# Smallholder Farmers' Seed Sources in Rwanda for Unsubsidized System: Case of Common Bean (*Phaseolus Vulgaris* L.)

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## ABSTRACT

This study was conducted in the Southern Province in four selected districts, namely Kamonyi, Muhanga, Ruhango, and Nyanza, of Rwanda, where bean seeds are not under the subsidy program, hence unclear seed sources and acquisition modalities. Therefore, this study was carried out to determine the bean seed sources and acquisition modalities used by farmer promoters in an unsubsidized system of bean seeds. Primary data were collected from 300 farmer promoters through a standard pretested questionnaire. Excel, SPSS, and GenStat computer packages were used to run data.

The farmer promoters in the southern province source seed from both formal and informal seed supply systems. The most used variety is Shyushya, which is a variety from the informal seed system with 26.6%, followed by NUA and Mutike, both from the formal seed system with 14.2%, while the least was recorded in Kivuta, a variety from the informal seed system with 0.4%. Farmer promoters that used certified bean seed were 20.3%, while 60.3% used informal seeds. The acquisition modality that was mostly used for the formal seed was through donations with 43%, while credit paid back was the least to be used with 5.8%. The majority, 88.4% of farmers, adopted the formal seeds because of grain yield, while the minority, 1.7%, adopted them for better seed quality. The informal bean seeds are mostly acquired through cash mode of accession with 84.7%, while the least used acquisition modality is the seed exchange among the farmer promoters with 15.3%, and the reason for the use of own saved seeds was that they give yield with 28.8%, while the least was Most Known in the area with 2.8%. The study revealed that the certified bean seed business is possible as long as it provides seeds that give farmers more grain yield and farmers are willing to buy seeds as their informal seeds are acquired through cash. The breeding program should consider Shyushya, Mutike, and NUA attributes of preferences by farmers to develop a variety that responds to farmers' needs.

**Keywords:** Common bean, Seed, Seed sources, Seed acquisition modalities, Farmer promoters, Southern Province of Rwanda

## INTRODUCTION

In Rwanda, common bean is the most widely produced crop, with 80% of all households involved in crops cultivation. According to NISR (2023), the majority of households that cultivate beans are from the Southern province at a rate of 85%, followed by the Northern Province at 82%, and the least is the Western province at 72%.

The average farm size in the country is 0.4 hectares, and 77.2 percent of agricultural households operate on a farm with less than 0.5 hectares, while less than 10 percent have a farm with one hectare or more. (NISR, 2021).

Just three of the main crops that farmers raise are covered by the seed subsidy program: wheat, soybeans, and

maize. As a result, farmers cannot obtain improved certified seeds for crops that are not included in the program for seed subsidies (IRDP, 2020).

The Crop Intensification Program (CIP), introduced in 2007 as a pilot program and expanded to the entire country in 2010, has been Rwanda's most prominent input subsidy initiative. The CIP, which came after a number of land policy changes, increased attempts to develop marshlands, terrace slopes, and consolidate land. It was also accompanied by fertilizer and seed subsidies that were specifically directed toward high-potential areas (Clay and King, 2019).

The "NKUNGANIRE" subsidy scheme is part of the Crop Intensification Program (CIP). Under the term "Smart Nkunganire System," the Rwanda Agriculture Board (RAB) and BKTechHouseLtd developed a platform to automate Rwanda's supply chain management for the country's farmers' subsidy program (SNS). By using a USSD short code for self-registration, this program creates a digital database of farmers (individuals and cooperatives) and other interested parties. By registering the quantity of inputs they need, farmers who are eligible for subsidies enable supply chain participants to forecast supply and demand. Consequently, both the general public and the impoverished are the focus of the subsidy programs (IRDP, 2020).

For smallholder farmers, having access to sufficient, high-quality seed can be a crucial first step in increasing resilience, productivity, and food and nutrition security (Almekinders *et al*., 2019; Ruane *et al*., 2022). Increasing the supply of certified seed of improved crop varieties is one way that many agricultural projects combat seed insecurity (Sperling and McGuire, 2010; AGRA, 2014). In order to combat seed insecurity and the high frequency of food insecurity, the Global South uses crucial agricultural remedies, such as community seed production, emergency seed relief, and crop input subsidies (Remington *et al.*, 2002; Bengtsson, 2007).

According to Sperling *et al*. (2013), a crucial yet undervalued aspect of seed availability is having access to pertinent information about the characteristics and maintenance of seeds. It's critical to distinguish access from availability since, although the seed may be available in the market or community, certain farmers may lack the financial means or social standing to obtain it. Social and economic access are the two types of access (FAO, 2015a). Economic access is the ability to obtain seed when needed, whereas social access is the ability to obtain seed through a household's social network.

In order to guarantee that all Rwandan farmers have access to advisory and extension services, the Rwandan government (GoR) developed the Twigire Muhinzi extension model, which is a decentralized, farmer-oriented national agricultural extension and advisory services delivery model. The methodology, which has been jointly implemented by RAB under MINAGRI and MINALOC at the district level, is predicated on two complimentary methods of farmer-to-farmer extension: Farmer promoters approach (FP): Use mobilization and demonstration plots in each village to quickly reach all farmers with basic extension messages; and (2) Farmer Field Schools approach: Gradually reach all farmers with in-depth knowledge by providing an experiential learning opportunity in the Farmer Field School (FFS) plot at the cell level (MINAGRI, 2020).

To get the amount and quality of seeds they require, smallholder farmers engage in both formal and community seed systems. Farmers usually use the formal seed networks to get access to particular crop kinds, mostly so they may sell their produce on the market. Farmers, on the other hand, favor crop varieties derived from local seed sources for reasons related to food preparation, flavor, and cultural requirements, in addition to profit margins. These are important variables that affect the choices farmers make regarding where to get seeds. Due to the numerous connections and interdependencies between these systems, crop varieties obtained via informal seed systems may also come from other sources, such as the formal seed system (Almekinders and Louwaars, 2002; Westengen *et al*., 2023).

Agrodealers cannot place direct orders for the seeds they require based on their unique requirements because they are not directly connected to the suppliers/importers of seeds and fertilizer. Consequently, farmers purchase what the government and certified suppliers make available to agro-dealers, and their preferences might not be met locally (IRDP, 2020).

Because common bean seeds are not covered by the subsidy program, it is unclear where to get seeds and how

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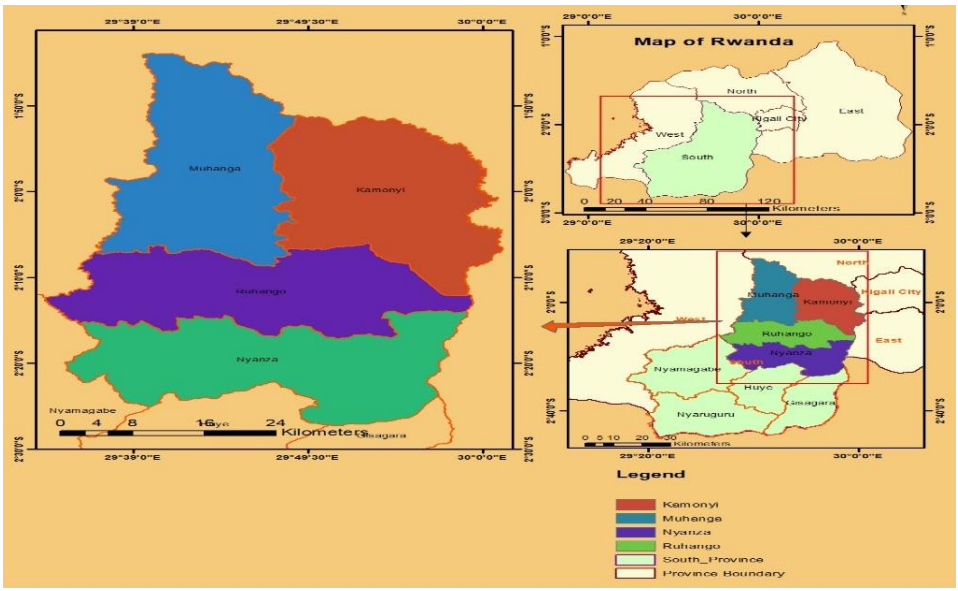
to get them. For Rwandans, the common bean is a highly valued crop; therefore, it is important to have clear seed sources and acquisition procedures in place to facilitate future improvements. Therefore, the objective of this study was to determine the seed sources used by farmers, the acquisition modalities of the bean seeds used and to identify the factors influencing the farmer's choice in the bean seeds they use.

# METHODS

## Study area

Southern province is one of the five Rwanda's Province; it was created early in January 2006 as a part of government decentralization program that re-organized the country's local government structures. Southern Province of Rwanda, has 8 districts namely Gisagara, Huye, Kamonyi, Muhanga, Nyamagabe, Nyanza, Nyaruguru and Ruhango. The population in the Southern Province is of 3,002,699, where 444,106 live in urban areas, while 2,558,593 live in rural area (NISR, 2023).




## Sampling procedure

The Southern province was purposively selected because it was a leading Province in bean production in Rwanda. The interviewed people were farmer promoters, where the system has one farmer promoter per village in 4 four selected districts namely Kamonyi district with 317 villages, Muhanga district with 331 villages, Ruhango district with 533 villages and Nyanza district with 420 villages hence making the population size of 1601. The sample size was 300 farmer promoters because some villages constitute towns of different districts and was determined using the following formula by Yamane (1967).

$$n=N/(1+N(e^2))$$

Where:

n=The sample size of the study

N=The population of the study

e=The margin error (0.05) at 95% confidence interval

## Data collection and analysis

A standard pretested questionnaire was used to elicit information from the farmer promoters as seed consumers and leading farmers. The questionnaire covered information on general demographics of the respondents such as age, gender, and education level. The data on used seed types and sources, seed acquisition modalities and

factors influencing farmers in choosing the type of bean seed they use were collected. Data were analyzed using descriptive and frequency statistics with the help of SPSS, GenStat and EXCEL computer software packages.

## RESULTS AND DISCUSSIONS

The majority of the farmer promoters in the selected districts of the Southern Province of Rwanda are aged above 50 years. This is the same in all the four districts as there is no significant difference.

The farmer promoters that cultivate bean in the four districts of the southern province of Rwanda is a task that is dominated by men with 58.3% while women are 41.7 as shown by the results. However in the district of Nyanza women were more than men as shown in the figure.

The highest number of farmer promoters in the southern province of Rwanda attended primary school with 72% followed by “O” level with 19% while the lowest number was observed in those who went to University with 2%.

Table 1: Demographic distribution of farmer promoters, Southern Province of Rwanda.

| Variables | Frequency | Percentage | Mean |
|---|---|---|---|
| Age | | | 50.59 |
| **Gender** | | | |
| Male | 175 | 58.3 | |
| Female | 125 | 41.7 | |
| **Education Level** | | | |
| No Education | 15 | 5.0 | |
| Primary | 214 | 71.3 | |
| "O" Level | 58 | 19.3 | |
| "A" Level | 7 | 2.3 | |
| University | 6 | 2.0 | |
| **Professional Training** | | | |
| Trained | 209 | 69.7 | |
| Not Trained | 91 | 30.3 | |

Conversely NISR (2021) said that the agricultural household population in Rwanda is predominantly youthful, with 68.0 percent of the population being 30 years of age or younger.

NISR (2023) also highlighted that the Percentage of agricultural households varies slightly according to the sex of household head. Out of total male-headed households, 70% are agricultural households. On the other hand, 67% of female headed households engage in agricultural activities.

The education level results are concurring with (NISR, 2023) where it says that the overall Net Attendance Rate

(NAR) at primary was 89.3% and Net Attendance Rate (NAR) at the secondary level of education was 22.3%.

The majority of farmer Promoters (69.7%) have received the professional training while the minority (30.30%) did not receive the professional training.

NISR (2021) indicates that the number of agricultural families receiving extension services was 65.0%. About the extension services that were offered, the majority of agricultural households (55.6%) received information about agriculture practices, followed by knowledge about erosion control measures (27.1%), horticulture skills (15.5%), and integrated pest management skills (13.4%). Furthermore, 13.8 percent of extension recipients learned how to use the Smart Nkunganire system (SNS), a supply chain management tool designed to digitize Rwanda's Agro-Input Subsidy program's whole value chain.

The highest percentage of farmer promoters use their own land with 63% followed by mixture of Own land and Rented land with 28.3% while the lowest percentage uses Rented land with 8.7%.

Table 2: Land Ownership and use distribution by Farmer promoters, Southern Province of Rwanda.

| Variables | Frequency | Percentage |
|---|---|---|
| **Type of cultivated land** | | |
| Own Land | 189 | 63 |
| Rented land | 26 | 8.7 |
| Own And Rented land | 85 | 28.3 |
| **Allocated area for bean production** | | |
| ≤ to 0.25 Ha | 134 | 44.7 |
| 0.25 t0 0.5 Ha | 71 | 23.7 |
| 0.5 to 0.75 Ha | 21 | 7 |
| 0.75 to 1 Ha | 42 | 14 |
| ≥ 1 Ha | 32 | 10.7 |

It is in agreement with (NISR, 2021) that the majority of agricultural households—87.6%—own their own land. Nonetheless, the results show that 49.5 percent of agricultural households rent their access to agricultural land. Even though a sizable portion of agricultural households are self-sufficient, 37.1% of them still rent other lands to supplement their own farm.

The maximum number of farmer promoters (44.7%) said they allocate a land size that is less or equal to 0.25Ha to bean cultivation followed by those that allocate a land that is between 0.25 to 0.5Ha with 23.7% while the minimum (10%) cultivate bean on 1Ha and above.

The kind of varieties grown in southern province of Rwanda include both varieties of formal and informal seed systems. The results show that the most used variety is Shyushya a variety of informal seed system with 26.6% followed by NUA and Mutike both from formal seed system with 14.2% while the least was recorded in Kivuta, a variety from informal seed system with 0.4%.

Error bars are standard errors

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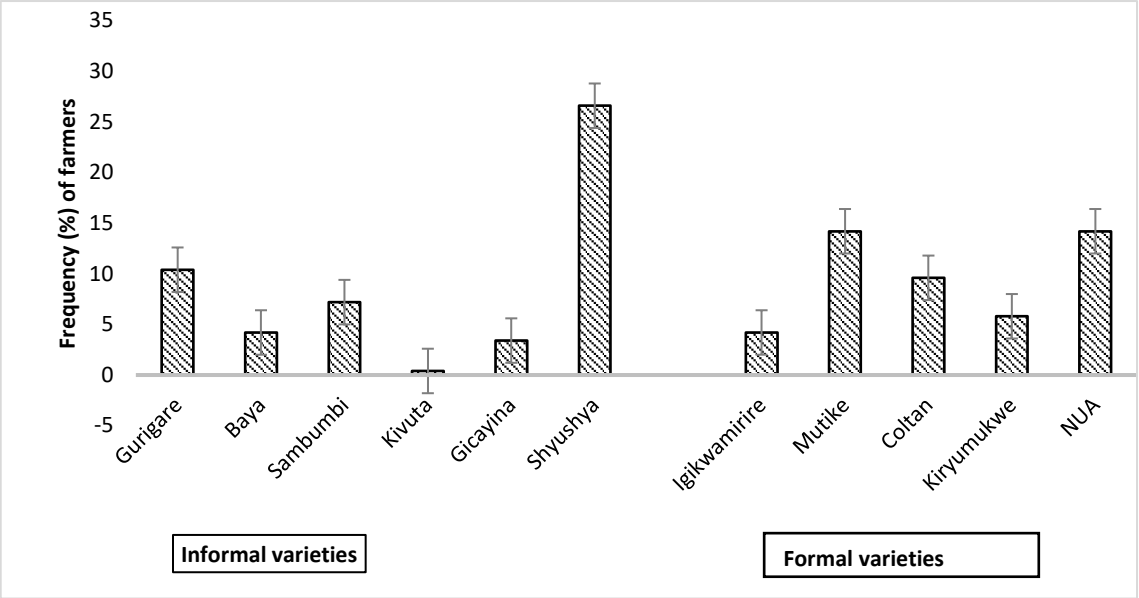


Figure 1: The cultivated varieties of common bean in the Southern Province of Rwanda.

Accordingly, different farmers use different channels depending on the sources that are available in their area, the variety and kinds of crops and varieties they cultivate, and a host of other economic, social, cultural, and political factors that affect decision-making at the individual and household levels (Louwaars and de Boef, 2012; McGuire and Sperling, 2016; Mausch *et al*., 2021). Additionally, farmers typically select a variety that fits well in their particular agro-ecological zone. Seed with traits that farmers like is referred to as variably suitable (FAO, 2016). Shrestha (2020) further subdivides varietal appropriateness into two categories: choice, which includes the desirable qualities fulfilling farmers' productivity, food, cultural, and market needs, and adaptability to local agro-ecological circumstances.

The results indicate that 59.7% of our respondents never used certified bean seed, while only 40.3% used certified bean seed. This means that when it comes to the farmer promoters in the chosen Districts, the majority of them have never used certified bean seed.

Error bars are standard errors

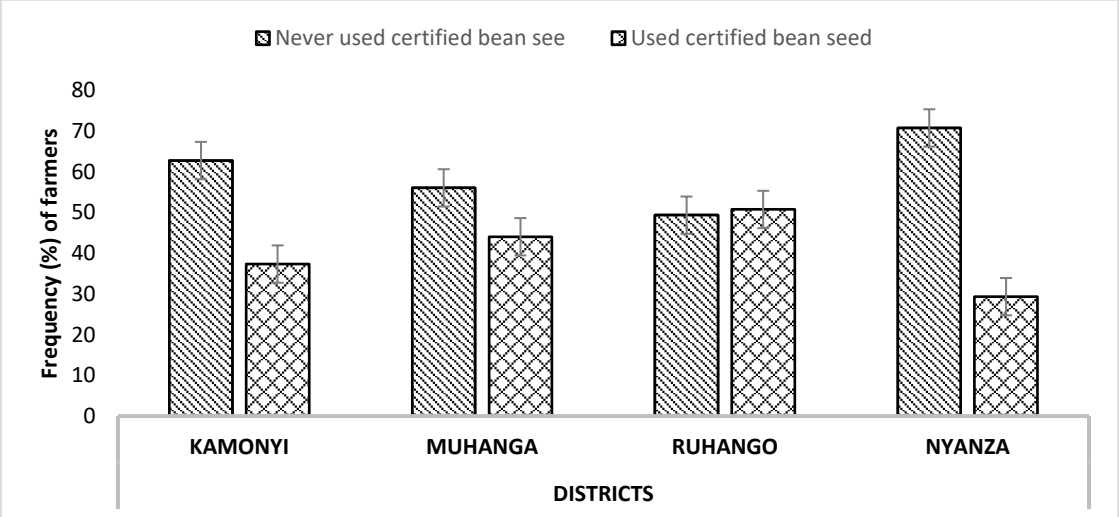


Figure 2: Certified common bean seeds distribution, Southern province of Rwanda

According to NISR (2021), just 44.6% of Rwandans used improved, certified seed. In the province of the South, the usage rate was 36.1% overall and 0.8% for beans specifically.

Almekinders and Louwaars (2002) also found that it is only feasible for a limited number of crops and in a very

small number of countries to aim for a formal seed business that supplies all of the seed needed for planting. Since old seeds of these crop species cannot be replanted owing to loss of hybrid vigor advantage, the most traded seeds in the formal sector are those of cross-pollinated crops like maize or vegetable F1 hybrids (Paudel *et.al*. 2013).

Table 3: Common bean seeds sources used, Southern Province of Rwanda

| | **Informal Seeds** | | **Formal Seeds** | | **Mixture** | |
|---|---|---|---|---|---|---|
| | **Frequency** | **Percentage** | **Frequency** | **Percentage** | **Frequency** | **Percentage** |
| Own Seed | 279 | 57.5 | | | | |
| Neighbor | 61 | 12.6 | | | | |
| Local market | 145 | 29.9 | | | | |
| RAB | | | 13 | 10.7 | | |
| Seed Companies | | | 4 | 3.3 | | |
| Cooperatives | | | 22 | 18.2 | | |
| Seed dealers | | | 34 | 28.1 | | |
| NGOs | | | 17 | 14 | | |
| Local Government units | | | 31 | 25.6 | | |
| **In General** | **181** | **60.3** | **61** | **20.3** | **58** | **19.3** |

Own Saved seed recorded the maximum (57.5%) of the used seeds of the informal system (most used system with 60.3%) followed by the market with 29.9% while minimum was recorded in seeds sourced from Neighbors with 112.6%. This is in agreement with Ncube *et al.,* (2023) who found that for smallholder farmers, seed security is higher when accessed through informal channels like social networks, own seed, and local marketplaces than when formal channels like agro-input dealers and seed aid are used. The availability of seed in close proximity to homes and at the appropriate time was guaranteed by informal rather than formal seed sources. The quality of locally procured seeds was found to be comparable to that of formal sources.

Sperling and McGuire (2010) also reported that most households don't grow enough seed to meet their needs, so they turn to other sources to boost seed volume, swap out seed of poor quality, obtain seed that they can't grow or store well enough (like many legumes or exotic vegetables), or get new varieties with desired traits.

Taking into consideration that the local government institutions, NGOs and Rwanda agriculture Board (RAB) constitute the freely donating organs in the above acquisition organs. The results show that the farmer promoters that ever used the certified seeds of bean, the highest acquisition was recorded to be from seed dealers with 28.1% followed by the local government institutions with 25.6% while the lowest record was observed among farmer promoters who acquired the seeds directly from seed companies with 3.3%.

Minot *et al*. (2007) also found out that private seed firms use cooperatives and agrodealers as their marketing channels to distribute seeds. This is confined to a few crops and kinds, such as hybrids, and is costly for poor farmers even though it is thought to be more cost-effective than seed distribution by parastatals. Additionally, agrodealers typically have inadequate coverage in more isolated regions (Rutsaert *et al*., 2021).

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Table 4: Bean seeds acquisition modalities, Southern Province of Rwanda

| | **Frequency** | **Percentage (%) of farmer promoters** |
|---|---|---|
| **Informal** | | |
| Paid cash | 177 | 84.7 |
| Seed Exchange | 32 | 15.3 |
| **Formal** | | |
| Paid cash | 49 | 40.5 |
| Credit paid back in cash | 7 | 5.8 |
| Credit paid back in kind | 13 | 10.7 |
| Donation | 52 | 43 |

The informal bean seeds in Rwanda, Southern Province are accessed via the cash and seed exchange transactions in all selected districts. The results show that in general the cash mode of accession is the most used with 84.7% while the least used mode is the seed exchange among the farmer promoters with 15.3%.

This concurred with Beyene (2010) that it is also important to recognize that some households may not produce their own seed at all, due to land scarcity or other reasons.

The most of the certified seeds of bean were acquired through donations with 43% followed by the ones received after paying cash that represent 40.5% while least used acquisition mode is credit paid back in cash that represents 5.8%. This is In agreement with Westengen *et al.* (2023) who reported that while public seed producers are primarily focused on certified seed production of major food security crops that are less appealing to the private sector, private seed companies primarily focus on crops with a high multiplication factor (i.e., high net yield of seed per seeding rate), which are more profitable. It aligns also with Davind & Sperling (1999) who found that since farmers often re-cycle their own crops for several seasons after receiving new germplasm rather than buying fresh seed from approved sources, the private seed industry has not found the bean seed business to be profitable.

Table 5: Reasons of acquisition of the seed used by farmer promoters, Southern Province of Rwanda.

| **Variables** | **Percentage (%)** |
|---|---|
| | |
| **Formal seeds** | |
| Replace old variety | 6.6 |
| Replace Old seed | 3.3 |
| Better Seed Quality | 1.7 |
| Grain Yield | 88.4 |

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| **Informal seeds** | |
|---|---|
| Most known in the area | 2.8 |
| Not timely delivered of others | 6.4 |
| Lack of quality trust | 14.9 |
| Economy | 21.0 |
| No other seed | 26.0 |
| It gives yield | 28.8 |

Among the several justifications offered by farmer promoters for the adoption and use of certified bean seeds, the majority cited grain yield (88.4%) as their top motivation, followed by the replacement of old varieties (6.6%) and the last being better seed quality (1.7%).

According to Zegeye *et al*. (2014), farmers frequently have different opinions about seed quality than formal experts in the seed system depending on the quality attributes (such as size, color, and taste) and values considered (such as productivity vs. tastiness and versatility of the seed). They may also not always prefer, be able to pay the higher price for certified seed (Sperling and McGuire, 2012). However, farmers frequently face challenges to their seed security since seed quality plays a significant role in yield and other agronomic performance in crop production (McGuire and Sperling, 2016; Jeffery *et al*., 2018).

The farmer promoters in the Southern province of Rwanda, they do have different reasons of the use of informal seeds of beans. The results show that the reason that recorded the highest were that the informal seeds Give Yield with 28.8% followed by No Other Seeds with 26% while the least were recorded for the reasons of informal seeds are the Most Known in the area 2.8%.

More than 80% of the seed planted by African farmers remains to originate from informal systems (African Union 2008; Byerlee *et al.,* 2007).

For local varieties with particular cultural, spiritual, or agro-ecological characteristics, as well as recycling improved varieties (Chivasa *et al*., 2022), farm-saved seeds are the main source of planting material for many smallholder farmers (Samberg *et al*., 2013). Smallholders can get several advantages from farm-saving seeds, such as lower seed acquisition costs and guaranteed seed supply for planting. Additionally, farmers may prefer their own-saved seeds since they are more acquainted with the agronomic, post-harvest, and consumption qualities of them (Almekinders *et al*., 1994).

Local varieties from informal sources do remain to meet the needs of many farmers and communities (Jarvis *et al.,* 2011). Farmers continue to use farm-saved seed of both local and modern varieties for a number of reasons (Lipton and Longhurst 1989; Tripp, 2001; De Boef *et al.,* 2010; Lipper *et al*., 2010);

Louwaars and De Boeuf (2013) said that the most frequently stated include: inadequate access to markets; the structure and functioning of market channels often unfavorable to those farmers living in remote areas; limited access to financial resources or credit to buy or produce seed; the limited effectiveness of the formal system in providing timely and adequate access to quality seed of improved varieties; and the lack of interest or capacity of the research system for developing genotypes that are specifically adapted to their production environment, owing to economic and organizational considerations.

The Farmer promoters that have ever accessed and used the certified seeds of bean, the maximum number (20.2%) from them per the results have accessed the certified bean seed in 2023 followed by the year of 2021with 19.3%.

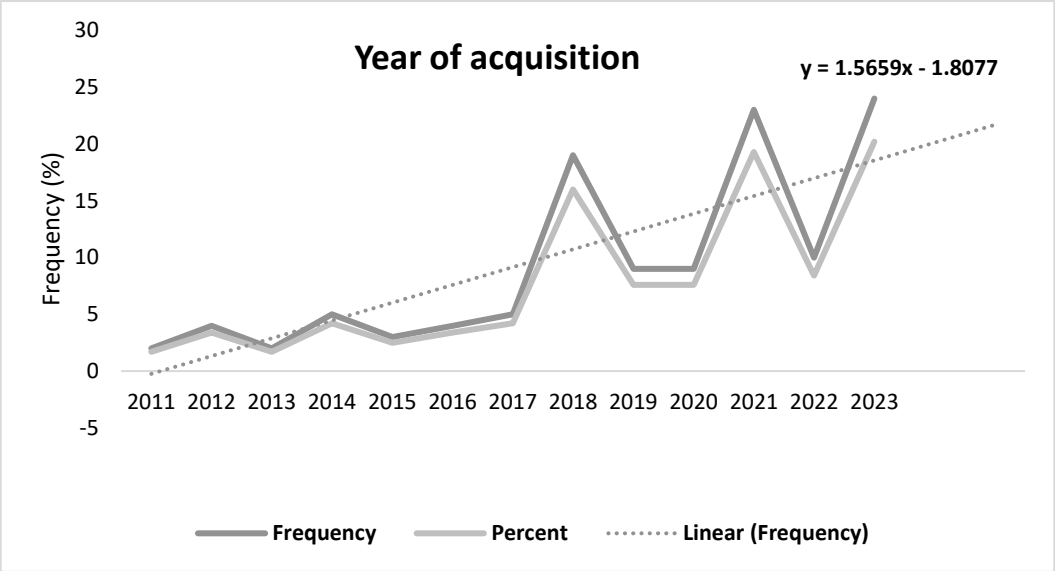


Figure 3: Distribution of the certified seeds acquisition period.

The trend line equation shows us that when one year is added the use of bean certified seed percentage by farmer promoters increases by 1.793 which is the fraction of 2.8077 to 1.5659. This results could align with the NISR (2021) that reported that by 2020 the farmer who had used improved certified seed of bean were 1.4% nationwide and 0.8% in the Southern Province of Rwanda.

## CONCLUSION AND RECOMMENDATIONS

### Conclusion

This study enables us to draw the conclusion that the majority of common bean seed used by smallholder farmers in Rwanda's southern province in the unsubsidized system comes from informal seed systems (60.3%), with own-saved seeds accounting for 57.5% of the total.

We conclude also by this study that Shyushya an informal seed, is the most popular used seed variety (26.6%) and that farmer promoters noted that it gives yield (28.8%) as reason of acquisition. The study also showed that farmers in general and farmer promoters use seeds from formal and informal seed systems.

Generally speaking, farmer promoters who have ever accessed certified seeds have done so through donations (43%); nonetheless, the study shows that, in addition to organs that donated seeds, seed dealers have a significant influence (28.1%) in the study area when it comes to certified seed access. The study found that certified seeds should generate higher grain yields as the main reason of use of informal seeds (28.8%) and the most common method of acquisition in the informal seed system was cash (84.7%). This suggests that a common bean seed business could be viable if it could develop bean varieties that address farmers' adoption motivations.

Given that formal seeds and a combination of the two systems accounted for 39.7% of the total seed usage and that local markets came in second place (29.9%) as sources of seeds in the informal seed system, it is clear that an integrated system that can enhance the quality of the seeds currently in use is desperately needed.

### Recommendations

The informal seed system is the primary source of seeds for farmer promoters, making it the predominant means of seed access for farmers. Therefore, it is important to strengthen the integrated seed system and prioritize the formal seed system by introducing varieties that are socio-economically responsive and adapted to the region.

Considering that the cash mode is the most popular method of acquisition in the informal seed system, and that seed dealers were the most popular means of acquisition for farmer promoters who ever used certified seed, it suggests that farmers are willing to pay for seeds. Hence the need to avail improved seeds.

The formal seed system should take into account the preferences of farmers for Shyushya, the most used informal variety, in addition to those of formal seeds (Mutike and NUA). This is especially important for bean breeders, seed specialists, organ donors, and seed providers. This may help ensure that seeds are accepted and adopted quickly.

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