BOTSWANA 2016/17 REPORT

Sustainable intensification of maize-legume cropping systems for food security in eastern and southern Africa (SIMLESA-2)

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Background

Agriculture in Botswana is essential for food security and contributes about 2.3 % of GDP. Botswana agricultural sector is characterized by poor productivity which could be attributed to recurring droughts and poor management. Yet, the government of Botswana has identified agricultural sector as key for economic diversification and employment creation. This could only be achieved if productivity across the sector is improved and requires substantial investment on appropriate technologies and capacity building. The sustainable intensification of Maize-legume cropping systems for food security in Eastern and Southern Africa (SIMLESA) therefore supports Botswana government's goal of improving national food security. In Botswana, SIMLESA Project aims to increase agricultural productivity through promotion of conservation agriculture, and sustainable integration of livestock and crop production system. The activities of SIMLESA in Botswana are driven by set objectives which are; Socio-economics, agronomy, innovation platforms and capacity building.

This report provides an overview of initiatives undertaken under SIMLESA project during 2016/17 cropping season, highlighting achievements and challenges during implementation under each objective. The trials were demonstrated both on-farm in Leshibitse and on station in Sebele. The cropping season in Botswana starts from October until the 31 January in the Southern part and 15 February in the Northern part.

The activities for the objectives were addressed as follows;

Objective 1: Socio-Economics

To characterize sorghum-legume production, input- output value chain systems and impact pathways, and identify broad systemic constraints and options for field testing.

A questionnaire was developed to address the above objective in Botswana. The survey is to be conducted in three districts being Kgatleng, Kgalagdi and Ngamiland. The three districts were selected because of their agro- ecological differences while Kgatleng was chosen because of its close proximity to Sebele. Kgalagadi is characterized by hot and dry weather conditions and the soils are mostly sandy with low fertility. Ngamiland experiences relatively higher rainfall than other parts of the country and is characterized mostly by sandy soils. The climate of Kgatleng is described as having very hot summers and mild winters rarely falling below freezing point. The annual rainfall ranges between 450mm to 550 mm. The soils are described on the land systems in the district, they are shallow and stony, deep light textured and acidic soils around notwane plains and the sandy of various colours and the loamy subsoils around the Thagale plain system.

A structured questionnaire was used to capture the following;

Demographics of the respondents
Their farming practices
Farmer's perceptions on conservation agriculture
Marketing constraints

The current team members for this objective are:
Moeti Kgosietsile MSc Agricultural Economics
Gotseleene Mangole MSc Agricultural Economics
Marea Motsepe MSc Agriculture Engineering
Odireleng Molosiwa PhD Plant Breeding

Methodology

A sample size was determined. There was a criterion used to determine sample size (n) to be used for this interview. A total number of 2688 farmers in Kgatleng and 5781 in

Ngamiland were identified through the district agricultural offices. Kgalagadi numbers
are yet to be confirmed.

The questionnaire was tested and validated in Kgatleng. A validation sample of twenty (20) farmers was used. The actual survey is currently running in the same district and three (3) extension areas have been covered with twenty five (25) farmers having been interviewed. Data entry is in on-going.

The actual survey in other two districts has been delayed due to shortage of funds.

Objective 2

Agronomy: To demonstrate uptake of improved varieties and crop management systems of maize, pulse and forage legumes.

Study Sites

The study was conducted at Leshibitse village (on farm) (23°50'37''E and 26°26'05''S) and Sebele (on station) Agricultural Research Station (24°34'25''S and 25°58'0''E).

Leshibitse Demonstration Trial

A demonstration trial was conducted at 4 farmers' fields namely Christina Dikgale (1.27ha), Jacob Tometsane (1.27ha), Isaac Dikgale (2.7ha) and Khabenyana Dikgale (0.97ha). On the 20th January glyphosate was applied at the rate of 6L/ha in all the four fields. The dominant weeds observed were broadleaved weeds (*Ipomea sinesis, Heliotropium steudneri, Zaleya petandra*) and grass weeds (*Urochloa mosambicensis*, *Tragus bertrononianus* and *Aristida congesta)*. All weeds were at mature stage. Planting was done on the 10th February 2017 at Ms Khabenyane Dikgale's field only. A full complement of treatments comprising three tillage systems - no till, shallow ripping and conventional tillage systems were super imposed with five (5) cropping systems being sorghum-cowpea intercropping, mono sorghum, mono cowpea, rotation sorghum and rotation cowpea implemented. In contrast the project could not be implemented at other farmers' fields because of the elapsed planting season. Therefore, those farmers were advised to continue with their conventional methods to avoid fallowing. Soil sampling was also carried out but the results are not yet released from the soil testing laboratory.

Methodology

Experimental Design

The experiment was laid out in a split plot design with tillage systems as the main plot and cropping systems as subplots. Main plots consisted of three tillage systems namely conventional (disc ploughing), shallow ripping and no-till. The subplots were five cropping systems namely, sorghum mono cropping, cowpea mono cropping sorghum- cowpea intercropping, sorghum rotation and cowpea rotation. The crop varieties used were Tswana cowpea and Sephala sorghum.

Progress

Crop stand at Ms Khabenyane's field was good for both sorghum and cowpea. Harvesting of cowpea has been completed and the yield is illustrated in Table 1 below. Sorghum harvesting has still to be done.

Table 1 Effects of three tillage systems on yield of sorghum and cowpea under five cropping systems.

Plot	Cropping System	Yield (kg/ha)
Mono Cowpea	No Till	234.09
Cowpea Rotation	No Till	165
Intercropping	No Till	66.03
Mono Sorghum	No Till	
Sorghum Rotation	No Till	
Cowpea Rotation	Conventional	54
Mono Cowpea	Conventional	18.01
Intercropping	Conventional	15.01
Sorghum Rotation	Conventional	
Mono Sorghum	Conventional	
Intercropping	Ripping	27.01
Mono Sorghum	Ripping	
Sorghum Rotation	Ripping	
Mono Cowpea	Ripping	9.01
Cowpea Rotation	Ripping	60.03

The yields as observed from Table 1, are generally low as compared to the potential of 1500 kg/ha for both cowpeas and sorghum under on-station research results. The effects of no-till on cowpea were superior compared to those of the other tillage systems.

The current team members for this objective are:

W. President Emmanuel (Coordinator) MSc Agronomy

Lekgari A. Lekgari PhD Plant Breeding

Odireleng Molosiwa PhD Plant Breeding

Mapena G, Ramokapane BSc General Agriculture

An illustration of the effects of the tillage systems on the growth of sorghum and cowpea at Leshibitse is outlined in figures 1a to 3c.

Figure 1a: No Till Cowpea

Figure 1b: No Till Intercropping

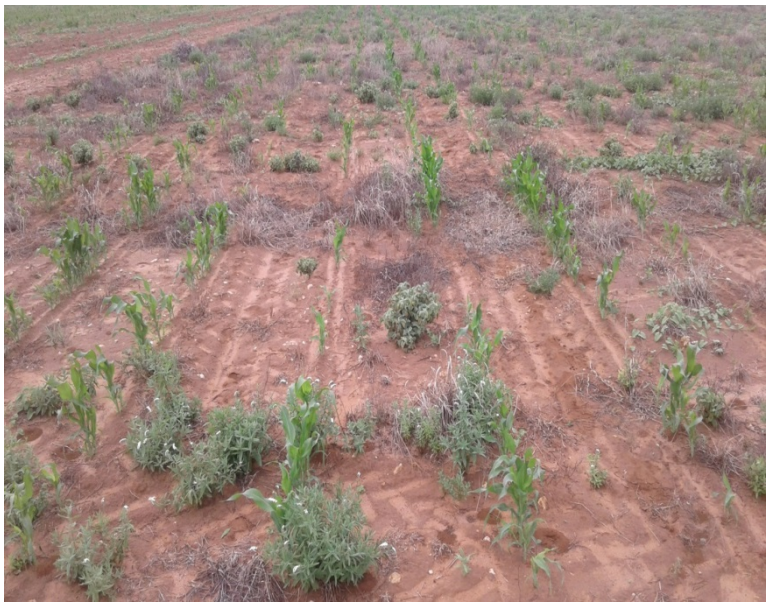

Figure 1c: No Till Sorghum

Figure 2a: Conventional Cowpea

Figure 2b: Conventional Intercropping

Figure 2c: Conventional Sorghum

Figure 3a: Ripping Intercropping

Figure 3b: Ripping Sorghum

Figure 3c: Ripping Cowpea

Challenges at Leshibitse Demonstration Trial

- Late commencement of rains
- Heavy continuous rains
- Shortage of farm implements (tractor)
- Shortage of transport

On-Station Trial

Two fields with different soil types were selected in Sebele. Sebele is located about 8km north of Gaborone City Centre along the A1 road. The altitude of the field is around 994m above sea level. The area has been described as having coarse (sandy) textured soil with a slope less than 10^{o} (DAR 1981). Two experimental plots which are 2ha each in size D21 and field 2 were used to conduct the experiments. D21 is mainly clay and field 2 is loamy sand soil. Field D21 was not ploughed because of flooding due to tropical cyclone Dineo. Field 2 was ploughed on 30 January 2017 using conventional tillage system and planting was done on 2 February 2017. At the commencement of land preparation continuous heavy rains were experienced which led to heavy infestation of weeds which could not be controlled with chemicals. This hampered the implementation of no-till and ripping tillage systems. Therefore only the conventional tillage system with all the cropping systems was implemented.

Progress

Crop stand was generally good for both sorghum and cowpeas. Harvesting of cowpeas has been completed. Sorghum is not yet harvested.

Table 2: Effects of one tillage system on yield of sorghum and cowpea under five cropping systems

Cropping Systems	Tillage System	Yield (kg/ha) cowpea
Mono Cowpea	Conventional	203.13
Cowpea Rotation	Conventional	178.82
Intercropping sorghum -cowpeas	Conventional	69.44
Mono Sorghum	Conventional	-
Sorghum Rotation	Conventional	-

Challenges at Sebele trial

- Continuous rains
- Delayed spraying
- Shortage of farm implements (tractor)

Fodder Research

During 2016/17 season, maize was intercropped with Lablab. The germination was good due to good rainfall received but maize was later destroyed by wildlife and our aim is to establish this trial again next season.

Objective 3 Seed Systems

To evaluate and select newly improved germplasm of maize and cowpeas for promotion in demonstration programs.

Newly released sorghum and maize varieties could not be demonstrated because of shortage of seed. However, sorghum variety, Sephala, was demonstrated. Cowpea variety, Tswana was used in 2016/17 cropping season as it provides a better soil cover.

Objective 4 Agricultural Innovation Platforms (AIP)

Innovation Platform is a group of individuals (who often represent organizations) with different backgrounds and interests: farmers, agricultural input suppliers, traders, food processors and government officials. The platform was formed in August 2015 following a consultative workshop organized by the SIMLESA. It was formed out of the need to share information among the players from research, policy makers, NGO's and farmers who are interested in the high agricultural production through Conservation Agriculture. On formation, a team was set up to drive the project.

Team members are:

1. Ms Kelebonye Bareeleng – Coordinator
2. Mr Ugele Majaule
3. Mr Tebogo Baloni
4. Mr Ditshupo Dinyao

Importance of AIP for Research Institute and farmers

It helps researchers to make relevant researches and to facilitate the adaptation and dissemination of findings, farmers and rural people using innovation groups to express interests and guide activities that are intended to benefit them.

Achievements

The coordinator attended one meeting with Dairy and small stock platform task force (DSiP) to bench mark and the task force from DSiP were invited to Department of Agricultural Research to share their experience with the SIMLESA team. The main constraint was that, team members are failing to meet regularly to start the platform as the success depends on the full buy-in of the members and this result in the difficulty to implement IP.

Conclusion

The principal focus is on formation of the IP team. However if funds are available IP will be conducted. It will assist in identifying and raising resources to complement the work of such members to the extent possible.

Objective 5 Capacity Building

During 2016/17 season, 40 farmers were provided with Napier cuttings to promote its production in Botswana. The Napier demand by farmers was very high and therefore Napier multiplication on Station was initiated to increase supply to poor resourced farmers.

Figure 10: Napier grass flourishing in a field

Key Observation:

Napier production can significantly increase feed resources available locally (yield 15 t/ha)

Leshibitse Farmer Training

The participating farmers were trained in CA aspects such as crop management practices and tillage systems.