Rapid Loss Appraisal in smallholder maize production in Eastern Cape/South Africa

Information brief for partners

Regional Training Course and Field appraisals

Content

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Acronyms

ARC	Agricultural Research Council, South Africa
ACCRA	GIZ project “SADC Adaptation to climate Change in rural Areas in Southern Africa”
AFASA	African Farmers´ Association of South Africa
BFAP	Bureau for Food and Agricultural Policy
BMZ	Federal Ministry for Economic Development and Cooperation Germany
CCARDESA	Centre for Coordination of Agricultural Research and Development for Southern Africa
Dep. Agr	Eastern Cape Provincial Department of Agriculture
EC	Eastern Cape Province
ECRDA	Eastern Cape Rural Development Agency
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GRAIN SA	Grain producers association
NAREN	GIZ project “Sustainable Agriculture”
RED Hub	Rural-Economic-Development Hub
RLAT	Rapid Loss Appraisal Tool
SADC	Southern African Development Cooperation
SSA	Sub Saharan Africa
VC	Value chain

1. Introduction

The Rapid Loss Appraisal Tool for Agricultural Value Chains (RLAT) was developed in Ghana in 2015 with the support of the GIZ Sector Project "Sustainable Agriculture" (NAREN) and the GIZ program for Market Orientated Agriculture (MOFA/Ghana). Its main objective is to identify critical loss points in smallholder agricultural value chains by using a quick and participatory methodology.

The tool was further tested and adapted for socio-economic and agricultural patterns in Southern Africa. The SADC Centre for Coordination of Agricultural Research and Development for Southern Africa (CCARDESA), supported by the two German funded projects NAREN and ACCRA, launched a regional call for proposals for the implementation of RLAT in Southern Africa (Annex A). Seven institutions from five different countries, namely South Africa, eSwatini, Tanzania, Zambia and Zimbabwe applied and the South African Agricultural Research Council/Grain Crops Institute in Potchefstroom (ARC) was awarded for the piloting of RLAT. The Agricultural Research Council organized the training in Potchefstroom, which was attended by participants from Tanzania and Zimbabwe whose applications to facilitate the processwere scored 2nd and 3rd best respectively, and was subsequently followed with a field appraisal in the Eastern Cape Province.

The main objectives of the SADC/South Africa pilot mission were

1. To train potential users from SADC member states in the application of RLAT in the maize value chain.
2. To adapt and pilot RLAT methodology in South Africa.

2. Background

2.1. SADC

Maize is the most important cereal crop in Sub-Saharan Africa and comprises the majority of the diet in at least eight of 14 SADC countries (FAO 2017). It is grown for human consumption, animal feed and industrial use (e.g. breweries, bio-fuels) on an estimated 178.4 million hectares in SADC by large-scale farmers (25 percent) and smallholders (75 percent). Although maize production systems are diverse across Sub Saharan Africa (SSA), the similar dominating production constraints include: effects of climate change (rising temperatures, erratic rainfall and increased frequency of droughts), lack of improved varieties, pest and disease pressures, insufficient credit, sharp seasonal fluctuations in maize prices (particularly in remote areas), lack of storage facilities and high storage losses. In addition, improper drying and a lack of appropriate mechanization are bottlenecks to efficient maize production. Across SADC, excluding South Africa, the agricultural market is generally characterized by the presence of informal or large markets with relatively high transaction costs, weak road and communication infrastructure, high transport costs, poor integration of processing with other stages of the marketing system and crudely developed credit systems. In most SSA countries, post-harvest losses and inefficiencies along maize value chains are a major impediment to rural development, food security and sustainable growth. While high losses occur along the SADC maize supply chain, there is however a general lack of reliable data. However, all the SSA countries have committed themselves to the “AU Malabo Declaration on Accelerated Agricultural Growth and Transformation for Shared Prosperity and Improved Livelihoods” (2014), aiming to halve the current levels of postharvest losses by the year 2025. However, estimation of the baseline losses must still be determined.

Across the region, apart from South Africa, there is a dominance of on-farm storage. Few formal storage facilities by commercial farmers and traders exists. One of the major actors in SADC maize value chain are the parastatal marketing agencies. These agencies often inadequately manage the storage facilities, which are underutilized and typically experience high rates of spoilage. Their existence creates distortion in the producer price of maize and

leads to delays in commence of the marketing season. Consequently, intermediaries offer farmers relatively low prices for their commodities.

2.2. South Africa

South Africa has a very diverse and almost dually organized agricultural sector, ranging from well-developed, highly mechanized and commercial farming to more-subsistence production in the deep rural areas, such as the former homelands of Transkei and Ciskei. In between these two contrasting groups is the small emerging agriculture and traditional farming sector. They occasionally have surplus production, which is further distributed in local communities. Around 39.000 large-scale farmers produce more than 95% of commercial maize. 1.3 million small-scale subsistence farmers, produce the remaining fraction of commercial maize, illustrating the subsistence focus in their production system.

Most of the small-scale farmers in the provinces of Limpopo, Mpumalanga and Free State sell their produce to commercial silo operators, which manage the storage and marketing. In the Eastern Cape Province, small-scale farmers have limited access to commercial silo operators and thus store their produce at home (Transkei). The elderly and women dominate the population structure, as young men typically leave the rural areas to make their living in urban centers or in the heavily industrialized northern Gauteng Province.

The food losses along the maize value chain include both pre-harvest and post-harvest losses. Pre-harvest losses include those attributed to delayed planting, untimely land preparation, pre-harvest insect pests and diseases, and delayed weeding, while post-harvest losses are attributed to post-harvest insect pests, improper drying, avoidable shelling/threshing losses, transportation, and quality damage via mycotoxin infection.

3. Methodology

3.1. Overview of the tool

The **purpose** of RLAT is: to provide a sufficiently accurate pre-screening tool for identifying intervention points along agribusiness VCs, to obtain approximate ideas about qualitative and quantitative losses and to identify leverage points to reduce pre- and post-harvest losses.

The principal methodology of RLAT is described in the RLAT “User Guide” and “Tool box” (GIZ 2015) and follows the following process steps:

Desktop study	Analysis of existing information to get a comprehensive overview over the targeted value chain, associated losses and socio-economic and policy framework (e.g. internet, reports)
Key expert workshop	Validation of the outcomes of the desktop study, identification and analysis of loss hotspots in the value chain, discussion of causes and solutions. Participants: highly qualified people and knowledge providers from different disciplines relevant to the food loss debate in general and to the maize VC in particular, coming from public and private sector, government, research, advisory services and agribusiness, development programs and other relevant organizations. Location: National level
Stakeholder workshop	Completion and validation of the findings of the desktop study and the Key expert workshop, assessment of loss perceptions of value chain stakeholders, assessment of loss hotspots and discussion of causes and solutions.

	Participants: representatives of operators from all stages of the value chain (e.g. input providers, farmers, traders and processors), from operational services (e.g. transport, storage) and from service providers having field experience. Location: region where the most important operational VC functions are based.
Focus group meetings with farmers, processors and traders **Participatory tools during meetings**	Validation of results from the previous process steps, information about specific and detailed loss issues, assessment of local loss perceptions, visual appraisals of value chain operations and discussion of causes and solutions. Participants: local farmer groups, local traders, trader groups and local processors. Depending on local circumstances, processors and traders might not be organized into groups and will be interviewed in individual meetings. Location: where production, trade, and processing occurs (e.g. field, farmers homestead, market, processing unit) "Transect Walks", "Loss Categories Definition" and "Loss Ranking Matrix" Checklists help to guide the interviews in a structured way.
Key informant interviews	In-depth interview to crosscheck existing information in case of anomalies and to complement results of the previous process steps.
Mycotoxin risk assessment	Assessment of the risk of mycotoxin contamination along the VC in a systematic manner to be employed wherever food value chains are known to carry a risk of mycotoxin build-up. Checklists help to guide the assessment, which is done after focus group meetings.
Biophysical measurements including laboratory analysis of Mycotoxins	Underscoring results from the meetings and workshops, collection of quantitative and qualitative information on loss causes (e.g. grain moisture, amount of damaged, shriveled and discolored cobs/grains, amount of insect damaged grains, confirmation of results from mycotoxin risk assessment).
Debriefing workshop	Feedback to stakeholders on first and preliminary results of the field visits and on critical loss points; discussion of open issues and validation of initial conclusions.

3.2. Selection of pilot region and farmers´ groups

The field appraisal took place in Transkei, where poor access to markets is prevalent. There is a lack of physical infrastructure (e.g. roads, organized market structure), means of transportation, and relatively high transaction costs for farmers. Relatively low education and lack of critical marketing and farm management skills are predominant regional features of the agricultural sector. In contrast to national statistics, which indicate that white maize is the most important staple for human consumption, the rural population of the Eastern Cape prefers yellow maize due to taste preference. Selection of the villages and farmers´ groups was organized in close cooperation with Grain SA, a voluntary association of grain farmers established to represent the members' interests and to conduct a development program for farmers with the Eastern Cape Rural Development Agency (ECRDA). In conclusion five villages were visited: Njijini and Lugangeni in the Umzimvubu (Mount Frere) local municipality, and Mbongweni, Khanyayo (GRAIN SA) and Skhumbeni (ECRDA) in the Mbizana local municipality.

Further a Rural Economic Development (RED) Hub in Mbizana was visited, which was formally organized as a secondary cooperative with 15 primary cooperatives forming its base (among them, Skhumbeni) and is currently managed by a board of directors. The RED Hub's main goal is to foster the small-scale maize value chain and to increase economic opportunities in poorly developed rural areas. The plan is to process white maize grown by local co-operatives for sale to the community or to national retail chains. The Hub covers the construction of silos, a milling plant, a weighing bridge and farming equipment.

3.3. Hotspot analysis

A loss hotspot at a given value chain function is characterized by two factors: the magnitude (percentage) of the losses at the specific value chain function and their importance regarding the number of stakeholders suffering from this specific loss (probability).

		Factor	Magnitude of losses			
			No losses	Losses negliggble	Losses are a concern	Losses are intolerable
Factor			0	1	2	3
Probability of losses (to be verified in group meetings)	Majoritiy of stakeholders concerned (>50%)	3				
	Lots of stakeholders concerned (25-50%)	2				
	Few stakeholders concerned (<25%))	1				
	No stakeholders concerned (0%)	0				

Both parameters are be scored from 0-3. The multiplication of the scores of both parameters (magnitude and probability) gives a product which is then the score for the hotspot. Hotspots are then sorted according to this score. The highest hotspot score achievable is 9 (3x3), the lowest score achievable is 0 (0x0).

Remark: the categories of loss magnitudes have been adapted during the field phase, see chapter 4.1.5.

4. Results

4.1. Lessons learnt from tool implementation and adaptation needs

RLAT has been recognized by stakeholders (Key expert and Stakeholder workshops, Key informants, farmers) as a promising tool to detect potential areas for improvement along the maize value chain in a participative and transparent way. Nevertheless, flexibility in adapting the methodology to local conditions has proven valuable during the exercise.

4.1.1 Training

The three-day training course took place from the 4th – 7th June 2018 in Potchefstroom and addressed twenty researchers, economists, nutritionists and agricultural officers, coming from South Africa, Zimbabwe, Malawi and Tanzania. In addition, three participants came from CCARDESA (Botswana).

There was positive feedback from the participants regarding the methodology and contents. The number of participants was appropriate and allowed working in sufficiently large groups. In addition, the duration of 2.5 days was adequate for the training and permitted sufficient time for input and interactive working groups. Alternating between presentations and working groups, be it for working on checklists adaptation or on practical maize samples, was highly appreciated by participants. Most of the training workshop expectations from participants corresponded to the objectives of the training. However, some aspects exceeded the main objectives and clarification

was required to avoid misconceptions. For example, the development of appropriate technologies and solutions needed further in-depth explanation.

Adaptation needs: If the training course is meant to be a single exercise, independently from a subsequent field phase, more time should be planned for practicing the use and adaptation of the checklists and the sample taking. In this case, the training course should be extended to five days and allow for short training visits at rural communities and/or nearby processing hubs. Farmers being available for such training elements should be remunerated accordingly (free lunch, in-kind presents) as they do not have immediate advantages.

4.1.2 Key expert workshop

The single-day Key expert workshop took place on June 8th at ARC's Grain Institute offices in Potchefstroom. It included all trainees from the training course, 18 postharvest/food loss experts from research and universities from SADC, South Africa, Malawi, Zimbabwe and Zambia, as well as a representative from the Small-Holders Farmers Union (AFASA North West) and researchers from ARC.

Participants readily accepted the workshop and training. Only one individual claimed that the tool did not meet the expectations. However, there was unanimity amongst the participants that loss data for Southern Africa is scarce and experts referred to the missing data made available through the African Post Harvest Loss information system (APHLIS+). Some major universities in South Africa (Kwazulu-Natal/Pietermaritzburg, Stellenbosch, North-West/Mafikeng) and adjacent countries (Harare/Zimbabwe) offer food loss topics within their curricula. Despite this, participants generally agreed that the topics are not well represented in agricultural colleges or training centers and yet these institutes are the ones responsible for training farmers and other agricultural experts for practical work on the ground.

Some participants questioned the scientific robustness of the methodology, particularly with regard to sample size. The discussion encompassed the fact that the methodology is "rapid and lean" but still reliable to identify critical loss points within a given value chain (pre-screening). As sampling is combined with several participatory tools and visual assessments to cross-check the information, the methodology is appropriate to support the identification of critical loss point without standing rigid scientific judgment, and allows for informed decision making using a justifiable and manageable amount of resources. It is in line with other traditional methodologies in calling for optimal ignorance rather than scientifically proven analysis in favor of quick action based on sufficient and reliable information.

Adaptation needs: The expectations of the Key expert workshop on regional SADC expertise level regarding its major objectives (validation of existing loss data, feed-in of latest research data) have only partly been met due to fewer participants than expected, and due to a large knowledge span between the regional (SADC) and the local South African level. This is an apparent difference to Ghana, where knowledge on the national level is quite condensed and where experts are easily to mobilize, most of them based in the capital Accra. Regarding further RLAT appraisals, it should be thoroughly questioned if a Key expert workshop in advance is necessary and adequate to gather critical information on losses and inefficiencies in the value chain, and at which level this should be performed. A weighing of costs and benefits considering already existing information or substantial doubts on data should guide the decision for a Key expert workshop. Hence, a Key expert workshop should be seen an optional but not a compulsory part of the RLAT.

4.1.3 Stakeholder workshop

The single-day stakeholder workshop took place on July 25th 2018 in Kokstad, KwaZulu Natal Province, next to Transkei.

In addition to the research team, a representative mix of various stakeholders of the VC (farmers, representatives from the Government, related agencies and private sector input suppliers) participated at the workshop.

A first draft of the maize value chain in Transkei was discussed and elaborated in detail. Further discussions covered formal and informal quality standards, traditional measures and moisture assessment, price building and alternative use of rejects and minor quality grain. The workshop was well attended by 19 participants (besides ARC staff) and it yielded sufficient results describing the stages of local maize production. The group made remarks to the extent that, it is appropriate and often necessary to gather information in a relatively short time, which otherwise might not be available on the internet or in published reports. With the right mix of attendants from Government, private sector, civil society, farmers´ organizations and research, valuable information about local maize VC conditions can be gathered and discussed.

4.1.4 Key informant interviews

The first Key informant interviewed by the team was Mr. Luke Collier, the GRAIN SA EC Coordinator. He provided valuable information about the four chosen villages for RLAT implementation with regard to the socio-economic situation of farmers, maize production constraints, possible solutions and other general data about local agriculture. He also explained the role of GRAIN SA's in the development and transformation of subsistence and smallholder farmers to commercial production.

A second Key informant was Mr. Keletso Masima from ECRDA, who gave interesting insights about the functioning of the RED hub and related programs to support agricultural cooperatives.

Key informant interviews proved to be indispensable and an effective way to get specific information on the maize VC and to validate information from other sources. There is no apparent need to adapt this process step.

4.1.5 Field phase

It was evident that field appraisals are important and significant for the results and reliability of the data.

In the Transkei RLAT exercise, not all **RLAT criteria of choice** for the selection of VCs were met, as there are (a) the existence a real loss problem within the VCs, (b) a compact value chain allowing for the visit to the different stakeholders (e.g. farmers, traders, processors) within a feasible distance and (c) sufficiently organized farmers. The first criteria (a) was not fully applicable due to a very specific support pattern to smallholders and minimal economic knowledge (see 4.2.1).

Focus group discussions with the producers should not last longer than 1.5 – 2 hours, and the subsequent transect walk on the field or the production places should not last longer than 1 hour. Altogether, a stay of maximum three hours with one group of stakeholders is reasonable in order not to overstretch the availability of the villagers. The optimal group size of interviewers is 3-5 people, with one or two taking notes, and one person leading the discussion. It proved useful to share the information later amongst the whole group, and to screen details that were not recorded by everyone. It proved to be important to plan enough time after each field visit for a preliminary analysis of the data obtained in order to formulate supplementary questions for Key informants and to allow for crosschecking of debatable information. One village per production site per day is more than enough.

The analysis of grain samples regarding **mycotoxin** infestation was done in the laboratory of ARC.

Biophysical measurements (e.g. presence of moisture, number of damaged or shriveled grain, number of insects in the sample) proved to be a valuable for "ground truthing" and retrieval of detailed information about physical losses. However, the use of the black light bulb to detect potential mycotoxin infestation did not yield the expected results and was of no added value, as rotten and infested grain can mostly be seen with the naked eye

and need no further validation. Apparently, the visual assessment of such parameters was adequate to estimate mycotoxin infestation risk in the given situation.

Adaptation needs: RLAT should be re-designed in a way to allow for more flexibility in different contexts of field appraisals. This refers to the definition of the four loss categories, which were not suitable in the specific context of the EC maize producers as maize is not the most important economic pillar for household economy (and losses may in fact not be of a concern to the farmers. Therefore, terminology had to be changed during the field phase.

New categories			Former categories	
category	Description	Remarks	category	remarks
1	Good	No (loss) problems	0	No loss
2	Fairly good	Some (loss) problems	1	negligible
3	Fairly bad	Quite a lot of (loss) problems	2	concern
4	Bad	Lots of (losses) problems	3	intolerable

Furthermore, the layout of the checklists, which are currently very detailed, should allow for more flexibility by open formulations for easy adaption under different circumstances. Instead of pre-formulated questions, headlines and key words should be listed in a structured manner and help to guide the discussions. This would also allow a more fluent group discussion, avoiding a simple question-answer process along the detailed questionnaire. Nevertheless, the use of an open guided document needs a thorough upfront preparation through the interviewers, who should master the key words and have an idea on how to engage the discussion around this.

The use of the participatory tools like the “loss ranking matrix”, the “value-chain map” and the “transect walk” should be put in the center of the focus group meetings, allowing the discussions to spin around the tools, which renders the exercise more interactive, vivid and focused.

The Black light bulb for mycotoxin detection did not give any additional results compared to visual assessments, whereas the laboratory analysis confirms the results of the mycotoxin risk assessments, proving the risk assessment to be a viable tool.

4.1.6 Debriefing workshop

The Debriefing workshop took place in Kokstad on 31 July 2018. Participants were mostly representatives from the private sector and GRAIN SA. There were no participants from governmental institutions, who however participated at the stakeholder workshop a week before. The timing for the workshop coincided with a visit by the provincial Minister of Agricultureto the region that same day. In different scenarios from this pilot implementation in EC, South Africa, a national debriefing could be equally meaningful.

Adaptation needs: The scope of the debriefing workshop should be decided at early stages during the implementation of the methodology. Flexibility and adaptation in combining and adapting the tools is paramount.

4.2. Results of loss appraisal

4.2.1 Agricultural practices

Maize production is not the main economic pillar of the small-holder rural households in Transkei. The majority of the farmers profit from different social grant schemes (e.g. unemployment, pensioners, and children) to secure their basic living. There is a **rather low business orientation** of smallholders due a number of reasons, namely the following: 1) small-holder agriculture is broadly subsidized by the Government, 2) important steps within the

maize production VC are taken over by external contractors, and 3) farmers often have little knowledge on economics and its application. Seemingly, before this background, major concerns about losses are not apparent.

Smallholder maize production takes place in “private” gardens or on communal lands. “Private” gardens are next to the household and are smaller than 1 hectare. Their harvest mostly serves for home consumption. Individual fields in communal lands provided by the traditional authority are much bigger (up to 2 ha or more). Fields could be more than 50 ha when managed by a group of farmers.

Fencing often does not take place in communal lands, and consequently livestock, particularly cattle, cause significant damage. Therefore, fields in communal lands are harvested very early, at the end of May or beginning of June, in order to reduce damage before cattle arrive for winter grazing, which has been a tradition and the date communicated by the local administration, with farmers having little control. This is ahead of the ideal time for physiological maturity of the crop at the end of July/beginning of August, and the grain is still very moist (18% or more), leading to difficult drying and a higher risk of mycotoxin damage.

Field preparation including ploughing, planting and the application of fertilizer and agrochemicals are carried out by external contractors and paid by the Department of Agriculture or GRAIN SA (50% support). From harvest onwards, farmers usually do not get any significant support and are fully responsible for the VC functions: harvest, transport, drying, threshing and storage. Access to formal markets is lacking, and most farmers sell their produce to neighbors where they can leverage better prices compared to formal markets.

There is little knowledge about formal quality aspects, as the majority of farmers do not supply the formal market. They nevertheless consider the length of the cobs, the size of the grain, presence of insect damaged grain and rotten cobs when sorting. High quality grain is gathered for human consumption and for selling within the community. Poor quality grain is not completely discarded, but used for animal feed (pigs, poultry) or for brewing Umqombothi (African beer).

The visit of the **RED hub Mbizana** revealed that this investment has not been fully exploited. One of the reasons the hub did not run at full capacity was due to technical and operational issues, which should be resolved. Other issues arose from the economic and administrative side. The RED hub only processes white maize mainly for the human consumption market, whereas most farmers who visited preferred to grow and eat yellow maize. Discussions within the team and with ECRDA leaned toward the possibility of privatization and reconstructing the operation to have a more demand-driven orientation. This would allow a promising business case for young well-trained entrepreneurs coming to and from the region. Earlier discussions with GRAIN SA indicate that the RED hub should also consider sourcing their maize from non-affiliated farmer groups with corresponding adaptation of storage capacity.

4.2.2 Critical Loss points along the value chain

Critical loss points with the highest ranking were **field preparation (9), planting (9) and storage (9)** (see also chapter 6).

The biggest challenge in **field preparation** (ploughing and planting) was the availability of the contractors to do the work in good time. This can lead to delayed planting by up to two months and therefore substantial effects on yield. If seedlings are not established under appropriate growing conditions, (e.g. regular precipitation and temperature) then there is a higher risk of stress and sub-sequential losses, which are typically present at the end of the growing season. In some cases this could lead to up to 70% losses (yields of 2-3 mt/ha instead of potential

8 mt/ha). Besides the timing challenges, farmers mentioned that contractors do not consistently have the required knowledge about handling machines, spacing of furrows or calibrations. This adds to another area of significant losses in yield potential.

Storage is considered as highly problematic because of inappropriate storage infrastructure (woven plastic bags, or metal tanks that easily corrode) and because of the length of the storage period, which can take up to 12 months until the next harvest arrives. Many farmers are conscious about the fact that after a period of six months the incidence of pests increases. They use insecticidal tablets (Phostoxin and Quickphos), but these are not always available on the market and are not efficiently stored in bags, as most of the active ingredients rapidly evaporate. Under such conditions, losses up to 60 % of grain can occur in the last months of storage, mostly due to insects (*Sitophilus sp*.), rats and termites. Such storage losses start to manifest themselves after 4-5 months. Therefore real losses over the complete storage period amount up to 30%.

The drying of the cobs is also considered a critical loss point (6). This is because drying is done on bare soil (can increase mycotoxin infestation), in wooden baskets (inqolobane), or on rooftops which are prone to recurrent rains. Adding to this is the relative high moisture content of grain (18%), because of regular early harvest, thus resulting in frequent rotten cobs.

Transport of the harvest to the homestead and threshing is considered only slightly problematic (1). Hired cars are available if necessary, but this adds extra cost to the farmer. If the fields are not too far away (< 2km), then the harvest is carried home. Threshing is done manually or by hired threshing machines. This procedure did not reportedly cause trouble to the farmers, despite women's consistent involvement in tedious work.

Input supply (seed, fertilizer and agro-chemicals) is obtained with relatively minimal difficulties in the five villages. After a tender process, seed is provided by different private sector companies (and subsidized either by GRAIN SA or by Government). In some cases, seed deliveries end up in regions where not appropriate, but this rarely occurs..

It was noted that untimely delivery of inputs and contractors' late field preparation are some of the most important bottlenecks of maize production for nearly all groups. Furthermore, contractors might not have the required qualification to do the ploughing and calibration of planting machines. This ultimately leads to inefficient field preparation.

Cumulative Loss Matrix

	1	2	3	4	5	6	7	8	9
VC function	stakeholders	Immediately felt effect	Later felt effect	Loss magnitude	Loss relevance	**Hot spot ranking (4x5)**	Percentage loss	Loss causes	solutions
Input supply	Pioneer, Pannar, Delkab, GRAIN SA, ECDRA		yes	0	0	**0**	----		
Field preparation	contractors		yes	3	3	**9**	----	Bad timing Lack of knowledge of contractors	Better control over processes by farmers
Planting			yes	3	3	**9**	----		
Application of agro-chemical, fertilizer			yes	1	2	**2**			
Harvest	Farmer (1 case combine harvester/RED hub)	yes		0	0	**0**	----		
Dehusking	Farmer	yes		0	0	**0**	----		
Transport	Farmer (hired car)	yes		1	1	**1**	-----		
Drying of cobs	Farmer	yes		2	3	**6**	-----		
Threshing	Farmer, Contractor	yes		1	0	**1**	Up to 5%		
Storage	Farmer	yes		3	3	**9**	Up to 60%	Bad storage facilities	Better facilities, communal approaches?

4.2.3 Results of biophysical analysis

The major causes of maize losses are excessive grain moisture content, issues with physical storage, environmental conditions and biological agents (e.g. insect pests, molds). The grain moisture content decreases significantly from field stage to the post-harvest drying stage. The percentage of insect infestation and insect damaged grain increases with the length of the storage period. Such an increase may develop rather quickly when stored maize is untreated.

Village	Njijini	Lugangeni	Mbongweni		Khanyayo	Okwethu	Red-hub
Local Municipality	Umzimvubu	Umzimvubu	Mbizana	Mbizana	Mbizana	Mbizana	Mbizana
Sample	Cobs	Cobs	Grain	Grain	Grain	Grain	Grain
Weight (gram)	500		400	500		500	457
Type	Yellow	Yellow	White	White/Yellow	Yellow	White	White
Variety	Several	Delkab 7374	DKC 7845	Maize – Roundup ready	Monsanto 8040	DKC 7845	DKC 7845
Type	Yellow	Yellow	White	White	Yellow	Yellow	White
Moisture Content (%)	10.0	13	13	14	18	11.9	13.5
Insect/500 gram	>100	2	0	16 (dead)	3	0	1
Insect Damage (%)	68	0	0	0	1.2	4.8	0
Discoloration (%)	3.6	12	2.4	7.15	0.3	3.2	0
Undersized/shriveled (%)	9.6	4.5	8.6	8.2	2.1	9	8.4
Mycotoxin Assessment							
Aflatoxins	< LOD*	< LOD	< LOD	< LOD	< LOD	< LOD	< LOD
Mycotoxins	1.43 ppm*	1.14 ppm	1.18 ppm	1.23 ppm	1.01 ppm	1.36 ppm	1.36 ppm
*LOD: Less than limit of Detection, ppm: parts per million							

5. Way forward

5.1. GIZ and CCARDESA

RLAT has the potential to be adapted to different production patterns and to specific sectors of the value chain and therefore allows for a wide range of applications. The principle and the structured approach of critical loss

point identification with the participation of the stakeholders appears to be a promising tool for tailor made solutions and stakeholder empowerment. Therefore, we recommend that GIZ supports further amendment of the approach so that it serves as a flexible tool box for use in small-scale agriculture. It will additionally complement other approaches for improved food loss assessment (FAO, WRI).

CCARDESA should spread the application of the methodology in the SADC region by engaging in a capacity building process in order to set up a regional RLAT facilitator pool. This would encompass the identification of interested partner institutions, arrangements of expert exemption and the mobilization of financial resources. Through CCARDESA´s regional network, the tool could be promoted towards other regional and national institutions which aim at reducing food losses and improving food security.

5.2. ARC

ARC could assist with the promotion and dissemination of the tool within relevant institutions in South Africa with the aim of reducing food losses and improving food security. Realizing that South Africa has different agro- ecological regions and different farming systems, ARC can assist in the adaptation of the tool to different farming systems in South Africa. Further information from different regions in South Africa will enable ARC to make national recommendations. However, this will depend on availability of funding.

5.3. Private and public support structures in Eastern Cape

Solutions to the inefficiencies in the maize VC have been discussed with the farmers and have steered attention to the following areas: diversified access to field preparation services to overcome service bottlenecks, capacity building for farmers in micro-economics for improved economic decision making, enhanced storage facilities and market access.

Besides the promising plans from GRAIN SA to facilitate better storage infrastructure, deeper insight on how to link non-adherent farmers to the RED hub services could give an economic push to the farmers. Initial discussions taking place between GRAIN SA and ECRDA are a very important step in this direction.