9.7
Total score (out of 100)	**81.5**	**78.5**	**80.0**

13) Productivity and profitability

As the agricultural practices followed by farmers are different, grain yield varied from 0.8 t/ha to 7.6 t/ha with an overall average of 4.0 t/ha. Figure 7 illustrates that the average yield per region was 4.7 t/ha for Imbo, 4.0 t/ha for Moso, and 3.6 t/ha for high elevation.

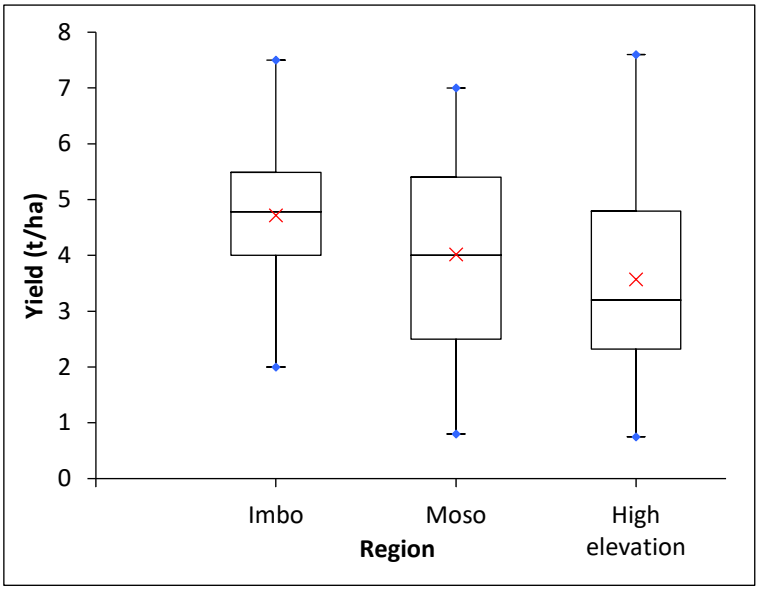

Figure 7: Yield per rice growing area in Burundi

Across rice growing conditions, average yield was higher under irrigated conditions (4.2 t/ha) than under rainfed conditions (2.5 t/ha) as shown in the Figure 8.

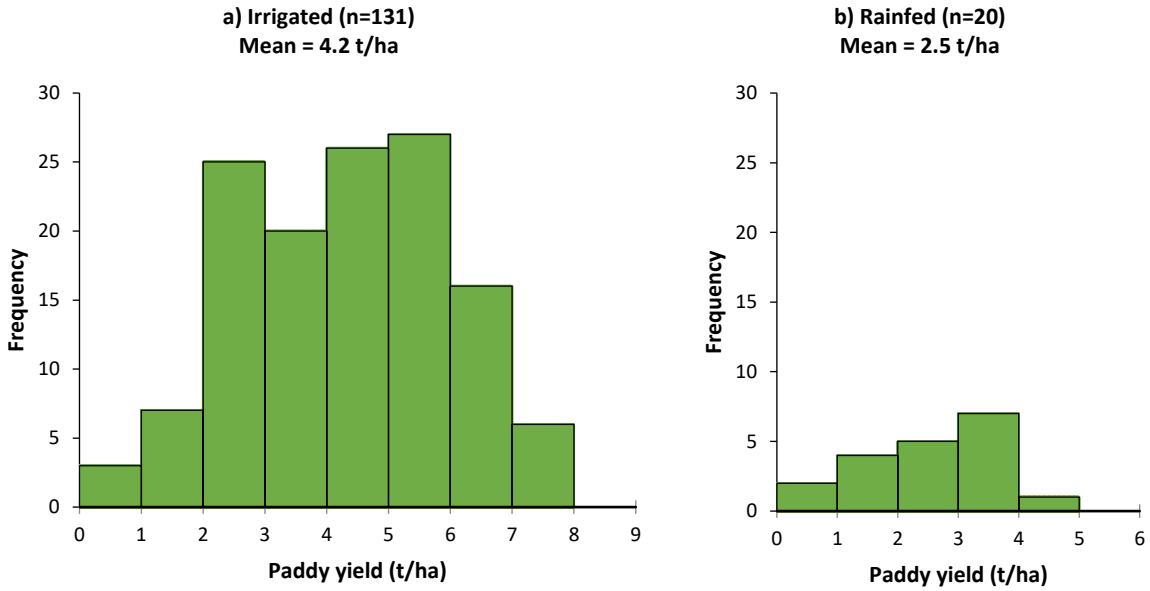

Figure 8 : Frequency distribution of grain yield under irrigated (a) and rainfed lowland conditions (b)

The paddy selling price at farmgate varies according to season and location. The paddy price collected during the interview range from 800 to 2000 Fbu per kg. The total cost is mainly dependent on the production system (irrigated or rainfed) and the use or non-use of mineral fertilizers and pesticides. Average production costs were 2,252,242 Fbu per hectare with a variation coefficient of 55%. Figure 9

shows the average percentage of the cost to total production costs for each activity. The result affirmed that land preparation, weeding, crop establishment and fertilizer applications are the most expensive operations in rice production.

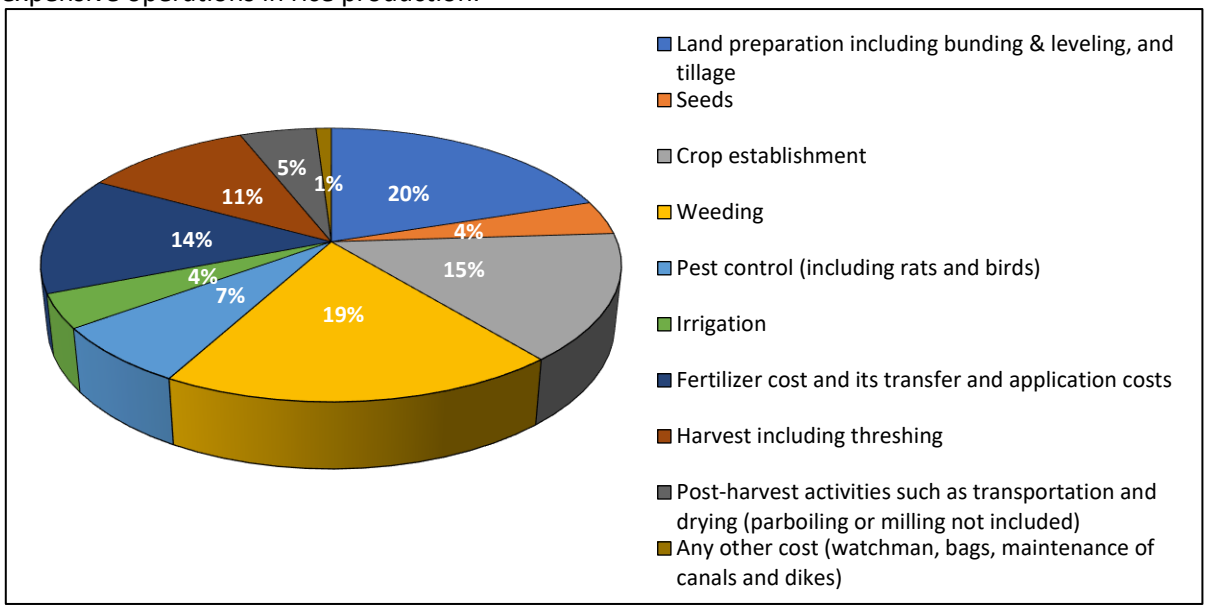

Figure 9: Percentage of costs to total cost per activity

The benefit-cost ratio (BCR) in rice production is a measure that compares the benefits of growing rice to the total production costs. Specifically, it is a financial metric used to assess the profitability of rice farming, taking into account both the costs incurred in producing rice and the potential benefits or returns from selling rice. Here, BCR ranged from 0.02 to 4.57, with an average of 1.54. The BCR is also used to compare the profitability of rice farming across different regions. For instance, the BCR for Imbo, Moso, and High Elevation regions are 1.62, 1.47, and 1.55, respectively. Additionally, 58% of rice farmers have a BCR greater than 1, indicating that most farmers find rice production profitable. However, 42% of farmers have a BCR less than 1, which implies that their production costs are higher than the benefits obtained (Figure 10).

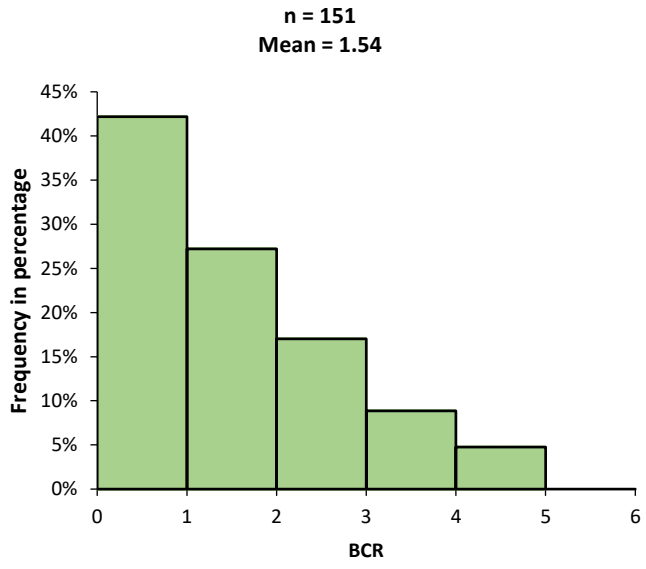

Figure 10: Frequency distribution of Benefit cost ratio among rice farmers in Burundi, expressed in percentage

In order to determine the relationship between agricultural practices followed by farmers, especially the type of agricultural inputs used, with variables that determine profitability, such as yield, cost of production, profit and BCR, MCA was performed (Figure 11). Axes F1 and F2 represents the maximum source of variance in the data (36%). Most variables have a higher contribution to the formation of F1, with the exception of variables related to the use and non-use of curative weed control. Here we have two contrasting groups of variables.

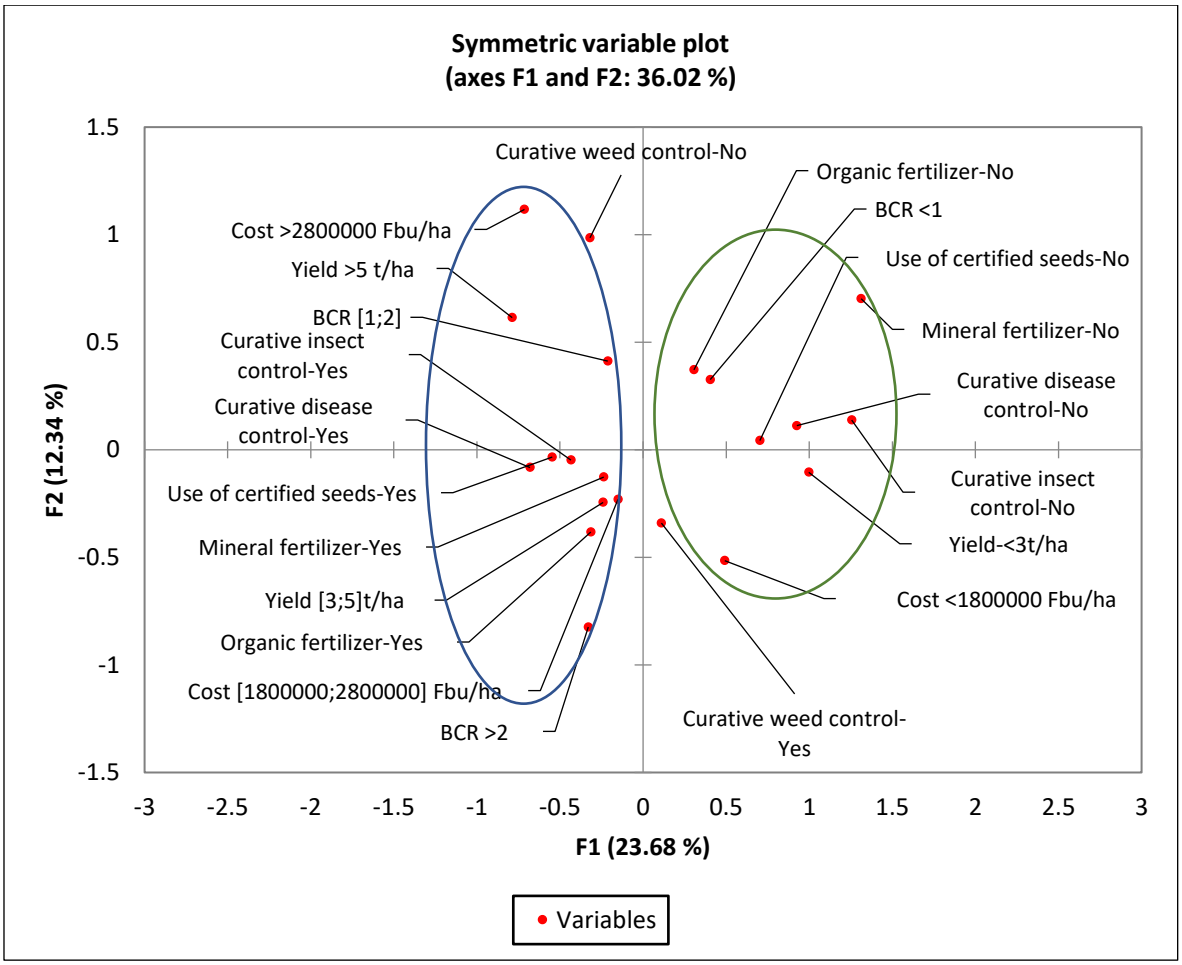

Figure 11: MCA showing relationship between agricultural practices and profitability

The green circle group represents farmers who do not use certified seeds, do not apply any fertilizers, whether organic or mineral, nor do they use curative methods to prevent insects and diseases, leading to low yields (<3 t/ha). However, their production cost is low (<1,800,000 Fbu/ha) due to the absence of fertilizer and pesticide usage, resulting in a lower BCR less than 1.

In contrast, the blue circle group achieves higher yields (more than 3 t/ha) by using certified seeds, fertilizers (both organic and mineral), and curative measures to prevent insects and diseases. Although their production costs are higher and these practices are more profitable with BCR greater than 1. Notably, a BCR between 1 to 2 is highly correlated with higher costs (more than 2,800,000 Fbu/ha) and yields (more than 5 t/ha). On the other hand, a production cost ranging between 1,800,000 to 2,800,000 Fbu/ha and a yield between 3 to 5 t/ha gave a higher BCR of greater than 2.

14) SRP standard score

The SRP Standard score measures the level of sustainability of rice production according to the SRP standards. It is a relative measure that can be used to compare a farm's performance with that of other rice-producing farms. It can also be used to track the farm's progress in improving its sustainability performance over time. The final score per farmer ranged between 33 and 83 out of 100 with an average score of 61 out of 100 as represented in the figure 12. The SRP survey has been conducted in 5 countries. The results indicated that Rwanda had the highest average score at 69%, followed by Uganda at 63%, Burundi at 61%, Kenya at 54%, and Madagascar had the lowest score at 45%.

In Burundi, the average scores for Imbo, Moso, and High elevation regions are 55, 58, and 66 out of 100 respectively. In order to claim that they are "Working toward sustainable rice cultivation," SRP has established both a minimum required score and a series of mandatory compliance levels in the following requirements, if applicable: heavy metal, integrated pest management, storage, personal protective equipment, chemical storage, pesticide disposal, child labor and hazardous work (SRP, 2020b). None of the interviewed farmers meet the threshold for all of these requirements that are related to farmer health and food safety.

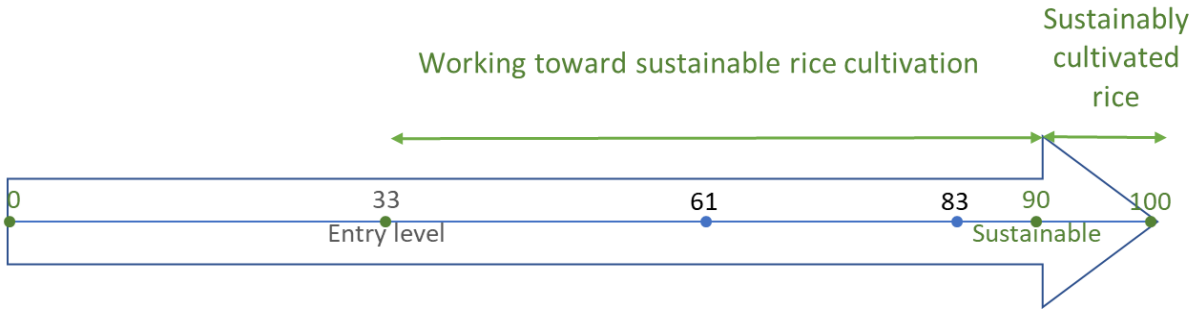

Figure 12: SRP scoring and claims with the minimum, maximum and average score among rice farmers in Burundi (adapted from SRP, 2020b)

Conclusion

This report presents the preliminary results of the SRP (baseline) survey of farmers in rice-growing areas of Burundi. The objectives of the survey were to understand current rice growing practices among farmers and production constraints in these areas, and to assess the level of sustainability of rice growing. We found that low adoption of improved varieties and certified seeds, low use of fertilizers (mineral and organic), and almost no mechanization are the main challenges in rice production. Rice yields vary according to the growing season and the level of agricultural inputs used. As farmers are mainly dependent on labor to carry out farming activities, even for the most labor-intensive activities such as land preparation, planting, weeding, harvesting, the cost of production of these activities is high. Thus, developing small-scale mechanization through a service provision model for smallholder farmers could be an affordable alternative to reduce labor use and production costs, and improve the relatively low benefit-cost ratio. Moreover, an improved crop and nutrient management technologies would be an alternative for improving the rice productivity. Many aspects of farm management, such as data record keeping in each season, assessment of heavy metals on

grains, integrated pest management, and nutrient management, need to be improved to meet the criteria for sustainable production. On the social side, worker health and safety, mainly personal protective equipment for pesticide applications, and compliance with chemical guidelines, such as re-entry time and side-drainage period after chemical applications, must be followed.

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References

IRRI. (2018). *Burundi _ International Rice Research Institute presentation*. Available on https://www.irri.org/where-we-work/countries/burundi. Accessed on 03/03/2023

MINISTERE DE L'AGRICULTURE ET DE L'ELEVAGE. (2014). *Stratégie Nationale de Développement de la Filière Riz Au Burundi*.

SRP. (2020a). *Performance Indicators for Sustainable Rice Cultivation (Version 2.1)*. www.sustainablerice.org

SRP. (2020b). *Standard for Sustainable Rice Cultivation (Version 2.1)*. www.sustainablerice.org