GCRF AFRICAP

CLIMATE SMART AGRICULTURAL DEVELOPMENT

AFRICAP BASELINE HOUSEHOLD SURVEY

REPORT FOR SOUTH AFRICA

agriculture, land reform & rural development
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REPUBLIC OF SOUTH AFRICA

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FREE STATE PROVINCE

NAMC
Promoting market access for South African agriculture

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EXECUTIVE SUMMARY

The AFRICAP survey aimed to evaluate the socio-economic and biophysical outcomes of different scales of farming in the Free State Province of South Africa. The survey involved farmers from two district municipalities, namely Lejweleputswa and Thabo Mofutsanyane. They were chosen based on two criteria: the commodities they produced (mainly soybeans, maize, potatoes, cattle and chickens) which were in line with those selected for the study; and the random sampling technique. During the survey, the information about farming systems, including crop cultivation and livestock systems and how to respond to unexpected weather events, was collected from a sample of three hundred and ninety-eight (n=398) farmers – i.e. 175 in Lejweleputswa and 223 in Thabo Mofutsanyane. This data was collected in the Open Data Kit (ODK) application using tablets. The results show the presence of more males relative to females, with farm ownership in the hands of household heads (represented by 223 in Thabo Mofutsanyane and 137 in Lejweleputswa). The farmers had access to pasture land (55 %) and active cultivation land (45 %). In terms of crop cultivation, the results show an average of 61 ha under farm cultivation in the past 12 months, implying that 68 % of the land under active cultivation was not cultivated over the reference period. Furthermore, evidence from the data indicates that maize (25 %), potatoes (8.3 %), sunflowers (4.5 %), soybeans (3 %) and dry beans (3 %) respectively were the first main crops. Data also shows that dry beans, soybeans and sunflowers were the third main crops for these farmers. The farmers' top five crops that were harvested included maize (29.1 %), potatoes (11.3 %), dry beans (11 %), sunflowers (10.6 %) and soybeans (8.3 %). The survey revealed that 12 % of farmers sold their produce in the nearest town, 5 % within their communities and 2.5 % in the fresh produce markets in Thabo Mofutsanyane and Lejweleputswa. The majority sold their produce in the nearest town (10 %), 7 % within the community and 4 % in fresh produce markets. The land areas for farmers growing dry beans (44), soybeans (33), sunflowers (42) and potatoes (45) ranged from 0.15-300 ha, 1-600 ha, 100 ha and 0.10-454 ha respectively. The survey shows that only 60 farmers (translated as 15.3 %) applied irrigation. Farmers revealed different types of fertilisers or manure applied in the past 12 months (2018/19 harvest). Farmers in Thabo Mofutsanyane used fertiliser (10.3 %) and NPK application (6.6 %), whereas 7.8 % of the farmers interviewed in Lejweleputswa applied NPK only in their farming practices. Approximately 81 % of the households interviewed kept livestock in their households, either cattle, sheep, goats or chickens, or a combination thereof. Of the two district municipalities, it was found that more households in Thabo Mofutsanyane (190) than in Lejweleputswa (131) were involved in livestock farming. Of the 223 farmers in Thabo Mofutsanyane, 33 (which is equivalent to 14.79 %) did not keep any kind of livestock in their households, meaning that about 85.20 % had some kind of livestock in their households. In relation to farming practices, households were asked whether their farming practices had changed as a result of weather shocks such as drought and floods. The results revealed that some farmers had changed their farming practices and other farmers were willing to change. Given the importance of agriculture in South Africa and the effect of climate change, these findings have serious implications for policy.

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ABBREVIATIONS AND ACRONYMS

AFRICAP	Agricultural and Food-System Resilience: Increasing Capacity and Advising Policy
CSAS	Climate-Smart Agri-Food Systems
DARD	Department of Agriculture and Rural Development
FANRPAN	Food, Agriculture and Natural Resources Policy Analysis Network
FSP	Free State Province
GCRF	Global Challenges Research Fund
NAMC	National Agricultural Marketing Council
NPK	Nitrogen Phosphorus Potassium fertiliser
SA	South Africa
SAZ	Special Agricultural Zone
SDG	Sustainable Development Goal
SEZ	Special Economic Zone
SSA	Sub-Saharan Africa
STATS SA	Statistics South Africaa
UK	United Kingdom

BACKGROUND

3.1. The AFRICAP Project

Developing Climate-Smart Agri-Food Systems (CSAS) in Sub-Saharan Africa (SSA) is a precondition for achieving the Sustainable Development Goals (SDGs). As a result, the Global Challenges Research Fund - Agricultural and Food-System Resilience: Capacity and Advising Policy (GCRF-AFRICAP) is a direct response to this challenge. This initiative seeks to build capacity for co-developing and demonstrating nationally owned Sustainable Development Goal (SDG)-compliant agri-food development pathways that can be productive, sustainable and climate smart. These pathways are informed by national characteristics and development priorities, as well as consistency with global mitigation objectives for the agriculture, forestry and land-use sectors. Working in four focal countries – Malawi, South Africa, Tanzania and Zambia – and at regional and international levels, GCRF-AFRICAP translates research into evidence, then evidence into policy, and policy into practice, undertaking capacity building at each stage through an innovative model of policy learning and experimentation based around the development of Special Agricultural Zones (SAZs). SAZs are similar to the Special Economic Zones (SEZs) used for piloting industrial policy, most notably in China, where Chatham House and partners successfully adapted the approach to implementing low-carbon pilot areas. This approach is envisaged to generate impact in real-time. At a regional level, this impact is assured through the extensive regional and international networks of partners and a cross-scale, research and knowledge exchange infrastructure.

GCRF-AFRICAP is designed around four themes, across which there are significant intellectual exchange, integrated research training and capacity development. Theme A aims to establish the programmatic groundwork: engaging key stakeholders, mapping national policies and synthesising the evidence on CSAS barriers and enablers, at farm and broader institutional levels. Theme B seeks to co-develop nationally appropriate, SDG-compliant agri-food development pathways with in-country stakeholders: integrating projections of changing climate and extreme weather with national development and global mitigation objectives to identify future technology needs. Based on the evidence generated in A, and the pathways developed in B, Theme C co-develops, tests and evaluates policies for SDG-compliant agri-food systems, building capacity for evidence-based national and regional policy making and cross-scale implementation. Theme D builds capacity in professional services and management required to implement international, interdisciplinary and impactful research, as well as to provide cross-project training.

3.2. Description of the Study Area

The Free State Province (FSP) is situated in the centre of the country, sharing borders with six other provinces, as well as international borders. It almost encloses the Kingdom of Lesotho, and is thus referred to as the “heart of the country” and also the “bread-basket of the country”. The province is divided into five district municipalities, namely, Xhariep, Lejweleputswa, Fezile Dabi, Thabo Mofutsanyane, and Mangaung Metropole. Currently, Mangaung Metropole has the largest share of the province’s population.

The FSP is the third largest province in South Africa, commanding an area of approximately 129 480 square miles or 12.9 million hectares, occupying 10.6 % of the total South African landmass, and it is considered to be one of the most important food hubs of the country, with 3.2 million hectares of cultivated land (Stats SA, 2011).

The FSP produces over 70 % of South Africa's grains and field crops, and this production largely takes place in three district municipalities, namely Thabo Mofutsanyane, Xhariep and Lejweleputswa. The top commodities produced include maize, wheat, sorghum, potatoes, sunflowers, red meat, dry beans, fruits, wool, milk, cherries, vegetables and peanuts. Generally, the province is endowed with natural resources such as rainfall, soil quality, vegetation and topography, which determine its agricultural potential and output. Most importantly, the three main soil zones include (a) areas covered by blanket sands in the west, mostly with deep sandy soils; (b) central and southern regions without blanket sands, where the solid geology (mudstone, shale, sandstone, dolerite) largely determines the soil properties and commonly gives rise to claypan soils, dark clays or shallow soils, and (c) areas towards the escarpment edge where sandy materials from certain geological formations give rise to predominantly moderately deep loamy soils. The soils under (a) above have unique properties that render them particularly valuable for rain-fed arable use, including good rainwater uptake and storage due to the deep, sandy or loamy profile; low or no natural acidity in the upper subsoils, which, together with relatively sandy textures, allow deep root penetration (unless compacted), and lastly, the presence of drainage-retarding layers at depth. Due to the latter, over large areas in Nala in Lejweleputswa and Moqhaka in Fezile Dabi, water tends to accumulate and rise through capillary action to within reach of the crop roots. This allows for much higher yields of deep-rooted crops than would have been possible by means of in-field seasonal rainfall alone. However, there is a downside to the sandy textures in the form of susceptibilities to compaction and wind erosion.

The soils under (b) above generally have less favourable water-absorbing and -retaining characteristics due to higher clay content and limited rooting depth. Mostly they also have low suitability for irrigation. However, they tend to support good rangeland and are sufficiently deep, offering a niche for strongly rooted crops such as sorghum and sunflower, which are able to extract water strongly from clayey layers. Where slopes occur, the moderate to high susceptibility of most of these soils to water erosion has to be taken into account. It may be noted that these soils typically occur where blanket sands were stripped away by stream action in the recent geological past. They thus extend along drainage lines into the west and east. In the latter area, they commonly constitute highly erodible land facets. Extensive areas covered by an association of shallow and clay pan soils occur in Xhariep. These support a False Upper Karoo vegetation, which is a degraded veld type dominated by Aristida and Eragrostis lehmanniana grasses. This vegetation is permanently under threat of invasion by bitterbos (Chrysocoma ciliata) during years of drought, particularly in areas where overgrazing by sheep occurs or has occurred (FSDARD, 2017).

The loamy soils under (c) above are arable and sufficiently deep. Areas underlain by Molteno sandstone (e.g. the Bethlehem area) are particularly productive. Clay contents are slightly higher than in the west. Drainage-retarding deeper layers may occur, which are most beneficial to field crops but are mostly detrimental to permanent crops as they may give rise to excessive seasonal wetness, at least at depth. Claypan and other wet soils are dominant in areas where stream incision took place during recent geological times. In those land facets, they pose an erosion hazard if cultivated or overgrazed.

Agriculture has always been considered the main sector for the FSP's economy. Despite

other sectors having surpassed agriculture in their contribution to the province's economic growth in the recent past, the sector continues to dominate the FSP landscape with cultivated land, natural veld and grazing land. Natural veld and grazing land dominate the agricultural landscape with 87 000 square kilometres, with cultivated land covering 32 000 square kilometres of the province. In 2011, agriculture contributed about 2.5 % to the economic growth of the FSP; however, it represented about 9 % of the total agricultural sector in the country. Furthermore, agriculture accounts for approximately 90 % of land use in the FSP. The province supplies significant proportions of the nation's sorghum (53 %), sunflowers (45 %), wheat (37 %), maize (34 %), potatoes (33 %), groundnuts (32 %), dry beans (26 %), wool (24 %) and almost all of its cherries (90 %). The agricultural sector in the FSP can, therefore, be regarded as one of the most important food hubs in South Africa (Stats SA, 2011).

The overview provided in this section is essential in understanding the interrelation linkages between the socio-economic and economic profile needed to ensure economic growth and prosperity for the population of the FSP through the development and implementation of sustainable agricultural projects. The eastern part of the FSP is semi-arid with an annual rainfall of about 700 mm. In the western part, rainfall intensity is erratic and ranges between 80 mm and 300 mm per annum. Figure 1 below illustrates the map of the Free State.

Figure 1: Map of the Free State

The AFRICAP survey aimed to evaluate the socio-economic and biophysical outcomes of different scales of farming. During the survey, information about farming systems, including crop and livestock cultivation systems and how to respond to unexpected weather events, was collected. The data was obtained in the Lejweleputswa and Thabo Mofutsanyane district municipalities of the Free State Province.

RESEARCH METHODOLOGY

4.1. Selection of Study Area

The study selected two district municipalities in the FSP, namely Lejweleputswa and Thabo Mofutsanyane. Firstly, the Lejweleputswa District Municipality is situated in the north-western part of the Free State with a total area of about 31 930 km². This district municipality borders the North West Province to the north, Fezile Dabi and Thabo Mofutsanyane to the north-east and east respectively, Mangaung and Xhariep to the south, and the Northern Cape Province to the west. The district makes up almost a third of the province, consisting of the following five local municipalities (with approximately 18 towns distributed throughout): Masilonyana, Tokologo, Tswelopele, Matjhabeng and Nala. The main economic sectors in this district include mining, construction, transport, electricity, trade and agriculture.

The Thabo Mofutsanyane District Municipality is situated in the eastern Free State Province with a total area of about 33 269 km², and borders on Lesotho and the provinces of KwaZulu-Natal and Mpumalanga. This district municipality comprises six local municipalities: Setsoto, Dihlabeng, Nketoana, Maluti-A-Phofung, Phumelela and Mantsopa. The main economic sectors are agriculture and tourism. The study areas were chosen based on agriculture – a common main economic sector – and their potential to address the research question of the study. In addition, the study aimed to identify and implement evidence-based policy pathways to facilitate the development of sustainable, productive, climate-smart agricultural systems to meet food security and economic development needs.

4.2. Selection of Study Participants

Prior to the selection of the study participants, a workshop was conducted in the FSP on 12 July 2018 to introduce the AFRICAP project to stakeholders, which included local and provincial government officials, FANRPAN officials, the SA node (NAMC) and farmers. The workshop also aimed to receive inputs from these stakeholders concerning the design and implementation of the project. From this workshop, a decision was taken to include 400 farmers in the study, which included commercial, subsistence and/or smallholder farmers. The farmers were also selected based on them producing the selected commodities, being mainly soybeans, maize, potatoes and livestock (cattle and chickens). The farmers were selected randomly, based on the commodities being produced, in line with the commodities selected for the study.

4.3. Ethical Considerations

Ethics are described as a "set of moral principles that offer rules and behavioural expectations about the correct conduct" (Onwuegbuzie & Teddlie, 2003). Ethics provide a researcher with a guideline on moral conduct, in order to prevent scientific misconduct (Weisner, 2005:32). Ethical considerations and guidelines, as proposed by these authors, were addressed at each stage of the research. In compliance with AFRICAP and NAMC ethics requirement, standardisation and uniformity were adopted during the study for all respondents. Permission to enter the farms was obtained from the Provincial Department of Agriculture and the farmers, who were consulted and informed about the objectives of the study. Information obtained from respondents was kept confidential. The results of the study were

generated from processed and analysed data from the questionnaire surveys. Respondents were treated with respect and dignity, and the objectives of the study were outlined. Participation in the study was voluntary for all respondents, and in the interviews the focus was solely on issues related to the study. Approval to conduct the survey was received from the NAMC's Ethical Clearance Committee on 17 May 2019.

4.4. Data Collection

On 20 May 2019 the NAMC, together with FANRPAN, convened a data-collection training session for the AFRICAP project. The objectives of the training were:

- To orient the enumerators regarding the AFRICAP programme and the purpose of the data-collection process;
- To capacitate the enumerators on the use of the data-collection tool;
- To capacitate the enumerators on how to collect the data; and
- To pilot test the data-collection tool and refine it as required.

For the data-collection process, 10 enumerators were hired and seven NAMC and FANRPAN colleagues were involved in the data collection. The training also included officials from the Provincial Department of Agriculture and the Department of Rural Development and Land Reform. The first day of data collection was strictly classroom training on the project, site description, the Household Assets Vulnerability Assessment (HAVA) tool and the operations of the tablets for data collection. Day two of the training included revision and piloting of the study, which included the incorporation of any amendments required. The data collection took place in the Thabo Mofutsanyane and Lejweleputswa districts as planned.

In total, 17 persons were used as the numerators for the AFRICAP data collection. Of the 17 numerators, 10 were enumerators hired from within the Free State Province where the data collection took place, and seven were NAMC and FANRPAN employees. The actual data collection ran for about four weeks, in both the Thabo Mofutsanyane and Lejweleputswa districts. In total, 398 questionnaires were administered.

4.5. Data Management

The data was collected in the ODK application using tablets. Each enumerator was given a tablet to input the data into the questionnaires. At the end of each day, the two supervisors checked the questionnaires together with the numerators and, once satisfied with them, the questionnaires were uploaded to the server. The data in the server was managed by FANRPAN and the University of Leeds. Later an agreement on data sharing was signed and the data was shared with the NAMC.

HOUSEHOLD SURVEY RESULTS

5.1. Module A: Household Characteristics & Demographics

The results presented in this sub-section relate to 'Module A: Interview and Household Description' of the questionnaire and were obtained from a sample of three hundred and ninety-eight (n=398) farmers from Lejweleputswa (175) and Thabo Mofutsanyane (223) respectively. In terms of the household description, it was discovered that the majority of the farms were owned by the heads of the households, which were male, represented by 223 in Thabo Mofutsanyane and 137 in Lejweleputswa respectively. Importantly, the gender splits were dominated by males, with a total of 163 males and 60 females in Thabo Mofutsanyane and 129 males and 40 females in Lejweleputswa. The results suggested that farming in these districts is predicated on family structure. In many instances, such farms have children less involved in farming due to school attendance or migrant work elsewhere. In addition, the head of the household took full responsibility for the farm. There was more participation by males (73 %) than females (27 %), indicating that more work needs to be done to close gender disparities.

5.2. Module B: Agricultural Landholding

The analysis in this sub-heading relates to module B of the questionnaire, which presents different types of land to which households have access. Access to these types of land could imply food diversity because the farmer would be more likely to engage in different types of farming enterprises, suitable for each type of land. Those who had access to different types of land averaged only 20 %, implying that access to land remains a huge problem for the majority of households. The top two types of land to which households had access were pasture land (55 %) and active cultivation land (45 %), suggesting that the study sites are more likely to be suitable for the production of field crops and livestock. As expected, woodland was the least prevalent type of land to which households had access, and this result can be attributed to unsuitable climatic conditions for forestry in these study sites. The table further shows that some (9 %) of the land to which the households had access was unused (fallow) land. One possible explanation for this is the lack of access to production inputs. In terms of total land size, the sample as a whole had an average of 242.9 ha, with fallow land (M = 219; SD = 284), pasture land (M = 212; SD = 335), active cultivation land (M = 188; SD = 414) and other land (M = 111; SD = 167) commanding the top average hectares respectively.

Soil texture and colour are important indicators of soil condition and climate, which in turn determine the agricultural product that can be grown. For instance, clay soils have high water-holding capacity and also tend to be warmer relative to sandy soils. However, a major notable observation from the table is that the majority of households did not disclose the soil texture and colour of their farming land, indicating a possible

dissonance between farmers' knowledge of climate and cropping/livestock requirements. Apart from this, "mixture" was the main texture of soil on the farming land of households, with colours of topsoil ranging from light brown (82) to black or dark brown (51) and red (43). The majority of households had acquired the land through government assistance (19 %) followed by purchase (12 %), inheritance (6 %) and lease (4 %), while the remainder did not respond. This result indicates the possibility of secured land tenure, which is more likely to attract agricultural investment.

Additionally, two fundamental questions are pertinent when dealing with land issues: when was the land acquired, and how was the land acquired? It is important to note that between the two districts, Thabo Mofutsanyane dominated with 56 % of households that provided feedback on when their land was acquired compared to 44 % of households Lejweleputswa. In Thabo Mofutsanyane (59.6 %) the majority of households did not disclose when they had acquired their land. At the same time, 40.6 % of households in Lejweleputswa did not disclose this information. From 1970 to 1979, households equally acquired land in both districts through purchase (20 %) and inheritance (80 %). However, between 1980 and 1989 the acquired land was skewed in the districts (66.7 % and 33.3 %), with mostly purchased land (50 %) and inherited land (21.4 %). From 1990 to 1999, the appetite for acquiring land started growing as households purchased land and the government granted land, with 38.5 % and 33.3 % respectively. Additionally, during that same period, households in Thabo Mofutsanyane acquired 60 % of the land and Lejweleputswa 40 %. The growing trend for land continued from 2000 until 2009 when 63.8 % of households in Lejweleputswa and 36.7 % in Thabo Mofutsanyane acquired land, predominantly granted by the government (51 %) and purchased (28.6 %). Noteworthy is that from 2010 to 2019, most households acquired more land than in any other years. The majority of these households mostly acquired their land through government grants (45.7 %) and leasing (15.7 %).

With regard to the history of the productive land before it was cleared to be farmland in both the district municipalities, it can be noted that 51 % of the farmers did not disclose or did not know the history of the land. In comparison, 20 % said it had been grassland, 16 % mentioned that the land had been used for other things such as a farm; or it had been an open field, pasture or vacant land, to mention a few. The majority of the land had previously been used for agricultural purposes. In both districts, when asked what had been on fallow land before it was cleared for farming, the majority of the farmers (91 %) did not know/disclose what was on the land before it was cleared, while 4 % said there had been grassland, another 3 % said there had been a hill or rocks, or that it was already fallow land.

Furthermore, out of the 398 respondents, 363 (91 %) farmers did not know what had been on the home garden before it was cleared, while 4 % of the farmers said there had been a kraal and others said a stand. When farmers were asked about what had been on the woodland before it was cleared, two farmers from Thabo Mofutsanyane said that it had been a natural woodland. Over the last 12 months, 192 farmers from both municipalities answered the questionnaire and of those, 21 % said they had experienced floods on their farmland. This could be an indication that the area is not prone to weather conditions such as floods, but they can happen. A total of 25 % of the farmers had experienced floods in Thabo Mofutsanyane, while 18 % of farmers had experienced floods in Lejweleputswa.

5.3. Module C: Crop Cultivation Systems

In the previous section, the results revealed that the sample had an average farm size of 242.9 ha, with land under active cultivation at 188 ha. However, in terms of crop cultivation, the results show an average of 61 ha under farm cultivation in the past 12 months, implying 68 % of the land under active cultivation was not cultivated over the reference period. To some extent, this result corroborates with Sihlobo (2018) who claimed that the area planted (especially for maize) by smallholder farmers has declined. Unfortunately, the study did not investigate the factors affecting the decline of land under farm cultivation. However, possible reasons could include, amongst others, climate change or drought and lack of access to inputs. It is noteworthy that this decline is more likely to raise food prices and imports, thereby increasing food insecurity.

Evidence from data shows that maize (25 %), potatoes (8.3 %), sunflowers (4.5 %), soybeans (3 %) and dry beans (3 %) respectively were the first main crops. Forty-eight per cent (48 %) did not disclose the first main crop from their total crops planted. The second main crops were dry beans, sunflowers, maize, soybeans and potatoes. Dry beans, soybeans and sunflowers were the third main crops for these households. In addition, maize, potatoes and dry beans were used for intercropping. The results indicate that the majority of the farmers in both districts did not practise intercropping. However, there was a small difference in this distribution in the Thabo Mofutsanyane district. Those that practised intercropping did so with dry beans and sometimes potatoes.

5.3.1. Crops harvested in the last 12 months

The farmers' top five crops that were harvested included maize (29.1 %), potatoes (11.3 %), dry beans (11 %), sunflowers (10.6 %) and soybeans (8.3 %). These results were expected because maize is the staple food for the majority of South Africa's population, as well as a principal source of animal feed, an important employer, a provider of raw material inputs for the manufacturing sector, and an earner of foreign currency (DAFF, 2018). In many instances of dietary preferences, maize is substituted for potatoes. As a result, maize had the highest mean allocation of land (117 ha), followed by groundnuts (100 ha), sorghum (80 ha), potatoes (34 ha) and dry beans (29 ha). This is an indication of the suitability of the FSP for dryland crop production. Other crops that were harvested were beetroot, spinach, cabbage, tomatoes, pumpkins and butternuts. The area planted to these ranged from 0,01 ha to 120 ha. This further implies that the reasons for growing vegetables range from home consumption to commercial surplus production.

Furthermore, the farmers were asked to list the crops they produced and to list the top three. The findings revealed that the majority (n=42) of the farmers in Lejweleputswa and Thabo Mofutsanyane (n=59) regarded maize as their main crop. The second and third most prevalent crops in Lejweleputswa were potatoes and sunflowers, whereas in Thabo Mufutsanyane the second most prevalent crop was dry beans.

The planting season for the main crop started around September and went deeper into January of 2019. However, the majority of the farmers planted in November 2018. The farmers indicated that traditionally, planting starts in September, but they had started to shift towards planting around November due to prolonged dry spells. Moreover, due to the drought, farmers had delayed planting up until January in extreme situations.

Noteworthy, the harvesting season ranged between December and August of the following year, with the majority of the farmers harvesting between May and July. Again, the main reason was due to delayed planting and this is logical because a delay of planting by a couple of months is expected to push the harvesting season back by a couple of months. Furthermore, the reason the harvesting season did not differ so much from the traditional harvesting season, which is supposed to be in April, May and early June, was that many farmers revealed that the adoption of early-maturing seed varieties seemed to be a reality so as to catch up with the changing climate.

After harvesting has been done, the average quantity of maize harvested, consumed at home, used for fodder, sold and that which was lost pre- and post-harvest. It also indicates the average price per quantity sold. The results show that maize production was market oriented, as indicated by larger quantities that went into the market versus the quantity used for home consumption. In addition, the farmers incurred greater losses post-harvest, compared to the quantities lost pre-harvest.

Maize is the main crop for most farmers. The survey found that farmers sold to various marketing channels; however, the most prominent channel was silos, followed by co-operatives. The finding that farm-gate sales were lower than the other markets was unexpected, as the majority of smallholder farmers tend to use farm-gate sales more frequently than other marketing channels.

With regard to transportation used to the market, the majority (60 %) of farmers used their own transport to deliver produce to the market, while 30 % used hired transport. Noteworthy, the average distance to the nearest town was 33,17 kilometres. Furthermore, the results showed that the majority of the farmers sold their maize to processors, followed by those who sold to intermediaries and directly to consumers. Over the years, harvest losses have become evident, and this includes the dominance of pre-harvest losses compared to post-harvest losses. The main reasons for such losses were prolonged droughts and pests

5.3.2. Market information for crops cultivated

With regard to the market information relating to the crops harvested by the farmers within Thabo Mofutsanyane, the survey revealed that the majority (12 %) of the farmers sold their produce in the nearest town, followed by those who sold their produce within their community (5 %) and a small number (2.5 %) who sold their produce to the fresh produce markets in the community. With regard to the farmers in Lejweleputswa, the majority (10 %) sold their produce in the nearest town, 7 % within the community and 4 % in fresh produce markets. The finding that farm-gate sales were lower than the other markets was unexpected, as farm-gate sales are a simple market amongst smallholder farmers, as well as commercial farmers in many instances. The finding that very few farmers had access to fresh produce markets could indicate that farmers were limited to formal markets. This could have been due to their volume inconsistencies and failure to meet the market requirements and standards.

5.3.3. Chemicals applied by the farmers

The use of herbicides, pesticides and fungicides is a common practice among farmers. The survey attempted to find out whether farmers within the two districts applied herbicides or pesticides certified to control pests or insects within their farming practices. The

chemicals included in the survey were Dipterex (Trichlorfon), Carbaryl, Trifluralin, Imazamox and Pendimethalin. It was unfortunate that most of the farmers did not apply chemicals in their farming practices. The results revealed that only a single farmer applied Trifluralin. In contrast, eight farmers used other chemicals to control pests or insects (for example, "Blue Death" was common among the farmers).

5.3.4. Land information

The results show that the minimum land area used to grow maize ranged between 0.10 and 3 000 ha for the majority of the 116 respondents. In terms of sorghum, only two grew sorghum on a land area between 40 and 60 ha; while one respondent grew groundnuts on a land area of 100 ha. Moreover, in the case of farmers growing dry beans (44), soybeans (33), sunflowers (42) and potatoes (45), their land area ranged from 0.15-300 ha, 1-600 ha, 100 ha and 0.10-454 ha respectively. It can be depicted that only two farmers grew mixed beans in an area ranging from 0.10 to 0.5 ha.

5.3.5. Seed procurement

The procurement of soybean seeds in the Thabo Mofutsanyane and Lejweleputswa local municipalities was mainly sourced from the local agro dealer/market, followed by direct procurement from a commercial seed company. This means a total of nine (2.3 %) and two (0.5 %) farmers sourced their soybean seeds from the local agro dealer/market in the Thabo Mofutsanyane and Lejweleputswa local municipalities respectively. Only a few farmers sourced their soybean seeds from co-operatives, recycled seeds and nearby stores. Interestingly, maize seed procurement was mainly from the local agro dealer/market, represented by 16 (4.0 %) farmers in Thabo Mofutsanyane and 17 (4.3 %) in Lejweleputswa, followed by direct procurement from a commercial seed company, with 2.8 % and 2.0 %, respectively. Finally, potato seed was mainly procured from the local agro dealer/market, represented by six (1.5 %) farmers in Thabo Mofutsanyane and only five (1.3 %) in Lejweleputswa recycled their seeds for planting.

5.3.6. Access to water and irrigation

The survey showed that only sixty (15.3 %) farmers applied irrigation. The sources of water for irrigation were commonly from the artificial domestic and local channel, which was either water from the household municipality water tap or household borehole, or water harvested from rainfall through water storage tanks. Farmers did not have a proper channel/infrastructure for irrigation such as drip irrigation, sprinkler irrigation, sub-irrigation or treadle pump. Through the transact walk during the survey, farmers who were farming at the household level were found to be using manual irrigation.

Land is one of the most important assets/ production resources in a farming practice which need to be managed. It was revealed that the farmers in the two districts did not practise any land management/cultivation practices. Although farmers were not practising these techniques, hand ploughing, ripping and weeding, disc ploughing, combined harvesting and crop rotation remain the main management/ cultivation practices in the Thabo Mofutsanyane and Lejweleputswa districts.

5.3.7. Access to information

Information is a critical component for smallholder farmers, especially in terms of technical know-how of farming practices. The results indicated that the majority of the farmers received information from the agricultural extension officers (crop and livestock

specialists) represented by 18.6 % and 14.8 % in the two districts (Thabo Mofutsanyane and Lejweleputswa) for crops, and 20.4 % and 19.8 % in the two districts for livestock respectively. Furthermore, peer-to-peer advice and community group participation remains one of the key sources of information for the farmers in the study area.

5.3.8. Application of fertilisers or manure

Farmers revealed different types of fertilisers or manure applied in the past 12 months (2018/19 harvest). The results revealed that the majority (10.3 % and 6.6 %) in Thabo Mofutsanyane made use of manure and NPK application in their farming practices respectively. On the other hand, the majority (7.8 %) in Lejweleputswa used NPK in their farming practices.

5.4. Module D: Livestock Systems

The study looked into livestock systems in both the district municipalities and the findings revealed that approximately 81 % of the 398 households interviewed kept livestock in their households – either cattle, sheep, goats or chickens, or a combination thereof. Of the two district municipalities, it was found that more households in Thabo Mofutsanyane (190) than in Lejweleputswa (131) were involved in livestock farming. The main types of livestock kept were cattle, sheep, goats and chickens for several reasons – either for commercial or food security purposes or both.

Moreover, in Thabo Mofutsanyane, about 75.33 % (168 out of the 223) households owned cattle compared to 71.42 % (125 out of the 175) households in Lejweleputswa. These households kept cattle either for meat or milk. With regard to sheep, only 49 farmers out of 223 households owned sheep in Thabo Mofutsanyane, compared to 42 out of 175 households in Lejweleputswa. Only a few households owned sheep and chickens in the two districts. The sheep were mainly kept for wool or meat, whereas chickens were mainly kept for meat or eggs.

With regard to the marketing of the livestock, about 37 and 35 sheep producers marketed their sheep in Thabo Mofutsanyane and Lejweleputswa respectively. The average selling price per sheep was R1716,77, with a minimum of R1500 and a ceiling price of R12000. In terms of per kg of sheep, the average price was R442,50. Notably, there was no milk or wool price recorded.

5.4.1. Shocks, coping and adaptation

In relation to farming practices, households were asked whether their farming practices had changed as a result of weather shocks such as drought and flooding. The results revealed that some farmers had changed their farming practices and other farmers were willing to change. Interestingly, some farmers said this did not apply to them, especially in Lejweleputswa. This is interesting because it might mean that the factors affecting other households in these districts did not affect these households. The farmers who had changed their farming practices employed the use of boreholes, or bought more tanks, bought feed for livestock, or delayed planting.

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

The impact of natural disasters such as climate change, leading to drought and flooding, has a dire effect on agricultural production. Agriculture relies on the weather, climate and water availability to thrive, thus it is easily impacted by natural events and disasters. It was evident that in the past four years (since) most of the farmers experienced unusual or unexpected weather patterns. Although farmers were applying historical knowledge in dealing with the effects of climate change, more adaptation and mitigation strategies are needed in both crop and livestock farming practices.

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