Smallholder farmer exposure to selected crop production and management technologies in Karamoja

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Abstract

Background: Supporting smallholder farmers with production technologies for improving crop productivity was and still being one of the major aims towards achieving food security particularly among farming communities in Karamoja. Financial and technical knowledge supports were provided by RWANU and NabuinZARDI respectively. Farmer groups located in Iriri and Apeitolim (Napak District), Kakomongole (Nakapiripirt District), Nadunget (Moroto District) were selected based on the previous participatory performances in evaluating crop varieties for adaptability and subsequent production. Farmers were introduced to appropriate crop production and management technologies for adoption and implementation during subsequent production. Implemented production technologies included method of planting (row/ broadcasting planting method, timing of planting dribbling method of sowing and depth of seed sowing) for both improved and indigenous early maturing crop varieties. Farmer groups in Kakomongole (Nakapiripirit District) andIriri (Napak district) were selected to implement the adopted crop management practices while their counterparts in Apeitolim (Napak District) and Nadunget (Moroto District) were introduced to idea of selected crop demonstration in the view of alluring them for variety selection and adoption.

Objectives: Main objectives included implementing adopted production and management technologies of selected crop varieties and demonstrating new crop technologies to other for adoption. Specifically demonstrating to farmers the evidence of applying selected agronomic practices in improving crop productivity.Achieving the objectives was performed through implementing production practices such as planting or sowing (row or broadcasting) by dribbling method, seeding rate, soil nutrient application and timing the planting. Other objectives involved exhibition to farmers,proper management of the plants and soil around the plant for proper plant growth through phytosanitary practices of weed control, thinning and nutrient application; Also, compared the performance of improved varieties and local germplasm through quantifying yield, assessing drought stress and naturally occurring pests and diseases; and finally allured more farmers to adoption of successfully evidenced technologies

Methodology: Five improved crop varieties of cowpeas, green gram, OFSP Sweet potato, beans, maize and sorghum and five local germplasm of same crop, were subjected to production and management methods for

farmers to gain knowledge. Fertilizers (Urea 46.6%N) at a rate of 60Kg/Ha^{-1} were added to improve plant vigour and growth. Farmer fields for demonstrations were established in Nadunget (Moroto District) and Apeitolim, (in Napak). A simple experimental design of split plot with three factors (germplasm, planting method and Management method were implemented. Plots were designed with sizes of 10 x 10m with plot interval of one meter and further divided two (ie 5m for improved variety and 5m for local germplasm) and also split according to agronomic methods. Data was collected on both quantitative and qualitative aspects involving number of household farmers participating in the trial production and management exercise; agronomic practices (production and management) identified by farmers to enhance good crop performance; crops and varieties identified by farmers to grow in the short rains season; successful agronomic practices that farmers observed to be adopted for implementation at their households; and yield outputs achieved based on imposed factors

Results: In regards to farmer implementation of identified production and management technologies in improving crop productivity and adoption, 16 households (64%) in Iriri and 24 households (96%) in Kakomongole participated in the crop production and management practices. Famers preferred crop to grow were mostly cowpeas (80% of farmers), green gram (47% of farmers), and sorghum (78) in Iriri while in Kakomongole farmers preferred maize (80%), sorghum (56%), cowpeas (80%) and pearl Millet (97%). In total the quantities of crop seeds planted were 50Kg of Nabe15 (beans), 200kg of Secow2W (cowpeas), 200kg of MM3 (maize), 100Kg of ICMV221 (Pearl Millet) with farmers in Iriri, while 200Kg (beans), 150Kg (Cowpeas) 200Kg (maize) and 100Kg Pearl Millet) were planted in Kakomongole. Maize was provide as a compensatory crop to the farmers. Most adopted and implemented agronomic practices were row planting (77% of farmers) and dribble sowing (82% farmers) though planted late due to unpredictable weather by the time. Yield varied greatly toexperienced drought stress at flowering leading to low carbohydrates partitioning, but farmers had gained knowledge and managed the crop well though could not irrigate to avoiddesiccation.However in regards to demonstrated production and management technologies of selected crop varieties to other farmers for production technology adoption, 56% and 67% of farmers in Nadunget and Apeitolim participated in establishing the demonstration trial respectively. But management of cropsby farmers was not so ideal suggesting the possible impact of disintegrating group.

Conclusion: Farmers especially in Iriri and Kakomongole exhibited interest in learning, adopting and implementation of good agricultural practices to improve their productivity. Given the opportunity of reliable rain fall especially in the main season, coupled with timely planting, reasonable yield can be obtained.

1.0 Introduction to smallholder farmer exposure crop production and management technologies

Crop production through smallholder farmer exposure to good crop production and management practices was identified as an ideal component for enhancing improved productivity and great contribution to ensuring food security in Karmoja. Farmers have the interest but due to infancy stage of crop production a lot of basic and applied production technologies were not being implemented. The lacked technologies included improved crop varieties, seeds and ideal knowledge for crop production and management. However, with the collaboration between NabuinZARDI and ACDI VOCA /RWANU, adaptable crop varieties were identified initially but yet to be widely disseminated to most farmers. Ideally, farmers could access the good crop varieties with good production technologies hence introduction of crop production and management practices to the predominant farmers who are the smallholders. Earlier assessment indicated that farmers broadcast seeds especially of small sizes and remain on top of soil hence exposure to rodents and scorching sun. A lot of seed being wasted leading high seed rate. But the ideal of proper planting / sowing using dribble method was proposed to be a good start up technology towards reducing seed rate and when applied together with good agronomic practices, high yield could be achieved under circulative soil moisture. Karamoja has one major season (*Akiporo*) ranging from end of April – Mid July with an average of 800mm rain and the micro season (August – beginning of Nov.) with average of 400mm. Therefore most crops are grown during the major season and only the most early maturing crop varieties are grown. Therefore activities concentrated on farmer implementation of adopted technologies on their respective individual farms.

2.0 Activity 2: Farmer implementation of identified production and management technologies in improving crop productivity and adoption

2.1 Introduction and rationale of activity

Based on the recommendations from the last cropping season (2014B) where demonstration of various production and management technologies on plants and soils around the plant for proper plant growth were conducted, the successfully identified agronomic practices needed to be implemented by farmers to assess the level of technology adoption. Two farmer groups of Kakomongole (Nakapiripirit District) and Iriri (Napak District) exhibited successive technology trial and therefore identified suitable technics

to implement for their validation and technology adoption. Therefore, the impact of demonstration by farmer practical participation for technology adoption, can be achieved if farmers implement the gained knowledge. Since demos were established and farmers practically trained, it was necessary to facilitate farmers with more seeds and monitor their production fields for possible identification of technologies practiced on their individual farms and ultimate technology adoption.

2.2 Objectives

Main objective was to apply selected agronomic (production and management) practices for crop performance assessment at individual household level. Practices such as planting and sowing (row or broadcasting) by dribbling method, seeding and seed rate, timing the planting were implemented by farmers. Management practices such as weed control, thinning, soil nutrient application and resilient practices for soil moisture retention were implemented. Participatory farmer assessment of potential crop performance based on growth parameters. Crop growth parameters considered included germination level, plant vigour and health, duration to anthesis and physiological maturity. Also farmer assessed total crop yield under implemented technologies and determining growth of yield contributing attributes and actual yield.

2.3 Materials and Methods

Five improved and indigenous crop varieties of Cowpeas, Green gram, Pearl Millet and Sorghum that were demonstrated under group /communal farming last season will be subjected to production and management methods in order to evaluated the potential for farmers gained knowledge and ability to implement it.Each farmer in production groups of Kakomongole and Iriri had equal chance of establishing own selected Crops (Improved versus Indigenous) at an individual household farm land. Farmers were provided with both indigenous and improved seed materials for planting and then subsequently monitored to ascertain the implementation of adopted technologies. Kakomongole is a subcounty in Nakapiripirit district situated in the green belt along Moroto-Nakapiripirit road (about 70Km) from Moroto). However, Iriri also a subcounty in Napak district (about 75Km) from Moroto – Soroti road. The area equally receives moderate amount of rainfall (average 600mm during the main rain season).

2.4 Results achieved

Activity 2	Farmer implementation of adopted selected crop production and management practices (improved variety)									
Location	**% HH Participation**		**% Crop Selection**				**% Implementation of selected agronomic technologies**			
	Male	Female	Cowpeas	G/gram	Beans	Maize	Row Planting	Dribble	spacing	
Iriri	57	85	78	65	56	48	57	53	63	
Kakomongole	54	78	85	72	60	75	75	64	65	
Crop Yield: Crop desiccated before flowering affecting yield potential.										
Activity 2	Farmer implementation of adopted selected crop production and management practices (Local varieties)									
Iriri	64	80	78	75	65	64	78	60	74	
Kakomongole	58	79	74	72	64	68	79	65	75	

2.4.1 Presentation and discussion of results

2.4.1.1 Improved varieties (crop and technology selection implemented)

Farmer participation based on their groups were predominated by women farmers indicating their active participation compared to men. In regards to selection of appropriate agronomic practice, 78%, 65%, 56% and 48% of farmers selected crops such as cowpeas, green gram, beans and maize respectively to implement the agronomic practices in Iriri, while in Kakomongole, 85%, 72%, 60% and 75% farmers selected the same crops. The selection suggested farmer experience in weather prediction and therefore selected crops that could exhibit mechanisms of drought stress avoidance in terms of early maturity. In terms of implementing agronomic practices, 57% row planted theirs crops (fig. 1), 53% practiced dribble method of planting and 63% spaced their crops hence enhance optimization of seed rate in Iriri, Napak District, while in Kakomongole, Nakapiripirit District, 75% row planted, 65% used dribble method of sowing (fig. 2) and 64% spaced their crops optimumly. The lower level of implementing the adopted agronomic practices by farmers suggested a not higher adoption rate but also the element of challenged labour factor more especially at planting time to take use of available moisture.

Figure 1: Row planted crops by farmers in Iriri Napak District

Figure 2: Dribble planting Method by farmers in Kakomongole, Nakapiripirit District (Improved Method)

Figure 3: Optimum Cowpea crop (var. Mauritius) spacing adopted by farmers in Iriri, Napak District (improved method)

The established crop exhibited a good vigour during the exponential growth stage, however, subsequently, drought affected the crop growth before flowering leading to the crop failure before fruiting. But indicators as per evidenced photos, farmers had implemented selected technologies, suggesting that at ideal season (main season: Akiporo) the same technology implementations will be observed on farmer's fields.

Figure 4: Crop affected by drought in Iriri, Napak District

2.4.1.2 Indigenous / Local materials (crop and technology selection implemented)

Continuous production and maintenance of farmer owned Indigenous materials was and still important within farming system to facilitate use and preservation of adaptive materials. Since improving crop production was the desired goal, farmers were allowed to grow their indigenous materials though in an improved production context. Table 1, showed level of farmer participation in producing their own indigenous materials. Similar to production of improved varieties, farmer participation in production of indigenous materials were predominated by women farmers (Table 1) indicating their active participation compared to men. Selection of appropriate agronomic practices (row planting, dribble sowing, seed rate optimization etc) were represented by 74%, 72%, 64% and 68% respectively for production of local crops such as cowpeas, green gram, beans and maize in Kakomongole, while in Iriri, 78%, 75%, 65% and 64% farmers also provided local materials of the same crops as selected for improved varieties. The context was to enhance farmer practice of new agronomic technologies during production of their indigenous crop materials. In terms of implementing agronomic practices, 78% of farmers planted their crops in rows (fig. 5), 60% dribble sowed seeds and 74% spaced their crops optimally hence enhance optimized local seed rate during production in Iriri and Napak District. Whilst, in Kakomongole, Nakapiripirit District, 79% farmers implemented row planting, 65% dribble sowed (fig. 2) and 75% spaced their indigenous crops optimumly (fig. 7). The higher percentage of implementing agronomic practices on indigenous compared to improved varieties indicated farmer's desired efforts of improving crop production at all levels using both indigenous and improved varieties.

Figure 5: Farmer implemented row planting

Figure 6: Farmer implementation of row and broadcasting methods

Figure 7: Optimum plant spacing implemented by farmers in Kakomongole, Nakapiripirit District

3.0 Activity 1: Demonstrating production and management technologies of selected crop varieties to farmers for production technology adoption

3.1 Background and introduction

Farmer adoption of production technologies is in most cases but not limited to the practically evidenced facts. Technologies are proved worth in terms of farmer demonstrated preferred traits such as early maturity, high yield and health etc in crops, superior over their available crops then evaluation is conducted and adoption effected. Therefore during the 2014 second cropping season, farmers in Nadunget and Kakomongole were introduced to improved crop production technologies through demonstration practices. However the performance of the demos were affected by drought and farmers did not ideally get exposed to real worth of crop performance. Technology demos were conducted on crops such as Cowpeas, green gram, Sweet potato, sunflower maize and sesame. However, upon analytical evaluation, it was considered relevant to re-apply the same demos so as to enable farmers observe, select and adopt the preferred technologies. Apeitolim farming system compared to Nadunget, is an area with high crop production potential, with high prospects for crop performance subject to application of improved crop production technologies. This season (2015B), the same crops as in 2014B were subjected to selected agronomic practices under the demonstration method,, considering the perspectives of method and result demonstrations as key to alluring farmers to improved farming.

3.2 Objectives:

The objectives pertaining this activity were focused on:

(i) Demonstrating to farmers the evidence of applying selected agronomic practices in improving crop productivity
   a. *Through practices such as planting methods (line and peg dribble), seeding and seed rate*

(ii) Exhibiting to farmers the management of the plants and soil around the plant for proper plant growth
   a. *Through management aspects such as weed control, thinning, soil nutrient application*

(iii) Compare the performance of improved varieties and local germplasm
   a. *By comparing yield, tolerance to drought stress, naturally occurring pests and diseases*

(iv) Allure farmers to adoption of successfully evidenced technologies

3.3 Materials and Methods

Five improved crop varieties of involving Cowpeas, green gram, OFSP Sweet potato, beans and sunflower and five local germplasm of same crop, were subjected to production and management methods for farmers to gain knowledge. Other materials will include fertilizers (Urea 46.6%N) addition. Farmer fields for demonstrations will be established in Nadunget (Moroto District) and Apeitolim, (in Napak). The design will be a split plot with three factors (germplasm, planting method, and Management method). Plot sizes will 10 x 10m with plot interval of one meter. However the plots were divided into two ie 5m for improved variety and 5m for local germplasm and also split according to agronomic methods

Table 2: Showing the demo design

54 Meters

Beans		***Green Gram***		***Sweet Potato***		***Sunflower***		***Cowpeas***	
Improved varieties									
Demonstrated factors: *line planting; dribble sowing; weed control; soil nutrient application and plant density control*									
AM	NAM	AM	NAM	AM	NAM	AM	NAM	AM	NAM
-Fert	***+Fert***	*-Fert*	***+Fert***	*-Fert*	***+Fert***	*-Fert*	***+Fert***	*-Fert*	***+Fert***
Local / Indigenous materials									
Demonstrated factors: *line planting; dribble sowing; weed control; soil nutrient application and plant density control*									
NAM	AM	NAM	AM	NAM	AM	NAM	AM	NAM	AM
+Fert	*-Fert*	***+Fert***	*-Fert*	***+Fert***	*-Fert*	***+Fert***	*-Fert*	***+Fert***	*-Fert*

5m

Key: AM = Application of agronomic methods: NAM = Non Application of agronomic methods

3.4 Results on demonstration

Activity 2	Farmer implementation of adopted crop production and management practices (Improved varieties)									
Location	HH Participation		% Crop Selection				Implemented Agronomic techn.			Yield/Ac
	% Male	% Female	Beans	G/gram	sunflower	cowpeas	line Planting	Dribble sowing	Density control	Nutrient application
Nadunget	38	58	65	56	45	57	58	54	59	
Apeitolim	56	78	78	64	68	78	72	60	69	
Activity 1	Demonstration of selected crop technologies for farmer adoption (Indigenous varieties)									
Nadunget	34	58	63	59	40	49	59	47	46	
Apeitolim	63	78	76	65	74	78	75	64	75	

3.4.1 Discussion of demonstration results

Obtained result showed that farmers participation in the technology demos for observing performance or and or products, enhances them to develop interest and adopt the technics. It's quite important they learn, apply and own technologies hence becoming practically oriented. Under demonstration of agronomic practices on growing improved crop varieties, women participated more in both areas but considerably more farmers in Apeitolim participated and observed demo performance across the crop varieties (Tab. 2). In Apeitolim, 78% of farmers need bean seeds, 64% farmers (green gram), 68% farmers (sunflower), and 78% farmers (cowpeas). Whilst, farmers are willing to implement line planting (72%), dribble sowing (60%) and plant density control (69%) (fig. 8), suggesting the interest and knowledge gained from demonstration hence leading to adoption for improving crop production in Apeitolim. The performance and adoption rate in Nadunget was rather lower (Tab.2), attributing it to more experience drought hazards. The results therefore demonstrate an instigation of seed materials to be availed to farmers and monitor their implementation of gained knowledge.

Figure 8:Demo field in Apeitolim

However, there was no farmer significant difference in participation, observation and adoption of agronomic practices on production of improved and indigenous crop varieties.

4.0 Challenges encountered

i. Drought stress especially during the short second season.

ii. Late financial support for the activities affected the timing of trial establishment and crop growth

iii. During second season, few farmers grow crops due to anticipation of crop failure resulting from poor rains. This exposes the established crops to grazing animals since the field is in isolation. Fencing is expensive while guarding is difficult since some animals are grazed at night when its cool.

iv. Fire burning is also a serious issue since crops tend to be burnt in the process.

Figure 9: Effects of drought and fire burningin Karamoja

5.0 Conclusion and recommendation

With analytical consideration, where drought stress is anticipated to challenge crop growth, the crops to concentrate on in productivity is pearl millet, pigeon peas, beans (Nabe15 and tapara), sunflower and sorghum. These crops have the expressive mechanisms to avoid, acclimatize and tolerate drought. Atleast little output can be realized especially during the second short rains if security for the crop is ensured. Some sorghum varieties especially seso3b if planted in the main season, has the potential to ratoon and a second harvest ensured during the short rain season. Beans (Nabe15) have the mechanism to reach anthesis stage much earlier hence avoiding drought stress. Pearl millet is the most drought tolerant (fig.xx) that can even grow on only 3 rain showers the whole season. Pigeon peas are equally drought tolerant. Therefore these are the crops to promote for productivity during the short rain season called *Akamu*. Other crops such as maize, cassava, groundnuts, sismsim etc are more favourable for good performance during the main rain season (*Akiporo*).

Figure 10: Drought tolerant Pearl Millet crop