# Using the LegumeCHOICE tool to support legume use on smallholder farms in South Kivu province in the Democratic Republic of Congo

ILRI PROJECT REPORT


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# Using the LegumeCHOICE tool to support legume use on smallholder farms in South Kivu province in the Democratic Republic of Congo

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# Summary

Focus group discussions (FGDs) were conducted in eight villages in South Kivu Province of Democratic Republic of Congo (DRC) to assess legumes grown by farmers, challenges they face, and the benefits of legumes. The LegumeCHOICE (LC) tool was used to support decision making on potential legume species that can be grown in the villages where the FGDs were conducted. Farmers were selected ensuring representation across gender and resource endowment.

Farmers in the villages understand legumes as crops which produce pods and nodules, and this is close to the formal definition of legumes. These farmers also identified several livelihood functions of legumes including provision of food, feed, soil fertility improvement, fencing and construction materials, fuel and income. The common challenges faced by farmers in legume production include lack of improved seeds, inputs (e.g. fertilizer) and technical information, incidence of pests and diseases, land scarcity, lack of market and climate change. Application of the LegumeCHOICE tool showed that seed availability, inputs and services, knowledge, water, markets, labour and land are all key constraints to legume production in the villages considered, though some variation in the magnitude exist between villages. In pairwise ranking and matrix scoring exercises across six legume functions (food, feed, income, soil fertility improvement, soil erosion control and fuel), farmers' preferences varied to some extent by gender and by site. However, food and soil fertility improvement were consistently the most preferred functions of legumes. Results from the LC tool hit list indicated suitability of several species (grain and tree legumes) for the target sites. This included pigeon pea, field pea, climbing bean, dolichos lablab, Leucaena, Gliricidia, Calliandra. There were challenges in immediate implementation of candidate legumes emerging from application of the LC tool, mainly associated with the lack of planting material in the region.

Based on the FGDs results, we conclude that there is an improvement on farmers' knowledge about the existence of diverse legumes and their functions in the villages where the study was done. Farmers have preference to legumes that they already know, but they are also willing to test legumes which have the potential to contribute to the various functions they need. However, planting materials for those legumes are not available and this remains a key challenge in extending to candidate legumes from the application of the LC tool.

# I. Introduction

Most smallholder farmers in South Kivu province practice integrated crop and livestock farming. Dominant crops in this province are roots and tubers (cassava, potatoes, sweet potatoes, yam) and bananas (Mushagalusa et al. 2017). As in many parts of sub-Saharan Africa, agriculture in South Kivu is rainfed and agricultural productivity in smallholder farms is constrained by a range of factors including climate change which has altered rainfall distribution and increased temperature. Crop yields obtained by farmers are insufficient to meet the food demands of households, thus the prevalence of food insecurity in the region (Murphy et al. 2015). Diversification of crops could be one option to improve productivity and mitigate the effect of change in rainfall pattern. Due to their various types and multiple functions including provision of food, feed, fuel, income, soil erosion control and soil fertility improvement, legumes could contribute to addressing many challenges faced by farmers, and therefore to improved food and nutrition security and livelihood (Duncan et al., 2019).

Although legumes have several benefits for smallholders, they occupy a small share of crops grown in the farming system in South Kivu. Where legumes are used, grain legumes are more common than herbaceous and tree legumes, possibly because farmers are more interested in short-term benefits. To increase effective use of legumes in smallholder farms in the region, there is need to help farmers in making informed decisions on suitable legumes using decision support tools. A prototype of the LegumeCHOICE tool was developed during the LegumeCHOICE project[1] and is now being applied in the LegumeSELECT project[2].

The LegumeSELECT project aims at improving the use of legumes in smallholder farming systems in sub-Saharan Africa (SSA) through improved decision making based on suitability to their environment. The project combines existing data and new data from on-farm and on-station experiments to better understand the relationship between legume traits and farmers' aspirations in a range of biophysical and socio-economic contexts. Under LegumeSELECT, the current version of LC tool was applied to eight villages in two territories of South Kivu, Kabare and Walungu, to assess legume species grown and the constraints/ challenges to their production, identify legume functions preferred by farmers, and subsequently identify candidate legumes that fulfil both the functions and the constraints. The report highlights the methodology used and the results from each of the eight villages.

## LegumeCHOICE tool

The LegumeCHOICE (LC) tool is designed to suggest potential legume species for smallholder farmers based on agro-ecology, socio-economic context, and farmer aspirations. Combining these factors generates a list of candidate legumes for the site in question, using expert-based attributes of a list of characterized legumes available for the tool. The agro-ecological filter excludes legumes which are not suited to the local agro-ecology defined by average rainfall, average annual temperature, altitude and soil pH. The socio-economic filter considers farming context factors which would limit legume production based on farmers' views: land, labour, seeds, inputs and services, water/rainfall and markets. The farmer aspiration filter considers prioritized functions of legumes (provision of food, feed, income and fuel, soil fertility improvement, and soil erosion control) and assesses farmer preferences in those functions.

1 LegumeCHOICE -"Realizing the underexploited potential of multi-purpose legumes towards improved livelihoods and better environment in crop-livestock systems in East and Central Africa" was funded by GIZ and implemented in DRC, Ethiopia, and Kenya

2 LegumeSELECT-Science-driven Evaluation of Legume Choice for Transformed Livelihood is funded by DFID through the University of Edinburgh. Timeframe: 2018–2021

# 2. Methodology

## 2.1 Study sites

The study was conducted in two sites of South Kivu province of DRC, namely Bushumba (located in Kabare territory) and Mushinga (located in Walungu territory). Each site comprised four villages: Bushumba Centre, Mulengeza, Muganzo and Itara in Bushumba and Luduha, Madaka, Karherwa and Ntabunge in Mushinga. Soils in Bushumba are mainly classified as Nitisols whereas those in Mushinga are mainly Ferralsols (FAO and UNESCO, 1974; Jones et al. 2013). The sites receive annual rainfall ranging between 1100mm and 2700mm in a bimodal pattern, and the altitude for both sites is between 1300 and 2000 meters above sea level. The common crops in Bushumba and Mushinga include cassava, common bean and maize.

## 2.2 Identification of participants

Prior to the application of the LC tool, 18 farmers including nine women and nine men were selected per village (i.e. 72 women and 72 men in the eight villages giving a total of 144 participants). The 18 farmers per village belonged to three different groups (typologies) defined on basis of land size:

- High resource (wealthy class): comprised farmers having at least two hectares of land
- Medium resource (middle class): comprised farmers with 0.6–1.9 ha of land
- Low resource (poor class): Farmers with less than 0.6 ha of land

The distribution of farmers into types, based on land size, was confirmed by the village chief and facilitator in each village before the day of the focus group discussions.

## 2.3 Data collection and analysis

The methodology for data collection in FGD follows the procedure described in Duncan et al. (2016). The FGDs were conducted in local languages (Mashi and Swahili) and were chaired by the project team (an UCB and IITA assistants) plus one external expert. Data were collected on:

i. Qualitative assessment of the local context and the pairwise ranking of the functions needed by farmers, through FGD

ii. The participatory matrix scoring, where individual farmer ranks the functions of legumes per the preferences.

Collected data were summarized and computed in Excel spreadsheets prepared by experts for the LC tool.

Participants to FGD in Karerwa

Women group discussion in Itara

## Qualitative assessment

In this assessment, the first discussions focus on identifying what participants understand as legumes and the legumes already existing in the farming system. Then a context assessment exercise for legumes production was done by roughly estimating the availability of land, labour, seed, inputs and services, knowledge and skills, water, and markets in the village. The context scores varied from 0 to 4, with 0 indicating that the factor being assessed does not represent a constraint to production, while four indicated the factor as a severe constraint.

## Pairwise ranking

A pairwise ranking was done in groups to assess farmers preferences for the various "legume functions" supplied by legumes. The LC tool prioritizes six legume functions namely food, feed, income, fuel, soil fertility improvement and soil erosion control. For the pairwise ranking exercise, participants are asked to choose the most preferred legume function for each possible pair of functions, and the final choice per pair made through voting.

## Participatory matrix

The participatory matrix scoring exercise has a similar objective as the pairwise ranking, but the choice of the preferred function is done individually. Each farmer received 20 bean seeds, which he/she distributed among the six legumes functions according to the importance, he/she gives to the functions. The distributions are recorded in the LC tool spreadsheet, which generates the scores.

# 3. Results

## 3.1 Mushinga site

### Village 1: Madaka

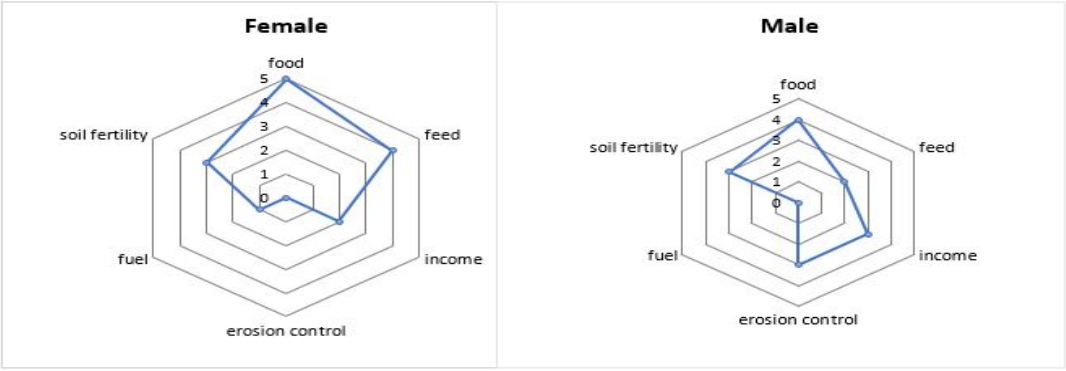
In preliminary discussions with farmers about their understanding of legumes, farmers in this village knew legumes as plants producing pods and having nodules on their roots for nitrogen fixation. Legumes grown by farmers included common bean, velvet bean, Calliandra and Desmodium among others (Table 1). Several benefits for legumes mentioned by farmers included provision of food, feed, fuel, soil fertility improvement and natural pesticides.

Table 1: Legumes grown in Madaka, their benefits and challenges faced by farmers in producing them

| Legumes grown | Benefits | Challenges |
|---|---|---|
| Common bean (bush type), soybean, field pea, groundnut, velvet bean, Desmodium, Tephrosia, Calliandra, Leucaena and Acacia | Food | Scarcity of land |
| | Source of income | Lack of fertilizer |
| | Animal feed | Lack of improved seed |
| | Soil fertility improvement | Poverty |
| | Fuel | Thieves |
| | Fencing | Lack of information |
| | Boundary demarcation Pesticides | Pest and disease attacks<br>Competition within crops |
| | | Climate change |

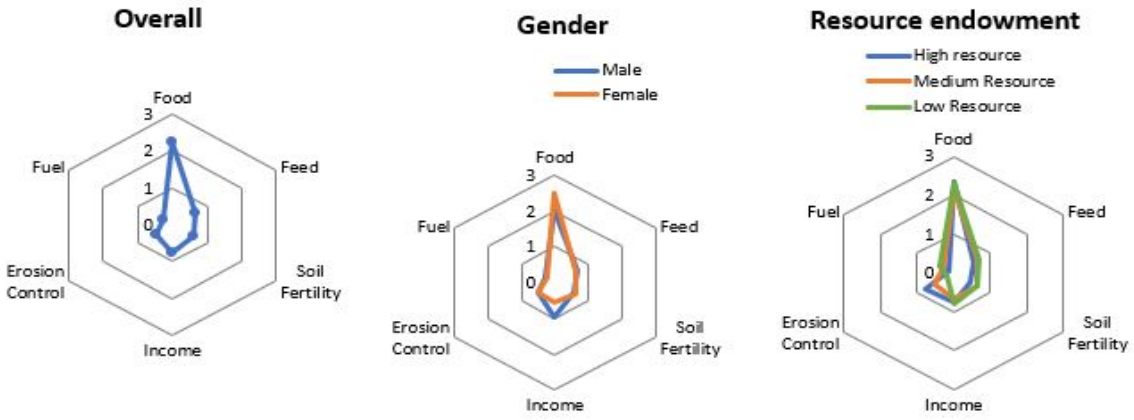
**Pairwise ranking**: Although the preferences for the functions of legume species were similar among all the participants, results of the pairwise ranking indicated slight differences between female and male farmers. The demand for food and soil fertility improvement was high in both female and male groups. However, female farmers had high demand for animal feed and fuel functions while male did not score the fuel function and expressed strong preference for income and soil erosion control functions (Figure 1). Pigeon pea comes out as the most suitable candidate fitting both the context, function and agro-ecology. Other grain legume candidates to be considered include lablab, climbing bean, field pea. For tree legumes, Leucaena diversifolia, L. trichanda and Callianda could be candidates.

Figure 1: Pairwise ranking scores for the preference for legume functions in female and male groups in Madaka, DRC




**Participatory matrix:** Results of the participatory matrix scoring showed similarity between genders and among farmer types (Figure 2). Both male and female farmers mainly preferred legumes as food. However, the demand for income was slightly higher for male than for female farmers. The preferences for legume functions among farmer types were almost the same but high and medium resource farmers' demand for erosion control was higher than that of the low resource farmers. We opted for the same list of legumes across all villages. Color codes: green = well fit; red= no fit; orange, yellow and light green are intermediate fits; Blue=rank fit <5.

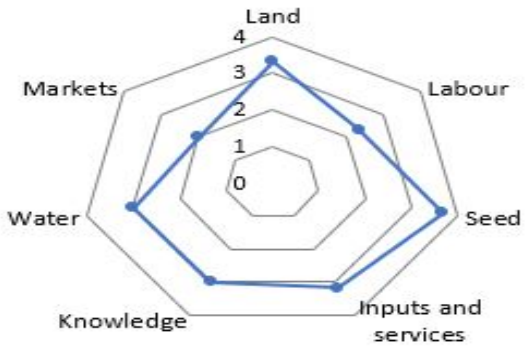
Figure 2: Demand for legume function in Madaka based on participatory matrix scoring for the overall participants and after disaggregation by gender and resource endowment




## Constraints to legume production

Participant farmers in the FGD identified several challenges that affect the production of legumes. These challenges include small land size, lack of fertilizer, lack of improved seed, poverty, thieves, lack of information, pest and disease attacks, competition within crops, and climate change. Similarly, the application of LC tool identified the lack of improved seed, land scarcity, and input and services as the most constraining factors to legume production in this village (Figure 3).

Figure 3: Scores of the major constraints for legume production in Madaka (4=Key constraint, 0=No constraint)



## Output from the legumeCHOICE tool application

Integrating the results from the various scores and the attributes of the legumes leads to the identification of how well legumes fit the context and the functions preferred by farmers, as well as the agro-ecology of Madaka (Table 2).

Pigeon pea comes out as the most suitable candidate fitting both the context, function and agro-ecology. Other grain legume candidates to be considered include lablab, climbing bean, field pea. For tree legumes, Leucaena diversifolia, L. trichanda and Callianda could be candidates.

Table 2: Legume species with suitable agro-ecological filter ranking, and either acceptable functional or context fit rank in Madaka. We opted for the same list of legumes across all villages. Color codes: green = well fit; red= no fit; orange, yellow and light green are intermediate fits; Blue=rank fit <5

| Legume name | | How well this option fulfils functional needs | | | | | | How well this option fits the context | | | | | | | Summary | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Food _fit | Feed _fit | Income _fit | Erosion control _fit | Fuel _fit | Soil fertility _fit | Land_ fit | Labour_ fit | Seed supply _fit | Inputs and services _fit | Knowledge and skills_fit | Water _fit | Markets _fit | Functional fit_rank | Context rank | Agro-ecological rank |
| Grain | Pigeon pea (Cajanus cajan) | 3.3 | 1.0 | 0.7 | 1.4 | 0.1 | 1.3 | 4.0 | 2.0 | 3.8 | 3.8 | 2.0 | 4.0 | 2.3 | 2 | 3 | 1 |
| | Climbing beans | 3.3 | 1.0 | 0.9 | 0.2 | 0.0 | 0.8 | 4.0 | 4.0 | 3.8 | 1.3 | 2.0 | 0.0 | 2.3 | 7 | 8 | 1 |
| | Bush bean | 3.3 | 0.2 | 0.9 | 0.2 | 0.1 | 0.2 | 2.0 | 0.0 | 3.8 | 1.3 | 0.0 | 2.0 | 2.3 | 24 | 25 | 1 |
| | Groundnuts | 1.2 | 1.0 | 0.9 | 0.9 | 0.1 | 1.3 | 0.0 | 0.0 | 3.8 | 0.0 | 0.0 | 2.0 | 3.9 | 17 | 23 | 19 |
| | Field Pea | 3.3 | 1.5 | 0.9 | 0.9 | 0.0 | 0.8 | 0.0 | 2.0 | 1.3 | 3.8 | 2.0 | 0.0 | 3.9 | 3 | 16 | - |
| | Dolichos lablab | 3.3 | 2.0 | 0.7 | 0.9 | 0.1 | 1.3 | 2.0 | 0.0 | 1.3 | 1.3 | 2.0 | 4.0 | 0.3 | 1 | 27 | 1 |
| Forage | Calliandra calothyrus | 0.0 | 2.0 | 0.5 | 1.8 | 0.2 | 1.3 | 4.0 | 4.0 | 0.0 | 3.8 | 2.0 | 2.0 | 0.3 | 13 | 17 | 1 |
| | Gliricidia sepium | 0.0 | 1.5 | 0.2 | 1.8 | 0.3 | 1.7 | 2.0 | 2.0 | 0.0 | 3.8 | 4.0 | 4.0 | 0.0 | 16 | 7 | 1 |
| | Leucaena leucocephala | 0.0 | 2.0 | 0.0 | 1.8 | 0.3 | 1.7 | 2.0 | 2.0 | 3.8 | 1.3 | 2.0 | 4.0 | 0.3 | 12 | 8 | 19 |
| | Leucaena trichandra | 0.0 | 2.0 | 0.5 | 1.4 | 0.3 | 1.3 | 2.0 | 2.0 | 3.8 | 1.3 | 2.0 | 4.0 | 0.3 | 18 | 8 | 1 |
| | Leucaena diversifolia | 0.0 | 2.0 | 0.5 | 1.4 | 0.3 | 1.3 | 2.0 | 2.0 | 3.8 | 1.3 | 2.0 | 4.0 | 0.3 | 18 | 8 | 1 |

# Village 2: Ntabunge

Both female and male farmers in Ntabunge understood legumes as plants with pods and grains and that have nodules on their roots. Men further added that legumes are crops that contribute to soil fertility improvement. Farmers mentioned several benefits and constraints of legume production (Table 3)

Table 3: Legumes grown in Ntabunge, their benefits and the challenges faced by farmers in producing them

| Legumes grown | Benefits | Challenges |
|---|---|---|
| Soybean, common bean (bush type), groundnut, field pea, velvet bean, Leucaena, Desmodium, Calliandra, Acacia, Tephrosia | Food | Scarcity of land |
| | Animal feed | Lack of fertilizer |
| | Fuel | Lack of improved seed |
| | Income generation | Poverty |
| | Soil fertility improvement | Thieves |
| | Medicine | Lack of information |
| | Boundary demarcation | Pest and disease attacks Competition within crops |
| | | Climate change |

**Pairwise ranking**: The results of pairwise ranking exercise indicated that there were differences in preferences for legume functions between men and women. Soil fertility improvement and fuel were more preferred by female while male expressed high demand for provision of animal feed and erosion control (Figure 4). Provision of food was the most demanded function by both female and male.

**Participatory matrix:** Similarly, the results of participatory matrix scoring exercise showed that there were some differences between genders and among farmer types (Figure 5). Women farmers preferred food and soil fertility improvement while male farmers preferred food and income generation functions. The preferences for legume functions

among the farmer types were almost the same but low resource farmers' demand for soil fertility improvement was higher compared with the other types while the demand by the high resource farmers of legumes as fuel was lower than the other two types.

Figure 4: Pairwise ranking scores for the demand of legume functions in female and male groups in Ntabunge, DRC

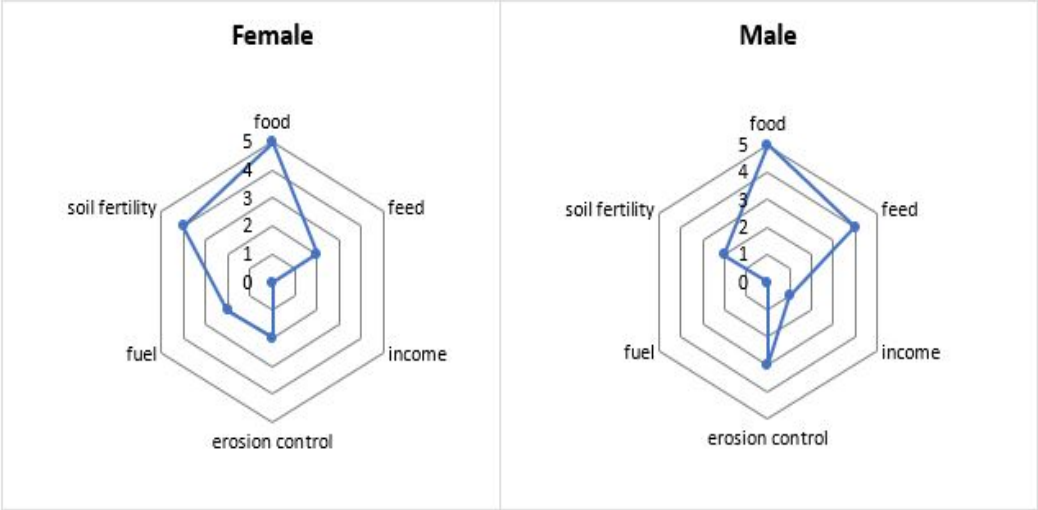
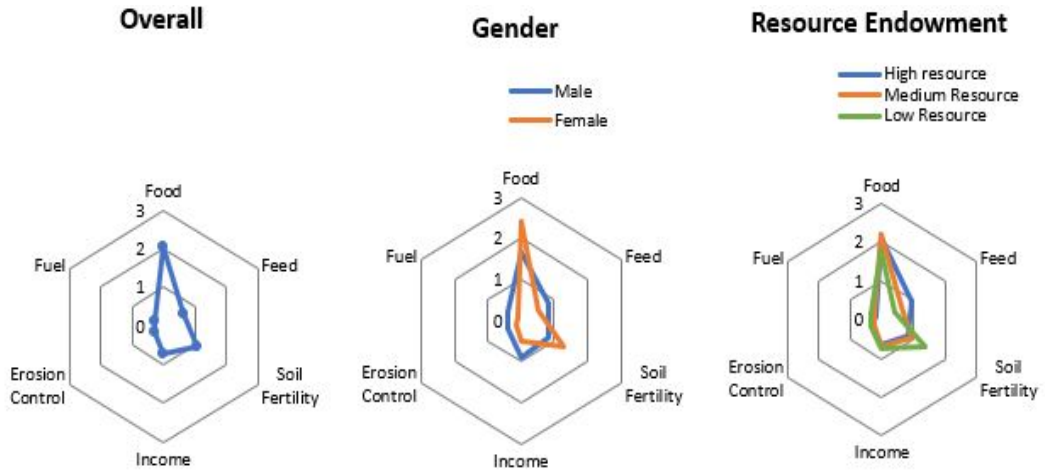


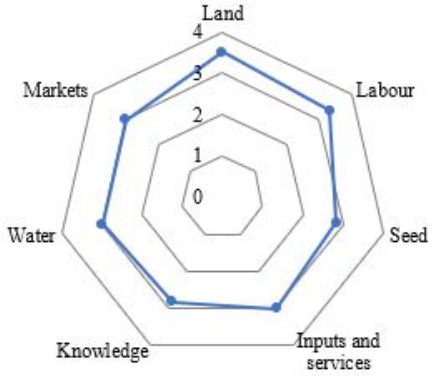

Figure 5: Demand for legume function in Ntabunge based on participatory matrix scoring for the overall participants and after disaggregation by gender and resource endowment




## Constraints to legume production

Participants of the FGD in Ntabunge village identified small land size, lack of fertilizer, lack of quality seeds of legumes, soil fertility degradation, climate change and lack of knowledge (to implement improved practices) as the main constraints/ challenges to the production of legumes in this village (Table 3). The application of LC tool indicated that all considered context factors were highly constraining legume productions with only slight differences in importance (in the order of their importance): scarcity of land, lack of labour, inputs and services, lack of water, markets, lack of improved seed and lack of knowledge as the most limiting factors to legume production in Ntabunge (Figure 6).

Figure 6: Scores of the major constraints for legume production in Ntabunge (4=Key constraint, 0=No constraint)




## Output from the LegumeCHOICE tool application

Integrating the results from the various scores and the attributes of the legumes, lead to the identification of how well legumes fit the context and the functions preferred by farmers, as well as the agro-ecology of Ntabunge (Table 4).

Pigeon pea emerges again as the most suitable candidate fitting both the context, function and agro-ecology. Other grain legume candidates to be considered include Field pea, climbing bean, lablab. For tree legumes, Gliricidia would be the plausible candidate.

Table 4: Legume species with suitable agro-ecological filter ranking, and either acceptable functional or context fit rank in Ntambunge

| Legume name | | How well this option fulfils functional needs | | | | | | How well this option fits the context | | | | | | | Summary | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Food _fit | Feed _fit | Income _fit | Erosion control _fit | Fuel _fit | Soil fertility _fit | Land_ fit | Labour_ fit | Seed supply _fit | Inputs And services _fit | Knowledge and skills_fit | Water _fit | Markets _fit | Functional fit_rank | Context rank | Agro-ecological rank |
| Grain | Pigeon pea (Cajanus cajan) | 3.5 | 0.9 | 0.6 | 1.2 | 0.3 | 1.2 | 3.0 | 1.3 | 3.9 | 4.0 | 2.0 | 4.0 | 2.0 | 2 | 4 | 1 |
| | Climbing beans | 3.5 | 0.9 | 0.8 | 0.2 | 0.0 | 0.8 | 3.0 | 3.8 | 3.9 | 2.0 | 2.0 | 0.0 | 2.0 | 7 | 6 | 1 |
| | Bush bean | 3.5 | 0.2 | 0.8 | 0.2 | 0.2 | 0.2 | 1.0 | 0.0 | 3.9 | 2.0 | 0.0 | 2.0 | 2.0 | 21 | 25 | 1 |
| | Groundnuts | 1.3 | 0.9 | 0.8 | 0.8 | 0.2 | 1.2 | 0.0 | 0.0 | 3.9 | 0.0 | 0.0 | 2.0 | 4.0 | 20 | 25 | 1 |
| | Field Pea | 3.5 | 1.4 | 0.8 | 0.8 | 0.0 | 0.8 | 0.0 | 1.3 | 2.3 | 4.0 | 2.0 | 0.0 | 4.0 | 3 | 7 | - |
| | Dolichos lablab | 3.5 | 1.8 | 0.6 | 0.8 | 0.2 | 1.2 | 1.0 | 0.0 | 2.3 | 2.0 | 2.0 | 4.0 | 0.0 | 1 | 23 | 1 |
| Tree | Calliandra calothyrus | 0.0 | 1.8 | 0.4 | 1.6 | 0.5 | 1.2 | 3.0 | 3.8 | 0.3 | 4.0 | 2.0 | 2.0 | 0.0 | 14 | 18 | 1 |
| | Gliricidia sepium | 0.0 | 1.4 | 0.2 | 1.6 | 0.6 | 1.6 | 1.0 | 1.3 | 0.3 | 4.0 | 4.0 | 4.0 | 0.0 | 16 | 7 | 1 |
| | Leucaena leucocephala | 0.0 | 1.8 | 0.0 | 1.6 | 0.6 | 1.6 | 1.0 | 1.3 | 3.9 | 2.0 | 2.0 | 4.0 | 0.0 | 11 | 10 | 19 |
| | Leucaena trichandra | 0.0 | 1.8 | 0.4 | 1.2 | 0.6 | 1.2 | 1.0 | 1.3 | 3.9 | 2.0 | 2.0 | 4.0 | 0.0 | 17 | 10 | 1 |
| | Leucaena diversifolia | 0.0 | 1.8 | 0.4 | 1.2 | 0.6 | 1.2 | 1.0 | 1.3 | 3.9 | 2.0 | 2.0 | 4.0 | 0.0 | 17 | 10 | 1 |

We opted for the same list of legumes across all villages. Color codes: green = well fit; red= no fit; orange, yellow and light green are intermediate fits; Blue=rank fit <5.

# Village 3: Luduha

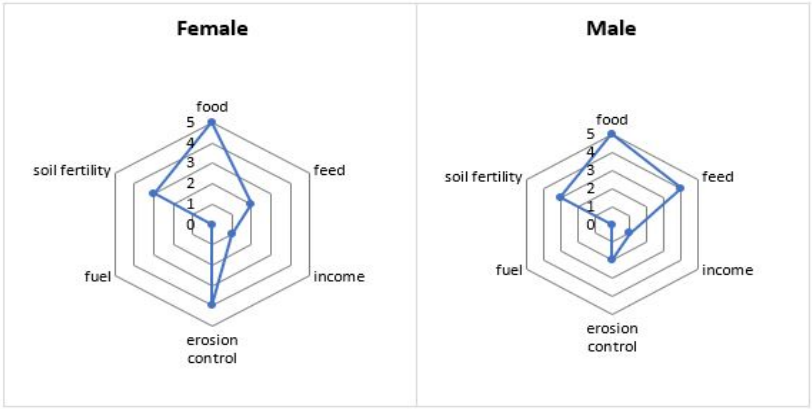
Both female and male farmers in Luduha defined legumes as plants which produce pods, have nodules on their roots and are annual plants. A summary of legumes grown by farmers in this village, their functions/ benefits and constraints to their production is given in Table 5.

Table 5: Legumes grown in Luduha, their benefits and the challenges faced by farmers in producing them

| Legumes grown | Benefits | Challenges |
|---|---|---|
| Soybean, common bean, field pea, groundnut, velvet, cowpea, pigeon pea, Desmodium, albizzia, Leucaena, Calliandra, *munyegenyege*, *mushebeyi*. | Food<br>Animal feed<br>Source of income<br>Fuel<br>Soil fertility improvement<br>Medicines<br>Pesticides<br>Erosion control<br>Materials of construction. | Land limitation<br>Lack of quality seeds<br>Soil fertility degradation, Soil erosion<br>Lack of fertilizer<br>Climate change |

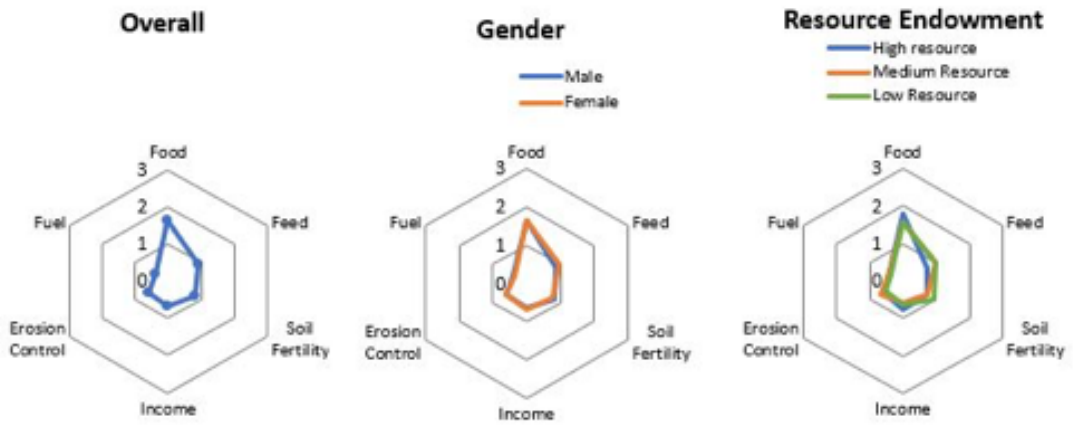
**Pairwise ranking**: Results of the pairwise ranking exercise indicated that there were some differences in the preferences for legume functions between female and male farmers in Luduha. Food, erosion control and soil fertility improvement (in the order of their importance) were more preferred by female while male expressed high demand for food, provision of animal feed and soil fertility functions (Figure 7). However, neither women nor men showed interest in the fuel function .

Figure 7: Pairwise ranking scores for the demand of legume functions in female and male groups in Luduha, DRC




**Participatory matrix:** The results of the participatory matrix scoring exercise indicated that there was no difference between gender and among farmer types in their preferences of legume functions (Figure 8).

Figure 8: Demand for legume function in Luduha based on participatory matrix scoring for the overall participants and after disaggregation by gender and resource endowment



## Constraints to legume production

Participant farmers of the FGD in Luduha identified lack of land, lack of fertilizer, pests and diseases, low soil fertility and lack of improved seeds as major challenges to legume production in their village (Table 5). Lack of knowledge, quality seed and inputs and services were identified as le major limiting factors to legume production in Luduha (Figure 9). Scarcity of land, lack of labour, water and markets were also identified as other limiting factors in this village, based on the context scoring (Figure 9).

Figure 9: Scores of the major constraints for legume production in Luduha (4=Key constraint, 0=No constraint)


## Output from the LegumeCHOICE tool application

Integrating the results from the various scores and the attributes of the legumes, lead to the identification of how well legumes fit the context and the functions preferred by farmers, as well as the agro-ecology of Luduha (Table 6).

Pigeon pea comes out as the most suitable candidate fitting both the context, function and agro-ecology. Other grain legume candidates to be considered include climbing bean, field pea, lablab. For tree legumes, L. diversifolia, L. trichanda and Gliricidia could be candidates.

Table 6: Legume species with suitable agro-ecological filter ranking, and either acceptable functional or context fit rank in Luduha

| Legume name | | How well this option fulfils functional needs | | | | | | How well this option fits the context | | | | | | | Summary | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Food _fit | Feed _fit | Income _fit | Erosion control _fit | Fuel _fit | Soil fertility _fit | Land_ fit | Labour_ fit | Seed supply _fit | Inputs and services _fit | Knowledge and skills_fit | Water _fit | Markets _fit | Functional fit_rank | Context rank | Agro-ecological rank |
| Grain | Pigeon pea (Cajanus cajan) | 3.3 | 1.0 | 0.7 | 1.4 | 0.1 | 1.3 | 4.0 | 2.0 | 3.8 | 3.8 | 2.0 | 4.0 | 2.3 | 2 | 3 | 1 |
| | Climbing beans | 3.3 | 1.0 | 0.9 | 0.2 | 0.0 | 0.8 | 4.0 | 4.0 | 3.8 | 1.3 | 2.0 | 0.0 | 2.3 | 7 | 8 | 1 |
| | Bush bean | 3.3 | 0.2 | 0.9 | 0.2 | 0.1 | 0.2 | 2.0 | 0.0 | 3.8 | 1.3 | 0.0 | 2.0 | 2.3 | 24 | 25 | 1 |
| | Groundnuts | 1.2 | 1.0 | 0.9 | 0.9 | 0.1 | 1.3 | 0.0 | 0.0 | 3.8 | 0.0 | 0.0 | 2.0 | 3.9 | 17 | 23 | 19 |
| | Field Pea | 3.3 | 1.5 | 0.9 | 0.9 | 0.0 | 0.8 | 0.0 | 2.0 | 1.3 | 3.8 | 2.0 | 0.0 | 3.9 | 3 | 16 | - |
| | Dolichos lablab | 3.3 | 2.0 | 0.7 | 0.9 | 0.1 | 1.3 | 2.0 | 0.0 | 1.3 | 1.3 | 2.0 | 4.0 | 0.3 | 1 | 27 | 1 |
| Forage | Calliandra calothyrus | 0.0 | 2.0 | 0.5 | 1.8 | 0.2 | 1.3 | 4.0 | 4.0 | 0.0 | 3.8 | 2.0 | 2.0 | 0.3 | 13 | 17 | 1 |
| | Gliricidia sepium | 0.0 | 1.5 | 0.2 | 1.8 | 0.3 | 1.7 | 2.0 | 2.0 | 0.0 | 3.8 | 4.0 | 4.0 | 0.0 | 16 | 7 | 1 |
| | Leucaena leucocephala | 0.0 | 2.0 | 0.0 | 1.8 | 0.3 | 1.7 | 2.0 | 2.0 | 3.8 | 1.3 | 2.0 | 4.0 | 0.3 | 12 | 8 | 19 |
| | Leucaena trichandra | 0.0 | 2.0 | 0.5 | 1.4 | 0.3 | 1.3 | 2.0 | 2.0 | 3.8 | 1.3 | 2.0 | 4.0 | 0.3 | 18 | 8 | 1 |
| | Leucaena diversifolia | 0.0 | 2.0 | 0.5 | 1.4 | 0.3 | 1.3 | 2.0 | 2.0 | 3.8 | 1.3 | 2.0 | 4.0 | 0.3 | 18 | 8 | 1 |

We opted for the same list of legumes across all villages. Color codes: green = well fit; red= no fit; orange, yellow and light green are intermediate fits; Blue=rank fit <5.

# Village 4: Karerwa

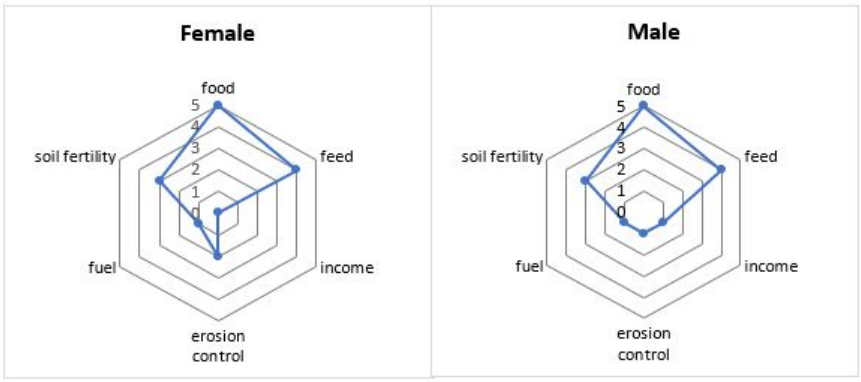
According to the participants of the FGDs at Karerwa, legumes are annual or perennial plants that produce pods, nodules on their roots and have the ability to improve soil fertility. A summary of the major legumes grown by farmers in this village, their benefits and constraints to their production is given in Table 7.

Table 7: Legume grown in Karerwa, their benefits and the challenges faced by farmers in producing them

| Grown legumes | Functions | Constraints |
|---|---|---|
| Soybean, climbing bean, common bean (bush type), field pea, groundnut, cowpea, velvet, pigeon pea, Desmodium, Calliandra, Leucaena, Acacia, Albizzia, *muyegeyege, mukaga bazimu,* | Food<br>Animal feed<br>Source of income<br>Medicines<br>Land limitation<br>Soil fertility improvement Fuel<br>Pesticides,<br>Material of construction | Lack of fertilizer<br>Lack of land<br>Lack of knowledge<br>Pests and diseases<br>Lack of seed supplier Climate change<br>Erosion control |

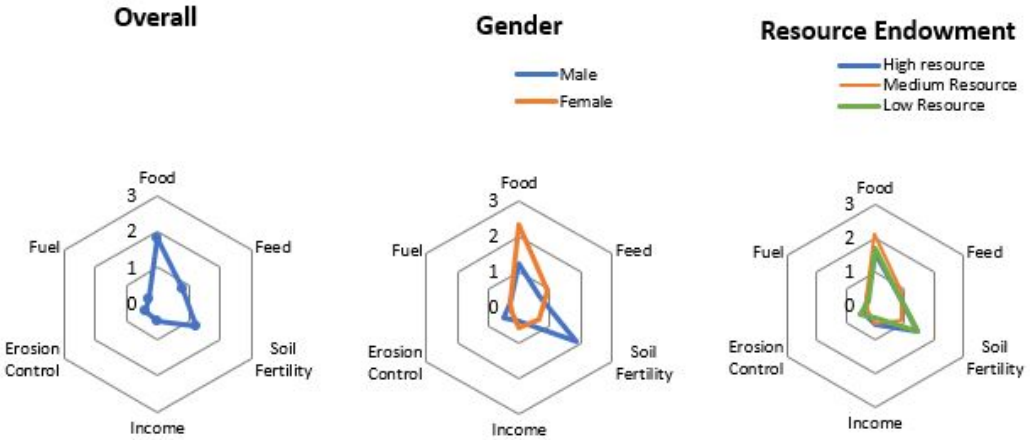
**Pairwise ranking:** The preferences for legume functions by female and male farmers were similar in Karerwa as shown by the results of pairwise ranking of Legume Choice tool application. Food, animal feed and soil fertility improvement were the most demanded legume functions by both female and male groups (Figure 10).

Figure 10: Pairwise ranking scores for the demand of legume functions in female and male groups in Karerwa, DRC




**Participatory matrix**: The results of participatory matrix scoring exercise show that there were no differences between genders and among farm types. Female and male farmers demand legumes mainly for food, improvement of soil fertility and provision of animal feed (Figure 11). However, the preference of legumes for provision of animal feed was highest for women while the demand for legumes for the improvement of soil fertility was highest for men. The preferences for legume functions among the farm types were similar, they all expressed demand for food followed by soil fertility then animal feed functions (Figure 11).

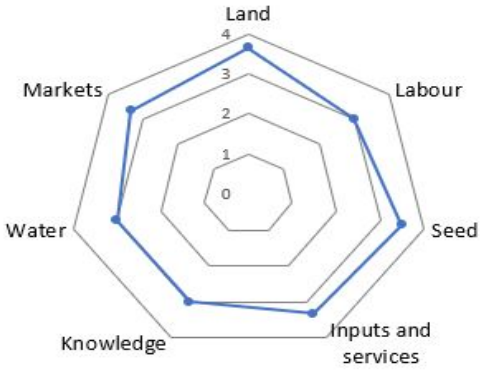
Figure 11: Demand for legume function in Karerwa based on participatory matrix scoring for the overall participants and after disaggregation by gender and resource endowment



## Constraints to legume production

Participants in the FGD identified lack of land, of fertilizer, knowledge, seed suppliers, improved seed, the incidence of pest and disease attacks and climate change as challenges faced in legume production (Table 7). Based on the context scoring, land and lack of improved seeds were identified as the most limiting factors to the production of legumes (Figure 12). Inputs and services, lack of markets, labour, knowledge and water were also identified as key constraints of legume production.

Figure 12: Scores for the major constraints of legume production in Karerwa (4=Key constraint, 0=No constraint)




## Output from the LegumeCHOICE tool application

Integrating the results from the various scores and the attributes of the legumes, lead to the identification of how well legumes fit the context and the functions preferred by farmers, as well as the agro-ecology of Karerwa (Table 8).

Pigeon pea comes out as the most suitable candidate fitting both the context, function and agro-ecology. Other grain legume candidates to be considered include field pea, lablab, climbing bean. For tree legumes, L. diversifolia, L. trichanda and Callianda could be candidates.

Table 8: Legume species with suitable agro-ecological filter ranking, and either acceptable functional or context fit rank in Karerwa

| Legume name | | How well this option fulfils functional needs | | | | | | How well this option fits the context | | | | | | | Summary | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Food _fit | Feed _fit | Income _fit | Erosion control _fit | Fuel _fit | Soil fertility _fit | Land_ fit | Labour_ fit | Seed supply _fit | Inputs and services _fit | Knowledge and skills_fit | Water _fit | Markets _fit | Functional fit_rank | Context rank | Agro-ecological rank |
| Grain | Pigeon pea (Cajanus cajan) | 3.4 | 0.6 | 0.7 | 0.7 | 0.3 | 1.2 | 2.7 | 2.0 | 3.0 | 3.8 | 2.0 | 4.0 | 1.3 | 5 | 4 | 1 |
| | Climbing beans | 3.4 | 0.6 | 0.9 | 0.2 | 0.0 | 0.8 | 2.7 | 4.0 | 3.0 | 1.3 | 2.0 | 0.0 | 1.3 | 8 | 18 | 1 |
| | Bush bean | 3.4 | 0.3 | 0.9 | 0.2 | 0.2 | 0.2 | 0.7 | 0.0 | 3.0 | 1.3 | 0.0 | 2.0 | 1.3 | 19 | 27 | 1 |
| | Groundnuts | 1.3 | 0.6 | 0.9 | 0.5 | 0.2 | 1.2 | 0.0 | 0.0 | 3.0 | 0.0 | 0.0 | 2.0 | 3.8 | 27 | 24 | 1 |
| | Field Pea | 3.4 | 1.8 | 0.9 | 0.5 | 0.0 | 0.8 | 0.0 | 2.0 | 1.0 | 3.8 | 2.0 | 0.0 | 3.8 | 2 | 8 | - |
| | Dolichos lablab | 3.4 | 2.4 | 0.7 | 0.5 | 0.2 | 1.2 | 0.7 | 0.0 | 1.0 | 1.3 | 2.0 | 4.0 | 0.0 | 1 | 25 | 1 |
| Tree | Calliandra calothyrus | 0.0 | 2.4 | 0.4 | 1.0 | 0.5 | 1.2 | 2.7 | 4.0 | 0.0 | 3.8 | 2.0 | 2.0 | 0.0 | 13 | 16 | 1 |
| | Gliricidia sepium | 0.0 | 1.8 | 0.2 | 1.0 | 0.7 | 1.6 | 0.7 | 2.0 | 0.0 | 3.8 | 4.0 | 4.0 | 0.0 | 18 | 6 | 1 |
| | Leucaena leucocephala | 0.0 | 2.4 | 0.0 | 1.0 | 0.7 | 1.6 | 0.7 | 2.0 | 3.0 | 1.3 | 2.0 | 4.0 | 0.0 | 11 | 9 | 19 |
| | Leucaena trichandra | 0.0 | 2.4 | 0.4 | 0.7 | 0.7 | 1.2 | 0.7 | 2.0 | 3.0 | 1.3 | 2.0 | 4.0 | 0.0 | 15 | 9 | 1 |
| | Leucaena diversifolia | 0.0 | 2.4 | 0.4 | 0.7 | 0.7 | 1.2 | 0.7 | 2.0 | 3.0 | 1.3 | 2.0 | 4.0 | 0.0 | 15 | 9 | 1 |

We opted for the same list of legumes across all villages. Color codes: green = well fit; red= no fit; orange, yellow and light green are intermediate fits; Blue=rank fit <5.

# 3.2 Bushumba site

## Village 5: Mulengeza

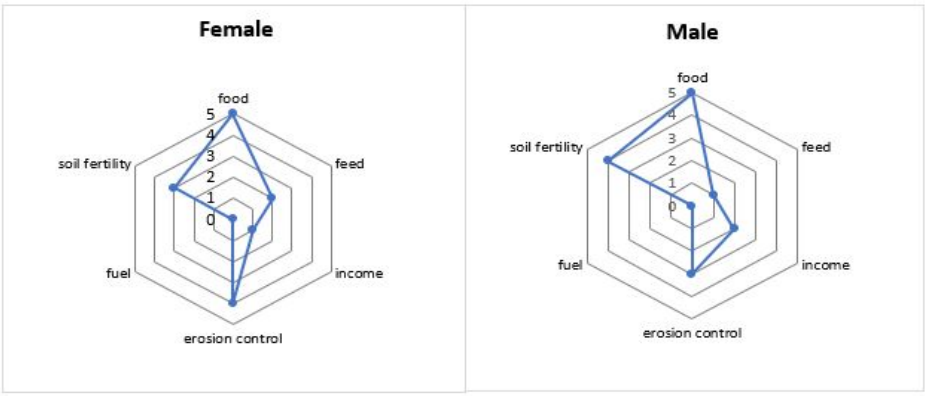
Farmers in Mulengeza village understood legumes as plants that produce pods and that have nodules on their roots for biological nitrogen fixation (BNF), have the ability to improve soil fertility, and plants with growing cycle of less than three months. A summary of legumes grown by farmers in this village, their benefits and constraints to their production is given in Table 9.

Table 9: Legume grown in Mulengeza, their benefits and the challenges faced by farmers in producing them

| Grown legume species | Benefits | Challenges |
|---|---|---|
| Soybean, climbing bean, common bean (bush type), field pea, groundnut, mucuna, pigeon pea, Calliandra, Leucaena, Acacia, Albizzia, Desmodium, *muyegeyege* | Food | Lack of land |
| | Source of income | Low soil fertility |
| | Animal feed | Lack of seed |
| | Medicines | Pest and disease attacks |
| | Soil fertility improvement Fuel | Lack of improved technologies, |
| | Pesticides | Poverty |
| | Materials of construction | Erosion control |

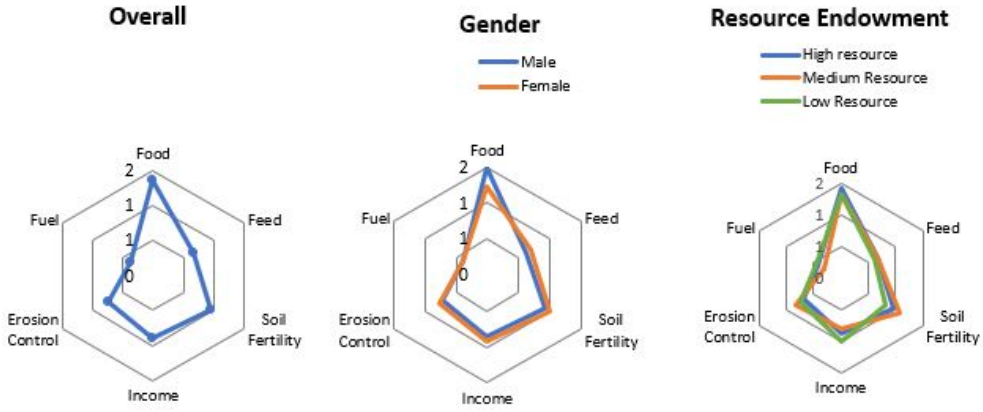
**Pairwise ranking**: The results of pairwise ranking exercise in Mulengeza show similarity in the preferences of legume functions between female and male farmers (Figure 13). Provision of food, erosion control and soil fertility improvement were most preferred by both men and women. However, the preference of legumes for soil erosion control was highest for women while the demand for legumes for the improvement of soil fertility was highest for men. Both female and male participants gave a score of zero for the fuel function (Figure 13).

Figure 13: Pairwise ranking scores for the demand of legume functions in female and male groups in Mulengeza, DRC




**Participatory matrix**: The results of participatory matrix scoring exercise in Mulengeza indicate that there were no obvious differences between gender and among farm types (Figure 14). Female and male farmers mainly preferred provision of food, soil fertility improvement and income generation as legume functions. The preferences for legume functions were similar among the farm types (Figure 14).

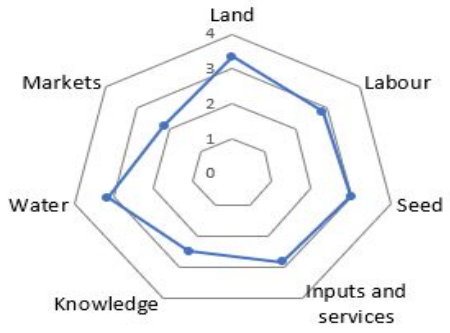
Figure 14: Demand for legume function in Mulengeza based on participatory matrix scoring for the overall participants and after disaggregation by gender and resource endowment




## Constraints to legume production

Small land size, low soil fertility, lack of quality seed and improved technologies, pest and disease attacks as well as poverty were mentioned by the participants of the FGD as the challenges to legume production in Mulengeza (Table 9). In the context assessment exercise land, lack of water and quality seeds were identified as the most limiting factors to the production of legume crops in this village. Lack of labour, inputs and services, lack of knowledge and of markets were also mentioned (Figure 15).

Figure 15: Scores for the major constraints to legume production in Mulengeza (4=Key constraint, 0=No constraint)




## Output from the LegumeCHOICE tool application

Integrating the results from the various scores and the attributes of the legumes, lead to the identification of how well legumes fit the context and the functions preferred by farmers, as well as the agro-ecology of Mulengeza (Table 10).

Pigeon pea emerges as the most suitable candidate fitting both the context, function and agro-ecology. Other grain legume candidates to be considered include field pea, climbing bean, lablab. For tree legumes, L. diversifolia and L. trichanda could be candidates.

Table 10: Legume species with suitable agro-ecological filter ranking, and either acceptable functional or context fit rank in Mulengeza

| Legume name | | How well this option fulfils functional needs | | | | | | How well this option fits the context | | | | | | | Summary | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Food_fit | Feed_fit | Income_fit | Erosion control_fit | Fuel_fit | Soil fertility_fit | Land_fit | Labour_fit | Seed supply_fit | Inputs and services_fit | Knowledge and skills_fit | Water_fit | Markets_fit | Functional fit_rank | Context rank | Agro-ecological rank |
| Grain | Pigeon pea (Cajanus cajan) | 3.2 | 0.5 | 0.9 | 1.6 | 0.2 | 1.5 | 3.8 | 2.3 | 4.0 | 3.9 | 1.7 | 3.9 | 3.9 | 1 | 3 | 1 |
| | Climbing beans | 3.2 | 0.5 | 1.2 | 0.3 | 0.0 | 1.0 | 3.8 | 3.9 | 4.0 | 2.3 | 1.7 | 0.0 | 3.9 | 8 | 13 | 1 |
| | Bush bean | 3.2 | 0.1 | 1.2 | 0.3 | 0.1 | 0.2 | 1.3 | 0.3 | 4.0 | 2.3 | 0.0 | 1.7 | 3.9 | 21 | 23 | 1 |
| | Groundnuts | 1.2 | 0.5 | 1.2 | 0.5 | 0.1 | 1.5 | 0.0 | 0.0 | 4.0 | 0.3 | 0.0 | 1.7 | 4.0 | 23 | 27 | 20 |
| | Field Pea | 3.2 | 0.8 | 1.2 | 0.5 | 0.0 | 1.0 | 0.0 | 2.3 | 2.0 | 3.9 | 1.7 | 0.0 | 4.0 | 3 | 18 | - |
| | Dolichos lablab | 3.2 | 1.1 | 0.9 | 0.5 | 0.1 | 1.5 | 1.3 | 0.3 | 2.0 | 2.3 | 1.7 | 3.9 | 1.7 | 2 | 25 | 1 |
| Tree | Calliandra calothyrus | 0.0 | 1.1 | 0.6 | 2.2 | 0.3 | 1.5 | 3.8 | 3.9 | 0.0 | 3.9 | 1.7 | 1.7 | 1.7 | 12 | 21 | 1 |
| | Gliricidia sepium | 0.0 | 0.8 | 0.2 | 2.2 | 0.4 | 1.9 | 1.3 | 2.3 | 0.0 | 3.9 | 3.9 | 3.9 | 0.0 | 15 | 17 | 1 |
| | Leucaena leucocephala | 0.0 | 1.1 | 0.0 | 2.2 | 0.4 | 1.9 | 1.3 | 2.3 | 4.0 | 2.3 | 1.7 | 3.9 | 1.7 | 14 | 6 | 20 |
| | Leucaena trichandra | 0.0 | 1.1 | 0.6 | 1.6 | 0.4 | 1.5 | 1.3 | 2.3 | 4.0 | 2.3 | 1.7 | 3.9 | 1.7 | 18 | 6 | 1 |
| | Leucaena diversifolia | 0.0 | 1.1 | 0.6 | 1.6 | 0.4 | 1.5 | 1.3 | 2.3 | 4.0 | 2.3 | 1.7 | 3.9 | 1.7 | 18 | 6 | 1 |

We opted for the same list of legumes across all villages. Color codes: green = well fit; red= no fit; orange, yellow and light green are intermediate fits; Blue=rank fit <5.

## Village 6: Muganzo

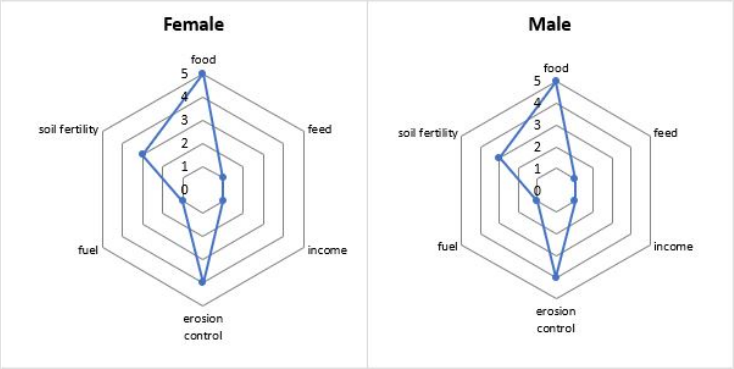
Farmers in this village understood legumes as plants which producing grains in pods and have nodules on their roots for BNF, plants that improve soil fertility. A summary of the legume crops grown in Muganzo, their functions/ benefits and constraints to their production is given in Table 11.

Table 11: Legume grown in Muganzo, their benefits and the challenges faced by farmers in producing them

| Legumes grown | Benefits | Challenges |
|---|---|---|
| Common bean (bush type), climbing bean, soybean, field pea, groundnut, cowpea, Tephrosia, pigeon pea, mucuna, desmodium, Calliandra, Leucaena, Acacia | Food | Lack of land |
| | Animal feed | Lack of fertilizers |
| | Fencing | Low soil fertility |
| | Construction material | Lack of improved seed and technology |
| | Fuel | Poverty |
| | Source of income | Climate change |
| | Medicines | Pests and diseases attack |
| | Improve soil fertility | |
| | Provide oil | |

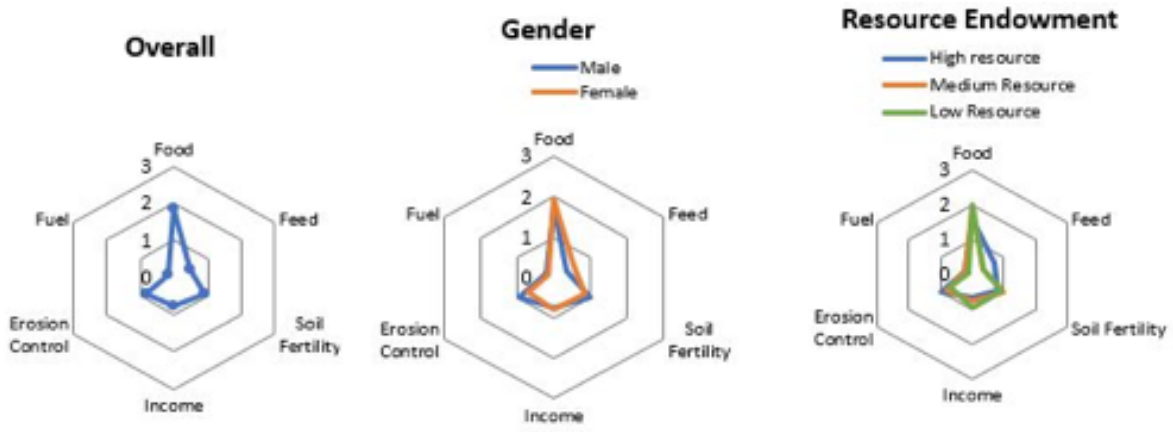
Pairwise ranking: Results of the pairwise ranking exercise in Muganzo indicated that there were no obvious differences between men and women farmers in their preferences for legume functions (Figure 16). Provision of food, erosion control and soil fertility improvement were most preferred legume functions by both women and men.

Figure 16: Pairwise ranking scores for the demand of legume functions in female and male groups in Muganzo, DRC




**Participatory matrix**: The results of participatory matrix scoring exercise show no differences between genders but slight differences among farm types in Muganzo. Provision of food, erosion control and soil fertility improvement were the most preferred functions by both female and male farmers (Figure 17). The preferences for legume functions were similar for medium and low resource farmers who had high demand for food and soil fertility improvement functions while high resource farmers mainly preferred food and erosion control functions (Figure 17).

Figure 17: Demand for legume function in Muganzo based on participatory matrix scoring for the overall participants and after disaggregation by gender and resource endowment




## Constraints to legume production

Small land size, lack of fertilizers, improved seeds and improved technologies, climate change, low soil fertility, poverty and pest and disease attacks were the major challenges to legume production indicated by the participants of the FCD in Muganzo (Table 11). In the context assessment exercise, lack of inputs and services, scarcity of land, lack of knowledge and water were the main constraints to the production of legume crops in this village. Lack of labour, quality seeds and markets were also identified by the tool (Figure 18).

Figure 18: Scores for the major constraints to legume production in Muganzo (4=Key constraint, 0=No constraint)

## Output from the LegumeCHOICE tool application

Integrating the results from the various scores and the attributes of the legumes, lead to the identification of how well legumes fit the context and the functions preferred by farmers, as well as the agro-ecology of Muganzo (Table 12).

Pigeon pea comes out as the most suitable candidate fitting both the context, function and agro-ecology. Other grain legume candidates to be considered include Field pea, climbing bean, lablab. For tree legumes, L. diversifolia, L. trichanda and Gliricidia could be candidates.

Table 12: Legume species with suitable agro-ecological filter ranking, and either acceptable functional or context fit rank in Muganzo

| | Legume name | How well this option fulfils functional needs | | | | | | How well this option fits the context | | | | | | | Summary | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Food _fit | Feed _fit | Income _fit | Erosion control _fit | Fuel _fit | Soil fertility _fit | Land_ fit | Labour_ fit | Seed supply _fit | Inputs and services _fit | Knowledge and skills_fit | Water _fit | Markets _fit | Functional fit_rank | Context rank | Agro-ecological rank |
| Grain | Pigeon pea (Cajanus cajan) | 3.4 | 0.4 | 0.7 | 1.8 | 0.5 | 1.2 | 4.0 | 2.3 | 3.9 | 3.8 | 2.0 | 4.0 | 2.7 | 1 | 4 | 1 |
| | Climbing beans | 3.4 | 0.4 | 1.0 | 0.3 | 0.0 | 0.8 | 4.0 | 3.9 | 3.9 | 1.3 | 2.0 | 0.0 | 2.7 | 7 | 16 | 1 |
| | Bush bean | 3.4 | 0.2 | 1.0 | 0.3 | 0.2 | 0.2 | 2.0 | 0.3 | 3.9 | 1.3 | 0.0 | 2.0 | 2.7 | 16 | 25 | 1 |
| | Groundnuts | 1.3 | 0.4 | 1.0 | 0.6 | 0.2 | 1.2 | 0.0 | 0.0 | 3.9 | 0.0 | 0.0 | 2.0 | 3.8 | 27 | 27 | 20 |
| | Field Pea | 3.4 | 0.5 | 1.0 | 0.6 | 0.0 | 0.8 | 0.0 | 2.3 | 2.3 | 3.8 | 2.0 | 0.0 | 3.8 | 3 | 8 | - |
| | Dolichos lablab | 3.4 | 0.7 | 0.7 | 0.6 | 0.2 | 1.2 | 2.0 | 0.3 | 2.3 | 1.3 | 2.0 | 4.0 | 0.7 | 2 | 24 | 1 |
| Tree | Calliandra calothyrus | 0.0 | 0.7 | 0.5 | 2.4 | 0.7 | 1.2 | 4.0 | 3.9 | 0.3 | 3.8 | 2.0 | 2.0 | 0.7 | 14 | 18 | 1 |
| | Gliricidia sepium | 0.0 | 0.5 | 0.2 | 2.4 | 0.9 | 1.6 | 2.0 | 2.3 | 0.3 | 3.8 | 4.0 | 4.0 | 0.0 | 11 | 7 | 1 |
| | Leucaena leucocephala | 0.0 | 0.7 | 0.0 | 2.4 | 0.9 | 1.6 | 2.0 | 2.3 | 3.9 | 1.3 | 2.0 | 4.0 | 0.7 | 13 | 9 | 20 |
| | Leucaena trichandra | 0.0 | 0.7 | 0.5 | 1.8 | 0.9 | 1.2 | 2.0 | 2.3 | 3.9 | 1.3 | 2.0 | 4.0 | 0.7 | 17 | 9 | 1 |
| | Leucaena diversifolia | 0.0 | 0.7 | 0.5 | 1.8 | 0.9 | 1.2 | 2.0 | 2.3 | 3.9 | 1.3 | 2.0 | 4.0 | 0.7 | 17 | 9 | 1 |

We opted for the same list of legumes across all villages. Color codes: green = well fit; red= no fit; orange, yellow and light green are intermediate fits; Blue=rank fit <5.

# Village 7: Itara

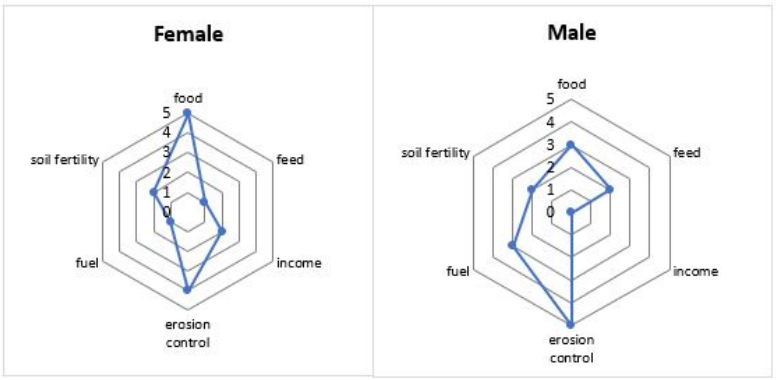
Legumes are plants that produce grains in pods and improve soil fertility through their nodules according to farmers in Itara. A summary of legumes grown in this village, their functions/ benefits and constraints to their production is given in Table 13.

Table 13: Legume grown in Itara, their benefits and the challenges faced by farmers in producing them

| Legumes grown | Functions | Constraints |
|---|---|---|
| Common bean, climbing bean, soybean, field pea, groundnut, pigeon pea, cowpea, Acacia, Calliandra, Leucaena, desmodium, mucuna, *mulukuluku, muyegeyege, cihinga, makubwe, makalaga* | Food<br>Animal feed<br>Medicines<br>Source of income<br>Improve soil fertility Construction materials<br>Sticks for climbing<br>Fuel | Lack of improved seed<br>Lack of fertilizers<br>Lack of land<br>Soil erosion<br>Poverty<br>Pest and disease attacks<br>Lack of technical skills and knowledge<br>Lack of inputs<br>Climate change |

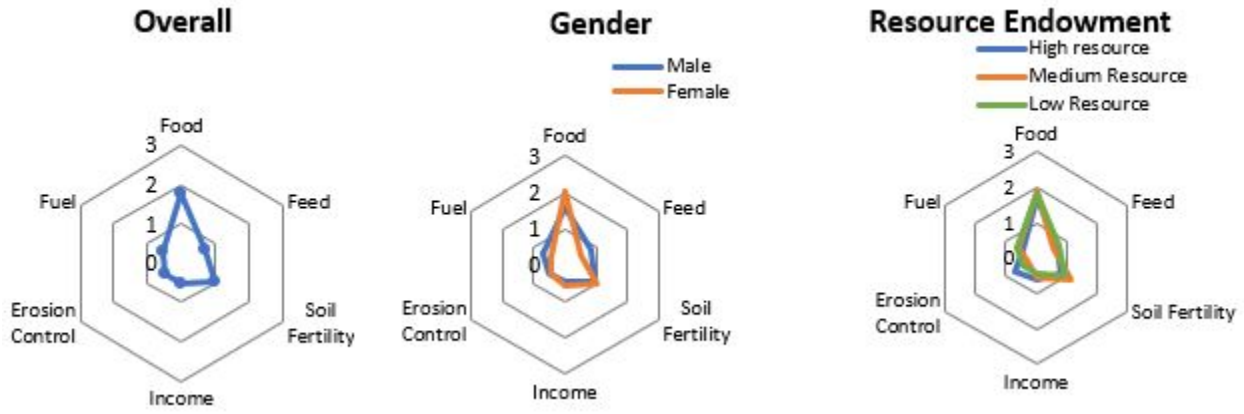
Pairwise ranking: Results of pairwise ranking exercise show that there were differences between female and male farmers in their preferences for legume functions. Women expressed high interest for food and erosion control functions while men had highest preference for erosion control (Figure 19). In addition, women demanded legumes for income generation while this function was not score by men groups (Figure 19).

Figure 19: Pairwise ranking scores for the demand of legume functions in female and male groups in Itara, DRC




**Participatory matrix**: Both female and male participants preferred food and soil fertility improvement legume functions based on participatory matrix scoring exercise (Figure 20). However, the demand of legumes as food was higher for women than for men farmers. The preferences for legume functions were similar among the farm types (Figure 20).

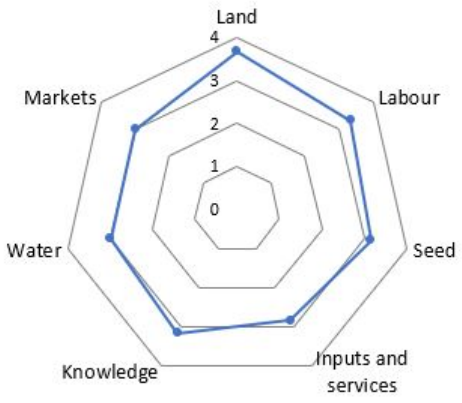
Figure 20: Demand for legume function in Itara based on participatory matrix scoring for the overall participants and after disaggregation by gender and resource endowment




## Constraints to legume production

Lack of land, fertilizers and improved seeds, soil erosion, pest and disease attacks, poverty, lack of technical skills and knowledge, climate change were indicated by the participants of the FGD as the major challenges to legume production in Itara (Table 13). Context assessment exercise indicate that scarcity of land was the main constraint /challenge to the production of legumes in Itara (Figure 21). Lack of labour, improved seeds and lack of knowledge, lack of water, markets and inputs and services were others limiting factors in this village (Figure 21).

Figure 21: Scores for the major constraints to legume production in Itara (4=Key constraint, 0=No constraint)



## Output from the LegumeCHOICE tool application

Integrating the results from the various scores and the attributes of the legumes, lead to the identification of how well legumes fit the context and the functions preferred by farmers, as well as the agro-ecology of Itara (Table 14).

Pigeon pea comes out as the most suitable candidate fitting both the context, function and agro-ecology. Other grain legume candidates to be considered include field pea, lablab, climbing bean. For tree legumes, Gliricidia, Calliandra, L. diversifolia and L. trichanda could be candidates.

Table 14: Legume species with suitable agro-ecological filter ranking, and either acceptable functional or context fit rank in Itara

| Legume name | | How well this option fulfils functional needs | | | | | | How well this option fits the context | | | | | | | Summary | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Food _fit | Feed _fit | Income _fit | Erosion control _fit | Fuel _fit | Soil fertility _fit | Land_ fit | Labour_ fit | Seed supply _fit | Inputs and services _fit | Knowledge and skills_fit | Water _fit | Markets _fit | Functional fit_rank | Context rank | Agro-ecological rank |
| Grain | Pigeon pea (Cajanus cajan) | 2.9 | 0.5 | 0.7 | 1.9 | 0.6 | 1.0 | 2.7 | 1.3 | 3.9 | 3.9 | 2.0 | 4.0 | 2.0 | 1 | 4 | 1 |
| | Climbing beans | 2.9 | 0.5 | 1.0 | 0.3 | 0.0 | 0.6 | 2.7 | 3.8 | 3.9 | 2.3 | 2.0 | 0.0 | 2.0 | 18 | 6 | 1 |
| | Bush bean | 2.9 | 0.1 | 1.0 | 0.3 | 0.2 | 0.2 | 0.7 | 0.0 | 3.9 | 2.3 | 0.0 | 2.0 | 2.0 | 27 | 23 | 1 |
| | Groundnuts | 2.2 | 0.5 | 1.0 | 0.6 | 0.2 | 1.0 | 0.0 | 0.0 | 3.9 | 0.3 | 0.0 | 2.0 | 4.0 | 16 | 23 | 23 |
| | Field Pea | 2.9 | 0.8 | 1.0 | 0.6 | 0.0 | 0.6 | 0.0 | 1.3 | 1.7 | 3.9 | 2.0 | 0.0 | 4.0 | 7 | 16 | - |
| | Dolichos lablab | 2.9 | 1.1 | 0.7 | 0.6 | 0.2 | 1.0 | 0.7 | 0.0 | 1.7 | 2.3 | 2.0 | 4.0 | 0.0 | 2 | 25 | 1 |
| Tree | Calliandra calothyrus | 0.0 | 1.1 | 0.5 | 2.5 | 0.9 | 1.0 | 2.7 | 3.8 | 0.0 | 3.9 | 2.0 | 2.0 | 0.0 | 5 | 20 | 1 |
| | Gliricidia sepium | 0.0 | 0.8 | 0.2 | 2.5 | 1.2 | 1.3 | 0.7 | 1.3 | 0.0 | 3.9 | 4.0 | 4.0 | 0.0 | 4 | 14 | 1 |
| | Leucaena leucocephala | 0.0 | 1.1 | 0.0 | 2.5 | 1.2 | 1.3 | 0.7 | 1.3 | 3.9 | 2.3 | 2.0 | 4.0 | 0.0 | 3 | 7 | 23 |
| | Leucaena trichandra | 0.0 | 1.1 | 0.5 | 1.9 | 1.2 | 1.0 | 0.7 | 1.3 | 3.9 | 2.3 | 2.0 | 4.0 | 0.0 | 12 | 7 | 1 |
| | Leucaena diversifolia | 0.0 | 1.1 | 0.5 | 1.9 | 1.2 | 1.0 | 0.7 | 1.3 | 3.9 | 2.3 | 2.0 | 4.0 | 0.0 | 12 | 7 | 1 |

We opted for the same list of legumes across all villages. Color codes: green = well fit; red= no fit; orange, yellow and light green are intermediate fits; Blue=rank fit <5.

# Village 8: Bushumba Centre

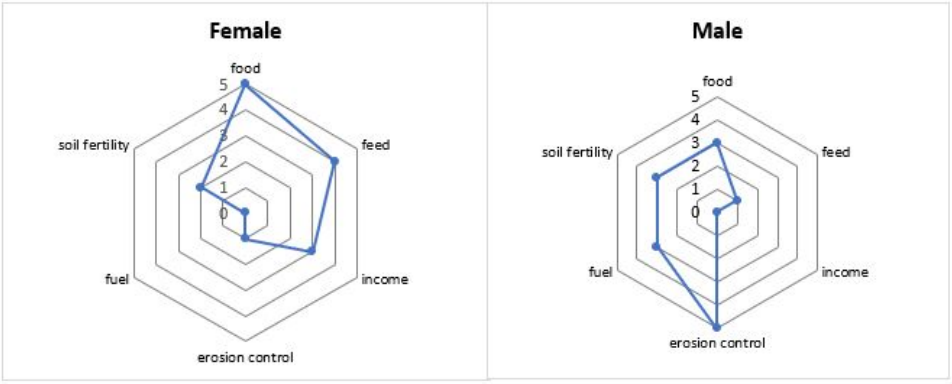
Farmers in Bushumba Centre defined legumes as plants that produce grain in pods and have nodules on their roots, improve the fertility of the soils. A summary of legumes species grown in Bushumba Centre village, their benefits and constraints to their production is given in Table 15.

Table 15: Legume grown in Bushumba centre, their benefits and the challenges faced by farmers in producing them

| Legume species grown | Benefits | Constraints |
|---|---|---|
| Common bean, climbing bean, soybean, groundnut, field pea, pigeon pea, Tephrosia, Mucuna, pigeon pea, desmodium, Calliandra, Leucaena, Acacia, Albizzia, mulukuluku | Food | Lack of land |
| | Source of income | Lack of knowledge and technical skills |
| | Soil fertility improvement Erosion control | Lack of inputs (seed, fertilizers) |
| | Animal feed | Low soil fertility |
| | Fuel | Soil erosion |
| | Materials of construction | Pest and disease attacks<br>Climate change |
| | Fencing | |
| | Sticks for climbing bean | |

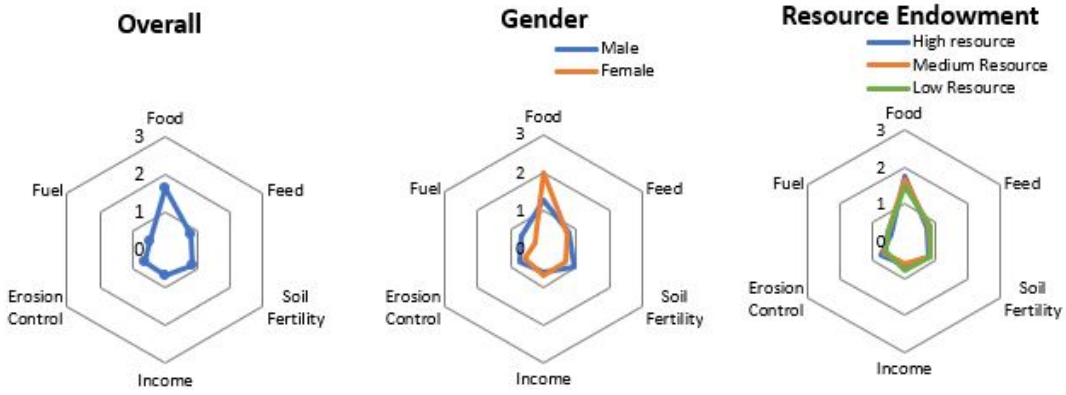
Pairwise ranking: There were differences between female and male groups on their preferences for legume functions as indicated by the results of pairwise ranking exercise in Bushumba Centre. Women farmers expressed high interest of food followed by animal feed then income generation functions while men had high preferences of legumes for erosion control followed by food, fuel and soil fertility improvement (Figure 22). In addition, fuel function was not scored by women while men did not score income generation (Figure 22).

Figure 22: Pairwise ranking scores for the demand of legume functions in female and male groups in Bushumba centre, DRC




**Participatory matrix**: Results of participatory matrix scoring exercise show that there were small differences between genders (Figure 23). Women farmers mainly prefer food, animal feed and income generation as legume functions while men mainly request legumes for food, soil fertility improvement and animal feed (Figure 23). The preferences for legume functions among farm types are similar with the highest demand for food followed by soil fertility improvement and animal feed functions (Figure 23).

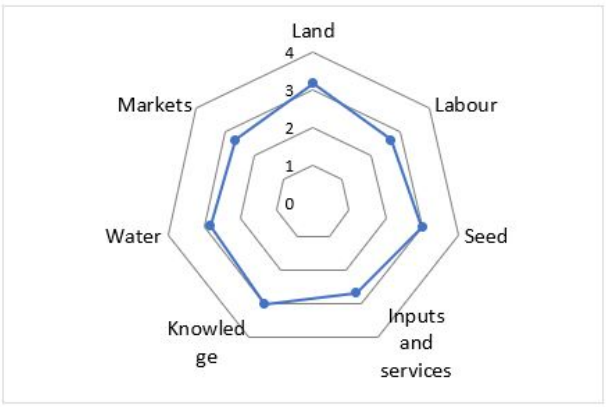
Figure 23: Demand for legume function in Bushumba centre based on participatory matrix scoring for the overall participants and after disaggregation by gender and resource endowment




## Constraints to legume production

Lack of land, knowledge and technical skills, lack of inputs (seed, planting materials and fertilizer), low soil fertility, soil erosion, pests and diseases and climate change were indicated by the participants of the FGD as the major challenges to the production of legumes in Bushumba Centre (Table 15). Similarly, the context assessment exercise identified the scarcity of land, lack of seed and lack of knowledge as the main constraints to the production of legumes in this village (Figure 24). Lack of water, inputs and services, lack of labour and markets were also identified by the tool.

Figure 24: Scores for the major constraints to legume production in Bushumba centre (4=Key constraint, 0=No constraint)



## Output from the LegumeCHOICE tool application

Integrating the results from the various scores and the attributes of the legumes, lead to the identification of how well legumes fit the context and the functions preferred by farmers, as well as the agro-ecology of Bushumba centre (Table 16).

Pigeon pea comes out as the most suitable candidate fitting both the context, function and agro-ecology. Other grain legume candidates to be considered include Field pea, lablab, groundnut. For tree legumes, Leucaena diversifolia, L. trichanda, Gliricidia and Callianda could be candidates.

Table 16: Legume species with suitable agro-ecological filter ranking, and either acceptable functional or context fit rank in Bushumba Centre

| Legume name | | How well this option fulfils functional needs | | | | | | How well this option fits the context | | | | | | | Summary | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Food _fit | Feed _fit | Income _fit | Erosion control _fit | Fuel _fit | Soil fertility _fit | Land_ fit | Labour_ fit | Seed supply _fit | Inputs and services _fit | Knowledge and skills_fit | Water _fit | Markets _fit | Functional fit_rank | Context rank | Agro-ecological rank |
| Grain | Pigeon pea (Cajanus cajan) | 2.8 | 0.8 | 0.9 | 1.4 | 0.5 | 1.1 | 3.9 | 2.7 | 4.0 | 3.8 | 2.3 | 3.9 | 2.7 | 1 | 3 | 1 |
| | Climbing beans | 2.8 | 0.8 | 1.2 | 0.2 | 0.0 | 0.7 | 3.9 | 3.8 | 4.0 | 2.7 | 2.3 | 0.3 | 2.7 | 16 | 13 | 1 |
| | Bush bean | 2.8 | 0.2 | 1.2 | 0.2 | 0.1 | 0.2 | 1.7 | 0.7 | 4.0 | 2.7 | 0.3 | 2.3 | 2.7 | 26 | 23 | 1 |
| | Groundnuts | 2.1 | 0.8 | 1.2 | 0.9 | 0.1 | 1.1 | 0.0 | 0.0 | 4.0 | 0.7 | 0.3 | 2.3 | 3.8 | 6 | 27 | 21 |
| | Field Pea | 2.8 | 1.2 | 1.2 | 0.9 | 0.0 | 0.7 | 0.0 | 2.7 | 2.0 | 3.8 | 2.3 | 0.3 | 3.8 | 3 | 15 | - |
| | Dolichos lablab | 2.8 | 1.6 | 0.9 | 0.9 | 0.1 | 1.1 | 1.7 | 0.7 | 2.0 | 2.7 | 2.3 | 3.9 | 0.7 | 2 | 24 | 1 |
| Tree | Calliandra calothyrus | 0.0 | 1.6 | 0.6 | 1.8 | 0.8 | 1.1 | 3.9 | 3.8 | 0.0 | 3.8 | 2.3 | 2.3 | 0.7 | 10 | 21 | 1 |
| | Glinicidia sepium | 0.0 | 1.6 | 0.0 | 1.8 | 1.1 | 1.5 | 1.7 | 2.7 | 0.0 | 3.8 | 3.9 | 3.9 | 0.0 | 9 | 6 | 21 |
| | Leucaena leucocephala | 0.0 | 1.6 | 0.6 | 1.4 | 1.1 | 1.1 | 1.7 | 2.7 | 4.0 | 2.7 | 2.3 | 3.9 | 0.7 | 13 | 6 | 1 |
| | Leucaena trichandra | 0.0 | 1.6 | 0.6 | 1.4 | 1.1 | 1.1 | 1.7 | 2.7 | 4.0 | 2.7 | 2.3 | 3.9 | 0.7 | 13 | 6 | 1 |
| | Leucaena diversifolia | 0.0 | 1.6 | 0.6 | 1.4 | 1.1 | 1.1 | 1.7 | 2.7 | 4.0 | 2.7 | 2.3 | 3.9 | 0.7 | 13 | 6 | 1 |

We opted for the same list of legumes across all villages. Color codes: green = well fit; red= no fit; orange, yellow and light green are intermediate fits; Blue=rank fit <5.

By grouping the results from the LegumeCHOICE application for all villages, nearly the same legumes come out as potential candidates, with only a few different in the order. Pigeon pea is consistently high ranking for context fit and functional fit and it fits the agroecology. Field pea has also in general a good rank both for function and context, whereas information to determine the agro-ecology fit are missing in the LC spreadsheet. Climbing bean and lablab, are promising. Whereas lablab has a good rank for the function, it often scores low on the context, whereas climbing bean has often a medium score for one or both, except in Bushumba Centre, the only village where groundnut emerges as plausible candidate based on function.

We noticed that the agro-ecological filter (particularly the altitude) eliminated some of legume species which normally perform well in the two sites, particularly soybean and groundnut. This could be due to the availability of varieties adapted to specific agro-ecologies. Based on the result of the tool and interaction with farmers, the team choose to promote Pigeon pea, Field pea, Climbing bean and lablab, along the Groundnut in Bushumba and soybean in Mushinga. The inclusion of the last two is based on the fact that they were eliminated to some extend by the context and also by the agro-ecological filter though they do perform well in the area, and through discussions, farmers have good aspiration for them.

However, for the first growing season (season 2020 A), which started immediately after the implementation of the tool, we were confronted to the lack of seeds of pigeon pea, lablab, Field pea, the first two being quite new in the area. We therefore opted to demonstrate climbing bean, groundnut and soybean in all sites, with plan to expand to the other species in future growing seasons. Field pea was included in the following season (season 2020 B), but efforts to outsource lablab and pigeon pea seeds did not materialize.


Field day to a demonstration trial of legumes from LegumeChoice tool in Mulengeza

# Conclusions

The LegumeCHOICE tool application exercise helped generate useful information to understand farmers' preferences for legumes and their functions, and the main constraints, which could impact the production of legumes. Based on the results from the focus group discussions, we can make the following conclusions.

- Farmers in the sites were familiar with the term legume and they identified them as plants which produces pods and nodules. They also mentioned several key functions of legumes including provision of food, income, soil fertility improvement, livestock feed and provision of construction materials.
- The preferences for legume functions varied between sites and gender in some cases. However, preferences for food and soil fertility improvement functions were similar across sites, genders and resource endowment.
- Several constraints limiting production of legumes were land scarcity, seed availability, inputs and services, knowledge, water, markets and labour. There were slight differences in the importance of these constraints between sites; though they were common key factors at all sites, such as land scarcity.
- Discussions with farmers on the output from the LC tool are useful, allowing confirmation of or identification of issues with the candidate legumes. Finetuning of the agro-ecological filter is needed so that it does not exclude species which are already known to perform well in the areas.
- While farmers are interested in trying new legumes from the tool, challenges of seed availability for those legumes prohibited their demonstration. This is in line with the general issue of access to quality seeds, even for crops known in the sites.

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