Small Scale Farmers' Legume Production in Nangoma Agriculture Camp Area: Challenges, Local Solutions and Opportunities for Scaling Up

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ABSTRACT

This study sought to explore the local solutions being used by small scale farmers to address legume production challenges in Nangoma Agriculture Camp Area and the existing opportunities for scaling up such local innovations. The study used a mixed method design which enabled the collection of both quantitative and qualitative data in order to have a comprehensive understanding of legume production challenges, local solutions and opportunities for scaling up such local innovations. The total sample size for the study was 254 in which 240 were legume small scale farmers selected using systematic random technique and 14 were key informants selected using purposive sampling. The findings of the study revealed that small scale farmers use local solutions such as village banking initiatives, loans from friends and personal savings to address the challenge of limited access to credit facilities. Additionally, the farmers use recycled seeds as a solution to the challenge of lack of access to improved and certified seeds. The study also found that farmers use oral history as well as learning from friends and successful farmers in their neighborhood on issues to do with legume production knowledge. This is done to address limited agricultural advisory services. For poor soils, the use of animal manure and intercropping as well as crop rotating cereals with legumes were found to be local solutions. While this was the case, the quantities of animal manure were found to be not sufficient to scale the practice. Additionally, problems of limited land among some farmers were resolved by way of land renting from farmers that have enough land and yet do not cultivate all of their land. Besides that, the use of boom paste, ashes and intercropping were found to be local solutions used to address legume production challenges related to pests and ants. The study also indicated that various opportunities existed for scaling up these local solutions in order to improve legume production. The use of village banks provided an opportunity for government to fund such groups to improve access to finance. Further, the use of animal manure to improve soil provides an opportunity for government to incorporate such manure into government support programs like FISP to promote large scale production from private sector. Besides that, learning from successful farmers, oral history and use of recycled seeds provides an opportunity for government and other stakeholders to employ more extension workers, promote out-grower schemes and village seed banks among others. Among other things, the study recommends that animal manure should be incorporated into the farmer input support program in order to scale up its usage and that government and other stakeholders should take keen interest in local solutions and scale them up to boost legume production among small scale farmers.

Keywords: Legumes, opportunities, Climate change, Small Scale Farmers.

INTRODUCTION

Legume production has gained increasing attention in Sub-Saharan Africa due to its multiple roles in enhancing household food security, improving soil fertility through biological nitrogen fixation, and generating income for smallholder farmers (Abobatta et al., 2021). In Zambia, legumes such as groundnuts, cowpeas, beans, and soybeans are important components of small-scale farming systems. These crops are not only significant for their nutritional value (providing essential proteins to rural diets) but also contribute to sustainable agricultural practices by reducing the need for synthetic fertilizers (Breen et al., 2024). Despite these advantages, the full potential of legume production remains largely untapped, particularly among small-scale farmers who dominate

the agricultural landscape in Zambia.

Small-scale farmers are crucial to the country's food production, yet they operate under challenging conditions characterized by limited access to productive resources, low levels of mechanization, poor infrastructure, and vulnerability to climate-related shocks (Teschemacher et al., 2024). In regions such as Nangoma Agriculture Camp Area, located in Mumbwa District of Zambia's Central Province, legume production is both a subsistence activity and a potential avenue for economic upliftment. However, farmers in this area continue to face structural and systemic barriers that affect the production of legumes.

While a there is a plethora of literature on challenges faced by farmers in the production of legumes, there remains limited literature that explores local solutions to these challenges and opportunities for scaling up such solutions. Therefore, this study sought to explore local solutions used by small scale farmers within Nangoma Agriculture Camp Area to address legume production challenges and the existing opportunities for scaling up such local innovations. By focusing on this localized context and situating the discussion within broader debates on sustainable agriculture, rural livelihoods, and food systems transformation the study aims to fill the existing knowledge gap on local solutions to legume production challenges, thereby contributing to ongoing policy and academic discussions on improving smallholder legume production in Zambia and beyond.

Research Context

Legume production has in recent years gained renewed global attention due to its vital role in advancing food and nutrition security, enhancing climate resilience, and promoting sustainable land management. Legumes such as beans, lentils, chickpeas, and soybeans are not only protein-rich crops critical for human nutrition particularly in regions with limited access to animal protein, but also contribute to sustainable agriculture through biological nitrogen fixation, which reduces dependency on synthetic fertilizers (Francis et al., 2024). Between 2000 and 2022, global legume production in the Global South increased by approximately 20–30%, largely driven by rising demand for plant-based proteins and the expansion of cropping areas in countries like Brazil and Argentina (Francis et al., 2024). This global trend aligns with several United Nations Sustainable Development Goals (SDGs), notably Goal 2 (Zero Hunger), Goal 13 (Climate Action), and Goal 15 (Life on Land), positioning legumes as strategic crops for transforming smallholder farming systems.

In many developing countries, the growing interest in legumes is influenced by a combination of factors, including rapid population growth, changing dietary preferences, and the increasing need for affordable and sustainable protein sources (Chen et al., 2022; Yanni et al., 2023). According to Abobatta et al (2021) pulse protein accounts for a relatively large portion of total protein consumption in low-income countries, which ranges from 10 to 35% in Africa. Additionally, the incorporation of legumes into conservation and agroecological farming systems is gaining momentum due to their capacity to improve soil structure and biodiversity. Governments and development agencies are increasingly supporting legume value chains through investment in improved seed varieties, enhanced market access, and provision of extension services (Lukurugu et al., 2021). As a result, Asia, Latin America, and sub-Saharan Africa have emerged as major centers of legume production over the past two decades (Breen et al., 2023).

Legume cultivation in Africa plays a critical role in addressing persistent challenges such as food insecurity, declining soil fertility, and limited access to affordable agricultural inputs (Breen et al, 2024). Legumes like cowpeas, groundnuts, common beans, and pigeon peas are integral to African diets and smallholder farming systems. These crops not only serve as important sources of nutrition but also as cash crops for millions of small-scale farmers (Abobatta et al., 2021). For example, groundnuts and soybeans have become major income-generating crops in countries such as Nigeria, Malawi, and Mozambique. In sub-Saharan Africa (SSA), more than 101 million households grow one or more tropical legumes for food, income, improved nutrition, and soil health (Antonaci et al., 2014), with an estimated 27 million hectares planted annually (Abate et al., 2012).

However, despite the wide range of benefits provided by legumes their full utilization and adoption is still relatively low in Sub-Saharan Africa (Muoni et al., 2019). The continent's farmers continue to face numerous constraints that hinder the uptake and scaling up of legume production. These include limited access to certified

seeds and affordable inputs, poor markets that limit financial returns, underdeveloped infrastructure, inadequate extension services, and insufficient technical training (Shelton et al., 2015; Yap et al.,, 2017). Moreover, policy support for legume production tends to be weak or inconsistent compared to the support given to staple crops like maize (Zulu, 2014). Climate change further exacerbates these challenges by increasing the frequency of droughts, floods, and pest outbreaks (Barnes et al., 2021). Additionally, market-related barriers such as price volatility, poor aggregation systems, and weak bargaining power limit profitability for small-scale producers (Abobatta et al., 2021). In many cases, legume production depends more on informal farmer networks and localized innovation than on coordinated policy support or institutional frameworks.

In Zambia, legumes have become increasingly important in smallholder farming systems, particularly as part of broader strategies to enhance food security and diversify crop production beyond maize. Legume cultivation, once limited to specific agro-ecological zones, has now become more widespread due to both nutritional concerns and market opportunities. Groundnuts, soybeans, common beans, and cowpeas are now commonly grown alongside maize, the staple crop (Muoni et al., 2019). According to Chapoto et al (2018) groundnuts were the second most widely grown smallholder crop in 2018, produced by nearly 50% of households. Similarly, the proportion of smallholder-produced soybeans increased from 17% in 2010 to 45% in 2019 (Mulenga et al., 2020). Common beans also remain a key crop, cultivated by 13% of smallholder farmers (Chapoto et al., 2018). National statistics indicate consistent growth in both acreage and output for key legumes, particularly soybeans and groundnuts, due to their export potential and value-added opportunities in agro-processing.

Several factors have contributed to the growing adoption of legumes in Zambia. These include government programs, donor-funded initiatives, and private sector investments aimed at strengthening legume value chains. Conservation agriculture initiatives have promoted legumes as soil fertility enhancers, while health and nutrition campaigns have underscored their role in improving dietary outcomes, particularly among children and women. Moreover, the expansion of local and regional markets for legumes has created new economic opportunities for rural farmers, many of whom are women.

However, despite these advances, smallholder farmers in Zambia continue to face several structural and institutional challenges. Access to quality seed remains a major bottleneck, as many farmers depend on recycled or informally sourced seeds with poor yield performance and low resistance to diseases (Magasu and Magasu, 2021). Inadequate extension services further limit access to agronomic knowledge and pest management strategies. Post-harvest losses are also significant due to poor storage infrastructure, while limited access to credit restricts farmers' ability to invest in inputs or scale up production (Teschemacher et al., 2024). Climate change-induced stresses such as erratic rainfall patterns and prolonged dry spells continue to pose serious risks to legume production, especially in rain-fed systems (Teschemacher et al., 2024).

These challenges are particularly evident in regions like Nangoma Agriculture Camp where legumes such as groundnuts, soybeans, common beans, and cowpeas are cultivated alongside maize, which dominates agricultural land use. These challenges continue to affect legume production among small scale farmers despite recent policy shift which have included the incorporation of many legumes such as soybean, groundnuts, beans and cowpeas into FISP in 2022 (Ministerial Statement on FISP, 2023; Phiri, 2023).

While existing literature highlights these different challenges that affect legume production among small scale farmers, there is no literature that has explored local solutions used by small scale farmers to address legume production challenges and existing opportunities for scaling up such innovations in the context of Nangoma Agriculture Camp Area. Hence, this study sought to explore these local solutions used by small scale farmers and establish what opportunities exist to scale them up.

RESEARCH METHODS

This study was conducted in Nangoma Agriculture Camp Area under Nangoma Constituency of Mumbwa District in Central Province. Nangoma was selected because the area is known for legume production such as soybeans, groundnuts, beans and cow pea, among others. Therefore, the area presented a suitable case to give a picture of how small scale farmers are addressing legume production challenges and the opportunities that exist

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to scale up such ways.

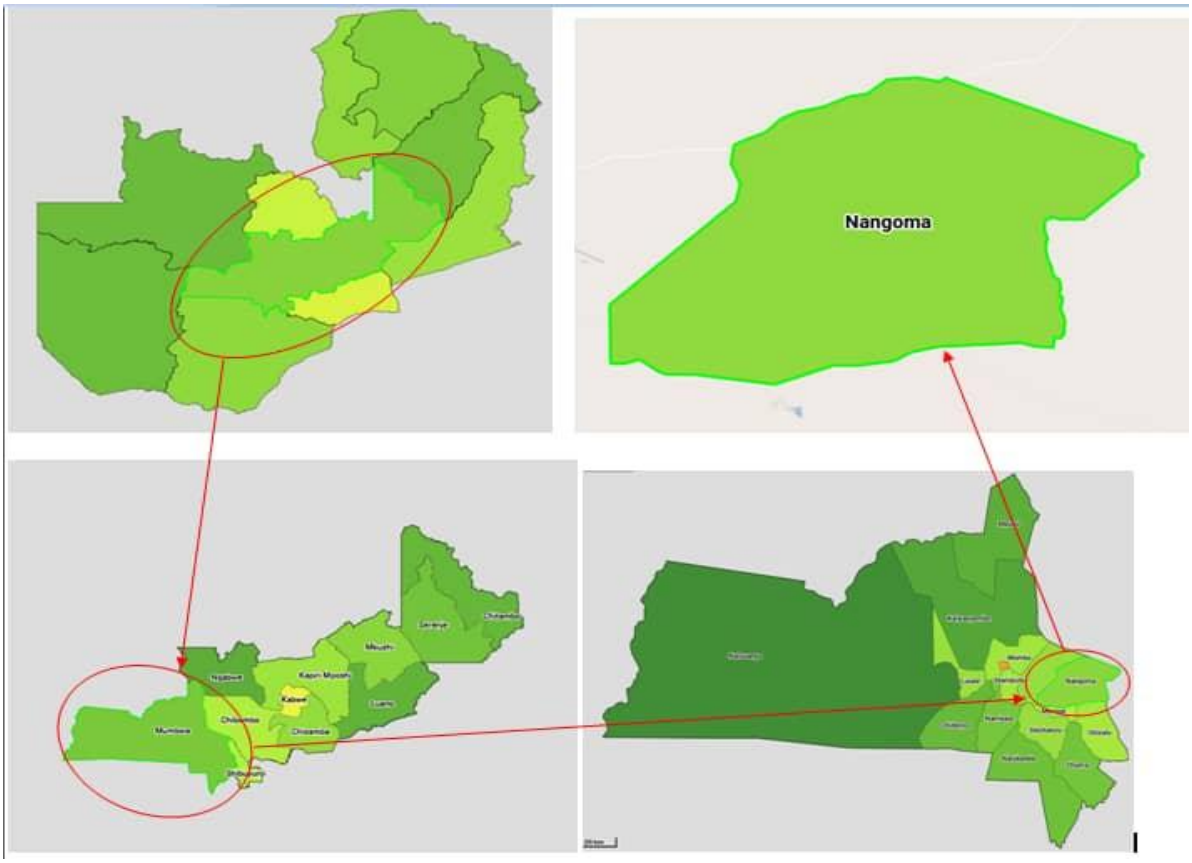

Figure 1: Location of Nangoma Agriculture Camp Area.

Source: Authors (2025).

The study employed a mixed methods design as it helped the researcher to collect different types of information that could not be collected by quantitative or qualitative methods alone, and provided a greater repertoire of tools to meet the aims and objectives of this study. Quantitative approach helped the researcher to gather information on the number of farmers using different solutions to address legume production challenges, while the qualitative approach helped gather information on how the farmers were addressing the legume production challenges and their views on how such solutions can be scaled up. This is in line with what Creswell and Clark (2007) argue that mixed methods research helps answer different research questions that cannot be answered by a single design.

The study used both probability sampling and non-probability sampling. Probability sampling was used to sample 240 Small Scale Farmers using systematic random sampling technique. A sampling frame containing 600 small scale farmers who had been growing legumes for the past seven years was obtained from the Camp Agriculture officer through ZIAMIS (online portal). From the sampling frame, respondents were selected systematically using a sampling interval which was obtained by dividing the sample size into the total population. The 240 sample size for Small Scale Farmers was arrived at using the Slovin's formula. In this study, the formula was used as it helped in ensuring that the sample was representative. The formula (sometimes written as Slovin's formula) was formulated by Slovin in 1960.

The Slovin's formula is **n = N/ (1+Ne2).** Where: **n** is the sample size**. N** is the population size**. e** is the precision level**.** The study used a confidence level of 95%. Therefore, the margin of error and sample size was calculated as shown below;

100% - 95%= 5%

5/100=0.05

Margin of error is 0.05

n= 600/ (1+600×0.0025)

n=600/ (1+1.5)

n=600÷ 2.5

n=240.

On the other hand, non-probability sampling was used to select the following 14 key informants:1 Camp officer, 1 Crop officer, 1 DACO, 1 Marketing and Development enterprise officer, 8 cooperative leaders and 2 Camp Agriculture Committee representatives using purposive sampling. Purposive sampling was used because it allowed the researchers to target a particular group or subset of the population that was most likely to provide valuable insights or relevant data that would help answer the research questions (Bryman, 2006).

As regards to data collection, questionnaires were used to collect quantitative data from the 240 Small Scale Farmers, while in-depth interviews were conducted with the 14 key informants. Quantitative data was analyzed descriptively using SPSS to generate tables, pie charts and bar charts. On the other hand, qualitative data was analyzed manually through thematic analysis. This involved the systematic identification, organizing, and offering insight into, patterns of meaning (themes) across a dataset. The data analysis process involved transcribing the data, familiarization, coding and development of themes. Themes were then reviewed and a meaning attached to each theme. Finally, reporting was done which included the interpretation of the different aspects of the analyzed data in the form of narrations without distortion of the responses from the study participants.

The study considered the following ethical issues during research; informed consent, avoidance of harm, confidentiality and anonymity, privacy, truth, conflicts of interest, power relations. All the participants were assured of anonymity and utmost confidentiality to solicit their free participation in the study. The respondents were assured of neutrality of information provided in the course of the study emphasizing that the results would be used only for academic purposes. The necessary steps were taken and informed consent of the respondents was made verbal before they participated in the research. Commencement of field work began after permission to undertake the study was obtained from the University of Zambia, Humanities and Social Sciences Research Ethics Committee.

RESULTS

Respondents' characteristics

Gender of the Respondents

Understanding which gender is more involved in legume production was important in as far as developing interventions and policies that reflect various issues affecting the different genders in legume production is concerned. The distribution of the participants according to gender is as shown in figure 2 below:

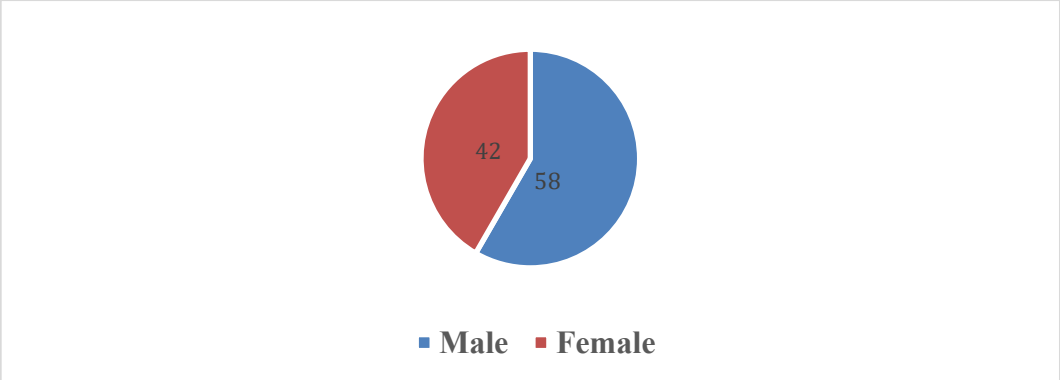

Figure 2: Gender of the respondents

Source: Field work survey (2024)

Figure 2 above shows that out of the 240 participants that responded to the survey questionnaire, the majority were males representing 58% (n=140) while females were only 42% (n=100) of the total participants.

Level of Education

The study inquired on the level of education given that education influences how people think and engage in agriculture production. The distribution of the respondents according to the level of education is depicted in figure 3 below:

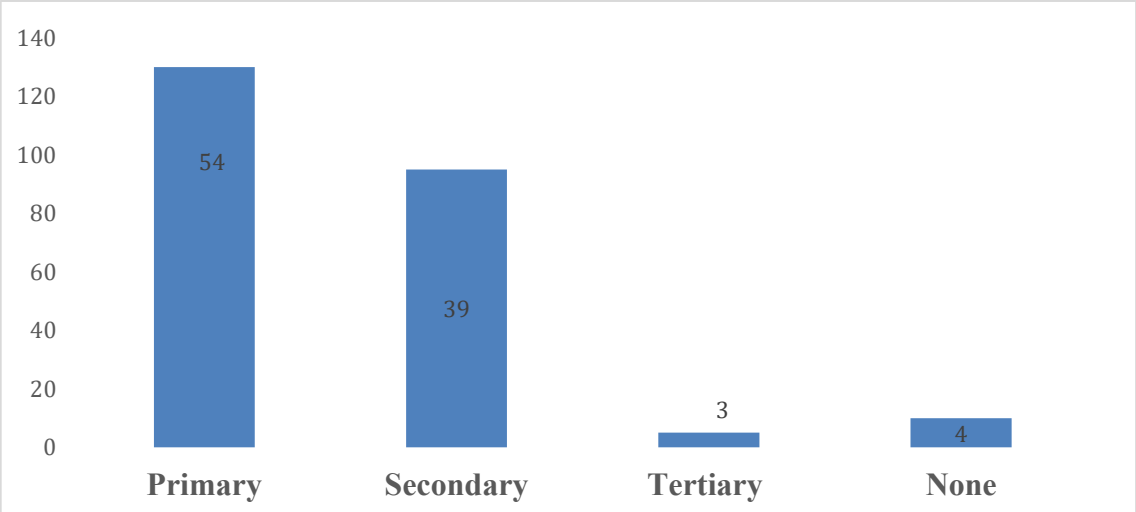

Figure 3: Level of education

Source: Field work survey (2024)

Figure 3 above indicates that majority of the respondents representing 54% (n=130) had an education level of up to primary school, while 39% (n= 95) had gone up to secondary school. It was further revealed that 3% (n=5) of the respondents had tertiary level of education and only 4% (n=10) had said none as to having any level of education.

Local solutions used by small scale farmers to address legume production challenges in Nangoma Agriculture Camp Area

The researchers inquired on the various local solutions used by small scale farmers to address the various legume production challenges that they face. This was key in producing information that is instrumental in informing the formulation of policies that builds upon indigenous ways of addressing legume production challenges. The responses are depicted in table 1 below;

Table 1: Local solutions used by small scale farmers to address legume production challenges

Legume production challenge	Ways small scale farmers use to address legume production challenges	Percentage of farmers using each method to address legume production challenges
Lack of credit facilities	1. Village banking 2. Loan from friends 3. Personal Savings	40%
Limited access to improved seeds	1. Seed recycling	35%

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Limited agricultural advisory services	1. Oral history 2.Learning from friends and successful farmers in the area	83%
Poor soils	1. Animal manure (goat, cows and chickens) 2. Indigenous fallow 3. Ashes	31%
Limited land for growing legumes	1. Renting of land 2. Intercropping	10%
Pests and ants	1. Use of ashes 2. Intercropping and crop rotation 3. Use of boom pests	36%

Source: Compiled from fieldwork (2024)

Table 1 above indicates that when it comes to the challenge of access to credit facilities, 40 % of the total number of farmers that participated in the study addresses such problems through village banking, loan from friends as well as through personal savings.

It was established that while there are very limited credit facilities within Mumbwa district were Nangoma Agriculture Camp Area is located and that the very limited credit facilities require collateral and charge high interest loans making it inaccessible to many small-scale farmers, some small-scale farmers have resorted to investing their monies through village banks were a little interest is gained at the time of sharing the money. It was also found that through the village bank initiatives, farmers are able to get a loan that they can repay later at a lower interest rate. It was found that most village bank programs charged 5% interest per month. During rain seasons, some farmers were in a habit of accessing such loans to purchase farm inputs and meet households' needs. When probed further on how the farmers manage to pay back such loans, the study revealed that some farmers do small businesses such as selling of vegetables and charcoal among others and use such to repay the loan.

In addition, the study revealed that some farmers get loans from their friends at a low interest rate. When in urgent need of farm inputs, some farmers go to their trusted friends and borrow upon agreeing on the repayment plan.

"As a cooperative leader, I have had people coming to me to borrow money to purchase farm inputs such as chemicals and herbicides. Sometimes the money they borrow is a lot, but sometimes it's just a k100 which they promise to pay back once things normalizes" one key informant narrated (Cooperative leader 2).

Personal savings were seen as another way farmers addressed the problem of limited access to credit facilities. Once farmers have money, they save it through different ways which include saving groups such as chilimba and village bank. These monies are used during rainy season to address various problems that the farmers may face in the process of legume production. When asked how sufficient the money was to scale their production, the study found that the money is not sufficient. While this was the case, the study revealed that the money is very helpful for the continuation of legume production in the area.

"The monies they save and some loans they get from village banks may not be lucrative, but it is something that has been helping these farmers without which, most of them would be in serious problems. What we should be talking about is finding ways of supporting and encouraging such groups" said one of the agricultural officials (Agricultural official 1).

Regarding how farmers address challenges related to access to improved seeds, it was revealed that 35% of the total respondents in the study addressed the problem of access to improved seeds by way of seed recycling. The study showed that access to improved seed is limited due to limited income by majority of the farmers as well as various beliefs and myths associated with tested and certified seeds. It was found that access to improved seeds was also hampered by limited infrastructure development in the area. To avoid all unnecessary costs that farmers have to face to purchase seeds, they end up leaving some legume as seeds each time they harvest.

In addition, it was revealed that seed recycling is used to address lack of access to improved seeds given that some farmers do not trust improved seeds due to instances were some farmers within the area had planted the seeds and failed to geminate. This trust issue, coupled with the costs associated with improved seeds was said to be the sole reason farmers address legume production challenges by way of recycled seeds.

While recycled seeds were seen as a common indigenous way farmers use to address legume production challenges related to access to improved seeds, agricultural experts indicated that the more farmers use recycled seeds the more the seed loses its potency and affects their overall yields. Farmers on the other hand, argued that they have been planting recycled seeds since they were born and these seeds give them good yields.

"Some of the legumes seeds that they say are improved end up not geminating, at first, we thought it was just these private sellers, but to our surprise, even those seeds from FISP sometimes fail to geminate and even if you report to the camp officer, they will also tell you that they will report to their bosses and the issue ends like that," stated one of the key informant (Cooperative leader 4).

In terms of lack of access to agricultural advisory services, the study found that 83% of the total participants addressed this problem through oral history as well as by learning from their friends and successful farmers in the area as shown in table 1 above.

The findings of the study show that agricultural advisory services are limited in the area despite the presence of lead farmers. The available advisory services are not often time, given to individual farmers that need them as camp officers provide their services when demanded by a lot of farmers. The study established that farmers in this case have always learnt how to grow and manage different legumes through their grandparents and parents. Words and knowledge on legume production is passed on from one generation to another.

"Most of the farmers in my cooperative have never gone to school or attended most meetings to learn how to grow beans, soya beans and groundnuts, the knowledge is gotten from birth because our parents taught us to plant such crops," A key informant said (Cooperative leader 1).

The researchers probed on the effectiveness of this knowledge in enhancing crop productivity given the evolving challenges of crop production. It was revealed that productivity is not affected just because someone learnt something from their parents. The study also indicated the need to combine expert knowledge and traditional knowledge in addressing legume production challenges. In line with this, one of the key informants said;

"You can't say the harvest is affected just because someone has not learnt something from the officer, farming is something that people have been doing since the time they were born. Some of these officers are not even deep into agriculture, so no, crop harvest is not affected. But there are some challenges like some chemicals, were we have tried our ways and it is very difficult to cover a big area, in such cases, we may combine what we know and their ways to solve the problem" (Cooperative leader 5).

As regards to the challenge of poor soils, 31% of the farmers said that they use animal manure, indigenous fallow as well as ashes to help improve soil. The study found that wood ash is rich in potassium and calcium and is applied to the soil to improve its pH and nutrient content. Further, it was revealed that some farmers alternate legume crops with other crops like cereals to help improve the soils. The farmers believe that where they planted soya beans or groundnuts, the soil is improved and the next crop always benefits.

While it was seen that some farmers used ashes and animal manure, the study also established that the manure and ashes are not enough to cover huge pieces of land thereby limiting their effectiveness. It was also said that

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the use of manure attracts some pests that end up affecting legumes.

"Some of these methods they use like application of ash, may lead to other environmental problems like deforestation. Actually, you will find that very few farmers use ashes and on a small portion because it's a limited commodity I may say. Talk of manure, people don't have enough animals to get, for example cow dung, so it's also limited. When it comes to animal manure, the results are good, just that farmers do not have enough of it," said one agriculture official (Agricultural official 4).

Besides that, the study revealed that 10% of the respondents address challenges like limited land for growing legumes through land renting and intercropping as shown in table 1 above.

During the interviews with key informants, it was established that some farmers desire to increase their legume production but have limited land. It was revealed that some farmers end up renting land from their friends who may not use all of their land. The farmers usually agree on the payment plan which, in some cases demands that the owner of the land is paid first. It was also indicated that some farmers don't cultivate their land and allow those with the financial resources and animals to cultivate the land. The owner of the land only demands that a portion of the harvest be given to them;

"This land renting is very successful here, because we have some farmers who don't use their land and some, their land is too big. So most of the farmers that have the money and would want to expand their legume production, go to such people and rent out fields, yeah, such things you know," one participant said (Agricultural official 2).

In terms of pests and ants, 36% of the respondents indicated that they use ashes, intercropping as well as boom paste to address such problems as shown in table 1 above.

Interviews with key informants revealed that in events were pesticide are hard to access, farmers have always resorted to using boom. The study found that farmers put booms in sprayers and spray their crops to kill any pests that affect their produce. The method though not effective sometimes, was found to be quicker in addressing the farmers problems. Ashes were equally found to be important but the quantities was always constraining. The study found that rotating crops mainly cereals such as maize with legumes such as beans helped in addressing ants and pests as such methods are seen to disrupt the ant's food chain and habitats

"When your fields, let's say beans or groundnuts have some pests or ants in it, the officer may come to check but may only provide serious help when there are a lot of people affected. So as a farmer I can't wait, I just buy boom, spray and also sometimes some warm ash and apply around the crop. Some ants die, rather than waiting for a lot of people to be affected," one of the key informants said (Camp Agriculture Committee Representative 2).

Opportunities for scaling up local solutions used by small scale farmers to address legume production challenges in Nangoma Agriculture Camp Area

The study inquired from key informants on opportunities that exist to scale up the different ways being used by small scale farmers to address legume production challenges and how technical support can be tailored towards such local innovations. From the interviews with key informants, it was found that challenges such as access to credit facilities present opportunities through which government can capitalize on. The study found that while government may have their own loans that they offer such as the recent agriculture credit window, such loans are still marred with bureaucratic challenges among others which makes them ineffective. Besides that, it was found that, the fact that the loans come from government, people perceive them the same way they perceive other loans in terms of conditionality. In view of this, the key informants indicated that, rather than government using its channels to give loans to farmers, they can use established village banks.

It was seen that village banks usually do not have sufficient monies to give all their members in the event where most of them need loans as such government can consider pumping in some money into such programs and farmers will be able to pay back through their periodic contributions that they make to the village bank. It was found that government needs to just assign an agriculture official at the camp level to work in collaboration with

various village banks. The key informants indicated that such a program might work well if managed by the village bank as this will enable a reduction in red tape and ensure quick loan disbursement. The study found that the role of government in this venture should just be to provide oversight.

"Getting loans from government or just any bank involves a lot of things and procedures; the conditions are not good sometimes compared to how we do it ourselves in our village banks. But the problem is that the money that we contribute weekly is not enough when many members want a loan, so they have to wait for other members to repay their loan for them to get. Now, this is where government can come in and pump money in such programs such that more people in the village bank can access loans even at once," stated one of the key informants (Camp Agriculture Committee Representative 1).

When asked if that cannot present challenges in the collection of loans by government if it were to commit to such a venture, the study found that such problems might be there but can easily be resolved given that each member of a village bank makes weekly contributions which can be used to repay their loans. The study also found that when government comes in, the repayment period is usually longer than the one that most village banks use. This was said to be advantageous to the members as it is able to give them more time to save a lot of money through their weekly contributions for repayments. The study indicated that government; however need to tailor their interest rates to those already being used by the village banks.

"Repayment problems are always there when it comes to financial issues, but when you look at such programs, one would argue that the problems of repayments can be something that they can manage as long as the interest charged after government comes in remain the same as he one they always used to charge themselves. The time period for repaying the loan should be lengthened and let the leaders of the programs collect the money. Trust me, this way, the program will be more effective," said one of the agriculture officials (Agriculture official 3).

As regards to the use of animal manure to address poor soils, the study indicated that while the challenge is lack of sufficiency of such manure, this provides an opportunity for scaling up given that government should integrate animal manure into its various support programs such as FISP as well as Food security Pack (FSP). The key informants indicated that programs like FISP have undergone various reforms to ensure that it remains relevant to the farmer's needs, as such integrating animal manure would just be one way the use of manure will be promoted on a large scale. The study found that once animal manure have been integrated into FISP, various private firms will come on board and provide such inputs which will help address issues of availability. In line with this, one respondent stated;

"You know people have been using animal manure since time in memorial and yet we still complain of scaling up the use of such products. If such product are supported by a serious government program that support private sector like FISP, you will see how these animal manure will be in all these agro dealers' shops. This will even benefit the farmers as they can equally sell their manure" (Agriculture official 1).

In terms of limited agricultural advisory services in which farmers use oral history and learning from their friends and successful farmers in their areas, the study found that through the office of the camp extension and in collaboration with other stakeholders there is need to strengthen events where people within the community come together to learn from successful farmers. It was also found that advisory services have always been offered by government except there are various challenges hindering the effectiveness of such services. The study found that government has recently been employing extension officers and providing those in the systems with extension kits and logistics needed to carry out their job in the quest to addressing the issue and support farmers with advisory services they need.

As regards to limited access to improved seeds, two opposing views emerged between agricultural officials and farmers represented by cooperative leaders and Camp Agriculture Committee representatives. The study found that agriculture officials were of the view that support that should be given to farmers in terms of accessing improved seeds beyond FISP can be through government promoting out grower schemes which will be giving farmers improved seeds and other inputs. The agriculture officials argued that recycled seeds that most farmers depend on lose its potency with time and that affect yields. On the other hand, farmers argued that some out grower schemes are exploitative and are not lenient when farmers have a bad harvest due to poor rainfall. While

that was the case, farmers indicated that village seed banks should be promoted by government so that it becomes very common as it is key in addressing access to seeds.

"Getting people's seeds with the way these rains are changing anyhow can just make you find yourself in problems, but what can work is what used to happen in the past where in the village, various sections will meet with different seeds, share the seeds and people plant. Such things don't happen now. Those are things that government should help us with because there are no risks," said one of the respondents (Cooperative leader 7).

Furthermore, the study found that some indigenous ways of addressing legume production challenges used by farmers could not be reconciled and support tailored at them due to consequences that may result from such. It was found that the use of ash to improve the soil and kill ants while important was not sustainable and had potential of leading to deforestation and other environmental problems. It was also found that while the use of boom paste sometimes works, it has not been proven scientifically to be used in addressing pest problems. The only support government can do is to conduct more research into such methods used by indigenous people so as to be sure if they could be relied on scientifically.

DISCUSSION

The study sought to explore the local solutions used by small scale farmers to address legume production challenges. This was done with the view to identify existing opportunities to scale up local solutions. From the findings of the study, it was discovered that problems of limited access to formalized credit facilities were being addressed by way of farmers belonging to groups such as village banking. It was noted that, through the village bank initiatives, farmers contribute amounts of money that they are capable of, weekly. Once a member has needs that require money, they are allowed to get a loan whose amount depends on how much they contribute weekly. This means that, members that make large contributions are able to obtain large amounts as loans. The study established that these village bank loans are associated with low interest. It was seen that a number of farmers access these loans to purchase various farming inputs and needs.

Besides that, personal savings are also used by farmers to address access to credit facilities among legume farmers in Nangoma Camp Area. It was established that these savings are done at individual as well as at group level through Chilimba, where individuals contribute money on agreed dates. On the agreed dates, one person in a group receives the money contributed by everyone. This cycle is repeated until everyone gets the money. Using this money, farmers are able to purchase farm necessities in as far as legume production is concerned. While these savings were crucial in addressing the inadequate access to credit facilities in the area, the study indicated that the moneys from such ventures were not sufficient to expand legume production; however, the moneys were instrumental in ensuring continuity of legume production in the area. These findings are rooted in the assumptions of the sustainable livelihood theory. The practice of saving at both individual and group levels through Chilimba exemplifies the social capital embedded in community-based financial practices, where farmers pool resources to help each other meet agricultural needs, such as purchasing farm inputs for legume production (DFID, 2000).

While these savings may not be sufficient for expanding production, they help mitigate financial barriers and ensure the continuity of farming activities, which reflects the sustainable livelihood theory's emphasis on resilience and adaptability in the face of limited external credit access. Moreover, this approach underscores the importance of collective action and local financial systems in enhancing the sustainability of livelihoods, showing how people use available assets; financial, social, and human capital to navigate challenges and maintain their livelihoods (DFID, 2000).

As regards to how farmers address challenges related to access to improved seeds, the study established that some farmers use recycled seeds. It was found that the use of recycled seeds were resulting from many factors such as limited income, limited infrastructure development in the area as well as beliefs and myths surrounding tested seeds. It was noted that the costs associated with purchasing improved seeds coupled with transportation costs from the point of sale, makes some farmers resort to using recycled seeds. Further, some farmers have experienced situations where the tested seeds planted failed to geminate. This situation is seen to create mistrust in tested seeds by some section of farmers.

These findings on the use of recycled seeds due to limited income and limited infrastructure aligns with the sustainable livelihoods framework's emphasis on resource constraints and asset vulnerability, demonstrating how farmers adapt livelihood strategies based on available resources (Ashley and Carney, 1999). The high costs and transportation challenges highlight the importance of physical and financial capital in accessing essential inputs. However, the influence of beliefs and myths and past germination failures shows how cultural and experiential knowledge can significantly influence livelihood choices, even when those choices may negatively impact productivity. The sustainable livelihood theory provides a holistic perspective that takes into account all such issues that affect livelihood.

Besides that, the findings of the current study on the use of recycled seeds by small scale farmers to address lack of access to improved seeds are in line with those of Dessalegn et al (2022) who, using a gendered perspective indicates that women faced challenges as regards to access to improved seeds, pesticides and fertilizers among others compared to men. It is argued that these farmers respond to such challenges by recycling seeds and mono-cropping lentils, despite declining soil and crop productivity, and increased occurrence of pests and diseases. In the case of chickpea, the study found that cultural norms also discouraged the adoption of the improved variety.

While farmers use recycled seeds as an indigenous way of addressing limited access to improved seeds, experts argued that the more famers plant such seeds, the less their yields given that such seeds loses potency as time goes by. Contrary to the assertion by agricultural officials, Lubungu (2013) indicate that open pollinated varieties (OPVs) is recyclable for up to five years with minimal yield loss, however, supplying recyclable seed is less profitable, so corporate suppliers tend not to promote them heavily.

Beyond the use of recycled seeds, it is noted that farmers face challenges related to access to agricultural advisory services. While farmers faced this problem, it was discovered that farmers use oral history to pass on knowledge on how legume production is done. In addition, farmers are also said to learn from their friends and other successful farmers in the area on how legume should be produced and managed. It is seen that while the camp is assigned an agriculture official and lead farmers, these usually attend to large groups as opposed to individual demands of farmers. This situation is seen not to cater for unique individual needs resulting in alternative learning on legume production among some farmers. While such methods are used, Liana and Goldsmith (2020) asserts that lack of technical support constrains adoption of the more complex rotation cropping system. Rotating soybean with maize too challenges farmers as there is not a specific prescription that can guide farmers operating across Africa’s diverse agro ecological environments.

The farmers' reliance on oral history, peer learning from friends and successful farmers and alternative knowledge systems contradicts a potentially overly formal or top-down view of knowledge transfer within the Sustainable Livelihoods Framework (SLF) (Scones, 2009). While the SLF emphasizes the importance of information and knowledge, this study highlights the significance of informal social networks and local knowledge in disseminating agricultural practices, revealing that farmers actively build their human capital outside of formal channels. The failure of formal advisory services to cater to unique individual needs further reinforces the importance of context-specific knowledge and suggests that the SLF should more strongly consider the role of informal social capital and local knowledge systems in shaping livelihood strategies, rather than relying solely on formal advisory services.

In terms of the effectiveness of acquiring knowledge on legume production through oral history, friends and successful farmers, it was revealed that productivity is not affected by way of individuals learning from their parents or successful farmers in their area as most farmers have since time in memorial used such knowledge. The study established that the most urgent need is to combine expert knowledge with traditional knowledge in addressing legume production challenges.

Findings on the use of animal manure, ashes and indigenous fallow to address poor soils are consistent with several assumptions in the Sustainable Livelihoods theory, particularly the emphasis on natural capital and environmental sustainability. The use of animal manure, ashes, and indigenous fallow to improve soil fertility reflects a reliance on local, natural resources to sustain agricultural productivity, which is a central tenet of the SLF’s recognition of the importance of natural capital. However, the findings of the current study highlights the limitations of these practices, such as the scarcity of resources and environmental drawbacks, which reveal the

vulnerability inherent in relying on traditional methods that may not be scalable or sustainable in the long run. These limitations align with the SLF's focus on trade-offs and the need for resilience in livelihood strategies (Ellis, 2000).

Contrary to the findings of the current study that animal manure is not present in sufficient quantities, de Wit, Westra and Nell (1995) indicate that although manure surpluses do exist at a regional level, specifically in parts of Western Europe but also near large cities in developing countries, most occur at the local level because of the large size of modern livestock enterprises. This is particularly so in the United States where some large feedlots market well over 50 000 heads annually and consequently produce more manure than 9 000 ha of high productive crops would require to maintain the P equilibrium.

Beyond that, it was seen that farmers practiced crop rotation, where cereals would be planted after legumes given that most farmers believed that legumes added some nutrients to the soil as such whatever crop is planted after legumes would benefit from soil improvement. This resonate with what Liana and Goldsmith (2020) assert that continuous cropping of maize has led to extensive degradation of soil and decrease in crop productivity and endangers household food and nutritional security. It is argued that introducing soy into rotation with maize is a method to diversify diets, better nutritional status, reduce abiotic and biotic stresses, and improve soil fertility, while enhancing crop productivity and generating more income for farmers.

Furthermore, most legume farmers are faced with the problem of limited land. The study established that this problem limit the expansion of legume production as such, farmers resort to renting land from their friends within the Camp area who do not cultivate all their land. It was noted that different modes of payments are used such as payments through cash as well as in kind, where the landlord is paid a portion of the legumes produced were being used. This method of addressing limited land was seen to be successful among those that were involved. Land renting also implied that those involved had enough resources to pay and cultivate beyond their available land. While there is enough arable land for soya bean expansion in Zambia as indicated by Siamabele (2019), the current study found that for some farmers land is a limiting factor and resort to renting in a bid to expand their production.

Besides that, ashes, intercropping and boom paste were used by some small scale farmers to address legume production challenges related to pest infestations. The study established that in instances where it was hard for farmers to purchase chemicals to address pest infestations, farmers spray boom paste to their crops. When it comes to the effectiveness of this method, the study indicated that sometimes the method kills the pest while on certain times it doesn't. The method was seen to be a quicker way of addressing pest infestation problems faced by farmers who could not afford to purchase chemicals. Ashes were found to be commonly used though availability in huge quantities was seen to be the limiting factor. Other methods used to cure pests included crop rotation of cereals with legumes which was believed to disrupt the ant's food chain and habitats. Contrary to the findings of the current study, O'Hara and Carr (2000) assert that when grown in intercrops or rotation with cereals, legumes also help control cereal crop diseases and pests, which in turn reduces the need for costly pesticides.

As regards to the opportunities for scaling up local solutions to legumes production, the study discovered that the use of village bank initiative by some farmers as a way of accessing finance can be used as an opportunity for government to tailor its support to such programs. The study revealed that such initiative have limited monies to have all its members get loans as such, government should support such initiatives with loans so that each time farmers need a loan will be able to access without delays. It was noted that the operation of such initiatives need to remain independent as government role should only be that of providing oversight. These findings are contrary to those of Sibeso (2022) who recommended that relevant authorities such as Bank of Zambia should institutionalize and provide a legal framework of village banking groups so that operations are regulated and done smoothly to avoid risks. The current study asserts that since village banking have been operating on their own informally, government should only provide support in forms of the loans as opposed to institutionalizing and regulating them.

The groups can be guided by a constitution and an executive committee to lead the operation of the group. This will help guide the group and members to follow the rules that govern the group. It will also help them to resolve

conflict among members. Members should be encouraged to abide by the group constitution to help reduce the defaults on loan repayments which could eventually reduce the group funds. It was noted that repayments of such loans may not present challenges to members of the village bank as government is able to collect its monies through village bank members' weekly or periodic contributions to the village bank. While this was the case, the study indicated that interest rates in the new program should be revised to match the ones that people are used to paying in their village bank initiatives.

Besides that, the study discovered that the use of animal manure by farmers presents an opportunity for government support through the incorporation of such products into serious government programs like FISP. It was seen that while there are issues of sufficiency of such products, the incorporation of such products on the program would enable the private sector to provide it in sufficiency quantities that would scale up its usage among farmers to improve their poor soils. This finding resonate to some extent with that of Shober and Maguire (2018) who argue that regulations and incentive programs that promote use of manure, transport of manure, or beneficial manure reuse (including alternative uses like composting, biogas generation, or manure to energy) is key to enhancing the productive use of manures and reduce environmental problems associated with nutrient surpluses in areas of intensive animal production.

In addition, the study discovered that existing platforms and collaboration need to be strengthened to allow successful farmers within their localities to share best practices of growing legumes. The emphasis on strengthening platforms for collaboration and encouraging successful farmers to share best practices reflects the sustainable livelihood theory's assumption that social networks and community-based knowledge exchange are crucial for building resilience and improving livelihoods (Pender, Place & Ehui, 2006). By promoting peer learning and knowledge sharing, farmers can enhance their human capital (skills and knowledge), which is a key aspect of the SLF's focus on capacity-building. Additionally, the findings of the study that government has been employing extension officers and the provision of extension kits and logistical support aligns with the sustainable livelihood theory's emphasis on the importance of institutional and governmental support in improving access to resources, knowledge, and services that can help farmers improve productivity and reduce vulnerability.

Besides that, the findings of the current study are in line with the ministerial statement presented in the 2023 national budget speech which indicated that government was scheduled to employ 256 extension officers, procure 1,623 extension kits, 1,000 tablets, 621 motorbikes and rehabilitate over 536 camp houses. With all these measures, government hopes to provide 1.5 million smallholder farmers with extension services through physical visits and e-extension platforms (National Budget Speech, 2023).

When it comes to addressing problems of access to improved seeds, agriculture officials support outgrower schemes as an effective way of ensuring access to improved seeds beyond the FISP. While this is the case, farmers see this method as something that is risk as in events of poor rainfall resulting in poor yields; they will still have to pay in full to the outgrower scheme. For the farmers, government support program should aim to bringing back village seed-bank as a key way of supporting their efforts in as far as addressing the problem of improved access to improved seed is concerned. The views expressed by farmers were similar to those of Kushwaha and Rakesh (2018) who argues that farmers do not want to get a loan or credit to purchase farming inputs as they see such as a risk.

The study revealed that methods like the use of ashes and boom pests are difficult to support given that the use of ashes may indirectly promote deforestation which may result in other environmental problems while the use of boom paste has no scientific backing. While this is the case on boom paste, it provides an opportunity to conduct scientific research into such methods to determine their validity and effectiveness.

CONCLUSION

This study sought to explore the local solutions being used by small scale farmers to address legume production challenges in Nangoma Agriculture Camp Area and the existing opportunities for scaling up such a local innovation. The findings of the study revealed that small scale farmers use local solutions such as village banking initiatives, loans from friends and personal savings to address the challenge of limited access to credit facilities. Additionally, the farmers use recycled seeds as a solution to the challenge of lack of access to improved and

certified seeds. The study also found that farmers use oral history as well as learning from friends and successful farmers in their neighborhood on issues to do with legume production knowledge. This is done to address limited agricultural advisory services.

For poor soils, the use of animal manure and intercropping as well as crop rotating cereals with legumes were found to be local solutions. While this was the case, the quantities of animal manure were found to be not sufficiency to scale the practice. Additionally, problems of limited land among some farmers were resolved by way of land renting from farmers that have enough land and yet do not cultivate of all of their land. Besides that, the use of boom paste, ashes and intercropping were found to be local solutions used to address legume production challenges related to pests and ants.

The study also indicated that various opportunities existed for scaling up these local solutions in order to improve legume production. The use of village banks provided an opportunity for government to fund such groups to improve access to finance. Further, the use of animal manure to improve soil provides an opportunity for government to incorporate such manure into government support programs like FISP to promote large scale production from private sector. Besides that, learning from successful farmers, oral history and use of recycled seeds provides an opportunity for government and other stakeholders to employing more extension workers, promoting out grower schemes and village seed banks among others. Once this is done, it can be argued that legume production will significantly improve among small scale farmers as the farmers themselves, are part of the solution to the problems they encounter.

RECOMMENDATIONS OF THE STUDY

Based on the findings of the study, the following recommendations are made;

1. Government should support established village bank initiatives with low interest loans. Here, government should use part of its money from the agriculture credit window and channel it to selected village banks. This will be key in ensuring that such banks have enough money to give its members loans when need be, consequently promoting access to finance that is free of bureaucratic challenges among Small Scale Farmers.

2. Camp extension officers and other non-state actors should encourage and support village seed banks as it seems to be an acceptable way by the majority farmers as opposed to contract farming as they perceive it to be risky.

3. FISP should be broadened to incorporate animal manure in a bid to scale usage of animal manure among small scale farmers. This will further help support indigenous ways of addressing legume production challenges as the method is cheap and environmentally friendly. This will also help bring on board the private sector which is key in addressing problems of sufficiency of the commodity.

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