

Seed System Security Assessment (SSSA) in South Sudan

(Final Report)



Organizations and Institutions

Government: MAFS, SMOAF and CAD

NGOs: Act for Humanity, AVSI, CODAID, CRS, Global Aim, JAM, NPA, SCI, STO, UMCOR, VSF-G, WCDO AND WVI

UN: FAO

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ACRONYMS

AAO	Agriculture Advisory Organization
ACROSS	Association of Christian Resource Organizations Serving Sudan
ACTED	Agency for Technical Cooperation and Development
AEZ	Agro-Ecological Zone
AGRA	Alliance for a Green Revolution in Africa
AVSI	Association of Volunteers in International Service
BC	Baltic Control
BECA	Bioscience Eastern and Central Africa
CAD	County Agriculture Department
CDOT	Catholic Diocese of Torit
CES	Central Equatoria State
CFSAM	Crop and Food Security Assessment Missions
CGIAR	Consultative Group on International Agricultural Research
CIMMYT	International Maize and Wheat Improvement Center
COBAMA	Community Based Market Oriented Seed Production
COMESA	Common Market for Eastern and Southern Africa
CPA	Comprehensive Peace Agreement
CRS	Catholic Relief Services
DRC	Danish Refugee Council
DRC	Democratic Republic of the Congo
DSD	Direct Seed Distribution
ECA	East and Central Africa
EES	Eastern Equatoria State
FAO	Food and Agriculture Organization of the United Nations
FAW	Fall Armyworm
FGD	Focus Group Discussion
FHI	Food for the Hungry International
GAIS	Global Agriculture Innovation System
GBELG	Greater Bahr el Ghazal
GUN	Greater Upper Nile
IARC	International Agricultural Research Centres
ICRISAT	International Crop Research Institute for Semi-Arid Tropics
IDP	Internally Displaced Persons
ILRI	International Livestock Research Institute
IPC	Integrated Food Security Phase Classification
IRC	International Rescue Committee
JAM	Joint Aid Management
KALRO	Kenya Agriculture and Livestock Research Organization
KMFG	Kogbo Multi-Purpose Farmer Groups
MAFS	Ministry of Agriculture and Food Security
MASCO	Magwi Seed Company Limited
MHADM	Ministry of Humanitarian Affairs and Disaster Management
MTDF	Multi Donor Trust Fund
MTI-EAF	Ministry of Trade and Industry and East African Affairs
NaCRRI	National Crop Resources Research Institute (Uganda)
NARO	National Agriculture Research Organization (Uganda)
NARS	National Agricultural Research System

NaSARRI	National Semi-Arid Resources Research Institute (Uganda)
NBEG	Northern Bahr el Ghazal
NCA	Norwegian Church Aid
NCASP	Norwegian Church Aid Sudan Program
NERICA	New Rice for Africa
NGO	Non-Governmental Organization
NPA	Norwegian People's Aid
NPT	National Performance Trial
NVRC	National Variety Release Committee
OPVs	Open Pollinated Varieties
PDU	Project Development Unit
PPB	Participatory Plant Breeding
PVS	Participatory Variety Selection
QDS	Quality Declared seed
R&D	Research and Development
RRC	Relief and Rehabilitation Commission
SEMI	Seed Enterprise and Management Institute
SPLM	South Sudan Liberation Movement
SSARTO	Southern Sudan Agricultural Research and Technology Organization
SSBS	South Sudan Bureau of Standards
SSCF	Seed Security Conceptual Framework
STASS	Seed Trader Association of South Sudan
UMCOR	United Methodist Committee on Relief
UOJ	University of Juba
USAID	United States Agency for International Development
VSF-G	Vétérinaires Sans Frontières Germany
VSF-S	Vétérinaires Sans Frontières Suisse
WARDA	West Africa Rice Development Association (now AfricaRice)
WBEG	Western Bahr El Ghazal
WCDO	World Concern Development Organization
WES	Western Equatoria State
WOTAP	Women Training and Promotion
WVSS	World Vision South Sudan

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SUMMARY

INTRODUCTION

Seed is an important input in the lives of many farm households in South Sudan. Farm households are seed secure when they have access to good quality seed of suitable variety in time for planting. The supply of seed both in qualitative and quantitative terms is determined by the physical, organizational and institutional components, and their actions and interactions, which defines the seed system. In South Sudan, both seed and food security are undermined by a number of factors. These factors include recurrent conflicts and civil unrest resulting into economic crisis, poor access and infrastructure; natural occurrences such as floods and prolonged dry spell or drought driven by climate variabilities; biotic constraints and environment factors.

To help understand the seed system in general as well as seed security of the farm households, FAO in collaboration with the Ministry of Agriculture and Food Security (MASF) and other key stakeholders conducted a Seed System Security Assessment (SSSA). The main objective of the assessment was to have a better understanding of the seed system in the country, with specific objectives of determining the seed security of farm households with respect to elements of seed security. The purpose of the assessment was to identify practices, constraints, opportunities and options for improvement. The assessment also aimed at providing recommendations for short- and medium-term improvement.

The assessment was conducted across the 10 former states and covered 10 out of the 12 livelihood zones between November and December 2018. A total of 29 counties were purposively selected to ensure good representation of major livelihood zones/agro-ecological zones (AEZ) within the ten states. The assessment team interviewed 1 424 households and 55 key informants using structured and semi-structured questionnaire respectively; conducted 69 focus group discussions; examined market situation in face to face interactions with 36 local market traders and 6 input agro-dealers. In addition, FAO commissioned a background study on the formal plant breeding and seed production activities across the country.

KEY FINDINGS AND RECOMMENDATIONS

Formal/semi-formal seed system

Research and plant breeding: In South Sudan breeding activities are mostly limited to adaptability trials by the Directorate of Research, but with some limited efforts from the University of Juba (UoJ) and a few NGOs such as World Vision working with Research. Between 2011 and 2018, 31 new varieties have been released. However, many of these new varieties have remained on the shelf of research. A few improved varieties are in use, and are mostly channeled to farm households by seed aid. Research

is constrained by limited funding; lack of ownership of released varieties and poor access to foundation seed; understaffing, and limited facilities for research.

Recommendation for research and plant breeding: MAFS needs to keep the momentum of the collaborative efforts between them CGIAR and FAO to ensure new materials are tested, and farmers exposed to advanced lines, and researchers capacitated. MAFS also all needs to ensure that they have Memorandum of Understanding (MoU) with NARS from the neighboring countries to facilitate easy acquisition of materials from the developers/maintainer. There is need for funding to support research activities as well as capacity development with focus on Participatory Plant Breeding (PPB) and/or Participatory Variety Selection (PVS); designing on-farm or adaptive trails; and data analysis using most recent versions of data analytical packages such as SAS, SSPS etc. Released varieties on the shelf of Research directorate need to be promoted by all key stakeholders and development partners. MAFS should therefore make these varieties available and accessible to all for demonstrations and on-farm trials. The breeding program needs to consider establishing time of planting for improved crop (sorghum) varieties; breeds for varieties with heavy biomass to support agro-pastoral communities; support on-farm trials in collaboration with CGIAR centers, FAO and NGOs. In addition, MAF needs to come up with a varietal catalogue detailing key characteristics of each varieties, their adaptation to the different agro-ecologies and suitability for various end uses.

Seed Production and Supply: In 2011, AGRA opened an office in Juba to support emerging private seed companies as well as breeding activities. As of 2018, there were about 13 registered seed companies, however, only 10 were operational as the other three were negatively affected by the war and ceased production in the country. Progressively over the years, the companies have increased production from about 65 tons in 2011 to 1 760 tons in 2018, with 90 percent of the production fields under the outgrower scheme. Of the total production figure for 2018, Maize, sorghum and groundnut contributed to 66, 15 and 9 percent, respectively. Overall, 63 percent of the seeds produced locally normally goes to the humanitarian organizations, about 23 percent is channeled through agro-input dealers, while some 9 percent remained as carry over (unsold) into the next season. The carry-over of seed could partly be attributed to significant seed import from neighboring country by FAO and other NGOs, with seed from outside considered cheaper than those produced in South Sudan. In addition to seed being produced by the seed companies supported by AGRA, FAO and a number of NGOs have been supporting the community-based seed production and supply initiatives through a number of projects. These efforts have helped in increasing availability and access to quality seed of adapted varieties within the communities.

Recommendations: There is a need to support maintenance and production of foundation seed in the country. Seed companies should expand their operation to a wider geographic area, scale up production to meet local demand, enhance seed

processing, delivery, marketing and sales strategy; test and adopt appropriate marketing and distribution approaches such as use of small or appropriate seed packs; and explore use of decentralized distribution points, such as the local shops or WFP aggregation centers found in rural areas. In addition, they need to establish demonstrations for new varieties, as well as showcase them in agricultural fairs. Besides the companies, STASS needs to be supported and strengthened. STASS needs to be supported to join the Africa Seed Trade Association (ASTA), and linked to other associations within East and Central Africa (ECA) in order to promote better seed trade. The management of STASS needs to be capacitated through training.

Community-based seed production and supply: Key areas that need attention and support are; a) improving access to quality starter seeds (foundation and/or certified); b) improving access to ox-ploughs and/or tractor hire service; c) quality assurance along production to market chain, and d) creating market linkages with potential buyers including seed companies, agro-input dealers and humanitarian organizations. FAO seed toolkits provide opportunity for building capacity technically, organizationally, and in terms of marketing.

Seed policy and regulation: South Sudan has a seed policy still in draft form, awaiting approval from authority. With the seed policy in draft, there is no regulatory framework or seed law in place. However, the MAFS recognizes regional efforts by COMESA on seed standards, and the harmonized seed policy and regulations for East Africa region. However, the MAFS lacks adequate capacity for seed certification in terms of personnel, facilities, equipment and infrastructure. The border posts at Nadapal (Kenya) border, Nimule and Kaya (Uganda) border have never been operational due to the lack of operational funds and technically skilled staff.

Recommendations for regulatory framework and capacity for seed quality assurance: The MAFS needs to renew and push for approval of seed policy by the relevant authority. Even in the absence of a seed policy, MAFS should develop seed production/certification and marketing guidelines and come up regulations/decrees that support these guidelines. In addition, there is a need to establish and build capacity for National Seed Certification Services (NSCS) through trainings, recruitment of qualified personnel, and improvement of border post and seed laboratories. With the support from resource partners, FAO and AGRA could play a critical role by providing technical expertise in this area.

Seed security across sites

Major crops and diversity: The types and number of crops grown by farm households in South Sudan vary from state to state, and across livelihood zones. The number of crops grown per households range from one crop to more than 8 crops. Overall, about 54 percent of the farm households grow 3-4 crops; and 18 percent grow between 5 and 6 crops. Major staple crops cultivated by household include sorghum (80%) maize

(63%), groundnuts (58%), sesame (34%), cowpeas (27%), and vegetables (28%). Other crops which are widely cultivated within specific states-livelihood zones are cassava (87% in WES-SS01; 56% in EES-CES/SS01), Millet (78% and 58% in Lakes-SS08 and SS07, respectively), beans (52% in EES-SS01; 48% in Lakes-SS08), and green grams (72% in Lakes-SS08; and 64% in WES-SS02), rice (56% in WES-SS01) and sweet potatoes (46% in EES-SS01). Other minor crops include pigeon pea and soybean.

Seed Sourcing: Farm households in South Sudan use multiple seed sources, even for the same crop and/or same variety. The informal seed sector contributed almost 85 percent of the overall seed sources used by the farmers in 2018, and this includes own-saved (51 percent), local market (21 percent) and social network (13 percent). Despite the existence of about 13 local seed companies and a few agro-input dealers, their direct supply of seed to farm households is insignificant. In general, seed aid remains the main channel through which seed from the formal sector get to farm households and it contributed to about 14 percent of seed source use. Expected changes in seed sourcing between 2018 and 2019 is minimal with very slight variation from source to source. Farm households expect own seed and seed aid to increase by just 2 percent in 2019 above the 2018 mark, while expecting local market and social networks to reduce by a similar percentage.

Seed requirement and demand: Nationally, about 45 800 tons of the five major staple food crops (sorghum, maize, cowpea, groundnuts and sesame) were planted in 2018, with about 26 percent (12 126 tons) of it sought through the market and social network. In the absence of humanitarian seed aid, or with more quality seed supplied through different market channels, the potential demand for seed could be higher. The current production (2018) by all the seed companies (1760 tons) could meet about 15 percent of the estimated demand.

Availability and supply of seed at community level: Irrespective of the seed sources, about 54 percent of the households interviewed indicated there was enough supply seed of various crops within their community. However, this varied across states and by crops. In five (WBELG, CES, WES, EES, NBELG) of the ten states, between 58 and 90 percent of the households indicated there was adequate supply while in four, there appears to be inadequate supply (less than 50 percent). From the seed fairs conducted by FAO across a number of states, the vendors supplied significant quantities of sorghum and groundnut sought by the beneficiaries.

Seed access: Despite all the difficulties, some farmers were able to access seed from other sources such as local market and social network, with more than 89 percent of the seed from local market being acquired on a cash basis. Even within social networks, about 15 percent of the seed is acquired on cash and credit. Given the fact that local markets contribute to more than 20 percent of the seed sourcing, and that nearly all the seeds sourced from the market are acquired on cash/credit, this demonstrated the capacity of some households to access seed from market. It ought to be noticed that the agro-input dealers' contribution is very low as they have no or very limited presence in

many of the sites visited. This presents an opportunity for expansion of formal seed business if peace prevails.

Seed quality: In terms of physical purity, 85 percent of responses on seed quality considered the seed as clean – with no impurities, physical damage or pest infestation. On germination, 69 and 25 percent of the responses rated germination as good and fair, respectively. These ratings varied with seed sources as well as the crops assessed. Therefore, seed quality appears to be of less concern to farmers.

Diversity, suitability and use of varieties: Farm households in South Sudan have a wide range of crop varieties, and diversity varied from crop to crop as well from state to state or across the livelihood zones. There has been no major concerns about suitability of varieties, with more than 90 percent of responses rating what they planted as their preferred choices. For some crops such as maize, more than 50 percent of responses in the Equatoria region indicated improved variety, while for sorghum, the use of improved variety was more pronounced in Upper Nile (42 percent) and Eastern Equatoria (35 percent) states. Similarly, use of improved sesame was highest in Upper Nile (58 percent) and Eastern Equatoria (24 percent) states.

Stress factors: With the advent of a revitalized peace agreement, about 41 percent of the farmers were optimistic that they would cultivate more area in 2019 compared to 2018. A few, 5 percent, considered that their area under cultivation would be less in 2019 compared to 2018, while 54 percent considered that they will maintain the status quo and plant the same area. Based on the gender of the head of households, women headed households appear to be less optimistic, and probably more stressed than male-headed households, with 33 and 45 percent respectively considering to be planting more. Out of the 5 percent who indicated they would plant less, 50 percent of the main reason involves seed-related factors such as lack of seed, high seed prices, lack of money, poor quality seed and lack of preferred varieties while the other half of the reasons being non-seed related.

Seed Aid: Humanitarian seed aid has been in South Sudan for decades with varying magnitudes and scales. Though there are varying opinions on seed aid, it has been the main source of new varieties among farmers, contributing about 74 percent of all source of new materials to farm households. Between 2013 and 2018 over 20 000 tons of seed of various crops (maize, sorghum, cowpea, sesame and groundnut) were distributed by FAO alone. Pockets of concerns expressed about seed aid mainly related to the timeliness of distribution and suitability of some of the varieties distributed. In terms of timeliness, 22 and 10 percent of the beneficiary respondents reported that the seed was supplied mid-season or end of planting season, respectively.

Use of other input: Use of inorganic fertilizers across all assessment sites was less than 1 percent in 2018. The main reasons farmers gave for not using inorganic fertilizers were: - mostly being unaware of them (53 percent), or had no knowledge on the correct

use (15 percent). Other reasons behind limited use of inorganic fertilizers were their unavailability (14 percent) and high cost. About 38 percent of farm households use organic amendment, with animal manure being the commonly used one (72 percent).

Recommendations for humanitarian seed support

Considering that farmers predominantly use informal sources, and that availability of some major crop seed at community level is the main element of concern across sites, the following needs to be taken into consideration:

- *Short-term:* There is a need to always conduct a rapid seed security assessment (RSSA) to determine the most constraining element of seed security, and design responses accordingly. Where seed availability is not of concern, but access is the major constraint, market-based interventions such as seed fairs and voucher or voucher systems need to be promoted. Seed aid should provide seed on time as much possible, as well as match varieties provided with agro-ecologies and beneficiaries' needs. It should also ensure that seed quality is verified at all levels, and any carry-over stock that has been kept for more than 6 months be retested. This could be achieved through collaborative work and consultation with research, regulatory bodies and institution, and technical agencies such as FAO and AGRA.
- *Medium – long term:* wherever possible, seed aid needs to be repackaged and directly or indirectly linked to resilience strategies that build assets and skills and contribute to the development of a sustainable, demand-driven seed sector. FAO and MAFS should collaborate with other stakeholders to have a comprehensive review of the effectiveness and relevance of repeated seed distribution across the country, especially in areas that consecutively received seeds more than 5 times.

Recommendations for building resilient seed systems at community level

Building resilience requires concerted efforts from all key stakeholders – policy makers, researchers, regulators, producers, traders and consumers as well as humanitarian and development actors.

Building resilience requires medium- to long-term focus that will impact the seed availability, access and quality and its focus should include developing crop varieties that are suitable to the different agro-ecologies and will withstand climatic, biotic and abiotic stresses; introduction, provision, and promotion of improved storage

technologies such as hermetic bags and structure; continuous support to seed bulking and storage and ensure adequate availability and access to quality seed; crop diversification and value addition for income generation; control and management of striga and other pests; support to local market traders in managing quality of what they sell as seed by promoting use of pallets, hermetic bags (50-100kg) and grain silos (200-500kg); and providing basic information on grain/seed quality aspects and management through trainings, leaflets and/or radio messages. There is also a need to develop and/or strengthen the agro-input dealers network across the country to ensure that farmers are presented with diverse array of alternative varieties from where they can make choices.

CONCLUSIONS

The seed system in South Sudan is still highly dominated by the informal sector, which contributed to about 85 percent of the seed sources used by the farmers. This situation has remained about same since 2010 where own-saved seed, local market and social networks are the major sources of seed used by the farm households in the country. The formal sector is still weak, with research work limited to testing of materials developed from outside the country. The few available released varieties have remained majorly on the shelves of research stations. This will require concerted efforts to enable farmers to access them. The volume of certified seed produced by the local seed companies is only 1760 tons of assorted crop seed, contributing to about 15 percent of the estimated seed demand in 2018. The community-based seed production and supply efforts also contributed to almost same amount. Nevertheless, the local production from local seed companies has continued to progressively increase in volume since 2011, and is expected to double in the next two years, provide security and peace prevail.

At the community level, the overall supply was considered enough by slightly more than half of households interviewed, but access by some households seems to be the major concern. It is important to note that almost half of all seeds obtained off-farm was on cash or credit, with more than 90 percent of the seed sourced from the local market acquired by using cash. No major concerns were raised on seed quality and suitability of major varieties planted by farm households in 2018; however, this could be due in part to limited exposure to improved varieties as access to new varieties remained low, at just 24 percent, mostly through seed aid with low diversity in terms of varieties and limited to 2 to 4 crops. The importance and contribution of seed aid varies from state to state, ranging from 10 to 25 percent contribution as an alternative seed source. While it makes a significant contribution in providing quality seeds and reducing household expenditure, cases of late distribution and provision of unsuitable varieties still undermines its importance in addressing the seed and food security concerns in some parts of the country.

1.0 INTRODUCTION

South Sudan faces unprecedented levels of food insecurity, as more than 6 million people – just under 60 percent of the country’s population – are severely food insecure, according to the latest Integrated Food Security Phase Classification (IPC) analysis. The outlook for the remainder of 2019 is far from promising. While famine has been contained since, it was declared in some areas of Unity state in February 2017, the IPC warns that the situation remains critical and the risk of famine persists, especially in isolated areas where conflict and other factors can quickly and dramatically increase. Some 1.7 million people are estimated to be in the Emergency level (IPC Phase 4) of food insecurity, and 47 000 at the Catastrophe level (IPC Phase 5).

Over the years, the IPC has been the major source of document informing humanitarian actions within the food security and livelihood cluster. It is being used widely by FAO and other humanitarian actor in providing emergency seed response across the country. IPC however lack critical analysis of the seed system in crisis and/or elements of seed security that are limiting.

1.1 Humanitarian Crisis in South Sudan

Food and nutrition insecurity: The recent IPC report (2019) shows that food insecurity continues to be driven by the cumulative effects of conflict, insufficient food production and associated population displacement. Conflict continues to disrupt food production, deplete livestock and constrain people's access to alternative food sources. Prolonged dry spells, flooding, crop disease and pest infestation have severely impacted agricultural production which is largely rain dependent. Poor people have been particularly vulnerable to high food prices and the limited availability of food in markets. At the current level of assistance, IPC showed that some 50 000 people will be facing catastrophe (extreme food insecurity) between May and July 2019, and without any assistance, this number could rise to 260 000. There is a real risk of famine in those areas which are already very food insecure, should the overall situation in the country deteriorate and should there be a prolonged absence of humanitarian assistance. Parts of the country that are particularly at risk are Unity, Jonglei, Upper Nile and Lakes. Food insecurity is projected to increase in 2019, and those most in need of assistance are malnourished women and children. Malnutrition levels remain critical in many areas, with some 860,000 children under the age of five severely malnourished. However, there is likely to be an increased incidence of acute malnutrition during the coming lean season in most parts of the country.

Economic crisis: The conflicts impacted negatively on livelihoods and created economic crises, which undermined people’s access to basic resources and increased

the cost of living markedly, particularly in urban areas. The inflation reached 183 percent in Juba, and the South Sudanese pound (SSP) continued to depreciate to lower-than-ever values of more than 130 SSP to 1 US dollar as of October 2017, and 270 SSP of October 2018. The shortage of fuels aggravated the situation by pushing prices of most basic commodities upwards. Within the public domains, there has been inconsistency in salary payments to public sector employees.

Population displacement: The fighting and surges of violence forced many people to flee their homes, many of them multiple times. The number of people uprooted since the start of the conflict in 2013 reached more than 4 million, including 1.9 million internally displaced people (IDPs), with up to 85 per cent estimated to be children and women. However, more than 2 million people went to neighboring countries as refugees while up to 1.3 million have been internally displaced since July 2016 conflict. As the conflict in South Sudan entered its fifth year in 2018, the humanitarian crisis continued to intensify and expanded due to the compounding effects of widespread violence and the deteriorating economic situation. Insecurity and related displacement undermined already compromised agricultural production, destroyed the livelihoods of farmers and herders therefore caused food shortages.

Refugees in South Sudan: At the end of 2017, some 279 000 Sudanese refugees were hosted in South Sudan, a number which increased to approximately 304 560 in 2018. The Sudanese refugees from South Kordofan and Blue Nile settled mainly in the former Unity and Upper Nile states, while a smaller number are from the Central African Republic, Democratic Republic of the Congo (DRC) and Ethiopia have been displaced on a protracted basis in Central and Western Equatoria.

1.2 Seed Aid in South Sudan

Emergency and humanitarian seed aid in South Sudan has been in existence for more than three decades, varying magnitude and scales. The Food and Agriculture Organization of the United Nations (FAO) has been at the forefront as the pipeline manager for a number of Non-Governmental Organizations (NGOs). In some years, the government has provided aid to the most vulnerable. It is worth noting that most of these emergency seed responses/interventions are normally carried out without proper analysis of the impact of crises on the seed security of the targeted population, or proper analysis of the wider factors affecting seed security nationally. Because many institutions and organizations do not carry out seed security assessments, their responses tend to favor direct seed distribution (DSD), with significant international seed procurement, which is unsustainable. Through both the government and beneficiaries do appreciate seed aid, there been a lot of critics, especially on seed procured from outside the county especially for late delivery, provision of unsuitable varieties and sometimes seed with poor germination capacity.

Over the past 12 years, FAO alone provided more than 30 000 tons of assorted crops seeds - maize, sorghum, sesame, groundnut, cowpea and beans (Fig. 1.1) to the most vulnerable populations such as returnees, Internally Displaced Persons (IDPs), refugees and host population across the country.

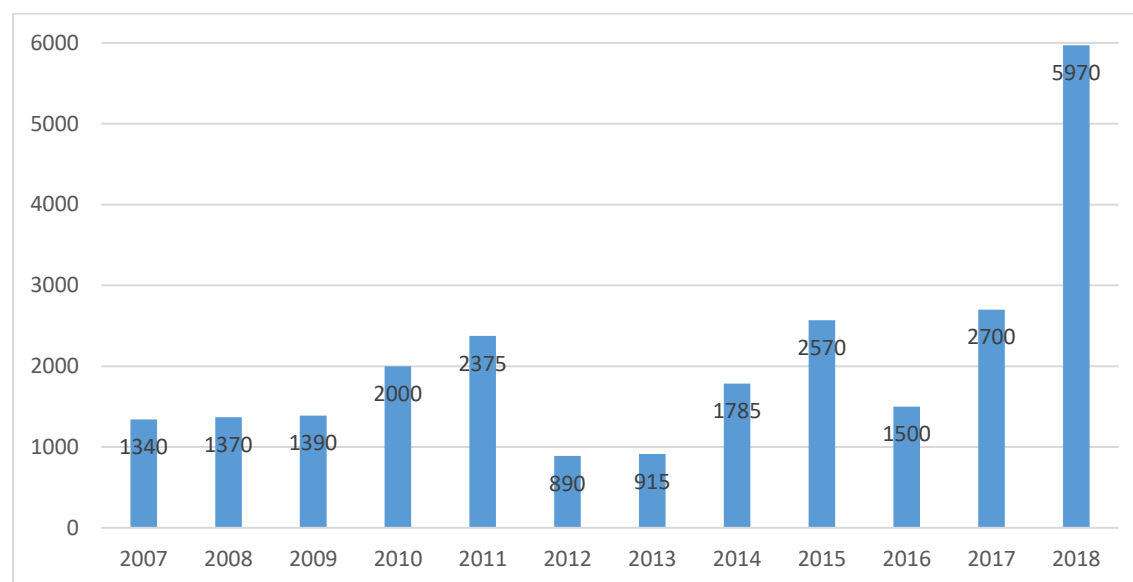


Fig. 1.1. Quantity (MT) of seed distributed by FAO and its partners – 2007 to 2018

The surge in seed aid between 2007 and 2009 was triggered by the Comprehensive Peace Agreement (CPA), while between 2009 and 2011 there was slightly scaled up seed aid as a result of the influx of the returnees triggered by the 2011 referendum which eventually led to the independence of South Sudan from Sudan. South Sudan was relatively peaceful after independence, and seed aid dropped to below 1 000 tons in 2012 and 2013 as there was a drive by most organizations towards recovery, reconstruction and development. This was however short-lived, and with the unfolding of the war on 15 December 2013, the country was once set on humanitarian mode by the political crisis, and again the July 2016 pushed the humanitarian agenda upwards with more seed being provided to the affected population. In 2017 significant numbers of displaced persons did not return to their original home, hence nearly double the amount of seed provided by FAO compared to 2016.

FAO has been the pipeline manager for seed and tools, providing supplies to most humanitarian organizations. The planning figures for such distributions are normally based on the Food security Integrated Phase Classifications (IPC), particular for those in phase 3 and 4. The IPC however does not provide a detailed analysis of how the seed system in those phases have been affected by crises or events, and therefore could be misleading if relied on alone. Providing large volumes of seed as an emergency response, and over multiple years, could weaken the development of the sector, if not carefully designed and executed.

1.3 The Revitalized Peace Agreement

The recently revitalized peace process promises to offer new opportunities in 2019 for South Sudan's women, men and children. The cumulative effects of years of conflict, violence and destroyed livelihoods have left more than 7 million people or about two thirds of the population in dire need of humanitarian assistance and protection in 2019, similar to the 2018 proportion while the situation is calm yet the country remains in the grip of a serious humanitarian crisis.

1.4 Agriculture in South Sudan

South Sudan has abundant land and six favourable agro-ecological zones providing huge potential for sustainable agricultural production and productivity. Of South Sudan's total surface area, 50 percent (65.9 million hectares) is prime agricultural land while the remaining 50 percent is composed of marginal arable land, forests, mountains, rivers and wetlands. Out of the total land area, only 27 712 sq.km (4.2 percent) is cultivated. The annual amount and distribution of rainfall is region-dependant ranging from 500 mm in the north to 2 000 mm in the southwest, enabling a growing seasons of 130 to 150 days and 280 to 300 days, respectively.

Despite abundant land resources, the majority of farm households cultivate only about two feddans¹ and predominantly using local landraces, with minimum application of fertilisers, pesticides and other inputs. The low area cultivated is due to the fact that most households use manual labour with very simple hand tools such as a hoe and *maloda* and 5 percent of the total cultivated area uses mechanized farming in the greater Upper Nile region.

In any crop production system, seeds and/or planting materials are the basic production inputs, and therefore a central part of farmers' life in South Sudan. FAO (2008) defines seed security as the "access by farming household members (men and women) to adequate quantities of good quality seed and planting materials of adapted crop varieties at all times in both good and bad cropping seasons". Alternatively, seed security is achieved "when quality seeds are physically available to households at the right time and place and when households have access to quality seed and planting materials of preferred/suitable crop and varieties" (FAO, 2016).

Seed systems can be defined as the sum of physical, organizational and institutional components, their actions and interactions that determine supply and use of seed in quantitative and qualitative terms (Thompson and Scoones, 2012). Seed systems

¹ 1 Feddan = 4200 m² or approximately 1 acre

normally represent the entire complex organizational, institutional, and individual operations and interaction associated with the development, production, processing, storage, distribution, and marketing of seeds in the country.

Seed security provides the opportunity for increasing productivity and production of crops, and subsequently contributing to improving food and income security for the producers. Food and seed security are related, but not the same, as one individual may have enough seeds to plant but no food to eat, or vice-versa. A household can have adequate food but lack access to preferred variety or right quality seed for planting. Although this rarely happens, it can occur if seed stocks kept in the house become heavily infested with insect pests or are otherwise contaminated, or if a disease outbreak requires a switch to a resistant crop variety. On the other hand (seed secure but not food secure), households with about 8-12 kg sorghum seeds will be able to plant about two feddans, a typical land area by farm household in South Sudan. However, households require more than 200kg of sorghum in order to be food secure over the year. In other words, although the two are similar in the element of availability, the quantities needed for planting and for consumption differ significantly.

In the context of food security, food is needed at all times, while seed is required mostly at the time for planting. Therefore, those factors that affect the food security of farm households may directly or indirectly affect seed security. In South Sudan, seed security is undermined by a number of confounding factors such as recurrent conflicts and displacement, inadequate seed systems, flood mostly in the flood plains, drought and persistent pests and diseases particularly for planting materials reproduced through vegetative propagation. The high levels of insecurity negatively affected infrastructure and access to most places in the country. These factors have continuously contributed to emergency seed responses in the country.

1.5 The Seed System Security Assessment (SSSA)

Humanitarian crisis normally triggers series of responses to avert the impact on the affected population and beyond. Seed distribution is one of the responses in support farming population in the affected areas, and predominantly in the form of direct seed distribution (DSD). The humanitarian organizations normally do this on the assumption that where there is food insecurity it automatically translates into seed need. In South Sudan, they rely on IPC reports and projections without contextualizing the similarities and differences between food and seed security. Understanding the impact of crisis on the seed system security requires undertaking an independent seed (system) security assessment.

1.4.1 The Scope and Objectives

The broader scope of the assessment is to create better understanding of the seed systems in South Sudan by looking at both the formal and informal sector, and of how they each respond to stress, with specific reference to the various agro-ecological and livelihood zones. Specifically, this assessment facilitates understanding of the seed security situation of farming communities based on the elements of the SSCF. The assessment examines the operation of the system; how farmers access quality seed of suitable varieties from various sources, and how they cope with changing socio-political environment, natural disasters (flood, drought, diseases) and economic crisis. The overall purpose of the assessment was the identification of practices, constraints, opportunities and options for improvement in the seed system sector. The assessment aimed at providing recommendations to various key stakeholders (donors, government, private sector, NGOs, and farmers) in short (2019) and medium terms (2020 -2021) for improving seed system security of South Sudan.

1.4.2 SSSA livelihood zones of South Sudan

The most recent zoning of livelihood zones sub-divided South Sudan into 11 zones classified as SS01 to SS11 (Fig. 1.2). The assessment covered targeted 10 out of the 11 the livelihood zones.

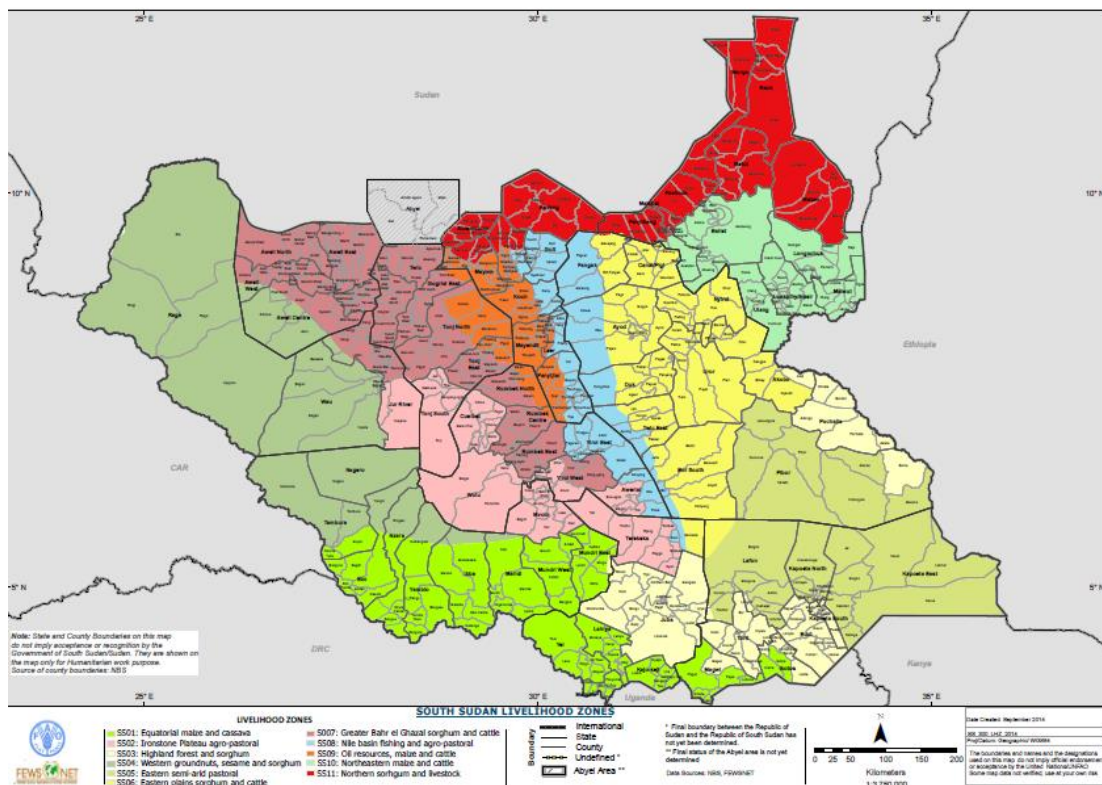


Fig. 1.2 Livelihood zones of South Sudan (FEWS NET)

Equatoria maize and cassava zone (SS01): This zone is characterized by equatorial rain forest concentrated particularly on the Uganda, Democratic Republic of Congo (DRC) and Central African Republic (CAR) borders. This is the only part of South Sudan with typical bimodal rainfall pattern and two reliable seasons. Precipitation is about 1 100 mm to 1 500 mm per annum in both rainy seasons. First rains normally commence around March with a break in late June and restart a second time in July through November. Major crops include maize, beans, sorghum, groundnut, cassava and sweet potato.

Ironstone plateau agro-pastoral livelihood zone (SS02): this zone cuts across the former Central Equatoria State (CES), Western Equatoria State (WES) Lakes, Warrap and Western Bahr El Ghazal (WBEG) state. Predominantly cultivated crops are sorghum, groundnut and sesame. Other crops are maize, cowpea, green gram (Lakes) cassava and sweet potato. More than 80 percent of the households in this zone keep livestock.

Highland forest and sorghum zone (SS03): This zone cuts across CES and Eastern Equatoria State (EES) but is located along the mountain ranges of the Greater Equatorial region and the border with Ethiopia and Uganda. Its topography is characterized by highlands and foothills with a mixture of forest, bush shrubs and grasslands. The zone has a unimodal rainfall pattern with average precipitation of about 1 100 mm to 1 300 mm per annum. There are two distinct seasons; a rainy season from April to November and a short dry season from December to March. The main crops are sorghum and maize, with the latter growing mainly in the eastern parts of the zone. Other crops cultivated in this zone include millet, sesame, cowpeas/green grams, sweet potatoes, cassava and groundnut. The livestock kept are mainly goats, a few sheep and poultry with relatively few cattle mainly owned by the better-off groups.

Western plains groundnut, sesame and sorghum (SS04): This zone is mainly located in WBEG and some parts of WES and Northern Bahr El Ghazal (NBEG) state. It is characterized by highlands, foothills and parts of the Ironstone plateau. Vegetation in the area is a mixture of forest and grasslands with mahogany and bamboo trees. The zone has a unimodal rainfall pattern, with average precipitation of about 900 mm to 1 100 mm. There are two main seasons: - the rainy season, which starts in April to October, and the dry season from November to March. Soils are mainly relatively fertile sandy clays. The main crops cultivated include sorghum, cassava, groundnut, sesame, cowpeas, sweet potatoes and assorted vegetables.

Eastern plains sorghum and cattle zone (SS06). This livelihood zones is located in eastern flood plains in former Jonglei state. It can be described as zone of short unimodal rainfall with annual precipitation ranging from 600 mm to 900 mm. The rainy season is normally between June and mid-October, and dry season from Mid-October

to May, respectively. The major crops grown include sorghum, groundnut and maize in addition to cowpeas and groundnuts.

Western flood plain sorghum and cattle zone (SS07). This is predominantly pastoral zone covering former Warrap state, parts of Lakes and Northern Bahr El Ghazal (NBEG) states. It has a very short rainy season that often starts in June and ends in September, with annual precipitation being between 500 mm to 700 mm. The most commonly grown crops being sorghum, millet and groundnuts. Cowpeas, green grams and sesame are also grown on limited scale.

Nile basin fishing and agro-pastoral (SS08). This zone runs along the Nile, cutting across CES, Jonglei, Lakes, Unity and Upper Nile, with significant livestock as well. The total annual rainfall is about 400 mm. The rainy season is normally short and starts in June to August and September. The major crops grown are sorghum, maize and groundnut. Other minor crops are millet, cowpeas, sesame and green grams.

North-Western Nile basin cattle and maize (SS09). This is another agro-pastoralist zone with recurrent flooding, located mainly in former Unity state. The rainy season are very short, hardly reaching three months with an annual precipitation of about 300mm. Farmers grow sorghum, maize, ground nuts and sesame as well as cowpea. Other crops of insignificant importance to locals are sweet potato and millet.

North-Eastern maize, cattle and fishing (SS10). This zone is located mainly parts of former Upper Nile state. It is characterized by flat land of black cotton soil with very poor drainage, and therefore prone to flooding. It is a pastoralist zone, but farmers cultivate maize and cowpea as major crop.

Northern sorghum, sesame and livestock (SS011). This livelihood zone is located mainly in the former Upper Nile state and has very short rainy season of about 2.5 to 3 months starting from July with annual precipitation of about 300mm. It is an agro-pastoralist zone where farmers grow sorghum and sesame in large acreages (Renk Mechanized Agriculture) ranging from 100 to 1 000 feddans². Other crops grown by farmers are maize, groundnuts and cowpeas.

² A feddan= 4200 m², aprox 1 acre

2.0 SEED SYSTEMS IN SOUTH SUDAN

This section gives brief account of seed systems in South Sudan, and roles of the key actors in the seed supply chains. It also looks into the seed security conceptual framework (SSCF) elements that guide any seed security assessment whether in emergency, rehabilitation and development context. The seed system in South Sudan can be broadly categorized into three sectors namely: - the formal seed sector, ii) semi-formal and iii) the informal or the farmer seed sector. These sectors operate simultaneously and interact at different levels with each other.

2.1 *Seed Systems*

2.1.1 The formal seed sector

The **formal** seed sector is normally regulated by governments and to some extent by industries as well. It provides new and improved varieties of certified seeds of consistent quality and relatively high purity. In Eastern Africa, between 3–20% of all seeds for a limited number of crops; mainly maize, sorghum and rice (CTA, 2014). The formal seed sector is the origin of improved crop varieties and of quality-assured seed and planting material used by farmers. The agricultural research, which is normally the backbone of the formal seed sector focuses at generating new varieties of improved characteristics. This normally integrates germplasm collection, characterizations and conservation with plant breeding activities. The plant breeding activities focus mainly on major staple crops such as sorghum, maize, groundnut, cowpea, cassava etc.

To date, the formal seed sector in South Sudan significantly depends on the importation of certified/foundation seed of improved varieties from the neighboring countries such as Uganda, Kenya and Sudan. The largest proportion of imported seeds are for humanitarian support to the most vulnerable households across the country. The seed import is normally facilitated by humanitarian organizations such as the FAO, NGOs and the Ministry of Agriculture and Food Security (MAFS). The importation of seed is mainly attributed to limited production/supply of certified seeds within the country.

2.1.2 The semi-formal seed sector

The semi-formal sector also referred to as “intermediate” is a blend of formal and informal sector, which usually aims at supporting the local community to produce quality seed of adapted crop varieties for local use and market. This approach is mostly

being promoted by FAO and several NGOs using various names such as the community-based seed production and supply (CBSPS), the Community-based market-oriented seed production (COMBA) etc. These initiatives focus on training of progressive farmer groups on basic agronomy of seed production, post-harvest handling and marketing. They also provide start-up kits such as foundation seeds, production and post-harvest inputs, and create market linkages by either buying the seed directly from the producers or linking the producers to seed fair activities.

Some of these initiatives have contributed to the formation, establishment or transformation of a formal seed sector operation. For example, the Agricultural Advisory Organization (AAO), formerly a CBO supported by FAO transformed itself into Generation Seed Company now on the list of AGRA supported companies. In Yambio, members Gitikiri community-based seed group supported by FAO, are being contracted by the Global Agricultural Innovations and Solutions (GAIS) Ltd. to produce seed on their behalf. In Eastern Equatoria, former manager of Magwi Action for Self-Reliance Association (MASRA) is now the Executive Director of Magwi Seed Company Limited (MASCO).

In areas where there are no functional seed companies or their agents or agro-input dealers, the community-based seed production and supply remains the only option where farmers could obtain seed of improved varieties of known quality.

2.1.3 The informal (farmer) sector

The informal seed system is unregulated and covers multiple methods of seed selection, production, and diffusion by farmers. Here the seed is usually produced and selected as part of normal crop production activities; saved/stored for next planting; exchanged/bartered or given as gifts between farmers and/or sold/bought in the local market. In South Sudan, the informal seed sector accounts over 80 percent of the seed used by smallholder farmers (CIAT *et al.*, 2011, FAO, 2013; NPA, 2012; FAO 2016). South Sudanis still highly dependent on the informal system due to its availability within reach at the time the seed is needed, easy access and suitability of rich biodiversity of landraces for some major crops such as sorghum.

2.2 Seed Policy and Legal Framework

Over the past few years, efforts have been made by the government in consultation with various stakeholders to develop a seed policy, of which a final draft was presented to the council of ministers as well as read in parliament for the second time. However, with the advent of the 2013 and 2016 crises, the process of passing this into a policy has stalled. Currently, no legal framework (laws or act) exists to guide seed sector

operations in the country. The workshop on seed sector development held in June 2016 at the Quality Hotel in Juba recommended for development of guidelines for seed import/export to control and facilitate the cross-border seed business, while waiting for the finalization of the seed policies and drafting of necessary seed regulations/laws. The meeting also emphasized the need to constitute and/or empower seed regulatory bodies as well as the national variety release committee to facilitate release of identified candidate varieties to the farmers who are in dire need of improved varieties. A draft guideline has been developed by the Directorate of Research, MAFS, in 2018 and is currently being reviewed.

2.3 Why Seed Security Assessment?

Over the past 10 years, FAO, with the support from donors, and in collaboration with other actors, has provided over 30 000 metric tons of assorted crop seed across South Sudan. The quantities provided by the government and NGOs could double or even triple the amount of seed provided by FAO as part of emergency responses. It is important to note that most of these emergency seed responses/interventions normally take place without proper prior analysis of the impact of crises on seed system or seed security of the affected populations. In 2018 alone, FAO in collaboration with partners reached out about 400 000 and 200 000 households with crop kits (5 600 tons of crop seed and tools) and vegetable seed respectively. Government and other humanitarian organizations equally have been distributing significant volumes of seed, with the bulk of the crop seed coming from the neighbouring countries, particularly Uganda, Kenya and Sudan.

With the massive seed aid going on for over two decades in South Sudan, as well as the emergence of private seed companies in 2011, there has been a strong sense among key stakeholders on the need to have a better understanding of the seed systems in South Sudan. This will help in redefining seed security programming, both for emergency responses and longer-term strategies for development and resilience as stresses from crises (civil and tribal conflicts) and natural events (drought and flood) continue to trigger humanitarian responses across sectors. The entrance of AGRA and emergence of private seed companies in 2010 raised a lot of hope within the formal seed sector. However, the socio-political crisis of 2013 and 2016 negatively affected operations of some of these companies and agro-input dealers.

The insecurity, coupled with poor infrastructure and road network, continues to affect crop production to dates, with farm households in some location either internally displaced or completely cut off from alternative seed market and supply. Even with the poor outlook across the country, there have been large areas where farm households have continued to survive with some sort of emergency seed assistance, though sometimes with questionable seed origin, quality, varietal suitability and duplication of

efforts. Notwithstanding all questions surrounding emergency seed response, there is observed appreciation among donors, government and humanitarian organizations that distribution that helps fill in the gaps and transition into a more sustainable market-oriented formal and informal channels later.

The last comprehensive assessment took place in 2010, before the arrival of AGRA and support to formal seed production and regulation in the country. The 2018 Seed System Security Assessment (SSSA) provided an opportunity for systematic review of the formal seed system over the past 10 years, taking stock of research activities, the emergence of seed companies, efforts to regulate and certify seed, initiatives promoting community-based seed production and supply, and the operation of seed stockers and traders. In addition, field assessments with various stakeholders (farmers, farmer groups, cooperatives, extension agents, and humanitarian actors) within the food security cluster provides better insight into seed security at household and community levels.

This SSSA takes full account of developments in both the formal and informal sectors, including policy and regulatory frameworks, development activities, and humanitarian responses, in order to identify key constraints, as well as opportunities, for seed security. A more holistic and up-to-date understanding of all the seed systems in South Sudan will help in forward planning, and in tailoring effective emergency responses. This SSSA will also inform longer-term strategic activities for building the resilience of seed systems in South Sudan, and thus feed into partners' Humanitarian Needs Overview, as well as further inform ongoing projects.

2.4 Seed Security and the Conceptual Framework

Seed security is achieved when a household has sufficient access to adequate quantities of good quality seed and planting materials of preferred crop varieties at all times following both good and bad cropping seasons (FAO, 2008). According to Sperling (2008), farm families are 'seed secure' when they have access to seed of adequate quantity, of acceptable quality, and in time for planting. Here, seed is broadly defined to include not just grains that are sown, but also cuttings, tubers, suckers and other agricultural planting materials.

The key elements of the Seed Security Conceptual Framework (SSCF) are availability, access, seed quality and varietal suitability (Table 2.1). Seed insecurity exists when any of the above aspects are significantly constrained and require appropriate seed and/food security intervention.

Seed system resilience: A particular individual, household or community can be said to be resilient in seed security when capable of maintaining or even increasing seed

security level despite the occurrence of a particular shock, series of shocks and /or longer-term stresses. In this sense, “resilience” is a quality which cuts across all four SSCF elements; availability, access, seed quality and varietal suitability.

Table 2.1. The SSCF: elements, definitions and indicators.

Elements	Definition	Indicators
Availability	Seed supply from one or more sources (formal, intermediate and/or informal) that is sufficient enough to meet seed needs of farm households within a defined geographic area at planting time.	<ul style="list-style-type: none"> a) <i>Quantity</i> – Seed should be sufficient (enough) to meet the planting need of all famers b) <i>Proximity (place)</i> – Seed should be within reach of all famers c) <i>Timeliness</i> – Seed should be available in time for planting
Access	<p>The willingness and ability to acquire seed through cash purchase, exchange, loan, barter or use of power in social networks.</p> <p>Whilst seed may be available from alternative sources, it may not be easily accessible by all farming families, especially when they have no or limited resources and poor access to credit.</p>	<ul style="list-style-type: none"> a) <i>Seed prices</i> – high price could limit farm family from accessing quantity of seed they need. b) <i>Disposable assets</i> – this may include livestock, harvest from annual and perennial crops that the famers may derive income from c) <i>Social capital</i> - ability to borrow; receive gift and remittances from other members of the society. d) <i>Access to credit</i> – presence of financial services could enable farm households access credit.
Seed quality	Capacity of the seed to establish good crop under normal growing conditions. Seed quality includes a number of seed attributes or indicators	<ul style="list-style-type: none"> a) <i>Germination</i> – ability of seed to sprout and grow into a normal seedling within a specified duration. b) <i>Analytical purity</i>: – the extent to which a given seed lot has other crop seeds, weed seeds, broken seed, and the inert matters. c) <i>Varietal purity</i>: – the extent to which a given variety is mixed with other varieties of the same crop. This may or may not be of concern to famers. d) <i>Seed health (Phyosanitary)</i>: – the extent to which a given seed lot or source has pests and/or seed borne diseases.
Varietal suitability	The extent to which crop varieties are adapted to local farming conditions (soils, rainfall condition) and practices (intercropping), as well as preferred (end use) by the farmers	<ul style="list-style-type: none"> a) <i>Adaptability</i>: – performance (growth & yields) of given variety within a range of agro - ecological zones. b) <i>Preference</i>: – meeting end-users needs (e.g. food, fodder, feed, value addition, market etc.) of the famers

Source: FAO (2015)

3.0 METHODOLOGY

The SSSA involves collection and analysis of data that could provide a better understanding of the seed system security situation at national, state and/or community level. At the same time SSSA would give possible options for seed interventions aimed at supporting the development of the seed sector and seed insecure households/communities at state or community level. A participatory data collection methodology and triangulation of information from various sources were used in order to ascertain the validity of the data and information collected. In order to provide practical recommendations for short, medium- and long-term interventions by key stakeholders, rigorous data analysis and interpretation of the findings was employed.

3.1 Sources of Data

At the National level, the Department of Research within the Ministry of Agriculture and Food Security (MAFS) and Alliance for a Green Revolution in Africa (AGRA) were considered key players within the formal seed sector. At state levels, the State Ministry of Agriculture (SMoA), County Agricultural Departments (CADs), offices of the Relief and Rehabilitation Commission (RRC) and the Seed Companies were the major sources of information. At the community level, members of farming community, seed traders and producers provided additional layers of information.

3.2 SSSA Training

In preparation for data collection, FAO conducted a five-day training of trainers (ToT) in Juba from 10 to 15 October 2018. The training was attended by 41 participants from national and state ministries (MAFS and SMoA), national and international non-governmental organizations (CAD, NPA, MAFS, FAO, JAM, RuCAP, VSF-G, WV, UMCOR, SC, WCDO, IRC, CRS, Cordaid, AVSI and ACTED). The training focused on creating better understanding of seed systems; seed security interventions; seed security conceptual framework (SSCF) elements and indicators; SSSA tools and how to administer them; pretesting of the tools and conducting fieldwork; and data analysis and reporting techniques.

3.3 SSSA Tools

The tools developed for the SSSA data collection were adapted based on FAO Practitioner's Guide for Seed Security Assessment (2016), and were grouped into five broad categories: a) Key Informant guide, b) seed trader guide for local market and

agro-input dealers, c) seed producer guide and d) Focus Group Discussion (FGD) guide, and d) household questionnaire. In addition, the team were required to make observations across broad range of issues as well as obtained secondary data from related crop/seed documents.

- a) *Key Informants Interview (KII) guide*: This targeted officials/experts from relevant organizations/institutions individually or in small groups (2 to 3 individuals). It provided contextual information – mostly qualitative but with some limited quantitative primary data. At the national level, the major focus was on a general overview of the crises, seed policy and guideline issues, and measures to address seed related problems. At state and county levels, the major focus was on: the farming and seed system; seed requirements and supply; crop production/ performance and the implications for seed security; and possible ways of addressing any seed insecurity problem. In addition, where applicable, secondary data relevant to the scope of the assessment were collected.
- b) *Seed Trader Interview Guide (STIG)*: Local markets and agro-input dealers (Ag-I-D) are potential sources of seed to farm households/communities across Africa. This tool was used to gather information on the various aspects of seed security: seed availability by crop and variety; seed sources, prices, quality and suitability of varieties available from these sources including use of improve new varieties. It also looked at some of the practices carried out by grain traders in regard to grain/seed quality.
- c) *Seed Producers Interview guide (SPIG)*: this tool helped in creating an understanding of seed production activities, types and volume of seed being produced by the various individuals, groups and/or seed companies in South Sudan. It also examined challenges and opportunities for improving seed production.
- d) *Focus Group Discussion (FGD) guide*: This tool was used at the payam/boma level. In each of the FGDs, between 8 to 20 farmers (males & females) participated in discussing seed security related issues such as the major crops and varieties grown in their area, average area cultivated per household, seed rates, and yields; seed sources/channels and tried to identify issues linked to seed availability, access, quality and varietal suitability for the major crops. The participants also discussed seed security related challenges and suggested ways how the community can address seed insecurity issues. This provided useful insights into the seed security situation at the community level.
- e) *Household survey questionnaire*: This was used to gather large volume of data from farm households. It examines the socio-economic and demographic characteristics that influence seed security, the cropping practices, seed sourcing

and elements of seed security, seed aids, use of other agricultural inputs and capacity building at farm levels.

- f) *Field observations*: in order to validate some of the information on crops performance and seed quality, and more specifically to check if the harvest in the previous year can be used as seed, the assessment team members made visits to various crop fields including cassava fields, and assessed the storage conditions and physical quality of seed with the seed traders.

3.4 Review of plant breeding and seed production activities

To have a better understanding of the formal seed sector in South Sudan, a consultant was hired by FAO to review organizational and operational arrangement, activities and achievements within the formal seed sector since 2011. The focus of the review was centered around plant breeding activities, seed production, processing and marketing. In addition, the review also examined the status of seed policy and legal framework for seed sector development.

3.5 SSA site selection and data collection

The assessment was conducted across the 10 former states, covering 29 counties (2-3 per state) and 67 Payams (2-3 per county). The counties were purposively selected to ensure good representation of major livelihood zones/agro-ecological zones (AEZ) within the states, while the Payams were selected in consultation with county agriculture departments (CADs) in consideration of accessibility and security. Overall there were 13 sites purposively selected to represent the livelihood zone and states, and 12 NGOs, 9 SMoA/CAD and FAO participated in field data collection across these sites (Table 3.1; Fig. 3.1). At each administrative level (state, county or payam), relevant SSA tools were used to collect primary and secondary data/information.

Table 3.1. Organizations that participated in data collection across the former ten states

Sate	Site #	County	Partners
CES	1	Juba, Lainya, Yei	UMCOR and SMoA/CAD
EES	2	Budi, Magwi and Torit	AH, AVSI, FAO, GA & SMoA
	3	Kapoeta East	CODAID and CAD
Jonglei	4	Bor, Duk and Twic East	CRS and FAO
	5	Akobo	SCI and AMoA/CAD
Lakes	6	Rubek East and Yirol East	FAO and SMoA/CAD
NBEG	7	Aweil Centre and Aweil East	FAO, JAM, WVI, SCI and SMoA
Unity	8	Panyijar	IRC and SMoA/CAD
	9	Ulang	FAO and SMoA/CAD

Sate	Site #	County	Partners
Upper Nile	10	Panyikang	RUCAP and SMoA/CAD
	11	Melut and Renk	FAO, WVI and SMoA
Warrap	12	Gogrial East, Tonj North	WVI, FAO, VSF-G and SMoA/CAD
	7	Twic	FAO, JAM, SMoA and SCI
WBEG	11	Jur River & Wau	FAO, CWDO and SMoA/CAD
WES	12	Ezo, Nzara and Yambio	FAO, STO and SMoA/CAD
	13	Mundri East and Mvolo	NPA and SMoA/CAD

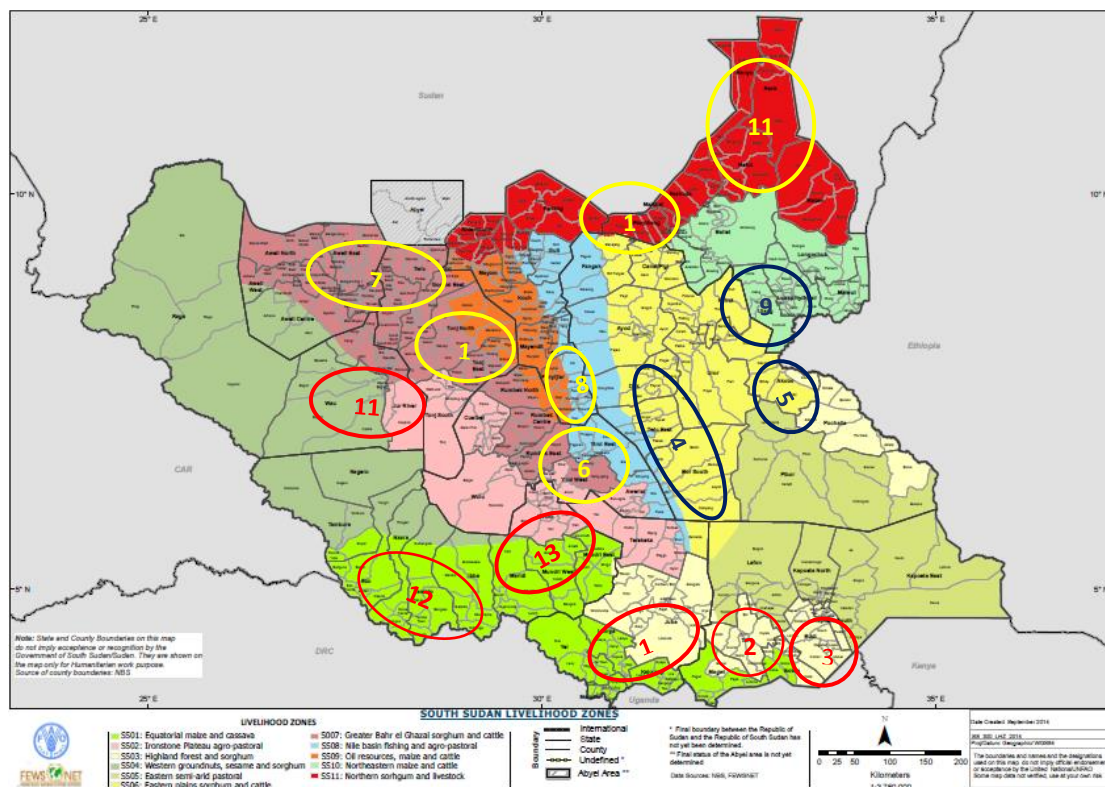


Fig. 3.1. Map showing field assessment sites

Overall, 1 424 of farmers and 60 key informants were interviewed at national, state, county and payam Levels. The key informants comprised of officials from the Government ministries and commissions and NGOs/CBOs. In addition, 36 local grain/seed markets, 8 agro-input dealers and 28 seed growers were interviewed. The sub-teams also conducted 64 FGDs across the assessment zones (Table 3.2). The assessment site-teams also collected secondary data at various levels for further review and triangulation with the primary data. This included seed related regulations and guidelines, recent Crop and Food Security Assessment Mission (CFSAM) reports, and information on seed production/stocks from the seed producers.

Table 3.2 SSSA Sample size across state, county and Livelihood Zone (LZ)

State	Counties	LZ	Payams	HH	KII	FGD	SP	LM	AgID
CES	Juba	SS03	1	50	2	2	0	1	2
	Lainya	SS01	1	50	2	2	0	0	0
	Yei	SS01	1	50	2	2	1	1	0
	Sub-total		3	150	6	6	1	2	2
EES	Budi	SS03	2	50	2	2	1	1	0
	Kapoeta South	SS03	2	50	2	2	0	2	0
	Magwi	SS01	2	50	2	4	1	1	1
	Torit	SS03	2	50	2	4	2	1	2
	Sub-total		8	200	8	12	4	5	3
Jonglei	Akobo	SS06	3	25	1	3	1	1	0
	Bor	SS06	2	50	1	2	2	2	0
	Duk	SS06	4	50	2	2	2	0	0
	Twic East	SS06	2	50	2	2	2	0	0
	Sub-total		11	175	6	9	7	3	0
Lakes	Rumbek East	SS07	5	50	2	2	0	1	0
	Yirol east	SS08	2	50	1	2	0	1	0
	Sub-total		7	100	3	4	0	2	0
NBELG	Aweil Centre	SS07	2	50	2	2	5	2	0
	Aweil East	SS07	3	50	2	2	5	2	0
	Sub-total		5	100	4	4	10	4	0
Unity	Payinjar	SS08/9	4	100	4	4	0	2	0
Upper Nile	Melut	SS11	1	24	2	4	0	2	0
	Panyikang	SS11	1	50	2	2	0	1	0
	Renk	SS11	2	55	2	2	0	2	0
	Ulang	SS10	2	50	3	4	0	0	0
	Sub-total		6	179	9	12	0	5	0
Warrap	Gogrial East	SS07	2	50	2	2	0	3	0
	Tonj North	SS07/9	2	50	3	2	0	2	0
	Twic	SS07	2	50	2	2	4	2	0
	Sub-total		6	150	7	6	4	7	0
WBELG	Jur River	SS02	3	72	2	2	0	2	0
	Wau	SS04	3	48	2	2	0	2	0
	Sub-total		6	120	4	4	0	4	0
WES	Ezo	SS01	2	30	3	2	0	0	0
	Mvolo	SS02	4	50	2	2	0	2	0
	Nzara	SS01	2	30	2	2	0	0	0
	Yambio	SS01	3	40	2	2	2	0	3
	Sub-total		11	150	9	8	2	2	3
	Grand Total	10	67	1424	60	69	28	36	8

3.6 Data Analysis

Analysis of the SSSA findings starts from the field. The site-teams analyzed and summarized their findings from various sources of information, and provided qualitative narratives with some minimum quantitative information. The central focus of the analysis was based on SSCF elements and indicators. The qualitative data analysis included identifying recurrent or common observations, concepts, ideas, and issues relating to the cropping and seed system as well as the elements and indicators of seed security. The information was triangulated from various sources to validate the consistency of the data. The findings and observations were discussed, and logical interpretations provided by assessment site-teams, and the key findings presented in two-day validation workshops attended by at least 2 participants from each of the site-team. During the validation workshop, members from other teams posed questions, sought clarifications and provided additional insights into the findings, and these shaped the specific team site reports.

The quantitative data collected from the primary and secondary sources, statistical summaries such as percentages, sums and tables were used to provide insight into the descriptive statistics. A large volume of data from household questionnaire was analyzed using Pivot Tables, an analytical tool with the Microsoft Excel.

This full report was produced after reviewing and analyzing the various reports presented by the sub teams and reports generated by consultants who carried background reviews and seed enterprise profitability analysis.

3.7 Limitations of the Assessment

Of the 11-targeted livelihood zones (LZ), SS05 (Eastern semi-arid pastoral) was not covered. One of the identified sites, Pochala was not covered due to logistical challenges and insecurity. The sampling methodology did not purposively target vulnerable groups such as the Internally Displaced Persons (IDPs) and/or Returnees and/or Refugees as well as mobile agro-pastoralist who were not taken care of during sampling.

4.0 OVERVIEW OF FORMAL SEED SYSTEMS (2011 TO 2018)

4.1 Introduction

The origin of most crop varieties used in the formal seed sector is from agricultural research, with plant breeding being the core activity. Plant breeding is the art and science of plant improvement. It is an art of ‘doing’ and science of ‘knowing’. Plant breeding is done by people who have actively studied or are researching the underlying biological mechanisms involved in plant improvement. The art and science of plant breeding bring together the application and educational and research aspects of this important activity (Lamkey, 2003).

Plant breeding in South Sudan dates back to the 1930s when the country was still part of Sudan. The initial plant breeding activities included germplasm collection (Tothill, 1948; ODA, 1954), with introduction and pre-varietal trails in the 1970s with the main research center being Yambio Agricultural Research Station.

Between 1970 and 2010, research work can be accredited to the work of the Project Development Unit (PDU) and the Norwegian Church Aid Sudan Program (NCASP). PDU established an agronomy section in 1974 in Yei, carried out food crop trials, and developed district testing sites throughout Eastern quatoria (Jebel Lado, Kajokeji and Torit), Western Equatoria (Maridi, Mundri and Yambio), and Lakes (Rumbek). In addition, the NCASP through its Norwegian Church Aid Rural Development Centers (RDCs), established crop trials at Loa, Palotaka, Hilliu, Lafon, Chukudum and Kapoeta. The 2010 Seed System Security Assessment (SSSA) documented a comprehensive list of improved and local varieties in South Sudan.

4.2 Recent Plant Breeding Activities

The recent plant breeding program has been based on the initial Southern Sudan Research and Technology Organization (SSARTO) strategic plan (2007 to 2011) which was updated into the Research Strategic Plan 2012 to 2017. These documents were developed out of wider stakeholder consultation, which identified key research areas, potential sources of new varieties from the neighbouring countries and research institutions in order to address local demand for food security.

The Directorate of Research within the Ministry of Agriculture and Food Security (MAFS) is the main institution responsible for implementing plant breeding activities in the country. Though the Directorate of Research within the MAFS is the main body responsible for plant breeding, it collaborates with other institutions such as the

University of Juba (UOJ) and organizations such as WVI and FAO in conducting adaptation trials.

There are three main research stations in the country based on agro-ecological zones:- Halima, Yei and Palotaka in the former states of Western Bahr El Ghazal (WBEG), Central Equatoria and Eastern Equatoria, respectively.

- i. *Yei Research Centre:* This station is designated as the Nation Seed Laboratory Centre taking advantage of the laboratory constructed and equipped by FAO in 2008. It also has residential and office block building put in place by United States Agency for International Development (USAID). The station is temporarily serving as Research Station for the Green Belt Agro-Ecological Zone (AEZ) until the fate of Yambio Research Station is determined. Yambio Research Station ceased working with the advent of 1983 civil conflict, and was never revived even after the signing of the Comprehensive Peace Agreement (CPA) in 2005.

Yei Research station specializes in maize, upland rice, beans, cassava, and sweet potato research activities. The station is within the vicinity of Yei town, and there has been massive encroachment into the research land by the local authorities turning them into residential plots. Currently, Yei State authority is occupying most of the buildings as most staff deserted the station due to the war.

- ii. *Palotaka Basic Seed Centre:* This station is designated as the Basic Seeds Center for the Greater Equatoria region. The center has three newly constructed staff residential houses, a guest house, a functional seeds processing unit and storage facility. There was arrangement to put in place for cold storage facility and irrigation system, which are mandatory for efficient foundation/basic seeds maintenance, but this was interrupted by war. Limited production of maize, cassava, sorghum and beans foundation seed took place at the station before 2013. All the buildings and equipment (tractors, generator, seed processor) are still in good condition.
- iii. *Halima Research Centre:* This station caters for the Iron Stone Plateau Agro-ecological zone and related crops (groundnuts, sorghum and sesame). It also serves as the Basic Seeds Center (BSC) for Greater Bahr el Ghazal as well as the National Soil Testing laboratory. Research work that took place at this station before the 2013 war included sorghum and groundnut variety trials. The station also has a seed testing laboratory (incomplete), office block, residential houses and a guest house that are in sorry states and need facelift.

Currently, plant breeding activities are limited to introduction and on-station/on-farm testing of some varieties that have either been released in the neighbouring countries and/or those from International Agricultural Research Centres (IARCs) that are in advanced stages.

Although the research activities in the main institutions and organizations such as FAO, World Vision International (WVI) and Solidarity International have also been active in introducing and testing varieties from IARCs. WVI in collaboration with Directorate of Research are conducting adaptive trails of advanced lines from IARCs.

4.2.1 Plant breeding efforts

The rationalized and harmonized protocols and procedures for variety evaluation, release and registration in East and Central Africa (ECA) provides for varieties to be validated for two seasons in the National Performance Trials (NPT) before the variety is released by the National Variety Release Committee (NVRC) and/or listed in the national variety catalogue (Waithaka *et al.*, 2011). Under the harmonization agreements, if a variety has already been released in another ECA member country it is tested for only one season if combined with sufficient data on previous testing from similar agro-ecological zones. The agreement further stipulates participation of the private sector in NPTs, concurrent on-farm trials where these are mandatory and standardization in the number, function and composition of members to the National Variety Release Committee (NVRC). This provided opportunity for South Sudan to benefit from the work done by National Research Systems (NARS) of ECA member countries (Uganda, Kenya, Ethiopia, and Sudan) as well as have access to germplasm from the International Agricultural Research Centres (IARCs).

Currently there is minimum ongoing research activity in the country. This could be attributed to factors such as the economic crisis, insecurities due to the 2013 and 2016 war, shortage of personnel and limited research funding. Amidst all these challenges, AGRA has supported the establishment of at least eight crop improvement programs (Maize, Sorghum, Cassava, Rice, Groundnut, Bean Cowpea and Sesame that was recently established). The major focus of the breeding programs is to encourage the quick release of adaptable, farmer preferred, disease resistant and high yielding varieties through accelerated efforts of participatory testing of some of the varieties released by the NARS of the neighbouring countries and those from IARCs that are in advanced stages. The breeding programs also manage variety maintenance, multiplication of early generation seed, variety promotion through various approaches including demonstration and support variety commercialization through strong linkages with local seed companies, agro dealership and community seed producers. Between 2011 and 2018 over 30 varieties (Annex 3) have been released by the National Variety

Release Committee (NVRC) through AGRA support. A number of varieties before 2011 are listed in Annex 4.

The Cereal Research Program: Between 2011 and 2018, the research released five varieties of sorghum, six maize hybrids and two Open Pollinated Varieties (OPV), three upland and two lowland rice varieties.

- i. *Sorghum:* varieties of sorghum that have been released in the recent past (from 2011 onwards) include Macia, Kari Matama 1, Sesso 1, 2 & 3. An old variety of sorghum that is still popular is Gadam el Hamam.

WVI has been working closely with the Directorate of Research and the International Crop Research Institutes for Semi-Arid Tropics (ICRISAT) using adaptive trials approach to introduce and evaluate over 49 local and international varieties of sorghum. The trials were planted at three sites in Rajaf in Central Equatoria, Warrap and Upper Nile state (Fig. 4.1) areas in May–July 2018. Only OPVs were included in the trials as the farming system and services available are not suited for hybrid varieties.

From the trials, sorghum varieties such as KAT 487, IESV91104DL, IESV92063DL, IESV92038/3SH, IESV92038DL Sel 1, IESV92174DL, IESV91131DL were selected by farmers as good performing varieties. The farmers recorded them with common characteristics such as very strong stand ability and medium height, high yield potential and large heads. Discussion with the Director of Research point to the need for further evaluation of these varieties, preferably through adaptation trials.

It is important to note that some of the most recently introduced varieties of sorghum such as Macia, have started degenerating, as there is no replacement of parent lines nor its maintenance in South Sudan.

South Sudan has one of the largest biodiversity of sorghum landraces (e.g. Mukwa, Nadok, Kabir, Macika, Labalua, Werekasi, Malual and Nyarango) that have stood the test of time, particularly in the Greater Bahr el Ghazal and Upper Nile Regions. The introduced early maturing, high yielding sorghum varieties are considered more susceptible to bird by farmers, but are preferably grown 2-3 months before the rains stop and can be deliberately planted not to coincide with the bird nesting season. These varieties are better suited for areas with short/less rains. It has to be pointed out that, they have less biomass from stalk compared to some long maturing local varieties for which the stalks are used as livestock feed, fuel and/or construction materials.



Fig. 4.1 a) Sorghum adaptive trials by WVI



Fig. 4.1 b) Pearl millet adaptive trials by WVI

Similar approach was used by WVI to introduce orange-flesh sweet potato and pearl millet varieties with relatively high vitamin A and mineral content, to address nutritional deficiencies.

- ii. *Maize*: The released maize varieties include both hybrids {KH500-46A, KH500-22A, PALMHY – 1, PALMHY – 2, GRENNGOLD (SC0923), MAXIM (SC719), Longe 6H and Longe 10H} and OPV (M45, and KDV4). Most of these varieties are still on the shelf of the research stations in spite of their high potentials relative to earlier released varieties. This task is to be undertaken by researchers, seed companies and other development partners. Longe 5 still remains the most popular maize varieties across locations where improved varieties are being cultivated. Some other old varieties of maize (Katumani, TZB and Western Yellow maize, 5DX, 9DX, 9DX7/11) have degenerated, and some are no longer in certain locations where they were previously being cultivated.

- iii. *Rice*: The upland varieties, NERICA 1, 4 and 10 have been performing well in Yei in particular as the seed companies and NGOs have been promoting them there and in Bahr el Ghazal. Unfortunately livestock prefer them to grasses and therefore need protection through fencing of the farms In 2018, Upon request from the State Ministry of Agriculture and Forestry (SMoAF) introduced a lowland variety (*Wita 9*) Aweil irrigated rice scheme. The variety matures faster than the old varieties being grown there, with less requirement for water. The farmers there are yet to come to terms with its appropriate agronomic practices within their farming cycle.

The Root Crop Research Program: Cassava and sweet potatoes are important root crops in the Greater Equatoria Region. They are major food security crops that bridge the “hunger gaps” during the months of May-June. Work by CRS and other humanitarian organizations in the early 2000s introduced about 11 varieties of improved cassava from International Institute of Tropical Agriculture (IITA) and 20 entries of sweet potato from International Potato Centre (CIP). About 3-5 of these varieties are still being cultivated by farmers in the Equatoria region.

- i. *Cassava*: In the recent years (2011-2014), five cassava varieties (NASE 14, NASE 15, PAYE 1, 2 &3) have been released. Most of the improved varieties that have been introduced are the sweet cooking types with high dry matter, yields and resistance to Cassava Mosaic Disease (CMD) and Cassava Brown Streak Disease (CBSD), and shorter maturity period. The traditional local varieties to co-exist and predominate the cassava system due to a number of attributes such as good field storability, less susceptibility to wild animals (bitter) and good floor quality.

- ii. *Sweet potato*: between 2011 and 2018 not much research work has been done on sweet potatoes by the Directorate of Research at the MAFS. However, field visits to Yambio revealed introduction by Solidarity International, an NGO running Sustainable Agriculture Project in Remenze. The organization

introduced orange fleshed sweet potatoes varieties from Italy, Vietnam and Tanzania. The Vietnamese variety is already widespread and accepted in their operation areas. In 2018, WVI also introduced a number of orange-flesh sweet potato planting materials under their adaptive trials program. Field mission to one of the sites in Western Equatoria revealed activities of pests in some of the trials. Such ad hoc trials when not carefully handled and monitored are potential source of introduced pests in the area.

Pulses Crop Program: Major pulses include cowpea, beans, green gram and to some extent soybean. Most recent research work on pulses has been mainly on cowpea by the University of Juba (UOJ).

- i. *Cowpea:* In 2016, three cowpea varieties (AGRAC 166, 216 & 316) developed by UOJ were released by the MAFS with some limited efforts to bulk but needs to be scaled up and promoted.
- ii. *Soybean:* Soybean remains a new crop in South Sudan that hardly progressed beyond the research stations, due to limited knowledge of its value chains, or of processing for home consumption; cooking it like beans, cowpeas and pigeon peas would leave it hard and less acceptable. It is locally consumed mainly in roasted form. In 2012, the MAFS released four soybean varieties (Maksay 1, 2, 3 & 4), but these have all remained on the shelf.
- iii. *Beans:* In the recent past, there is no formally released variety of beans. The improved bean varieties (K132, Rococco) being cultivated, mostly in the Equatoria region of South Sudan were introduced by either relief organizations, traders or returnees from neighboring countries (Uganda – K132 and Kenya - Rococco). No clear information exists on the performance of these varieties for any of the agro-ecological zones of South Sudan. The bean breeding program through the support of AGRA is in the process of releasing at least 3 bean varieties by 2019. The variety release report will provide information on the performance of other tested varieties.
- iv. *Green grams:* This an important crop grown in Mundri and Mvolo in Western Equatoria as well as in Lakes state. There is no evidence of any breeding activity on this crop in the recent past.

The Oil Seed Crops program: Two major oil seed crops are groundnut and sesame, but there is potential for sunflower as well. Groundnut and sesame are widely cultivated across most of the livelihood zones, but do much better in the green belt, ironstone plateau and hills and mountains. Most research work oil seed crops is being conducted by the Directorate of Research, MAFS.

- i. *Groundnut:* In 2018 the ministry released three groundnut varieties (YEPA 1, 2 & 3). They are considered early maturing, higher yielding and easier to shell

than the commonly grown Red Beauty and Berbeti varieties. Other attributes include high oil content, resistance to Groundnut Rosette Disease (GRD) and drought tolerance. These varieties are being cultivated on a very limited scale that need concerted efforts from key stakeholders to ensure that farmers are exposed them. Earlier introduced varieties of groundnut include Mahulu Red, Atizo, Red Beauty, Igola, Serenut1&2 and Manipinta. These varieties are being maintained and cultivated by farmers in pockets of locations.

- ii. *Sesame*: There is not any recently released sesame variety, and very limited breeding activity on this crop. Popular improved varieties being distributed and cultivated is Sesame 1&2, varieties developed by the National Agriculture Research Organization (NARO) of Uganda.
- iii. *Sunflower*: No on-going research work on sunflower as far as introduction and/or testing of new varieties. There is perception that the value chain (oil extraction) for sunflower goes beyond capacity of the local communities, and yet the per capita consumption of cooking oil in South Sudan is relatively high. Given the market segment for cooking oil, and favourable soils and weather for sunflower production in the country, sunflower production and value remains untapped opportunities in the advent of peace and in the nearby future.

Conclusion: Plant breeding in South Sudan is still at a very infant stage which need a lot of support from development partners in order to upscale its profile. Despite all the challenges, the research is making headway by releasing improved varieties that could significantly contribute to improving production and productivity, and subsequently food and nutrition security. However, most of these varieties have remained on the shelf of research, and there remains a need for concerted efforts to introduce and promote them among farm households. Therefore, more on-farm trials and demonstrations are needed to popularize them among farm households.

4.1.2 Collections and characterization of sorghum germplasm

Germplasm collection and characterization forms the foundation of any successful breeding program and ought to be taken seriously. However, in South Sudan very limited work is being undertaken on few crops. The most recent germplasm collection, characterization and conservation efforts have been conducted by the MAFS and ICRISAT.

Collection of sorghum germplasm: In 2013, MAFS in collaboration with ICRISAT collected 68 entries of local sorghum from Equatoria region, and added more 36 from Eastern Equatoria, Greater and Jonglei States in 2016. The low number of entries collected in 2016 was partly attributed to insecurities. Local collection, conservation

and promotion of local germplasm of maize, bambara nuts, and cowpeas is being carried by some organizations such as the Solidary International.

Characterization of sorghum germplasms: The collected sorghum germplasm were sent The Bioscience Eastern and Central Africa (BECA) based at the International Livestock Research Institute (ILRI) - Kenya for characterization. One staff from the MAFS was sent there for a three months training in 2015. He was supported to analyze the materials collected from Greater Equatoria in 2013 against ICRISAT collections. The objective of this analysis was to establish the level of genetic diversity within the locally grown sorghum landraces in the Greater Equatoria. Identify the pattern of genetic diversity in relation to South Sudan's accessions and global collection (ICRISAT gene bank). These accessions therefore provide a better understanding of the genetic base, and opportunity for future sorghum improvement program.

4.1.3 Capacity for plant breeding research

Human capacity: In the recent past, and with support from various donors, the department of research has been building a pool of researchers to support various breeding programs. Within the cereal program, there are two principal breeders with a research assistant and one maize breeder with an assistant. The oil seed crops and pulse program, there one breeder for each of the following crops – groundnut, sesame, cowpea and beans. Root crops has two breeders, one for cassava and another for sweet potato. To support the breeders, the department has two socio-economists and depends on the service of two entomologists and one pathologist from the University of Juba. The department of research lacks a virologist, and there are hardly any well trained laboratory technicians (micro-biologist, pathologist, virologist, soil analyst, food analyst etc.)

Facilities, infrastructure and equipment. Though the Directorate of Research has some researchers to begin with, the research lacks proper facilities and infrastructures. There are no well-equipped laboratories for conducting the required research – the seed lab in Yei is currently not functional, the soil lab in Halima/Wau is not set up, nor any virology, pathology and/or entomology laboratory in the country.

4.1.4 Crop variety promotion

Promotion of varieties goes beyond research work and requires collaborative efforts between research-extension and development partners such as donors, public institutions, NGO and private sectors (seed companies). A very limited range of improved varieties are in use and are mostly channeled through the seed aid and/or resilience building program on community-based seed/crop production (Table 4.1). The seed companies have not been adequately active in promoting potential varieties

in their area due to the war and limited access to some locations within South Sudan. Furthermore, the national extension services, which ought to promote such varieties is not functional. FAO and NGOs have significantly contributed to promotion of such varieties.

Table 4.1. Common varieties provided by humanitarian organizations

Crop	Variety	Origin	Year introduced	Year released
Maize	Longe 5	NaCRRI-Uganda	2002	
Sorghum	Sesso 3	NaSARRI Uganda		2011
	Gadam El Hamam	ARC - Sudan	2002	
	Wad Ahmed	ARC - Sudan		
Sesame	Sesame 2	NaSARRI-Uganda	2003	
	Sesame 1	NaSARRI-Uganda	2003	
Cowpea	Secow 2WT	NaSARRI-Uganda		
	Secow 1T	NaSARRI-Uganda		
Groundnut	Serenut 4	NaSARRI-Uganda	2000	
	Serent 6	NaSARRI-Uganda		
Cassava	TME 12	IITA-Uganda	2000	
	NASE 14	NaCRRI-Uganda	2000	2011
Rice	Wita 9	NaCRRI - Uganda	2018	

Ideally, the seed companies should compete on quality, selection of varieties, and price. The researchers are to maintain foundation seeds on demand by specific seed companies. For planting materials such as cassava and sweet potatoes, the bulkiness, high perishability and low demand make them less attractive to most seed companies. In most East and Central Africa (ECA) member countries, government institutions (research, prison farms), FAO and NGOs have been taking lead in promoting sustainable business models. In South Sudan, FAO and NGOs have been at forefront in promoting spread of cassava and sweet potato varieties through the community-based seed multiplication and supply approach. Attempt are being made to introduce and promote these crops in new areas like Bahr el Ghazal and Upper Nile. However, high livestock population that graze on planting materials and the recurrent and seasonal flooding in flood plains are the key limiting factors to spread and production of root crops in the area.

4.1.5 Challenges to plant breeding research

- i. *Limited funding:* With current economic crisis, and donor reluctance to directly fund government programs, the Directorate of Research is no exception. Most researchers are confined to their offices due to lack of funds to facilitate field based research work.

- ii. *Lack of ownership of released varieties:* Most varieties of maize and sorghum released in South Sudan were developed by research institutions from Kenya and Uganda, and full ownership of the parent materials are still with these countries.
- iii. *Poor access to foundation seed:* linked to ownership of released varieties, getting the parent materials or first-generation foundation seed is a big challenge to those interested in multiplying the materials. Attempts have been made by the Directorate Research to directly obtain foundation seed from sister institutions in the neighboring countries to be multiplied at Palotaka basic seed center. This access to foundation seed has been based on personal connection between the researchers, and yet the little that was provided did not make any significant impact in terms of volume produced and access by the seed companies.
- iv. *Understaffing and limited capacity:* the Directorate of research is still understaffed with low number of senior researchers and young graduates that need time to develop and perfect their research skills.
- v. *Limited facilities for research:* although there are three main research stations, most of these stations lack basic equipment, tools and laboratory facilities for research.

4.1.6 Opportunity for improving crop variety release and promotion Methods

Crop variety release process and promotion has improved in the last decade, and the efforts should be encouraged in South Sudan to fit in the Regional and International Plant Breeding communities.

- a) *Value for Cultivation and Use (VCU)/National Performance Test (NPT):* VCU trials are to be executed for all agricultural crops submitted for release and registration. It increases cost-effectiveness in agriculture by determining (i) crop adaptability to test environments, (ii) validates the crop performance for the purposes of release and commercialization.

VCU should be conducted by an independent institution (University/ Crop protection & Agronomy Units of MAFS) in at least three locations for only one year to confirm the yield performance of the candidate varieties for registration. A variety possesses a **sufficient Value for Cultivation and Use** when it shows a significant improvement over an existing variety (variety commonly grown in the area) in terms of cultivation or a high value of the harvest (yield), or the products that are obtained. A lower score for a specific characteristic (for

instance yield) can be compensated by specific positive properties such as a disease resistance.

- b) *Distinctness, Uniformity and Stability (DUS) Test*: The DUS is conducted for one year/ location to generate a description of the variety, using its relevant characteristics (e.g. plant height, leaf shape, time of flowering). Its specific objectives are to (i) establish variety identity, (ii) generate descriptor for use in seed certification and variety maintenance, (iii) release of new varieties for commercialization, and (iv) grant of Plant Breeders Rights. DUS Test should be based mainly on growing tests, carried out by (University/ Crop protection and Agronomy Units of MAFS) for granting plant breeders rights. Guidance of UPOV and those used by the neighboring countries (Ethiopia, Uganda, Kenya) for DUS examination may be used. DUS will be done for field crops and some horticultural crops for release and registration in South Sudan.

DUS test for Release of Variety ensures that the released variety is new and improved. Hence, the Variety Release Committee will only consider varieties which have undergone DUS testing within the country. Thereafter, the new variety will then be included in the National Variety Catalog of agricultural, vegetable and fruit plant species whose seed can be legally produced and marketed in South Sudan. Apart from the variety release, DUS testing generates descriptors shall be used for seed certification. Before field inspection commences, the seed company producing or other seed growers including NGOs producing seeds for commercialization must provide proof of origin of the parental materials of the varieties registered for inspection and the descriptors.

- c) *On-farm Trials*: The common method is the mother-and-baby trials, conducted for one year to generate more information under farmer's normal practice to support the release of a new variety and encourage its adoption. It is concerned primarily with experiments where the farmer has considerable involvement including decision making about the candidate variety. On-farm trial includes any experiments that farmers conduct to test new products, technologies, and management practices prior to wide-scale adoption on their farm. Farmers generally conduct on-farm trials in collaboration with researchers, local agronomists or crop consultants, extension agencies and NGOs.

On-farm testing networks offer new ways to bring together science, technology, and a farmers' own personal knowledge, ideas, and experiences. These networks help to enhance the understanding of how and where farm management improvements are possible. This brings researchers and farmers to work together, often with extension staff and NGOs.

In the design of On-farm trial, the control is mostly the farmer's normal practice or variety that should be compared with the new varieties (a minimum of two and maximum of five against which other varieties are compared). Inclusion of many treatments/ varieties in an On-farm trial usually confuses the farmer and implies complexity of the design, which may lead to partial failure of the trial. It is assumed that the plot size should be larger for on-farm trial (20m x 20m or 10m x 20m per variety) than for on-station trial. There are two types of data collected from On-farm trials:

- i. Measurement of performance (adaptability) - time of flowering, disease scores, yield components etc.; and
 - ii. Measurements of the farmer's opinion (preferences) based on informal discussions or from questionnaires.
- d) *Demonstration Test*: Choice of variety is critical to farmers when selecting the right implement to work the field. Demonstrations are used to promote released varieties for possible adoption by farmers. The main objective of demonstration test is to showcase performance, adoptability and profitability of different technologies/ newly released variety under farmer's management practices. It involves giving at least two different new varieties to a farmer to plant along his best (variety commonly grown in the area) for comparison. The common methods include seed-drop combined with monitoring visit and learning.

4.2 Seeds Production and Supply

The seed production and supply in South Sudan could be loosely categorized into two:- the formal and semi-formal. The former focuses at producing certified seed at national level while the later at producing and supplying Quality Declared seed (QDS) at community level. The semi-formal has the potential to evolve into the formal seed sector.

4.2.1 Community-based seed production initiatives

Three Community Based Market (COBAMA) oriented seed centers were established in 2010/11 out of funding from the Embassy of Netherlands based on similar interventions in Ethiopia and Uganda, technically supported by Wageningen University and Research Centre (WUR). These were established in Manga in Yei (CES); Owiny Ki Bul and Lopit (former Eastern Equatoria State). The communities were mobilized, trained and supported to cultivate 50 feddans of seeds; 25 feddans each for maize (Longe 5) and sorghum (Macia). The seeds produced were successfully sold within vicinities of the production areas.

Seed storage facilities with capacity of 100 tons were constructed at each of the stations and installed with water tank, borehole and 30-Watt generators. Mobile seeds processing units were imported for each of the centers. However, for some logistical limitations and war, the units remained in Juba, exposed to rain and sun over the years leading to damages beyond repair.

The Embassy of the Netherlands found it to be not cost effective enough to continue with Wageningen University arrangement and joined hands with the USAID/Howard Buffet to fund the establishment of local seed companies with grants for take-off. The Wageningen University implementing staffs were seasonal consultants with high related costs; transport, per diem, insurances, consultancy and administrative costs.

The Alliance for a Green Revolution in Africa (AGRA) was to implement this project with the COBAMAs eventually becoming seed companies themselves or out growers for the newly established seed companies. Unfortunately, this arrangement has not worked due to insecurities. The facilities are all intact at these localities pending resumption of peace.

FAO and a number of NGOs across the country have been implementing community-based seed production and supply initiatives to increase availability/supply of quality seed of adapted and preferred crop varieties. They use mostly farmer groups and individual progressive farmers, providing them with trainings and inputs required to support production (Fig. 4.2; Box 4.1) and processing of quality seed of crops such as maize, sorghum, rice, beans, cowpea, sesame, cassava and sweet potato.

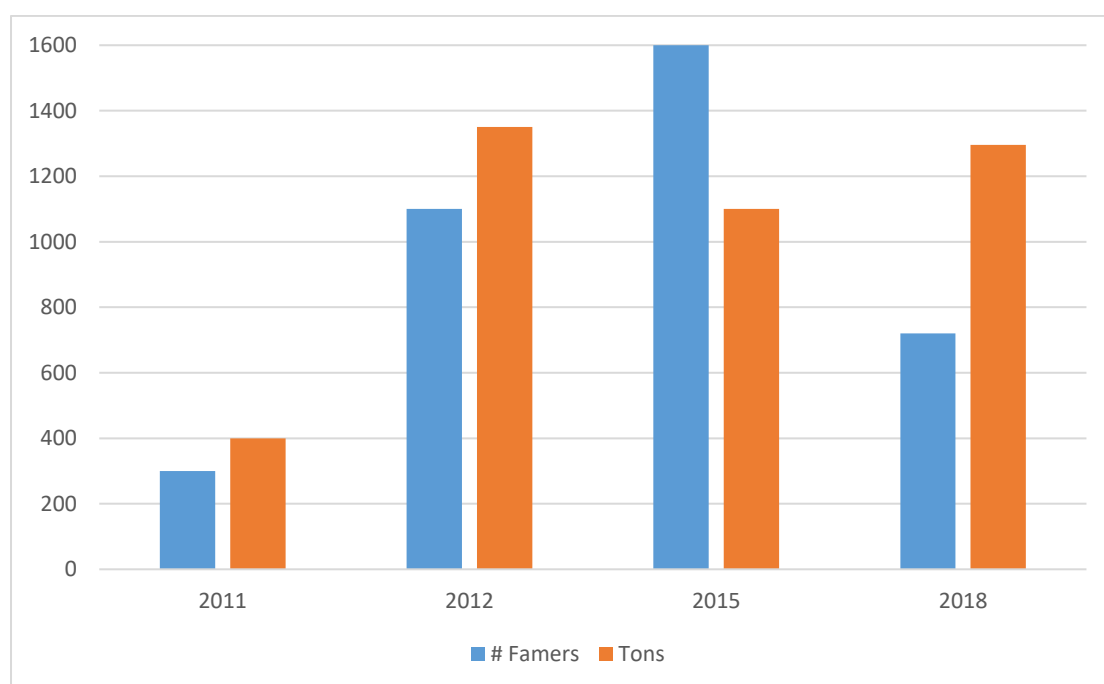


Fig. 4. 2. FAO Supported community-based seed production (Source: FAO projects)

BOX 4.1. Market based seed producer groups – An entry point for improving seed security at community level: - a case of Wuonaheer cooperative in Bor, Jonglei state

Wuonaheer cooperative started in 2016 as a Seed Producer Group with the support from Catholic Relief Services. The group was supported with groundnut seed and tools and agriculture extension services. Comprised of 40 members (25 men & 15 women). The group registered (2017) as a Cooperative with the Ministry of Agriculture, Forestry and Fisheries. The objective of the Cooperative was to produce high value crops through selecting high quality seed and agro-processing part of the crop produce into various products and pursuing collective market linkages with other Agro-dealers.

Members mobilized their resources together and invested in groundnut production. Their shared vision helped them pool together agriculture labour for their groundnut farm, as the crop had a very huge demand in the region. CRS offered them technical support, and in 2017 the group produced **5.15MT** kg of groundnut from 6 feddans and sold **4.15MT** to humanitarian agencies (who needed seed for seed aid) at **2.14 USD** per a kg and they earned a total of **8,881 USD** that year. From these sales they managed to expand their production from 6 feddans to 12 feddans in the 2018 agriculture season, where they managed to harvest 400 bags (20 tons) of unshelled groundnuts. Part of this production was to be processed into various products such as peanut butter for sale, leaving some for sale as seed for the 2019 cropping season.

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Some of the organizations that were working with FAO saw the opportunity of going private (Box 4.2) with seed production when AGRA established their office in Juba with the aim of supporting private seed companies.

Box 4.2: Evolution of Seed Company: Success from community-based production initiatives by FAO

Between 2008 and 2011, FAO promoted a community-based seed production and supply approach across several states in South Sudan. FAO worked closely with a number of NGOs such as Danish Refugee Council (DRC) and Kogbo Multi-Purpose Farmer Groups (KMFG) in Yei, and Agriculture Advisory Organization (AAO) Central Equatoria; Magwi Self Reliance Association (MASRA) and Catholic Diocese of Torit (CDOT) in Magwi County, Eastern Equatoria; ACROSS in Lakes states; and WOTAP in Wau, WBELG state. FAO provided seed production, processing and marketing trainings and various inputs to support community-based seed production to these NGOs and farming groups and individuals under them.

When AGRA came into South Sudan in 2011, the managers of the seed activities from two of the community-based organizations (MASRA and AAO) saw the opportunity of going private in seed production. Mr. Clement Metaloro (RIP) together with his associates in AAO registered the **Generation Seed Co**, turning most of the groups and individuals under the community-based seed production initiative with FAO as their contract growers. Similarly, in Magwi Mr. Cosmas Oryem who was the manager of MASRA, saw the opportunity and team up with others to form Magwi Seed Company Ltd. (MASCO).

In Western Equatoria, The Global Agriculture Innovation System (GAIS) tapped into the initiative by FAO and WVI collaborative efforts in areas such as Gitikiri where FAO constructed a community-based seed store. The company inherited some of the groups and individuals trained by FAO/WVI as the out-growers.

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4.2.2 AGRA and the seed companies in South Sudan

The Alliance for a Green Revolution in Africa (AGRA) was founded in 2006 to trigger a uniquely African Green Revolution by putting smallholder farmers first on the agenda, designing technologies and delivery systems and building capacities at various levels. In 2011, AGRA established its office in South Sudan with the key focus on the formal seed sector – supporting both research and seed production activities (Table 4.2; Fig. 4.2). With funding from donors (USAID, Howard Buffet and the Netherlands) AGRA supported the establishment of a number of seed companies with startup grant, and opportunities for specialized trainings at the Seed Enterprise and Management Institute (SEMI) of University of Nairobi and on the job. This included seeds production, quality control, processing and marketing together with their counterparts from the neighboring countries who successfully compete for exporting seeds to South Sudan, mostly for humanitarian seed distribution by FAO and NGOs.

Table 4.2: Local seed companies in South Sudan

Company	former state	Location	Comment
Green Horizon*	CE	Juba/KK	Active

AFFA*	WE	Maridi	Active
AFFA*	WE	Maridi	Active
Seed grow*	CES	Juba/Magwi	Active
GAIS*	WES	Yambio	Active
GAIS*	Lakes	Rumbek	Active
Pro Enterprises	CES	Aru Junction	Active
Gumbo Glow	CE	Juba-Gumbo	Active
Kerepi*	CE	Bilinyang-Bor Rd	Active
ARUDA*	Lakes	Awerial	Active
SUDDs Enterprises*	UPN	Renk	Active
Afrogarnics*	EE	Torit	Active
South Famers*	CE	Morobo)	Active
Century Seed Co*	CE	Yei	Dormant
Green Belt*	CE	Yei	Dormant
Generation*	CE	Morobo	Dormant

*AGRA-supported Seed Company



Fig. 4.2 States with presence of seed companies in South Sudan

4.2.3 Production by the seed companies

There are about 13 registered seed companies in South Sudan, and most are supported by AGRA with capital grant and technical support. Over the past 8 years, production by seed companies has been taking place mainly in the Equatoria region of South Sudan. The overall production is still below 2 000 ton per year, varying between 500 tons to 2 000 tons (Fig 4.3). The major crops/varieties being produced are maize (Longe 5), sorghum (Sesso 3, Macia), groundnut (Red Beauty, Serenut 4, Serenut 6T), Cowpea (Secow 2WT). The bulk of the crops being produced are maize, contributing to about 66 percent of the total quantity of seed produced by the companies.

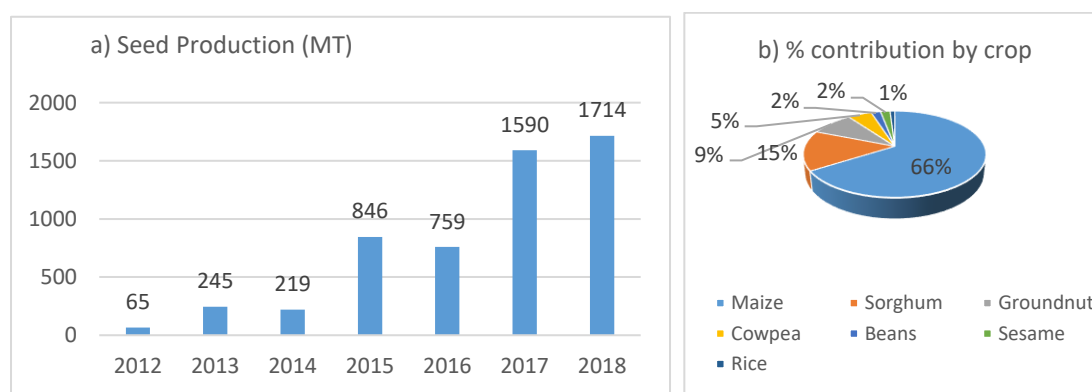


Fig 4.3. Seed Production (MT) by local companies in South Sudan (Source: AGRA)

In 2018, about 1700 tons of assorted crop seed were produced by 10 seed companies, with varying capacity ranging from 14 tons to 400 tons (Fig. 4.4), with about 90 percent of production area planted by the out growers. The number of contracted out growers varies from 35 to 300 farmers per company (Table 4.3), with an average land size of 1.4 *feddan*³ per out grower. The small field size of the out growers presents a challenge in carrying out inspections as well as in aggregating seed lots that are homogeneous.

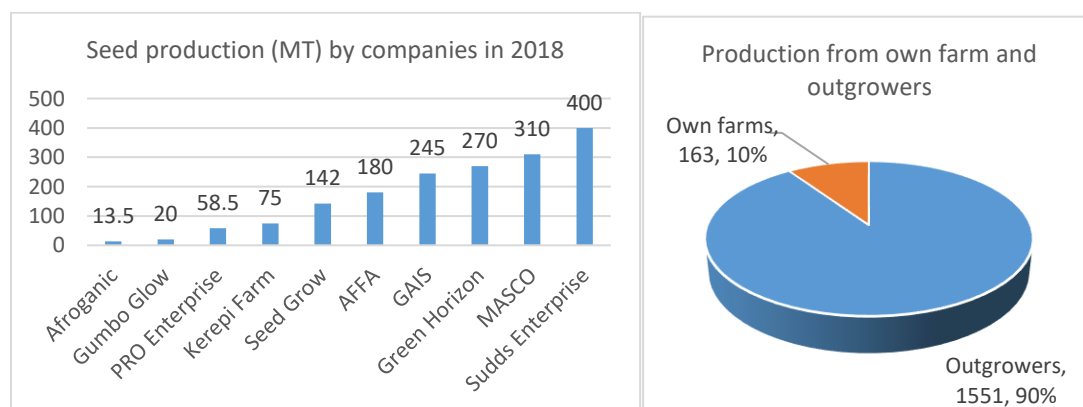


Fig. 4.4. Production by local seed company in 2018 (Source: AGRA)

³ 1 feddan = 4200m²

Table 4.3. South Sudan Seed Company production profiles

S/No.	Company	No. of out growers	Out growers feddan	Own farm (feddan)	Total land (feddan)	2018 (MT)	2017 (MT)
1	Green Horizon	95	118	14	132	270	25
2	MASCO	67	130	35	165	310	254
3	AFFA	85	90	50	140	180	138
4	Seed Grow	89	85	0	85	142	
5	GAIS	120	105	0	105	245	340
6	PRO Enterprise	22	35	12	47	58.5	0
7	Gumbo Glow	0	0	15	15	20	126
8	Kerepi Farm	0	0	50	50	75	0
9	ARUDA	0	0	0	0	0	0
10	Sudds Enterprise	150	300	0	300	400	0
11	Afroganic	0	0	0	0	13.5	0
12	Century Seed	0	0	0	0	0	200
13	South Farmers	0	0	0	0	0	300
	Total	563	863	91	654	1714.0	1383

Data Source: AGRA South Sudan office (2019)

The self-sponsored seed companies (Pro Enterprise and Gumbo Glow) came into play for the first time in 2018. They have contributed significantly towards formation of the Seed Traders Association of South Sudan (STASS), and in some research work, such as evaluating new crop varieties. Pro Enterprise Seed Company is engaged in evaluating varieties of cassava, orange-flesh sweet potatoes, ground nuts and beans released in Uganda. They are doing this in collaboration with the researchers at the MAFS, Juba. The company is also in the process of developing their own hybrid maize varieties out of inbred lines from CIMMYT. The successful crop varieties out of the trials are expected to be released and registered in the name of this company. The rest of the companies are involved in demonstration and promotion of the varieties released by the MAFS. The self-sponsored seed companies are more committed and are have taken the lead in the formation of the Seed Trader Association of South Sudan (STASS).

4.2.4 Seeds processing

Seed processing is an important activity within the seed value chain. It ensures that seeds meet the desired quality standards, and in a form that is suitable for storage and marketing. Limited efforts have been put in place to provide seed processing facilities and equipment in South Sudan.

Large-scale seed processing facilities: In 2014, a large-scale seed processing facility was installed under Multi Donor Trust Fund (MDTF) in Palotaka (Fig. 4.5). The processing unit has a capacity of about 5 tons/hour, fully equipped with a 200 KVA generator. However, this remained unused to date. The processing unit and its

accessories are not affected by the war. There is need to work out strategies to operationalize the unit effectively or privatize it.



Fig. 4.5. Palotaka Seeds Processing Center

Similarly, in 2012 FAO delivered similar sizes of seeds processing units (5 ton/hour rotary cleaned) to Wau and Rumbek. The equipment in Wau was not installed to date, while the one delivered to Rumbek was vandalized after the December 2013 war. Some parts of the equipment delivered to Wau were lost or were damaged due to poor storage. It may be possible to salvage or donate remaining equipment to the emerging seed companies

Under COMESA/ACTESA partnership, a small-scale seeds processing unit was delivered to Wau and housed in the soil testing laboratory together with basic seeds testing kit. All are in good working conditions.

The mobile seed cleaners – The Ministry of Agriculture and Food Security (MAFS) imported three mobile seed cleaners with the capacity of 2 tons/hour. This equipment remained unused due to insecurity and war that broke out in 2013 and 2016. The equipments have been exposed to harsh weather and some parts such as belt and moving bearings need replacement.

Manually operated seed cleaners: In 2016 FAO imported six units of manually operated seed cleaners. Three were delivered to Yambio, Western Equatoria and three to Aweil, Northern Bahr el Ghazal (Fig. 4.6) to support the community-based seed producers in these two former states. The ones in Aweil remain unused to date.



Fig. 4.6. Manual seed cleaners procured by FAO in Aweil

4.2.5 Seed market and marketing by the companies

Seed markets determine profitability of any seed enterprise, as well as continuity and sustainability. Deploying strategic marketing strategies by a company will enhance not only profitability but also sustainability of the enterprise. With support from AGRA, most seed companies have been trained on marketing strategies, that includes advertisement, sale promotion (demonstration of their materials being superior) direct sales and use of agents outside their immediate areas of operation.

The main seed market for the seed companies in South Sudan has been the humanitarian organizations (UN/NGOs) distributing seeds to the most vulnerable households in South Sudan. Overall, about 63 percent of the seed produced locally normally goes to the humanitarian organizations and some 23 percent sold to agro-dealers, while some 9 percent remained as carry over (unsold) into the next season (Fig 4.7). Much of the seeds from the companies are expected to be cheaper due to them being subsidized by business, although they face relatively stiff competition from the seeds coming from outside the country. The seeds coming from outside have remained relatively cheaper than those produced locally (FAO, 2017/18 procurement update). The relatively high price of seeds produced locally could partly be attributed to the high costs of production and doing business in South Sudan.

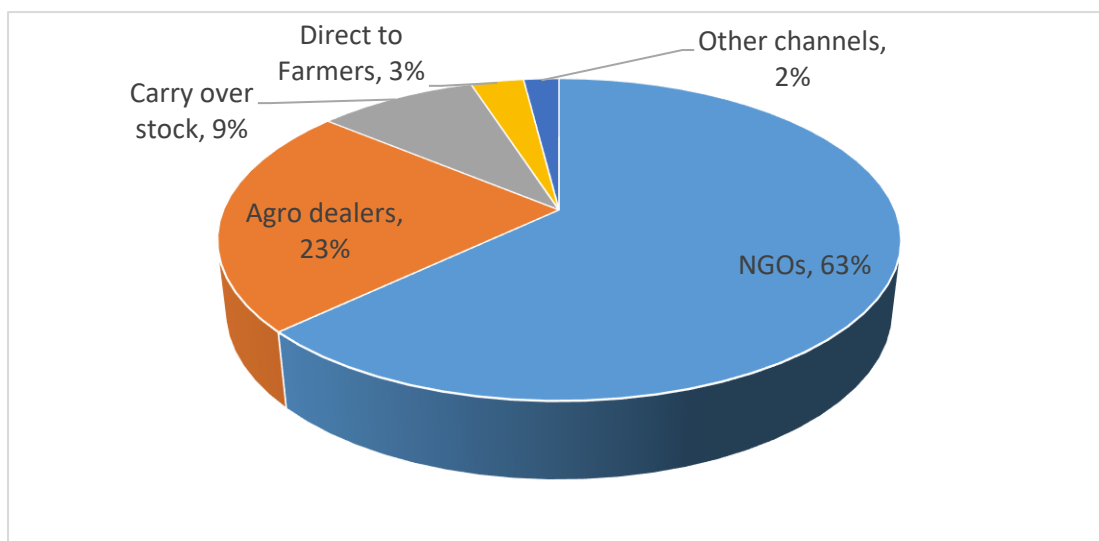


Fig 4.7. Market share seed being produced locally by seed company (Source: AGRA)

The companies also view the free seed distribution in most parts of the country by humanitarian organizations as having a negative impact on their direct sales of their seed to the farming population. The feel farmers are not keen on buying from them or their agent (agro-input dealers) when they anticipate forthcoming free seed distribution.

Notwithstanding the conflicting humanitarian seed market channel against the commercial seed channel in normal situations, it is important to note that access to most areas in South Sudan is very limited due to war, conflict and poor infrastructures (roads and storage facilities). This makes it quite difficult for the seed companies and their associates to reach farmers in many remote areas. It is fair to note that repeated seed aid through direct distribution likely weakens the local markets, but even without any seed aid, the challenges of marketing would remain for the seed companies – especially when they are offering widely-known varieties of few crops.

4.2.6 Seeds policy and quality assurances

South Sudan has a draft seed policy document which still pending approval. Although there are variations across countries, most seed policies and associated regulations address a common set of seed issues such as variety registration and release, seed quality control, market etc. The rationalized and harmonized regulatory framework for East and Central Africa (ECA) region (Annex 5; Waithaka *et al.*, 2011) provides an opportunity for South Sudan to regulate the sector in the absence of homegrown laws and regulations. However, there is a need to have specific regulations to address internal seed value chain challenges.

Inspection and certification services: This is a task being shared by the Directorate of Research and Plant Protection within the Ministry of Agriculture and Food Security (MAFS). However, the team in place is small with limited capacities to undertake the required tasks. The two directorates also lack adequate facilities and necessary equipment for inspection and certification. FAO and other NGOs have been chipping in supporting these services, as they are also directly involved in local seeds production and importations. In the absence of home grown seed regulatory framework, the standard COMESA seed label color for the various classes of seeds is the recognized by South Sudan authorities. The South Sudan Bureau of Standards (SSBS) has authorized Baltic Control (BC) to assist with seeds quality verifications in the country, anticipated to be on the International Seed Testing Association (ISTA) Standards.

Phytosanitary measures: South Sudan has been involved in significant seeds imports without any exports. More than 90 percent of the imported seed are for humanitarian response to support crises affected population. Sometime some of the seeds enter the country without proper documents and documentation. Seed Import and Re-Export Documents needed to ensure adequate phytosanitary measures are put in place include;

- Plant Import Permit
- Phytosanitary Certificate
- Non-compliance Notification
- Re-export Phytosanitary Certificate
- Seed testing Certificate
- GMO declaration

For the first time, in 2018, the country started the process of formally rejecting substandard seeds of cowpeas using the Non-compliance Notification and Re-export Phytosanitary Certificates. FAO through its quality control mechanisms detected low quality cowpea seed supplied by one of the companies, rejected the seed, and notified the responsible office for the need to re-export the low-quality seed.

To enforce control of unpermitted or poor quality seed, the government under Multi-Donor Trust Fund (MDTF) constructed seeds border posts at Nadapal/Kenya border, Nimule and Kaya/Uganda border. The stations are installed with 30 kVA generator set, bore hole and water tank. Computers and furniture for the stations were purchased but not delivered to date. However, these border posts have not been operationalized, as there are limited number of well-trained inspectors with appropriate equipment.

Seed testing facilities: The FAO constructed seeds laboratory in Yei is still in good condition with need for minor renovations. However, most of the installed equipment may be obsolete or damaged due to poor storage as dictated by the war conditions. FAO constructed a seed laboratory in Halima Research Station. The final finishing and installation of equipment has not taken place yet. Need to revisit the initiative

4.2.7 The Seed Trade Association of South Sudan (STASS)

Seed trade association is an umbrella that brings all the seed companies and other parties interested in seed trade together. The Seed Trade Association of South Sudan (STASS) was launched on 23 November 2018 with the objectives to i) Promote the development and adoption of improved crop varieties; ii) Mobilize resources for enhancing the capacities of the member seed companies so as to improve the quality and quantities of seeds produced in the country; iii) Create a seed forum that provides a platform for interaction amongst the various stakeholders for information flow and sharing; iv) Establish linkages with regional and global bodies in the seed industry for the benefit of the local industry and v) Diligently serve the interests of our key stakeholders (farmers, seed companies, researchers and the government) professionally and adequately. This association is still very young and will require substantial support from regional and international bodies.

4.3 Concluding Remarks

In summary, plant breeding activities in South Sudan are still limited in scope, with most of the activity entailing adaptive trials of varieties released in neighboring countries or advanced trials done by the IARCs. Most of the released varieties have remained on shelf, with very limited efforts made to move them to the farming communities. With more than 30 varieties released since 2011, the potential to boost agricultural production and productivities exist. For this to happen, a deliberate effort is needed from development partners—including public-private support—to disseminate, promote and demonstrate the potential of these varieties in boosting production and productivity.

The average annual varietal release stands at about four per year, and most of the releases are cereals. Important pulse crops such as beans, green grams and pigeon pea have little or no research attention yet could significantly contribute to both food and nutrition security of the farm households. Similarly, oil seed crops such as sesame and sunflower have attracted very limited research efforts. Strategic research approaches need to look at balancing these efforts and providing the necessary support to some of these crops.

The major change within the seed system in South Sudan since 2011 has been the emergence of private sector-led seed production and marketing. Though still limited in scope of operation and scale of production processing and marketing, there has been a progressive upward trend in production, and as of recently (2018) expansion to other regions.

The key bottleneck in the seed value chain in South Sudan is the lack of capacity by MAFS to ensure that all requirements for producing and distribution certified seed are met. A concerted effort is therefore required to ensure that a strong and vibrant National Seed Certification Agency or body is established and empowered to ensure that quality certified seed are produced and that imported seed meet all the meet minimum standards for international seed trade, or in line with the ECA harmonized regulatory framework.

5.0 SEED SECURITY ACROSS SITES

This section examines crops and production system across states and agro-ecological zones by looking at the major crops grown by households; seed requirements and estimates of seed demand. Centrally to seed security, it provides a seed security outlook at community levels by examining seed sourcing and the elements of seed security: - availability, access, seed quality and varietal suitability. The section also examines seed aid and use of other productivity enhancing inputs and services across the country, providing insight into some of the drivers of seed insecurity.

5.1 Crop Production Systems

South Sudan has six agro-ecological zones with eleven livelihoods zones supporting various cropping systems. Most of the livelihood zones in the Greater Upper Nile (GUN) and Greater Bahr el Ghazal have only one planting season while larger areas in the Greater Equatoria, particular the green belt and hills and mountain livelihood zones, have two planting seasons.

5.1.1 Crop profile and diversity across states and livelihood zones

The types and number of crops grown by farm households in South Sudan vary from state to state and across the livelihood zones. The number of crops grown per households range from to just one crops to more than eight crops. Overall, about 54 percent of the household grow 3-4 crops and some 18 percent grow between five and six crops (Fig. 5.1a; Fig. 5.1b).

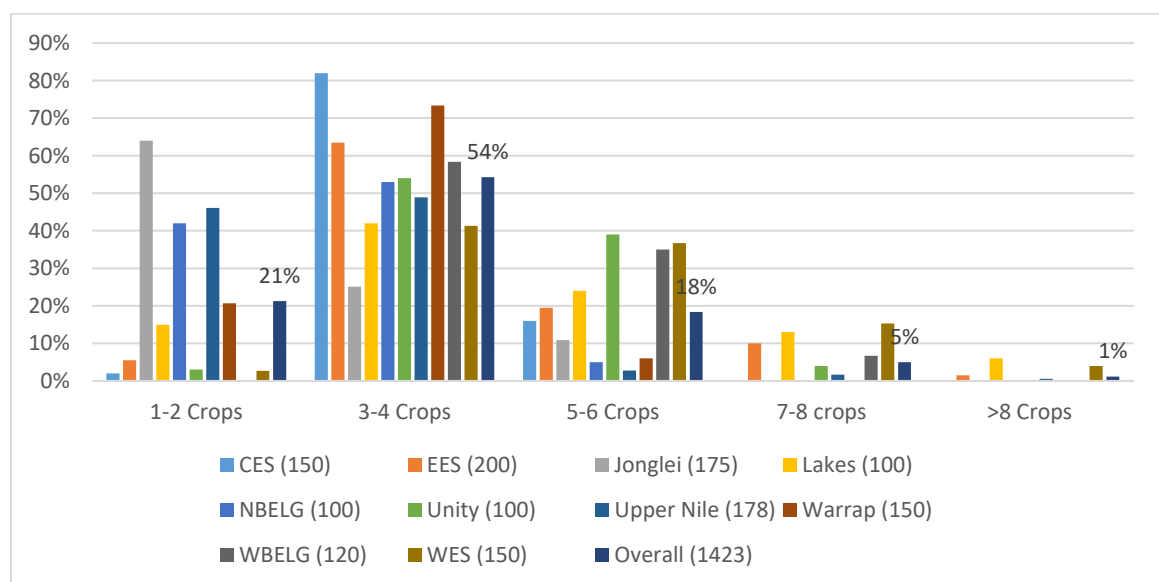


Fig. 5.1a. Households growing specific number of crops

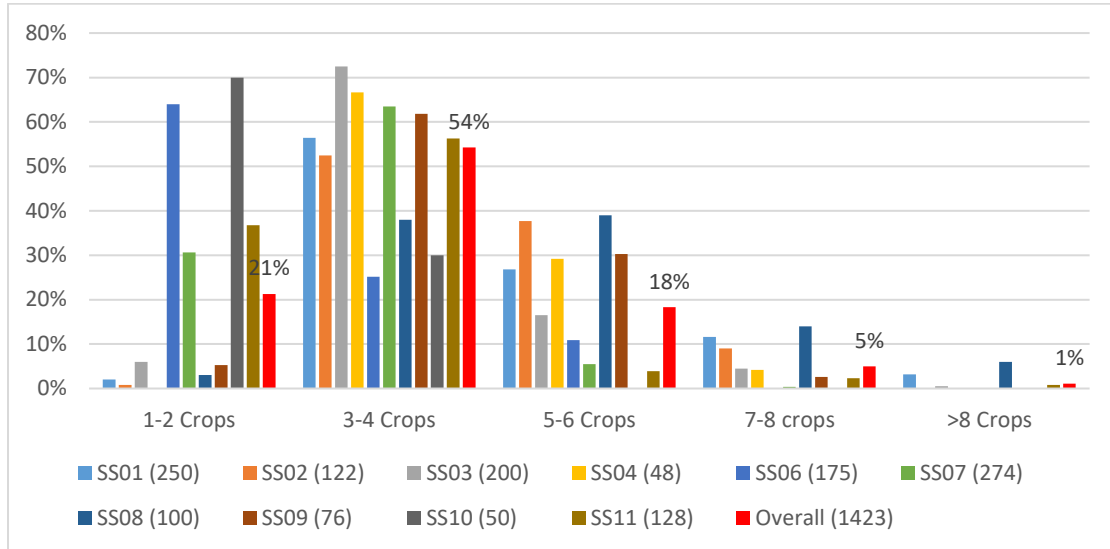


Fig. 5.1b. Households in Livelihood zones growing specific number of crops

McGuire and Sperling (2013) noted that diversity is important for seed system resilience, in terms of crop, variety and even supply channels. They considered that not all diversity is equally functional, and rotating germplasm and outlets to deal with unpredictable time (seasonal, yearly) and geographic variation in the seed channels used becomes essential. Across states, more than 60 percent of the house in Jonglei (SS06), and between 40 to 50 percent in NBEG and Upper Nile cultivated only one to two crops in 2018. Therefore, these three states are most likely at greater risk of food insecurity in case of crop failure due to factors such as bad weather and disease and/or pest outbreak.

About 64 percent of the population in Jonglei state are considered to be in crisis, emergency and catastrophe (IPC, Jan 2019). Although more than 50 percent of the household in Upper Nile state cultivate 3-4 crops, in Ulang County (SS10) about 70 of the farm households grew only 1-2 crops. This put them in a much similar situation with the assessed counties in Jonglei (Bor South, Duk and Twic East). In essence, a more diverse crop profile can potentially increase a farming household’s resilience to shocks caused by biotic or climatic factors. In this context, Sperling and McGuire (2010) noted that narrowing the diversity of crops/varieties in key supply channels such as seed aid weakens famers’ adaptive capacity to stresses.

5.1.2 Cereal crops

The majority of cereals grown are sorghum, maize, millet and to some extent rice. Overall, about 80 percent and 63 percent of the farm households grow sorghum and maize, respectively. Across former states, Lakes, Warrap and Western Equatoria states are the leading states in production of sorghum followed by Unity and Northern Bahr El Ghazel states. For maize, more than 75 percent of the farm households in the three

former states of Equatorial, Upper Nile and Unity (Panyijar County) cultivated maize in 2018 (Table 5.1).

Millet and rice are not widely grown across the country. In most states, fewer than 15 percent of farmers grow millet. However, about 68 percent (78 percent and 58 percent in SS08 and SS07 LZs, respectively) of the households in Lakes grow millet, significantly higher than the national average of 16 percent. In WES LZ01 about 56 percent of the farm households cultivate rice. It should be noted that biggest rice scheme is in NBEG, this is mostly limited to Aweil Rice Scheme managed by the State Ministry of Agriculture and Forestry (SMoAF). However, the result from NBEG showed that households in the state do not grow rice, probably indicating limited influence of the rice scheme on rice production in the state. The low interest by famers in cultivating millet and rice could partly be attributed to factors such as labor intensiveness and lack of processing (for rice) facilities and services.

Table 5.1. Major cereal crops grown in South Sudan

State	LZ	N	Sorghum%	Maize %	Millet	Rice%
CES	SS01	100	53%	79%	0%	2%
	SS03	50	82%	66%	2%	0%
EES	SS01	50	56%	100%	2%	0%
	SS03	150	91%	79%	18%	0%
Jonglei	SS06	175	85%	55%	0%	0%
Lakes	SS07	50	88%	12%	58%	0%
	SS08	50	100%	44%	78%	0%
NBEG	SS07	100	92%	8%	12%	0%
Unity	SS08	50	98%	100%	32%	0%
	SS09	50	96%	100%	20%	0%
Upper Nile	SS10	50	10%	98%	8%	0%
	SS11	129	83%	68%	3%	0%
Warrap	SS07	124	98%	37%	21%	0%
	SS09	26	100%	69%	0%	0%
WBELG	SS02	72	99%	60%	11%	0%
	SS04	48	94%	67%	21%	0%
WES	SS01	100	17%	95%	33%	56%
	SS02	50	100%	18%	20%	0%
Overall		1424	80%	63%	16%	4%
STDEV.S			28%	30%	21%	13%

5.1.3 Pulses and legumes

The most commonly grown pulses or legumes in South Sudan are cowpeas and beans. Across the country in 2018, about 27 percent and 11 percent of farm households

respectively planted cowpea and beans. Cowpeas are widely cultivated in Unity state (Panyijar County) by 76-90 percent of farm households, followed by Upper Nile (27-72 percent), Eastern Equatoria, WBELG CE, WE (Table 5.2). Beans are commonly cultivated by farm households in EES, WES, WBELG and Lakes states, with between 15 to 52 percent of the farm households cultivating the crops. It is important to note that beans normally thrive in areas with loamy soils and are commonly found within these states.

Other pulses being cultivated in South Sudan include green gram, pigeon pea and soybean. It is worth noting that pigeon pea and soybean are of special importance in EES particularly Torit and Magwi, respectively. This could have been due to the efforts by the Catholic Diocese of Torit (CDOT) in the fight against malnutrition amongst children and lactating mothers in the two counties. Though not widely cultivated across many states and counties, green gram appeared to be an import pulse in the Lakes state and the former counties of Mvolo and Mundri in Western Equatoria states (Table 5.2).

Table 5.2 Common pulses and leguminous crops grown in South Sudan

State	LZ	N	Cowpea	Beans	Green gram	Pigeon pea	Soybean
CES	SS01	100	29%	22%	0%	1%	1%
	SS03	50	18%	2%	0%	0%	2%
EES	SS01	50	46%	52%	4%	16%	12%
	SS03	150	36%	15%	1%	2%	0%
Jonglei	SS06	175	7%	3%	0%	0%	0%
Lakes	SS07	50	14%	8%	22%	0%	0%
	SS08	50	26%	48%	72%	0%	0%
NBEG	SS07	100	3%	0%	1%	0%	0%
Unity	SS08	50	76%	10%	0%	0%	2%
	SS09	50	90%	4%	0%	0%	0%
Upper Nile	SS10	50	72%	12%	0%	0%	0%
	SS11	129	27%	4%	4%	0%	0%
Warrap	SS07	124	1%	1%	0%	0%	0%
	SS09	26	0%	0%	0%	0%	0%
WBELG	SS02	72	24%	18%	0%	0%	0%
	SS04	48	48%	17%	0%	0%	2%
WES	SS01	100	23%	5%	11%	2%	3%
	SS02	50	40%	2%	64%	0%	0%
	Total	1424	27%	11%	7%	1%	1%

5.1.4 Oil seeds, roots and tubers

Oil seed crops, such as groundnuts and sesame are important in the farming system of the South Sudanese. About 58 percent and 34 percent of households in the entire country produce groundnuts and sesame, respectively. Whereas in WES, NBELG and Lakes 98, 92 and 89 percent of the households interviewed are groundnut growers while in WES, WBEG and Lakes 94, 79 and 78 percent of farmers cultivate sesame on their farms.

Root crops such as cassava and sweet potato, play key roles in the livelihoods of the farm households in South Sudan, particularly in Equatoria regions where 65, 43 and 25 percent of the farmers in WES, CES and EES, respectively cultivate the crops (Table 5.3). In Warrap, Unity, Jonglei and Upper Nile states farmers are not cultivating cassava and sweet potato. This could be attributed to factors such as heavy-clay soils which tend to crack a lot with extended dry spells, flooding of most fields during raining seasons which could lead to rotting of the roots, and uncontrolled grazing of large number of livestock. In the meantime, the importance of vegetables across the country varies in degrees, with greatest importance honed in NBEG, EES, Warrap and WBEG states followed by Jonglei and Unity compared to the remaining states (Table 5.3).

Table 5.3. Major oil seed, root and vegetable crops in South Sudan

State	LZ	N	Oil seed crops		Roots and tubers		Veg
			G/nut	Sesame	Cassava	S. Potato	
CES	SS01	100	62%	37%	56%	4%	14%
	SS03	50	92%	24%	16%	18%	42%
EES	SS01	50	44%	14%	56%	46%	46%
	SS03	150	26%	29%	15%	15%	41%
Jonglei	SS06	175	38%	12%	0%	0%	25%
Lakes	SS07	50	84%	10%	0%	2%	4%
	SS08	50	94%	78%	10%	10%	22%
NBEG	SS07	100	50%	43%	17%	1%	48%
Unity	SS08	50	44%	10%	8%	4%	20%
	SS09	50	62%	16%	8%	4%	26%
Upper Nile	SS10	50	0%	0%	0%	0%	12%
	SS11	129	40%	33%	1%	0%	11%
Warrap	SS07	124	66%	47%	0%	0%	44%
	SS09	26	65%	58%	0%	0%	19%
WBEL G	SS02	72	99%	79%	14%	4%	38%
	SS04	48	98%	29%	17%	0%	27%
WES	SS01	100	99%	27%	87%	21%	23%
	SS02	50	64%	94%	22%	12%	14%
	Grand Total	1424	58%	34%	18%	7%	28%

5.1.5 Main uses of cultivated crops

Overall, most households cultivate for food, however the importance varies from crop to crop with more than 80 percent of sorghum, millet, maize and cowpea cultivated for food. Rice is an important crop in WES, and it considered by 75 percent of those who planted as an income crop. Similarly, about 50 percent of those who planted green grams (Lakes state and Mvolo and Mundri Counties in WES) and vegetables consider these crops as important income generating crops (Fig. 5.1c). Although cassava is grown mainly in the SS01 and SS02, and to some limited extent in SS03, it an important food and income crop in these livelihood zones.

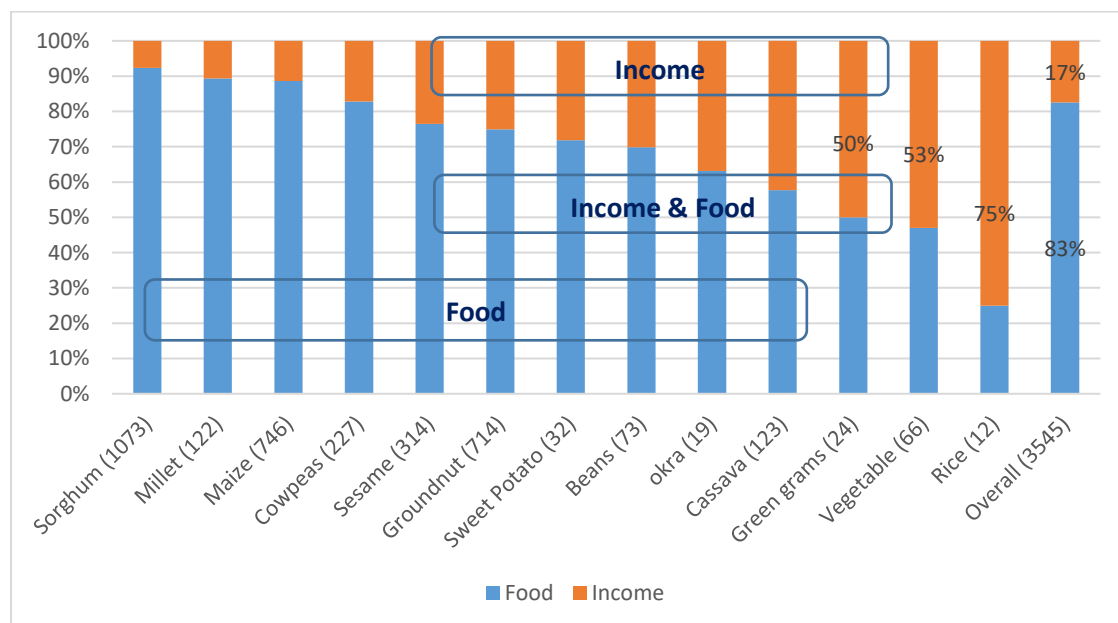


Fig. 5.1c. Importance of crops as food and income sources

5.2 Seed Sourcing, Requirements and Demand

The assessment examined how famers within the assessed locations obtained seed from available sources; the assessment teams thoroughly examined the indicators of the elements (availability, access, quality and varietal suitability) of seed security for the upcoming seasons; to provide evidence-based conclusions and appropriate recommendations for appropriate future actions, the assessment teams thoroughly examined drivers of seed security.

5.2.1 Seed sources used by famers in the 2018 seasons

In order to understand how farm households source seed of three most important crops, they were asked to list all the sources used in 2018, and each of the sources used was examined against the indicators of seed availability, seed access, suitability of the variety and seed quality. The results from the analysis showed that farmers across South

Sudan used multiple sources, both formal and informal seed sector. Overall, the informal seed sector (own, local market and social network) contributed to over 80 percent of the seed used by the farmers. The bulk of the seed from the formal sector is normally supplied in the form of seed aid.

Overall, own-saved seed contributed about 51 percent of the seed sourcing by the households, local market contributed 21 percent while seed aid and social network contributed about 14 and 13 percent, respectively (Fig. 5.2a). These findings are comparable to the other similar studies carried out in a number of countries (CIAT *et al.*, 2011; FAO, 2013; FAO, 2014) and other countries in Africa (CIAT *et al.*, 2011; Sperling *et al.*, 2009; FAO, 2012; FAO 2014; ISSD, 2012; ISSD, 2014; CRS, 2015). McGuire and Sperling (2016) in their review of seed sourcing across six and covering 40 crops, noted that farmers access 90.2 Percent of their seed from informal systems with 50.9 % of that deriving from local markets.

There are however variations across states. In WBELG and Warrap, own seed contributed to slightly above 70 percent while in Lakes and NBELG it contributed slightly above 60 percent. In Unity (Panyijar) social networks contributed to more than 41 percent. The seed aid also played a significant role in supply of seed in EES, Jonglei and Upper Nile states, in addition to social networks. This signifies the dynamics of seed sourcing by the farm households even under very difficult circumstances.

It is important to note that local market contribution in Unity (Panyijar) is minimal (0.5 percent) and in Jonglei it stood at only 5 percent. This could partly be attributed to a number of factors, but mostly to insecurity and poor road access that do not allow movement of traders and vendors. It could also reflect low purchasing power of the households, especially where market appears to be functional. On the other hand, local markets appear to be contributing significantly to seed supply in EES, CES, WES, Lakes and NBELG. These states have better access than other states.

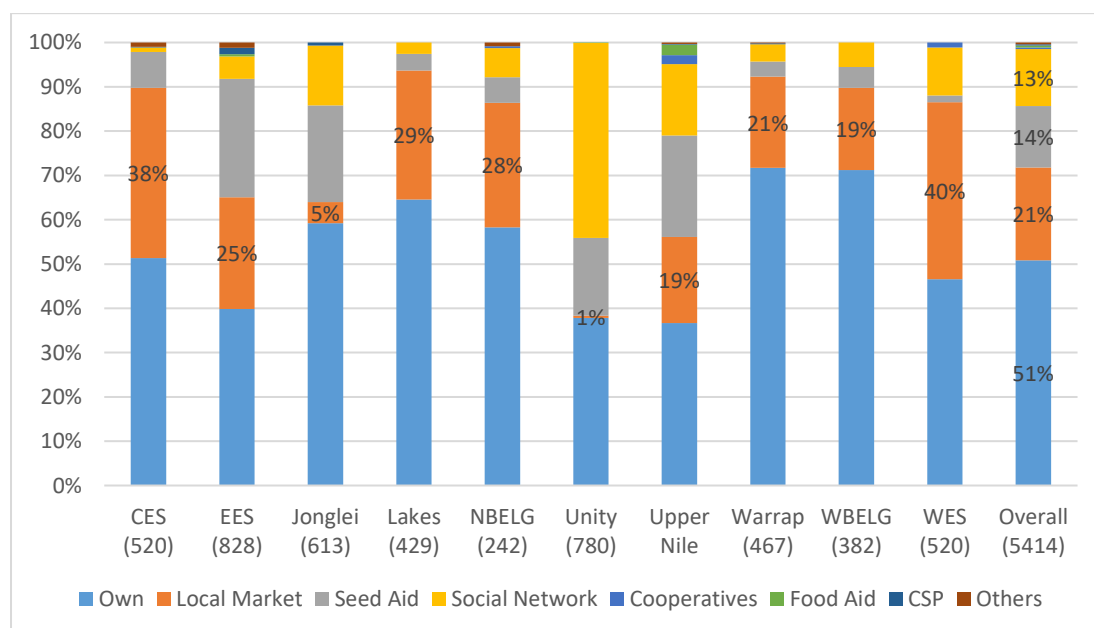


Fig. 5.2a. Seed sources for farmers in South Sudan during 2018 cropping season

5.2.2 Sources for different crop seeds in 2018

Similar to sourcing across sites (states), for important crops farmers relied heavily on own seed, local market and social network sourcing sorghum, maize, sesame and ground nuts seeds in 2018, followed by local markets in obtaining ground nuts and sesame seed. Seed aid was a major source of okra and vegetable seeds contributing around 36 percent for each. It is important to note that the local market is an important source of rice and beans contributing to 64 percent and 36 percent, respectively (Fig.5.2b).

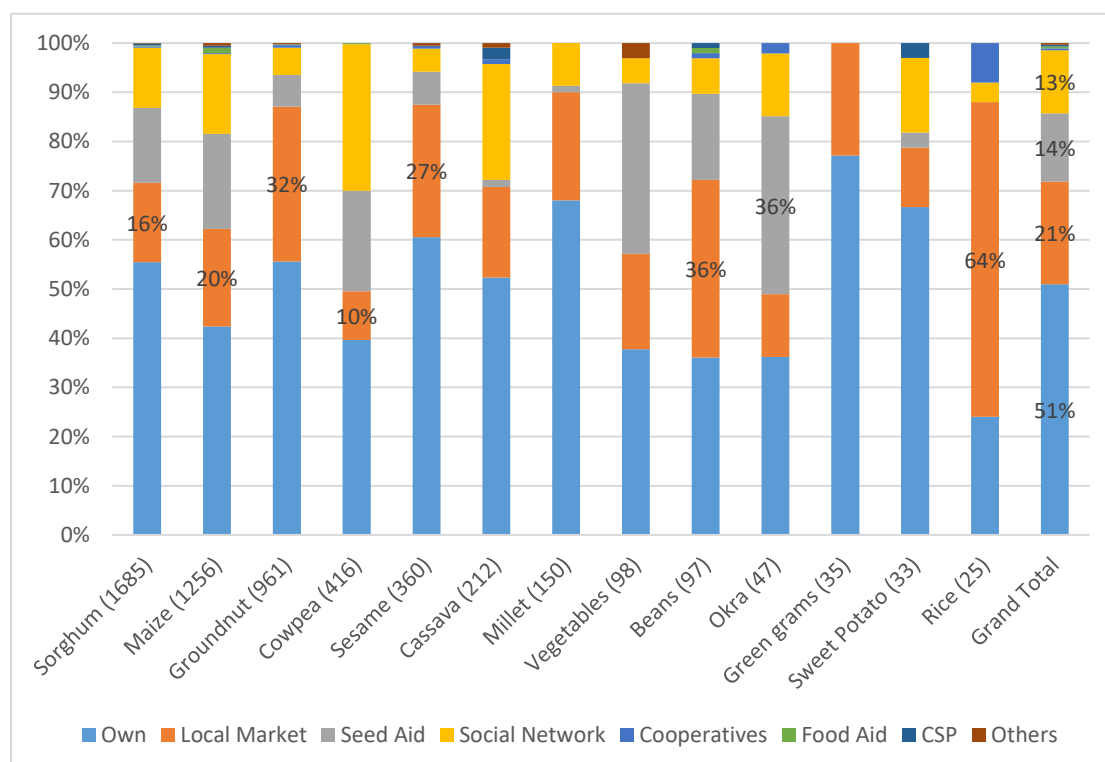


Fig. 5.2b. Percentages of seed sources for different major crops

Despite the fact that the number of local seed companies has increased, their influence on seed supplies seems to be insignificant since they prefer selling to organizations providing humanitarian seed aid. It probably because economies of the large quantities of seed procured by these organization that makes that attractive, and in most cases, they pay in hard currency other than the unstable local currency. It is important to note that out of 1 760 tons of assorted crop seed produced by the local seed companies in 2018, more than 67 percent was maize while the rest of the crops (sorghum, groundnut, cowpea and sesame) shared the remaining 33 percent.

Seed sourcing by refugees and returnees: Seed sourcing by the different residential status and household head (male or female) in the year 2018 varied across the assessed areas in the former ten states. The Internally Displaced Persons (IDPs), majority of them found in Central Equatoria, Upper Nile and Western Equatoria (where SPLM-IO presence is well known) accessed seed mainly from own seed local markets, seed aid and social networks. Although seed aid contributes just about 14 percent (overall), it is

an important seed source among the Refugees, mostly in Upper Nile (41.7 percent) and Returnees (31.6 percent), particularly in Jonglei and Upper Nile. This signifies the important contribution of humanitarian assistance to this most vulnerable segment of the population. Besides own save seed and seed aid, male headed households among the refugees were able to access seed from market (39 percent) as well, while the female headed households depended only on own-saved seed and seed aid (Fig. 5.2c), potentially signifying their greater vulnerability.

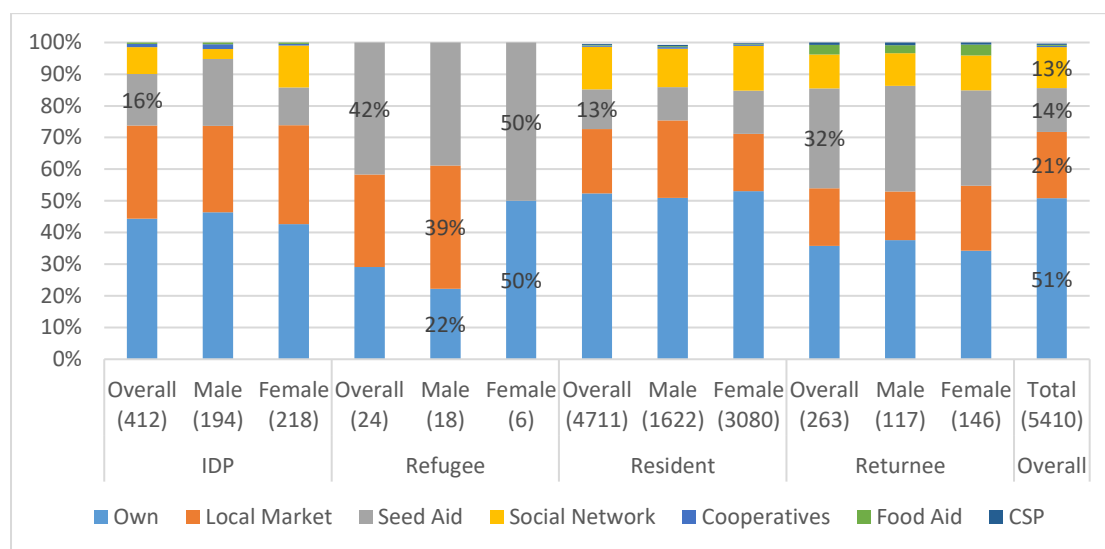


Fig. 5.2c. Seed sourcing by residential status and gender of household head.

5.2.3 Changes in seed sourcing between 2018 and 2019

Expected change in seed sourcing between 2018 and 2019 is minimal with very slight variation from source to source. Farms households expect own seed and seed aid to contribute more by 1-2 percent in 2019 compared to 2018, while local market and social networks are expected to decrease by a similar percentage range. Expected changes in seed sourcing between 2018 and 2019 is minimal with very slight variation from source to source. Farms households expect own seed and seed aid to increase by just 2 percent in 2019 above the 2018, while local market and social network to reduce by similar percentage (Fig. 5.2d).

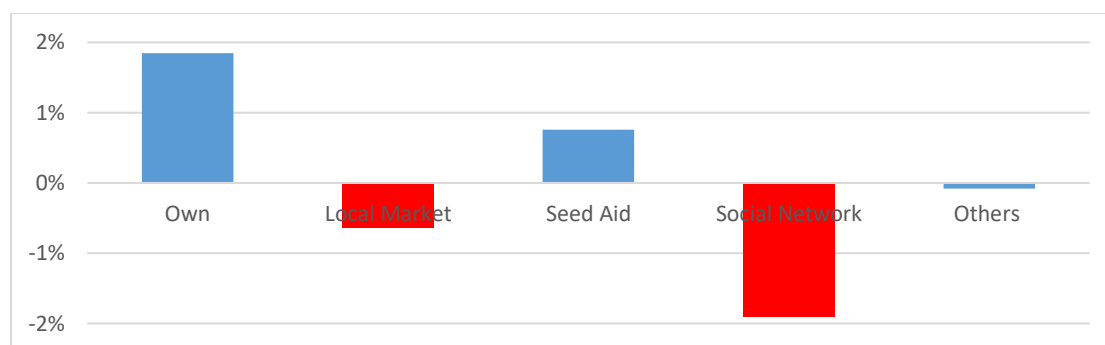


Fig. 5.2d. Expected changes in seed sources in 2019 in relation to 2018.

Box 5.1. Seed aid in the eyes of IDPs in Upper Nile

From FGD, in Melut, Renk and Maban: farmers consider seed aid as alternative option but not the most important source of seed.

“When we were in Bailet, we used to plant our own seeds but after the crisis, we have been forced to depend on NGOs for seed” Rebecca Aban Tor, a farmer and finance focal point for the Women’s Group in Kor-Adar IDP camp.

To them the most important source of seed is their own-saved seed and have more preference for local varieties than those provided in seed aid. This matter requires attention by the humanitarian agencies in ensuring that adapted and preferred varieties or those with similar characteristics to the local varieties are provided. In the longer-term perspective, there is need to consider evaluation and validation of local crop varieties in order to improve on the security of the farmer seed system.

5.2.4 The agro-input dealers

Although data from households surveyed did not indicate strong use of agro-input dealers as source of seed (0.1 percent), there are a few agro-input dealers operating in South Sudan, particularly in the Equatoria region. In Yambio, WES for instance, there are three agro-input dealers while in Juba, there are more than 15 of them operating within the city. They sell crop seeds such as maize, groundnuts sorghum, rice, beans, cowpeas, finger millet, and a range of vegetable seeds such a tomato, onions, green pepper, eggplant, okra etc (Table 5.4 and 5.4). The stock of seed is normally brought from Uganda, Kenya and DRC.

In the Equatoria region where there are two seasons, and sale of crop seeds normally peak in March/April and July/August, which are the main planting times for first and second seasons, respectively. The agro-input dealers in Juba have more diverse crop and varieties than those in Yambio, and the seeds come in various packaging sizes (2kg, 3kg, 5kg, 10kg and 25kg). The common packaging for vegetable seeds are 50gr, 25gr, 20gr and 10gr. Prices also vary from crop/vegetable to crop/vegetable and from variety to variety in some cases. The dealers sell their stock for cash and give some credit to 10-20 percent to their customers.

Table 5.4. crop seed prices in Yambio and Juba

Crop	Variety	UoM	Yambio	Juba
Maize	Longe 5	kg	650	700
	H20	kg	-	1250
	Katumani	kg	-	1250
Sorghum	Seso 3	kg	500	500 – 600
	Serena	kg	-	500 – 600
	Gadam Hamum	kg	-	600
Sesame	Sesame 1	kg	-	1000
	Sesame 2	kg	-	1000
Finger millet	Red variety	kg	-	800
Rice	Nerica 6	kg	750	-
G/nuts	Red Beauty	kg	800	700 - 800
Beans	Green	kg	200	
	K132	kg		800

Table 5.5. Prices (SSP) of vegetable seed with Agro-input dealer in Yambio and Juba

Crop.	Variety	UoM	Yambio	Juba	Rank ⁴
Tomatoes	Tengeri 97	50gr	3000		
	Money maker	50gr		1200	4
	Rio grandis	50gr		2000	2
	Roma	50gr		3000	1
	Cal. J	50gr		3000	4
	Rambo F1	50gr		8000	5
	Nur F1	50gr		15000	6
Cabbage	Baraka Fi	10gr	1500		
	Drumhead	50gr		1000	2
	Copenhagen	50gr		1000	1
	Summer queen F1	50gr		4000	3
	Gloria F1	50gr		4000	4
Onions	Bombe red	50gr	2000	2000	2
	Red creole	50gr	-	2000	1
Watermelon	Sugar baby	50gr	3000	5000	
Egg plant	B. beauty	50gr	2000	2000	
Green pepper	California wonder	50gr		2000	
Collards		50gr		2000	

Key challenges faced by the agro-input dealers include: high transportation costs, poor road conditions, multiple taxations along the road, and delays in payment by some organization that receive seed on credit. In Juba, the agro-input dealers complain of multiple and high taxations such as service fee, signpost inspection, garbage collection and fees by the City Council Authority.

⁴ Most preferred variety by famers – highest sales by agro-dealers in Juba

Other inputs: The agro-input dealers in Juba are diverse in the types of inputs they sell, and this include agro-chemicals (insecticides, fungicides, herbicides) hand tools (hoes, sickles, slashers), ox-plough, sprayers and protective gears, micro-irrigation equipment (watering cans, treadle pumps, motorized pumps), fertilizers (UREA, DAP, NPK + foliar types), power tillers and other equipment.

5.2.4 Local market

Local markets play a significant role in the livelihoods of farm households. To some, it is the main outlet for their produce where they generate income from the sale of their produce, while for others it is they can acquire what they do not have or have not produced themselves. Seed from both the formal and informal sector could be found in the local market. In most cases, grains being sold as food become potential seed (selected) during the planting time. In some cases, however, vendors do sell material specifically for use as seed at a slightly higher price than grain – i.e. because they have sourced it from a particular supplier or have sorted it already.

Across the assessment areas, there were a number of vendors in the local market, ranging from big grain dealers supplying various markets to farm households bringing grains to sell at a given time. The common crops farmers buy from the local traders include sorghum, groundnuts, cowpeas, maize and sesame. Some of local grain traders are producers/farmers, while others are traders who buy from other farmers within the community, process them for future use as both seeds and grains. In the state markets, the available stock of seed varies from trader to trader and with season. Typically, the stock ranges from 2-100 bags (bag of 50kg). For field crops, most traders sell varieties adapted to agro-ecologies within their catchments. Prices of their grain/seed varies with season, crop and variety being sold. However, there are local traders who also sell vegetable seed sourced from the formal sector.

Traders normally source seeds/grains between September and November, taking advantage to buy cheaply at harvest time. The grains are sold as seed mostly between March and July. Their major considerations when buying grain/seed include freshness, cleanliness and purity of the grain. In addition, efforts are made to clean and sort out those that appear to have poor quality.

The seed are normally stored in smaller store within the market as well as other store located outside the market. The stall conditions vary from those with mud floor to cemented floor. In most cases bags of seed are placed on floor without any pallets, and some of the stores have very poor ventilations.

Major challenges on seed marketing are:

- Transport cost and poor road network
- High taxes on road blocks
- Storage pests

- Poor rains
- Lack of credit facilities

They also requested help in:

- Storage pest control
- Farmers tools e.g. Ox-ploughs trainings
- Any possibility of NGO buying more seeds in 2019.

5.2.5 Seed requirement and demand

Seed requirement: Seed requirement refers to the total quantity of seed for given crops needed by the household, or community or nation in order to meet their planting needs. Seed requirements at household levels depend on the types of crop, area to be planted and the seed sowing rates. At state or national level, the proportion (percent) of farm households cultivating a given crop becomes an important factor in determining the quantity of seed required for planting (Box 5.2).

Box 5.2. Estimating seed requirement

The seed requirement was calculated as follows;

$$Y = (A) \times (B) \times (C) \times (D)$$

Where;

- Y= Total seed requirement
- A=Number farm households involved in farming (CFSAM, 2018),
- B= Percentage of household that have grown a given crop – SSSA HH data
- C= The average household field size (feddan) – SSSA HH data
- D=Average seed rates (Kg/feddan) – SSSA HH data

Seed demand: This refers to the quantity of seed acquired from sources such local markets, agro-input dealers, seed producers and social networks without taking into consideration of own-saved seed.

- i. *Overall seed demand:* the total quantity acquired from all alternative sources other than own-saved seed.
- ii. *Effective seed demand:* the total quantity of seed acquired through purchase, credit/loan, and exchange with other goods and services (labour).

For the five major crops—sorghum, maize, cowpea, groundnut and sesame—the requirements and demand are as shown in Figure 5.4. The estimates of the total quantity of seed planted for the five crops was about 45 800 tons in 2018, with about 35 percent (15 868 tons) of it demanded through the market and social network (Fig. 5.3). The effective demand for the seed of these crops was estimated at 12 126 tons (26 percent of the total requirement) of the requirement. The actual demand could be higher than estimates as seed aid may have reduced the overall or effective demand, but also lack

of good network of agro-input dealers and other supply chains for quality seed lowers demand estimates.

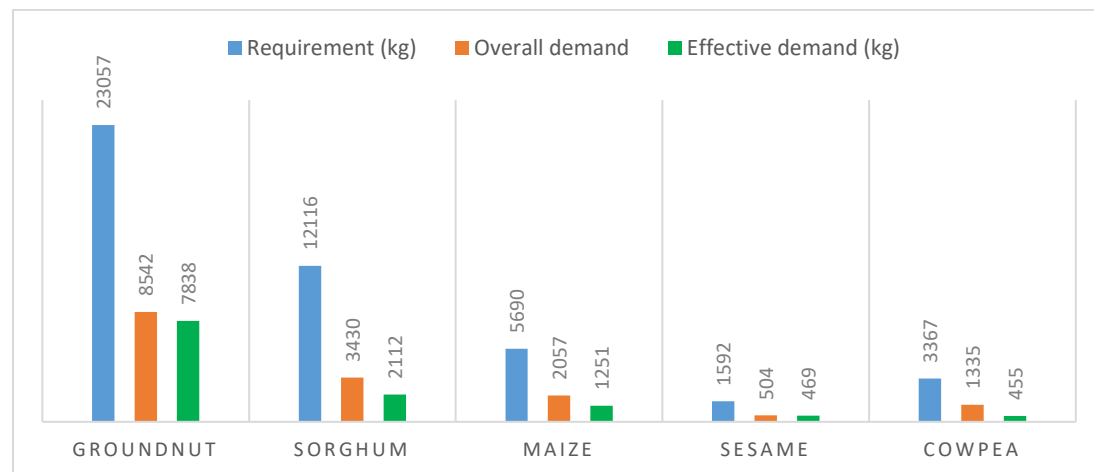


Fig. 5.3. Estimated seed requirement and demand for five major crops (2018)

5.3 Seed Security Stress Factors

5.3.1 Planting less or more by farmers

Stress factors: With the advent of a revitalized peace agreement, about 41 percent of the farmers were optimistic that they would cultivate more area of land in 2019 compared to 2018. Only 5 percent considered that their area under cultivation would be less in 2019 compared to 2018, while 54 percent considered that they will maintain the status quo and plant the same area (Fig. 5.4a). Based on the gender of the head of households, women headed households appear to be less optimistic, and probably more stressed than male-headed households, with 33 and 45 percent respectively considering to be planting more (Fig. 5.4b).

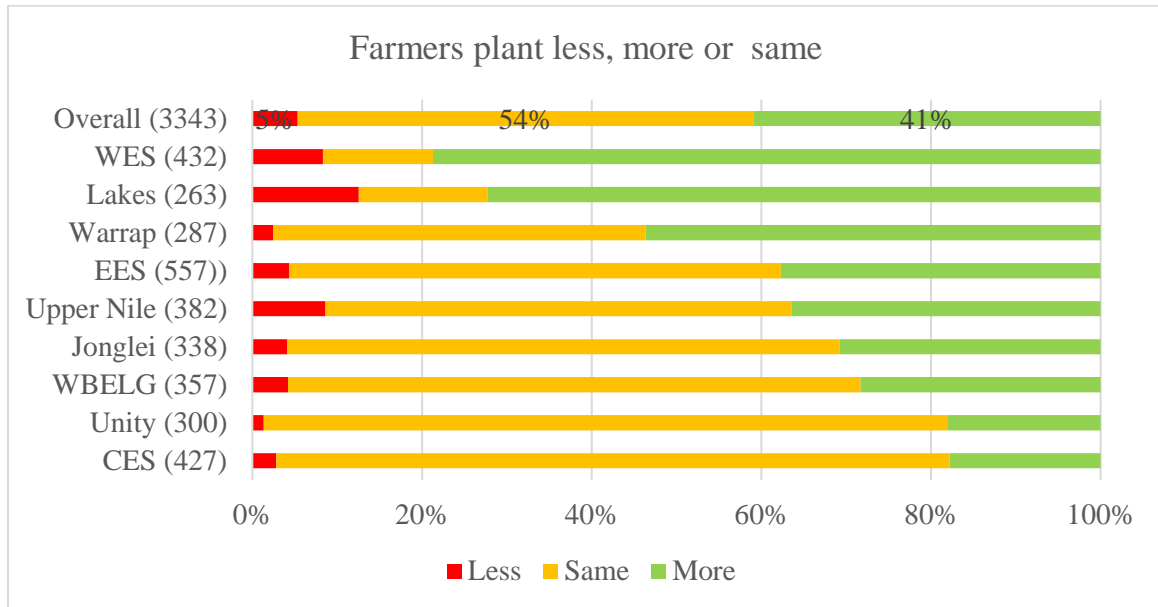


Fig. 5.4a. Percent of farm households planting less, same or more of the crop area

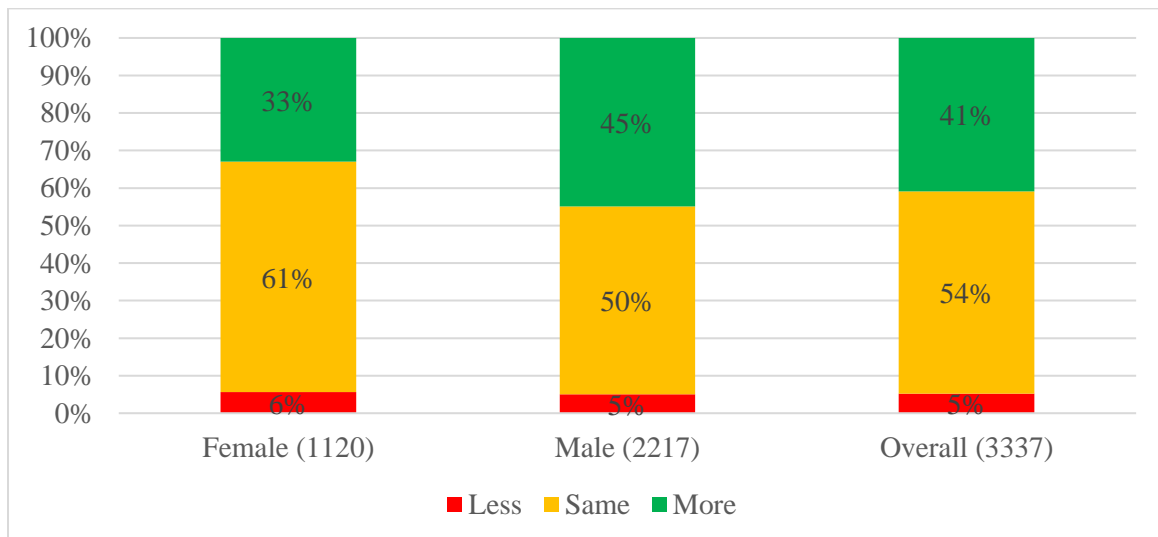


Fig. 5.4b. Planting less or more by male and female headed households

5.3.2 Reasons why farmers would plant less (stress) or more

Among the farm households that would plant less or more of land area to the major top three crop, 34 percent of them attributed their intention to do so to indicators of the elements of seed security (availability, seed access, varietal suitability and seed quality) while 64 percent attributed their plan to non-seed related factors.(Fig. 5.4c).

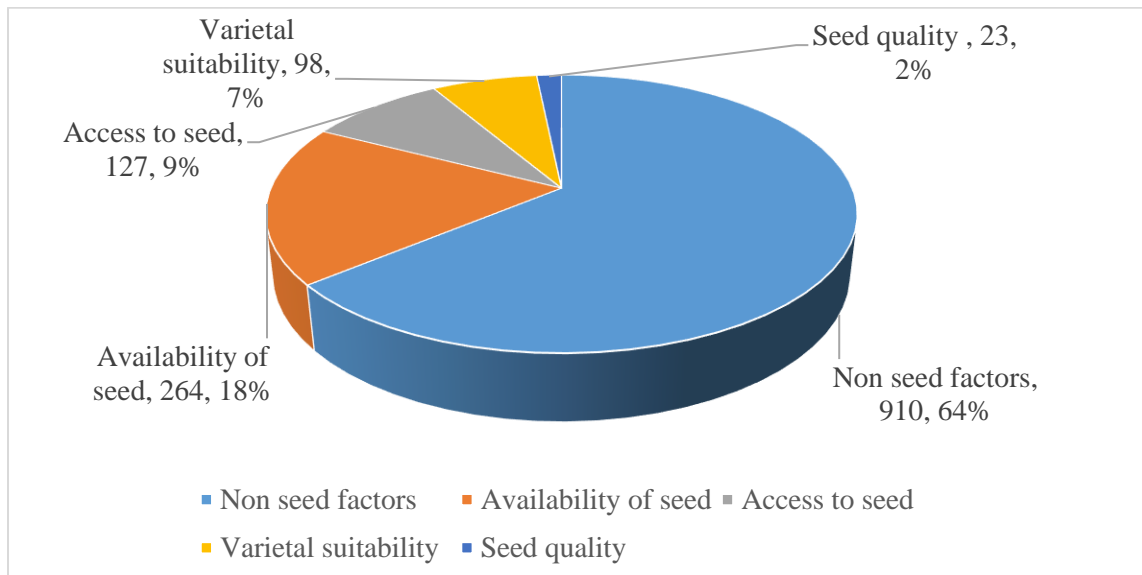


Fig. 5.4c. Main reasons for planting less or more by farmers in 2019

For those households who intend to plant more in 2019 (n=227), seed related reasons such as availability of seed, affordability of seed, access to new varieties and good quality seed account for 38 percent. On the other hand, non-seed related factors such as better market for produce, availability of labor, fertile land, access to credit/loan for production, good weather, security and access to tools and other inputs account for 62 percent of the reasons for planting more (Table 5.6a).

Table 5.6a. Reasons why farmers would plant more in 2019.

Category	Reasons	Frequency	Percent
Seed related	Seed is available	227	17%
	Seed is affordable	92	7%
	Access of new variety	91	7%
	Seed aid	75	6%
	Good seed	15	1%
	Sub-total	500	38%
Non seed related	Better market	197	15%
	Access to more labor	173	13%
	fertile land	145	11%
	Access to credit/loan	121	9%
	Good weather/rainfall	79	6%
	Good security	60	5%
	Access to tools	43	3%
	Access to other inputs	14	1%
	Sub-total	832	62%
GRAND TOTAL	1332	100%	

Considering that only 5 percent of the respondent indicated that they would plant less, and just slightly above 50 percent of them indicated seed related factors such as lack of seed, high seed prices, lack of money, poor quality seed and lack of preferred varieties. Non-seed related factors include insufficient labor, limited land, pest and diseases, poor weather and lack of market.

Table 5.6b. Reasons why famers would plant less (stress) in 2019.

Category	Reasons	Frequency	Percent
Seed related	Lack of seed	37	22%
	High seed prices	19	12%
	No money to buy seed	16	10%
	Poor seed quality	8	5%
	Lack of preferred variety	7	4%
		87	53%
Non seed factors	Insufficient labor	25	15%
	Limited land	13	8%
	Pests & disease	11	7%
	Poor weather	8	5%
	Insecurity	7	4%
	Limited tools	6	4%
	Lack of Markets	5	3%
	Others	3	2%
		78	47%
	Grand Total	165	100%

5.4 Elements of Seed Security and their Implications

The four elements of seed security are: availability of seed, access to seed, seed quality and varietal suitability. These elements may contribute to seed insecurity alone or in combination, and positive interaction among them and other external factors contributes to the resilience of the seed system.

5.4.1 Availability of seed for planting in 2018

Key indicators of seed availability include having sufficient quantity and good supply of seed within close proximity to households and farming communities, in addition to being available at the right time for planting.

Availability of seed within communities: Irrespective of the seed sources used by the households, about 54 percent of the households interviewed indicated there was enough supply of seed of various crops within their community. However, this varied across states and by crops. In five of the ten states, between 58 and 90 percent of the households indicated there was adequate supply, while in four of the states there appears

to be inadequate supply (1 to 46 Percent). Nearly all the households in Panyijar (Unity state) indicated there were not enough supply of seed in their community. In Panyijar, use of local markets by farm households as was very insignificant (Fig. 5.5a).



Fig. 5.5a. Farmer's view on overall supply of seed across states in 2018

5.4.2 Changes in availability of seed for planting between 2018 and 2019

In comparison to 2018, changes in seed availability varieties across states, with farmer households considering more or better availability in 6 out of the ten states, with an increase in ration of seed being enough by between 1 and 19 percent above 2019, while in three states (NBEG, Warrap and Jonglei) experienced negative availability in 2019 (Fig. 5.5b).



Fig. 5.5b. Changes in supply of seed within assessed communities from 2018 to 2019

The supply of crops such as sweet potato, green gram, cassava, okra, groundnuts, millet and sorghum were considered adequate by more than 50 percent of the households. For crops such as beans, maize, rice and cowpeas, only 34 to 46 percent of the households considered the supply adequate.

Interactions with local market traders in some locations point to stressful situation among farmers, and it appears that a high level of poverty makes it difficult for some farmer households to access seed from the local market, hence relying mainly on own seed, social network and seed aid. Focus group discussions with communities revealed that local markets have their preferred varieties of crops such as sorghum, maize, and sesame, but lack enough money to pay for the adequate quantity of seed remains the main challenge to many households. The focus group discussion and local market traders interview indicated availability of seed in the market, and that the social network contributions is significant. The results from the households indicating overall low availability, particularly in Panyijar could have been influenced partly by aid dependency syndrome among the population.

The seed fairs conducted by FAO and its partners across a number of states revealed how significant quantities of some crop seeds were supplied by the vendors in specific fair locations, while others such as sesame, cowpea, were limited in quantity. Overall, there was a good quantity of sorghum and groundnut especially in NBEG, Upper Nile (Renk County) and states compared to other states, while green grams and millet were limited to fairs conducted in the Lakes state (Fig. 5.5c). In Lakes, about 72 and 47 percent of the households in SS7 and SS8, respectively, grow green grams. Similarly, in WES (Mundri East) 87 percent of in SS2 do cultivate green grams. This possibly points to good adaptation of green grams in these three agro-ecologies.

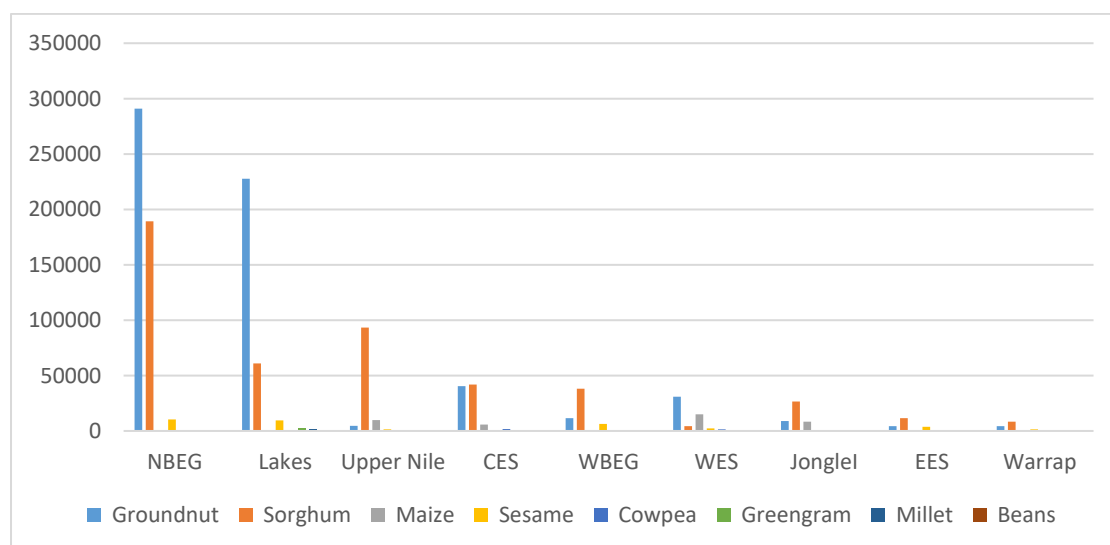


Fig. 5.5c. Quantity (kg) of various seed supplied during the 2018 seed fairs.

Timeliness of seed availability: In terms of timeliness of the overall seed supply, 46.2 and 44.8 percent of farmers interviewed across the states agreed that they were either

available before or at the start of the season while only 9 percent said seed was available after the season. About 25.7 percent of the farmers in EES expressed concern over delivery of seed mid-way the planting season. Across seed sources, there were concerns by 20 percent of household that the seed from either seed aid or companies are the ones that normally come mid-season (Fig. 5.5d). Analysis of responses among beneficiaries in Eastern Equatoria indicate that about 50 percent of the seed sourcing (221 frequencies) showed that seed aid being supplied mid-season (Fig. 5.5e). This requires immediate attention from the humanitarian organizations operating in EES.

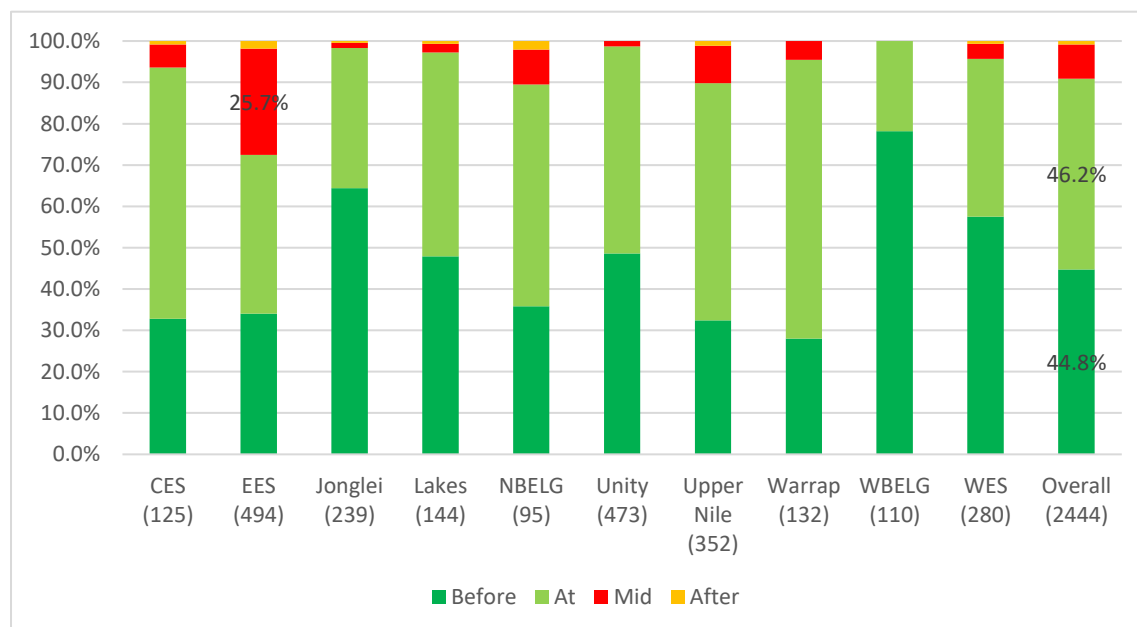


Fig. 5.5d. Timeliness of seed availability by state.

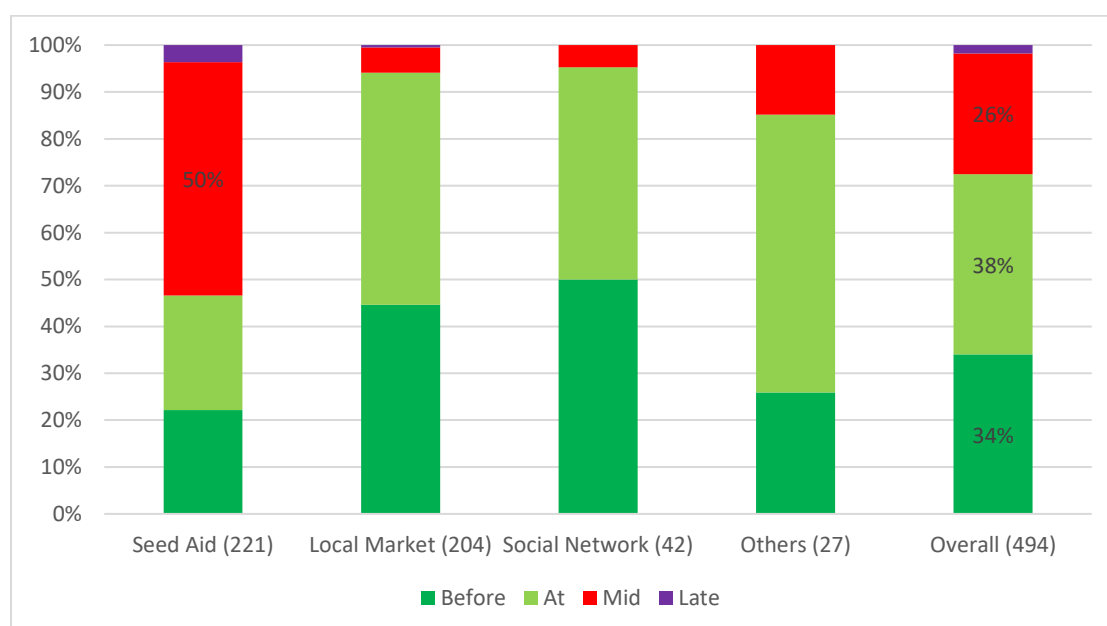


Fig. 5.5e. Timeliness of seed supply in Eastern Equatoria state in 2018.

Proximity of the different seed sources to farmers: Overall, more than 70 percent of the seed sources (exclusive of own seed) used by farmers were either within their boma or nearby boma. However, in Unity and Lakes states 38 percent of the seed sources are either in another payam or another county. In Jonglei state, about 20 percent of the seed sources are from another county (Fig. 5.5f). There appears to be some flow of the seed from neighboring countries especially in Eastern Equatoria state and Upper Nile, accounting for about 5 and 9 percent, respectively. Despite the protracted crisis, movement between Uganda and South Sudan has never stopped and many cross the borders with seed and planting materials. Similarly, in Upper Nile, the route to Sudan through Renk has not been closed, allowing for movement of people and materials. Renk and Melut in Upper Nile have mechanized agriculture and many farmers there source some of their seed (sorghum and sesame) from Sudan.

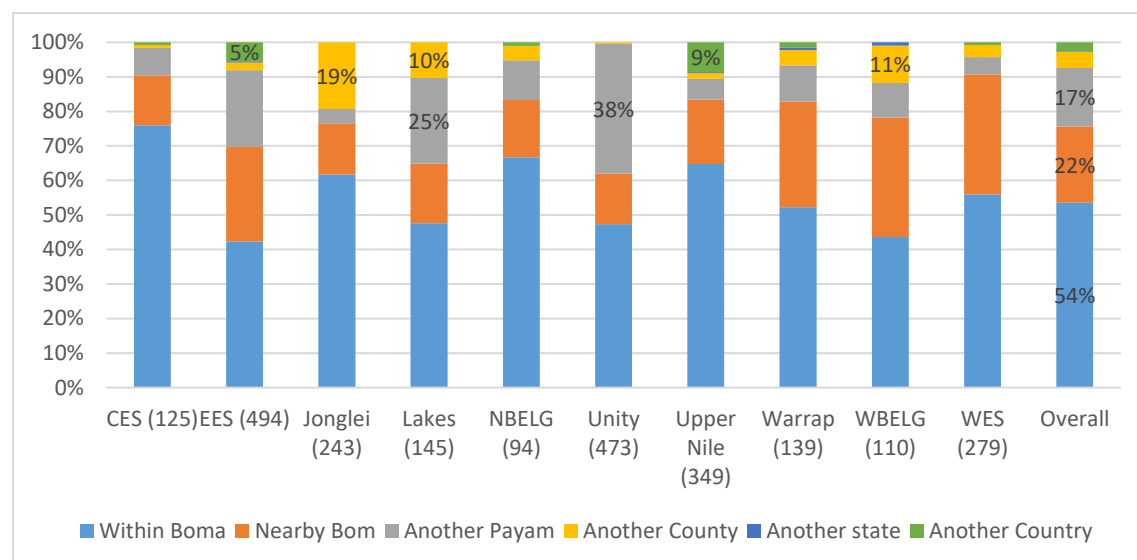


Fig. 5.5f. Proximity of the seed source to farm households

5.4.3 Access to seed

Access to seed denotes an ability to acquire seeds from sources other than one's own-saved seed. Access to seed could come from acquiring seed by paying cash, receiving credit/loan, exchanging seed or other goods (bartering), providing labor in exchange for seed, or from receiving seed as a gift or aid. Whilst seed may be available within the community, it may not be accessed due to lack of cash, power, status or influence needed by the household to acquire it. Seeds may also be obtained through bartering – i.e. in exchange for another commodity or service such labor, and it may be given on loan, on the condition that an equal or greater quantity returned at later date. Seeds may be acquired through marketplaces (local and formal) in exchange for cash, on credit and or exchange with other goods and services.

Overall, 53 percent of the seed from off-farm sources was acquired free of charge while 40 percent was acquired using cash. Others such as seed on credit, battering and labor

contributed to only 7 percent of means of acquiring seed (Fig 5.6a). From the local market, more than 89 percent of the seed was acquired using cash while some 7 percent were acquired on credit.

On crop basis, more than 75 percent of groundnut seed from off-farm sources was acquired using cash (69 percent) or on credit (9 percent). Similarly, 63 percent of seed sesame seed was acquired through cash purchase. Even for vegetatively propagated crops, such as cassava, that people assume are rarely bought, farmers are buying using cash (Fig 5.6b)

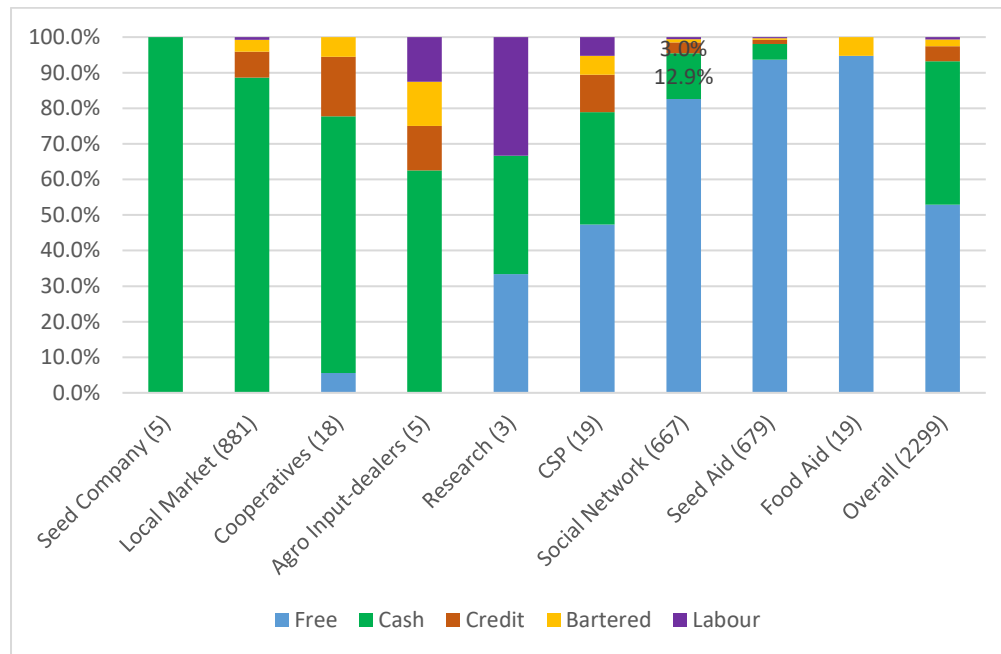


Fig. 5.6a. How farmers acquired seed from various sources

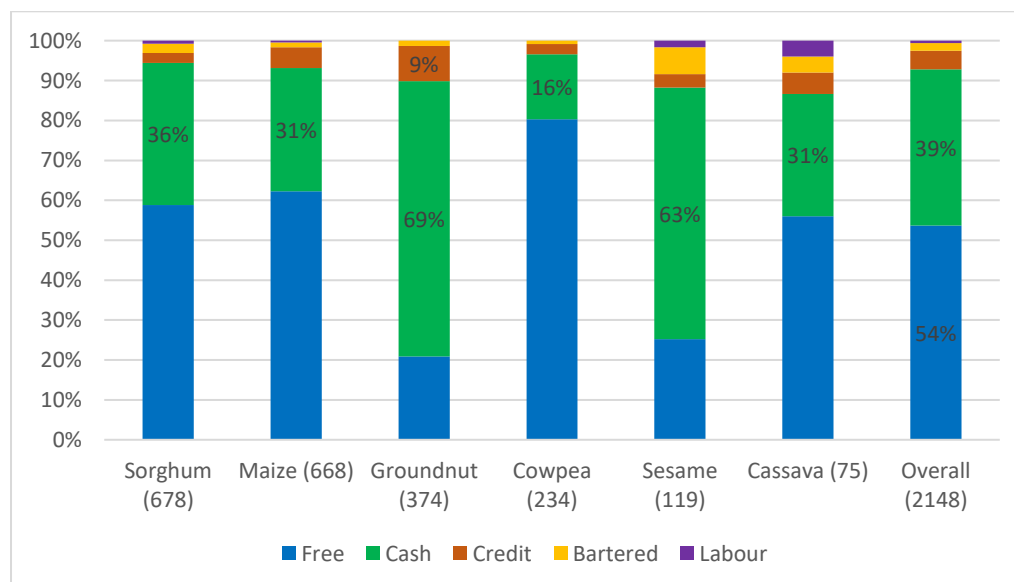


Fig. 5.6b. How famers aquired seed of selected crops from off-farm sources

Given the fact that local markets were the second most important source of seed after own-saved seed in 2018, it not only demonstrates the dynamics and resilience of informal sector in supply seed source options but also the willingness and ability of the farm households to acquire seed using cash even during crisis. Most of the seed that were accessed free-of-charge come from the seed aid organizations and social network.

5.4.4 Seed quality

Seed quality is an important element of seed security as it defines the success or failure of crop establishment and contributes to productivity of the crop planted. Quality seed can be defined as seed with high level of genetic and analytical purity, free from pests and diseases, with the right moisture content for better storage, and with high germination and vigor. High germination rates and vigor make emerging seedlings less susceptible to attack by pests and diseases and help seedling to make good use of limited moisture supplies in drier areas. Superior quality seeds generally germinate into vigorous seedlings, produce numerous flowers and result in higher yields.

Physical purity: The overall quality of crop seeds showed that 85 percent of the crop seeds used by the farmers were described as physically clean, and 14 percent as fairly clean. Households across the states rated most major crops to be of very good quality (clean) except for rice and to some extent pigeon peas and onion. About 40 and 12 percent of the interviewed farmers respectively considered rice varieties to be clean or fairly clean, respectively (Table 5.7a).

Table 5.7a. Seed crop variety percent cleanliness

Crop	Clean	Fairly Clean	Not clean	Frequency
Sorghum	87%	13%	0%	1 664
Maize	82%	17%	1%	1 246
Groundnut	82%	16%	2%	950
Cowpea	93 %	7%	0%	413
Sesame	89%	11%	0%	350
Millet	88%	10%	2%	134
Beans	81%	19%	0%	97
Vegetables	90%	10%	0%	95
Okra	89%	11%	0%	47
Green grams	100%	0%	0%	27
Rice	48%	40%	12%	25
Onion	77%	23%	0%	9
Pigeon peas	67%	33%	0%	9
Grand Total	85%	14%	1%	5 324

On the seed source basis, the majority of farm households perceived seed obtained from most sources positively, though some (26 percent) felt that local market provided materials that are fairly clean. Overall, 85 percent of seeds sourced from various sources

was clean and 14.4 percent considered seeds available from different sources clean (Table 5.7b).

Table 5.7b. Seed source and percentage of seed cleanliness

Seed source	Clean	Fairly Clean	Not clean	Frequency
<i>Own</i>	88%	11%	1%	2 643
<i>Local Market</i>	72%	26%	2%	1 085
<i>Seed Aid</i>	87%	12%	1%	731
<i>Social Network</i>	88%	11%	1%	688
<i>Cooperatives</i>	85%	15%	0%	20
<i>Food Aid</i>	85%	15%	0%	20
<i>CSP</i>	83%	17%	0%	18
Grand Total	85%	14%	1%	5 205

Rating of seed germination: The overall germination of seed as rated by the farmers interviewed across the ten former states was 69 percent good, 25 percent fair and only 6 percent poor. The germination percentages were crop-type dependent, in which 96 percent green gram seed was good followed by okra (89 percent) and vegetables (80 percent) while 64 percent of rice seed germination was fair compared to 36 percent good (Table 5.8a). For other crops, sorghum, maize, sesame and groundnuts displayed some instances of low germination, which could due to poor conditions of storage, high moisture content and seed maturity.

Table 5.9a. Germination percentages of different crop seed

Crop	Good	Fair	Poor	N
<i>Sorghum</i>	71%	23%	6%	1 656
<i>Maize</i>	65%	27%	8%	1 244
<i>Groundnut</i>	66%	29%	5%	946
<i>Cowpea</i>	68%	27%	5%	414
<i>Sesame</i>	72%	21%	7%	349
<i>Cassava</i>	75%	23%	2%	207
<i>Millet</i>	68%	24%	8%	132
<i>Vegetables</i>	80%	17%	3%	95
<i>Beans</i>	75%	19%	6%	93
<i>Okra</i>	89%	11%	0%	47
<i>Sweet Potato</i>	79%	21%	0%	33
<i>Green grams</i>	96%	0%	4%	27
<i>Rice</i>	36%	64%	0%	25
Overall	69%	25%	6%	5 303

Seed quality varied across seed sources with major sources such as own seed and seed aid registering the rating of 72 and 77 percent, respectively (Table 5.8b). Farmers tend to trust their own seed, and aid organization appeared to be providing good quality seed.

In most cases, seed aid organizations such the Food and Agriculture Organization of the United Nations (FAO) put in rigorous process to ensure that quality seed are delivered to the beneficiaries. From social networks, 13 percent rated the seed germination as poor. This could be partly attributed to the fact that most farmers tend to preserve and plant good quality seed before giving out balance to others within their social network.

Seed from other source such as companies, agro-input dealers, cooperatives, though used rarely, was considered to be of good quality. Attempts to use grains distributed for food proved a little bit disastrous with 60 percent rating of germinations as poor. Use of food aid grain as source of seed only denotes desperate situations in some circumstances. Of the 20 respondent who tried to use food aid as seed, 15 (75 percent) were from Panyikang, Upper Nile state; three from Magwi and one from Torit, EES; and one from Panyijar Unity state. The food aid crop tried as seed are maize (13), Sorghum (3) and the rest and beans and cowpea.

Table 5.8b. Germination rating of seed from various sources

<i>Seed source</i>	<i>Good</i>	<i>Fair</i>	<i>Poor</i>	<i>N</i>
Own	72%	23%	5%	2 639
Local Market	63%	32%	5%	1 073
Seed Aid	77%	17%	6%	730
Social Network	58%	29%	13%	685
Cooperatives	75%	25%	0%	20
Food Aid	15%	25%	60%	20
CSP	83%	17%	0%	18
Agro Input-dealers	88%	13%	0%	8
Seed Company	75%	13%	12%	8
<i>Overall</i>	69%	25%	6%	5 204

5.4.5 Varietal suitability

Varietal suitability is defined by two key aspects – a) adaptability to agro-ecologies, related to the genetic potential of a given variety and its interaction with the environment (GxE), and b) preferences for various end uses by consumers within a given community. The former tends to look at the performance of the varieties in terms of yields; tolerance to pests and diseases, climatic variabilities (drought, dry spell, floods, temperature fluctuation) and soil factors (acidity, alkalinity, salinity) while the latter in most cases considers the socio-cultural and economic dimensions (market and uses).

Overall, 97 percent of the varieties from all sources used by were preferred by the farmers while some 3 percent are not preferred. Preferences are relative and vary from location to location (Box 5.3), and among farm households. Relative preferences of for improved and local varieties varies by crops (Fig. 5.7a).

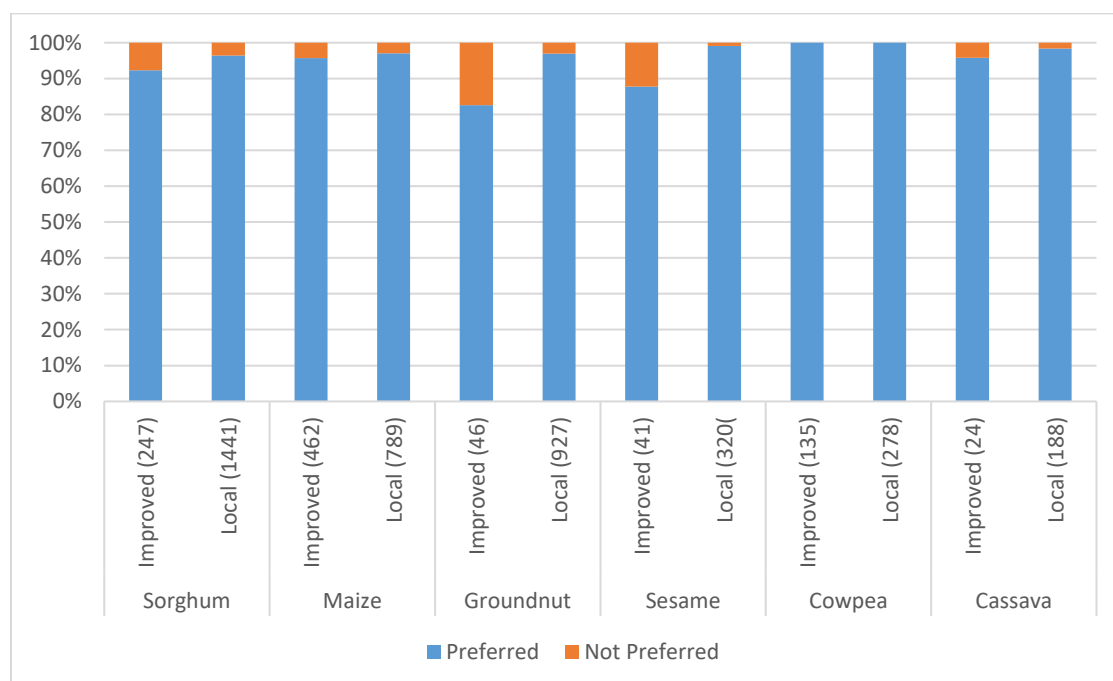


Fig 5.7a. Preferences of improved and local varieties of selected crops

Generally, the local varieties are more preferred than improved varieties. Richard B. Jones *et al.* (2002) noted that despite repeated distributions of relief seeds of improved varieties to farmers in southern Sudan, the population largely continued to plant seed of their own preferred local varieties. Major local varieties are those that have been selected and used over time and have stood the test of time. They normally act as a reference check on any newly introduced varieties based on both adaptation and preference for the end use. In a nutshell, varieties provided by humanitarian organizations should not be considered a one-size-fits-all, but careful consideration should be given based on agro-ecology (adaptation) and preferences (socio-economic) by the end users.

Box 5.3. Preferences for some crop varieties by farmers in Jonglei States

- *Sorghum*: Local landraces of sorghum such as *Akuorachot* (high yielding and pest resistant), *Athil/Bheer* (sweet taste and storage pest resistant) and *Dhuet/dhet* (early maturing, high yielding, resistant to birds, floods and dry spells) are more preferred to improved varieties such as Serene/Serena, Sekedo or even the Sesso 3 popular with humanitarian organizations. The improved varieties are considered to not perform well compared with the land races and are more susceptible to bird attack.
- *Maize*: Although Longe 5 (maize variety) is popular in the Equatoria region, in Jonglei, it is considered inferior and late maturing compared to Yellow Corn. The latter is considered high yielding and tolerant of drought or flood.
- *Groundnut*: Mateleka, a short maturing groundnut variety, is very popular across states compared to Red Beauty, referred as *Arooi/Rooi* in Jonglei. The latter is considered long maturing but high yielding variety.
- *Sesame*: Sesame I&II introduced through seed assistance appears to be less preferred compared to local black seeded sesame in some locations in NBEG though they are popular in the Equatoria Region. The latter is considered resistant to drought and has special taste and flavor.

5.4.6 Use of improved varieties of major crops

Farmers' knowledge of improved crop varieties remains unclear as some of the earlier released varieties are now considered by farmers as local varieties. This makes it quite difficult for some farmers to see the benefits of the improved varieties over the landraces. However, the few improved varieties for some of the most important crops such as maize, sorghum, groundnut, sesame and cowpea improved varieties are quite common.

Maize Varieties. Maize is the second most important cereal after sorghum. Use of improved maize varieties has gained popularity in the Equatoria region with improved varieties observed between 55 and 70 percent of maize planted in EES, WES and CES (Fig. 5.7b). The most popular variety of maize in this region is *Longe 5*, an Open Pollinated Variety (OPV) from Uganda, and commonly distributed by humanitarian organizations but also sold by seed companies and agro-input dealers across the region. Other states appear to use less improved varieties of maize compared to local or older released ones. This could be attributed to a number of factors such as poor adaptability of improved varieties, especially in the Greater Bahr el Ghazal and Upper Nile where flooding is very common, and in some locations due to difficulty in processing maize into flour using traditional grading stones compared to sorghum. However, in some locations such as Ulang and Panyikang, farmers are shifting to maize due to high levels of damage to sorghum from birds, especially on the improved varieties provided by the humanitarian organizations.

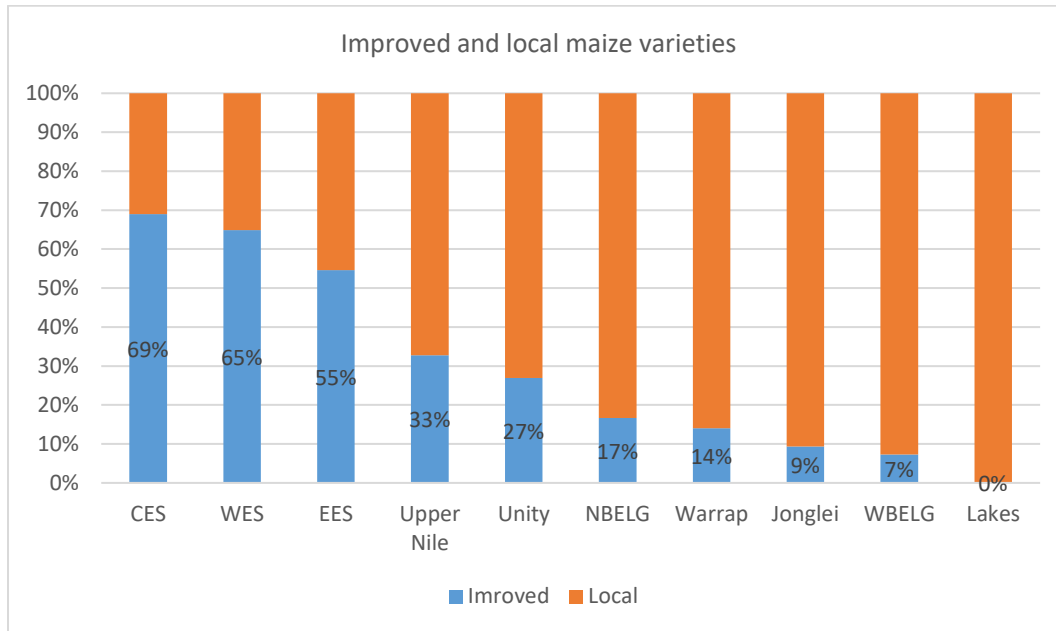


Fig. 5.7b. Use of improved maize varieties across the former ten state

Sorghum varieties: Use of improved varieties of sorghum is low compared to maize, hence giving room for traditional varieties to continue dominating. A relatively higher percent (18 to 41 percent) of improved sorghum varieties are being used in Upper Nile, EES and Unity states (Fig. 5.7c). The high use of improved varieties in Upper Nile could be attributed to seed accessed from the mechanized farms in Renk and Melut. Most of the improved varieties (*Wad Ahmed* and *Federitha*) of sorghum used in the large schemes in Renk and Melut are supplied from Sudan. Being OPVs, farmers normally use the seed harvested for two or three seasons before getting fresh stock supplied by the companies in Sudan.

In CES, about 35 percent of the sorghum planted is of improved varieties. The state is bordering Uganda where a number of improved varieties of sorghum such as *Sesso 3*, *Sekedo*, *Macia* are being produced and supplied, giving the state more exposure and opportunity to access these varieties. In addition, the state has favorable agro-ecological conditions, similar to that of Uganda where these varieties are grown.

Although humanitarian organizations have been giving significant volumes of improved varieties such as *Sesso 3*, *Sekedo* and *Serena* across a number of states (Jonglei, Lakes, WBELG, NBELG, CES and WES), use of these varieties appears to be low. This could partly be attributed to poor adaptability of these varieties to the diverse agro-ecologies of South Sudan as well as preferences for various end use. Therefore, there is a need for organizations to work closely with research in order to identify most preferred and well adapted local varieties within specific agro-ecologies for cleaning, bulking and use fairs and voucher approach to enable those in need access the varieties.

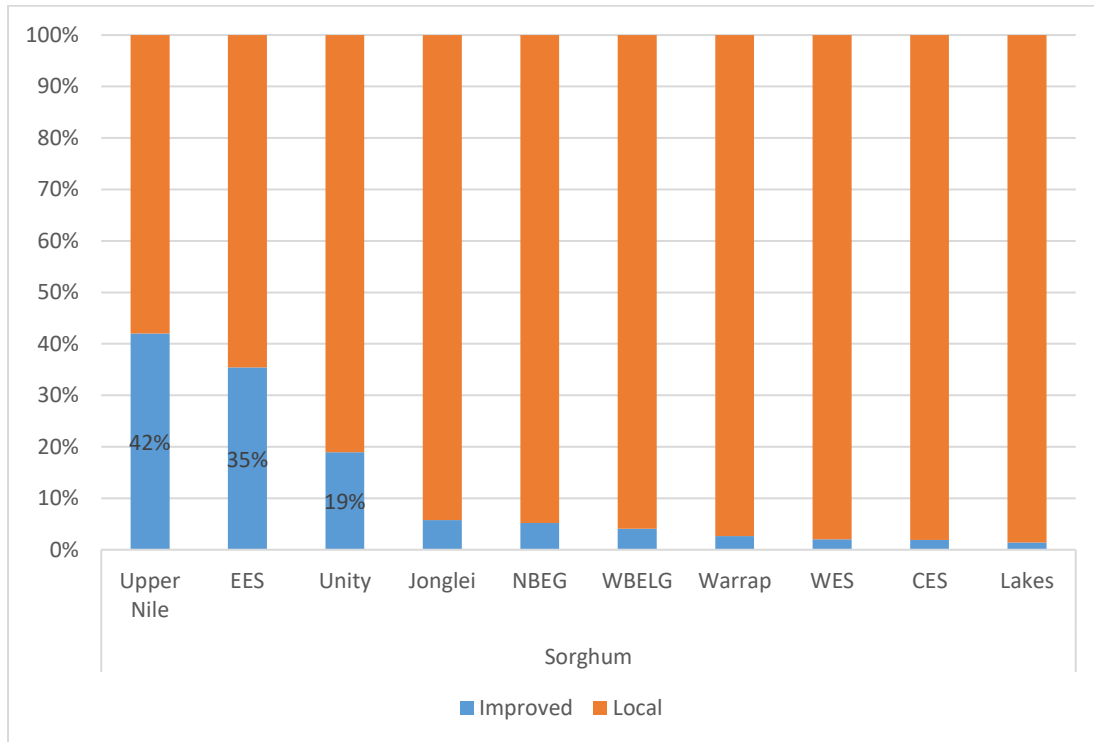


Fig. 5.7c. Use of improved sorghum varieties across the former ten states of South Sudan

Groundnut: Groundnut is one of the major oil seed crops in South Sudan. Use of improved varieties is still limited to a few states, but was at the highest in EES and Unity at 38 and 28 percent, respectively. Upper Nile and Jonglei follow at 9 and 3 percent, respectively, with the rest of the states still far behind (Fig. 5.7d). High use of improved varieties in Eastern Equatoria could be partly attributed to its proximity to Uganda where most of the improved varieties such as *Serenut 2*, *Serenut 4*, *Serenut 6T* have been introduced from, in addition to facilitated access to Uganda.

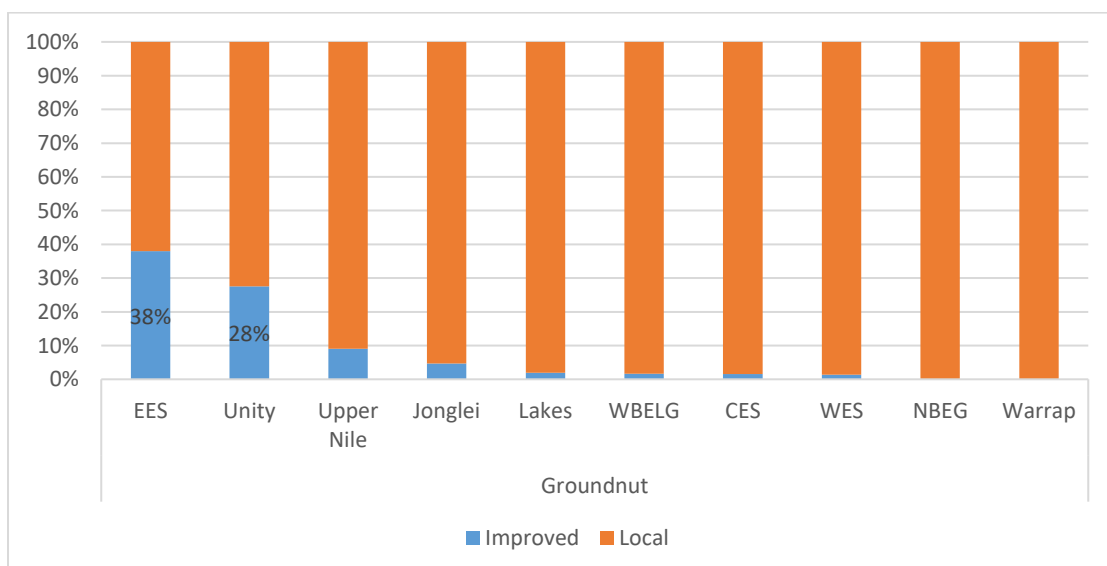


Fig. 5.7d. Use of improved groundnuts varieties in South Sudan

Sesame Varieties: Sesame is the second most important oil seed crop after groundnut. Upper Nile and Eastern Equatoria states have relatively high use of improved varieties at 58 and 24 percent, respectively (Fig. 5.7e).

In Upper Nile, the high use of improved sesame could partly have been influenced by the mechanized production in Renk and Melut which use improved seed supplied by companies from Sudan. In recent years, there has been some significant shift from sorghum to sesame in the mechanized sector Upper Nile. This has been due to high demand for sesame from agro-processors in Sudan, mainly for oil extraction and processed products such as *Tahnia* which are commonly found in South Sudanese markets.

In Eastern Equatoria, the supply of improved seed from Uganda could have influenced use of improved varieties such as *Sesame 1 & 2*. Other states appear to be depending much on local varieties though some improved varieties such as *Sesame 1 & 2* are being distributed within the humanitarian context across the country.

It important to note one of the key attribute for retention of any new sesame variety is its marketability, accounting to nearly 60 percent of the attribute choices. Upper Nile and Easter Equatoria have better access to Sudan and Uganda, respectively. These two countries offer international market oportunities to farmers in these states, thus explaining the high use of improved varieties compared to other states. The commonly bought sesame varieties are the white seed ones.

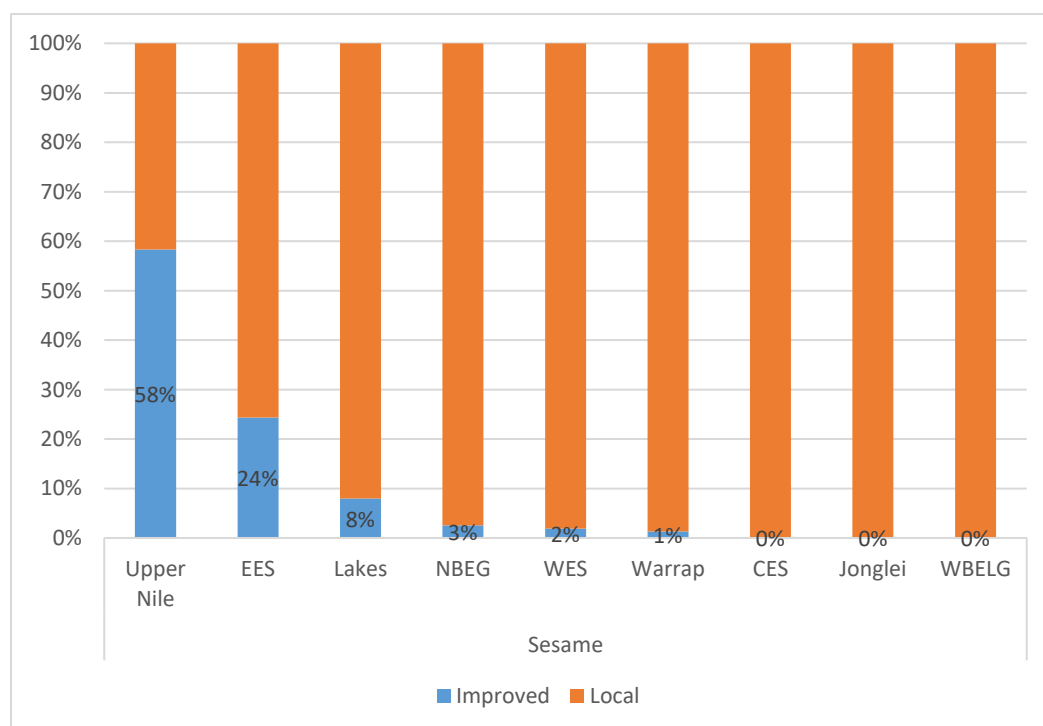


Fig. 5.7e. Use of improved sesame varieties across in South Sudan

5.4.7 Access to new⁵ varieties over the past five years

Introduction and diffusion of new crop varieties in South Sudan varies across states and agro-ecologies. Across the country, on average 24 percent of the households had access to new variety, and this varied from state to state. Panyijar (Unity state) recorded the highest percentage (59 percent) of farm households that had access to new variety in the last five years, followed by EES (43 percent) while the rest had between 6 and 26 percent. It is important to note that majority of the farm households are getting new varieties through seed aid, and most varieties used in seed aid (Maize –*Longe 5*, Sorghum-*Sesso 3* and *Wad Ahmed*, Sesame – *Sesame 2*, Cowpea – *Secow 2WT* and *1T* etc.) have been around for sometimes, and this may explain low levels of recoding of new varieties among farmers. As mentioned in section 4, most of the released varieties have remained on research shelves and will require concerted promotional efforts in order to get them to farmers.

Source of new variety: The main source of new varieties has been seed aid, contributing to 74 percent of the access, followed by social networks (19 percent), with contributions varying from state to state. In Lakes, social networks played no role in diffusing new varieties, but local market played a significant (25 Percent) role (Fig. 5.8a). In Panyijar (Unity state), seed aid and social networks contributed about 48 percent each in providing access to new variety.

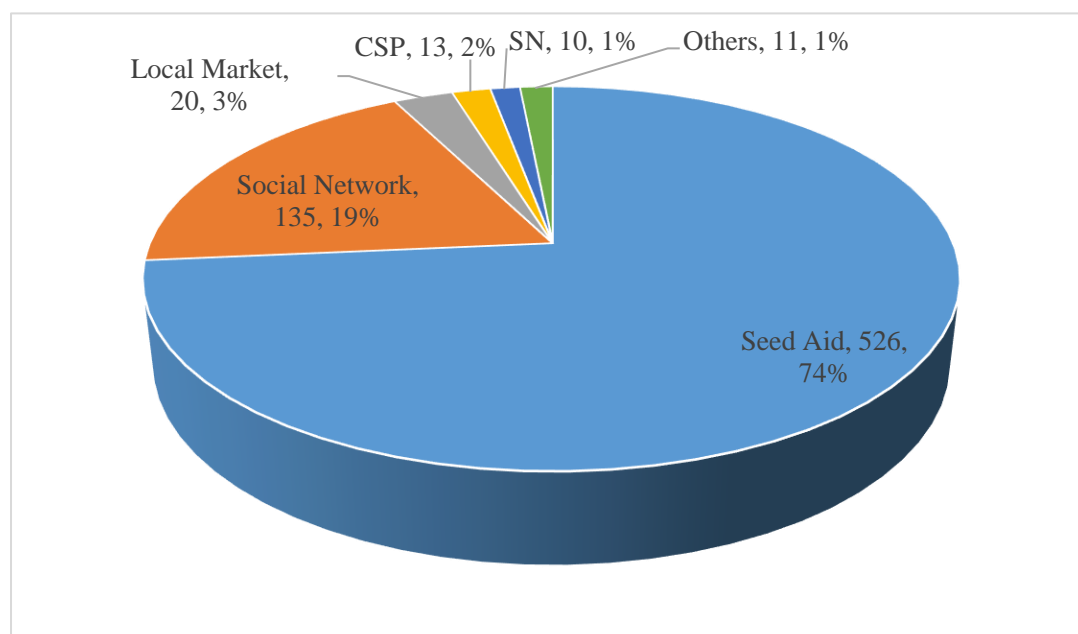


Fig. 5.8a. Sources of new varieties in different states

Year of access to new variety: The majority of households who had new varieties indicated having received them in 2018 (55 percent), followed by 2017 (25 percent) and the remaining 20 percent got their new varieties between 2013 and 2016 (Table 5.9a). Given the fact that seed aid is the major source of new varieties among farmers,

⁵ New varieties in the context of SSSA refers to a variety that a given a household has never used before. It can be an improved variety or even a local land races brought from another location.

a critical review of volume of seeds distributed between 2013 and 2018 showed an increase in volume of seed distributed from about 900 tons to about 6 000 tons.

Table 5.9a. Percent of famers obtaining new varieties in different states

State	2013	2014	2015	2016	2017	2018	Frequency
CES	0%	0%	0%	0%	0%	100%	21
EES	0%	1%	4%	9%	34%	52%	150
Jonglei	0%	4%	1%	20%	35%	40%	95
Lakes	0%	0%	0%	0%	7%	93%	15
NBELG	8%	2%	11%	6%	13%	60%	53
Unity	0%	0%	0%	22%	30%	48%	197
Upper Nile	0%	0%	0%	11%	8%	81%	37
Warrap	2%	4%	19%	22%	24%	30%	54
WBELG	0%	5%	0%	3%	16%	76%	37
WES	0%	0%	0%	5%	13%	83%	40
Grand Total	1%	1%	3%	14%	25%	55%	699

Among those who obtained the new material, 88 percent indicated preference for using the new variety (Fig.5.8b). Attributes that encourage farmers to acquire and/or retain new varieties are many, and sometimes crop-specific. Overall, 26 to 30 percent of farmers keep new varieties because of good taste and high yielding while another 14 and 13 percent prefer short maturing and pest and disease resistant varieties, respectively (Table 5.9b).

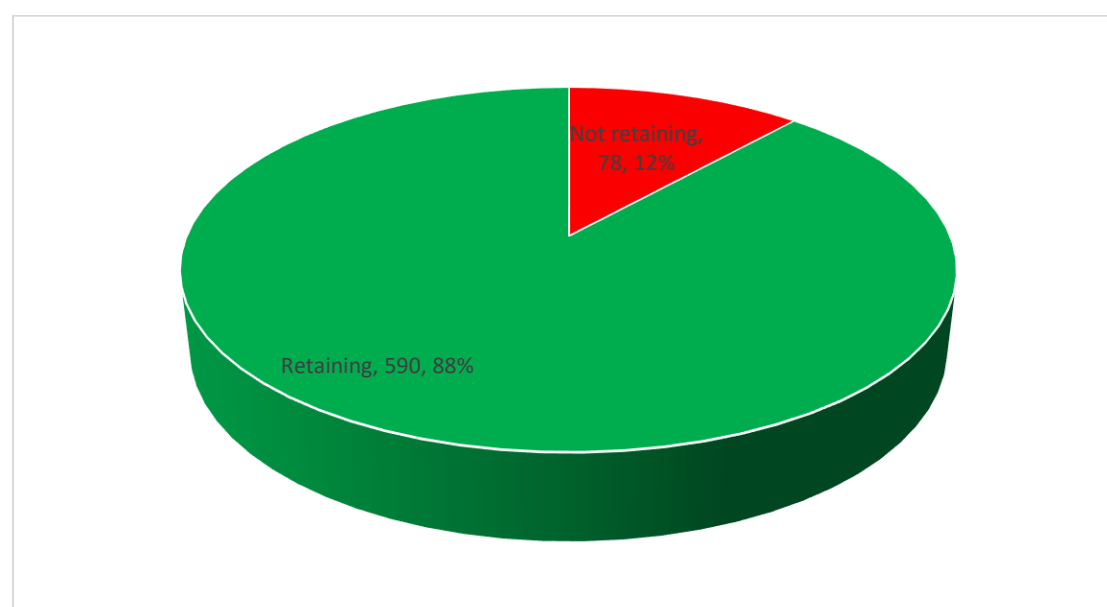


Fig. 5.8b. Percent of farmers retaining new varieties they obtained in the last 5 years.

- *Cereal crops:* For sorghum and maize, the major attributes are good taste, high yields and short maturity period. For millet, the key attribute appears to be good taste.

- *Oil seed crops*: For groundnut, high yields, good tastes and resistance to pests and disease are the top three important attributes farmers desired, while for sesame, high yields and marketability are key to retention of a given variety.
- *Pulses*: For cowpea, taste is the most important attribute, followed by high yields and resistance to pests and diseases, while for beans the main attributes are marketability and taste.
- *Vegetable crops*: In general, for vegetable crops, the attributes are high yields and marketability. Specifically, for okra, the key attributes are short maturity, followed by high yields and marketability. For tomato it is high yield, followed by resistance to pests and diseases. For collards (*Sukuma wiki*), the preferred attributes are resistance to pests and diseases and marketability.
- *Root crops*: The major root crops in South Sudan are cassava and sweet potato. The top three most important attributes of new cassava varieties that will determine their retention and use among farmers are good taste, high yields and short maturity.

Other varietal attributes such as drought and flood tolerance, storability and shattering did not emerge among the principal attributes for retention of varieties by the farmers. In the context of South Sudan where drought and/or flood are a common occurrence, considering the two with what farmers desire is important. McGuire and Sperling (2013) noted that promoting farmers' access to seeds of their choice, and fostering diversity of varieties and access channels, are important elements to building resilient seed systems. Therefore, matching of varieties with agro-ecologies as well as preferences by farmers need to be taken into consideration when planning emergency seed aid.

Table 5.9b. Main reasons for using new varieties

Crop	Good taste	High yield	Short maturity	Resistant to Pest and disease	Market	Tolerant to drought	flood tolerant	Storability	Less shattering	Freq
<i>Sorghum</i>	30%	27 %	17%	10%	1%	12%	3%	0%	0%	211
<i>Maize</i>	31%	26%	14%	13%	8%	1%	6%	1%	0%	167
<i>Cowpea</i>	46%	25%	5%	16%	4%	2%	2%	0%	0%	85
<i>G/nut</i>	20%	32%	7%	20%	7%	5%	10%	0%	0%	41
<i>Okra</i>	10%	15%	40%	10%	15%	10%	0%	0%	0%	20
<i>Sesame</i>	0%	45%	10%	10%	15%	5%	10%	0%	5%	20
<i>Tomatoes</i>	7%	36%	7%	43%	7%	0%	0%	0%	0%	14
<i>Cassava</i>	33%	22%	22%	11%	11%	0%	0%	0%	0%	9
<i>Veg</i>	43%	0%	14%	0%	43%	0%	0%	0%	0%	7
<i>Beans</i>	40%	0%	0%	0%	60%	0%	0%	0%	0%	5
<i>Millet</i>	100%	0%	0%	0%	0%	0%	0%	0%	0%	5
<i>Collards</i>	0%	20%	0%	40%	20%	0%	0%	20%	0%	5
<i>Overall</i>	30%	26%	14%	13%	6%	6%	4%	0%	0%	598

5.4.8 Summary of the key findings

The informal sector dominates across all crops and regions, with own-saved seed and local market as the main sources within the sector. Own-saved seed remains important in some states and for some crops, the role of own-saved seed is less. Local markets important base still for seed security, especially for legumes + sesame (though there are suggestions that markets may be disrupted in some places, such as in Panyijar).

Seed aid – importance varies by region studied, but rarely more than 25% of what was planted, and often less than 10 percent. While it makes important contributions, providing quality seed and reducing household expenditure, it is important to recognize that farmers’ seed security depends on multiple sources. Even especially vulnerable populations, such as IDPs and refugees, which are often prioritized for seed assistance, seed aid – while important for them, is not the only source they use.

Seed access - almost half of all seed obtained off-farm was done for cash or credit. Even under constrained circumstances, farmers are investing in seed – especially for marketed crops such as groundnut and sesame, but also for cassava. This suggests that, with appropriate design and support, market-based approaches could be leveraged to improve farmers’ access to more diverse and better-quality seed and planting materials of well-adapted varieties. Affordability was commonly mentioned as an issue, however, and there will remain significant groups of households who may need assistance in accessing seed.

Seed quality - generally positive, with very little concern about poor quality from sources used or crops planted.

Varietal suitability – use of improved varies across states, mostly low, and some of the varieties provided by seed aid are not universally preferred.

Access to new varieties – low exposure (24 percent), mostly provided by seed aid. Highlights importance of re-establishing more sustained and sustainable mechanisms for identifying and disseminating innovations to farmers.

5.5 Seed Aid in South Sudan

Seed aid has remained one of the channels through which vulnerable farm household access seed in South Sudan. It has been in existence since the operation lifeline Sudan, and normally triggered by various stress factors such as flood and/or drought, conflict and displacement of population.

5.5.1 Seed aid in the last five years

Over the past five years, almost 40 percent of the farm households across the country received some sort of seed aid. The proportions varied from state to state, ranging from 21 percent in Western Equatorial to 61 percent in Eastern Equatoria (Fig. 5.9a). Intensity of seed aid activity also varies greatly from year to year, based on the IPC phase classifications.

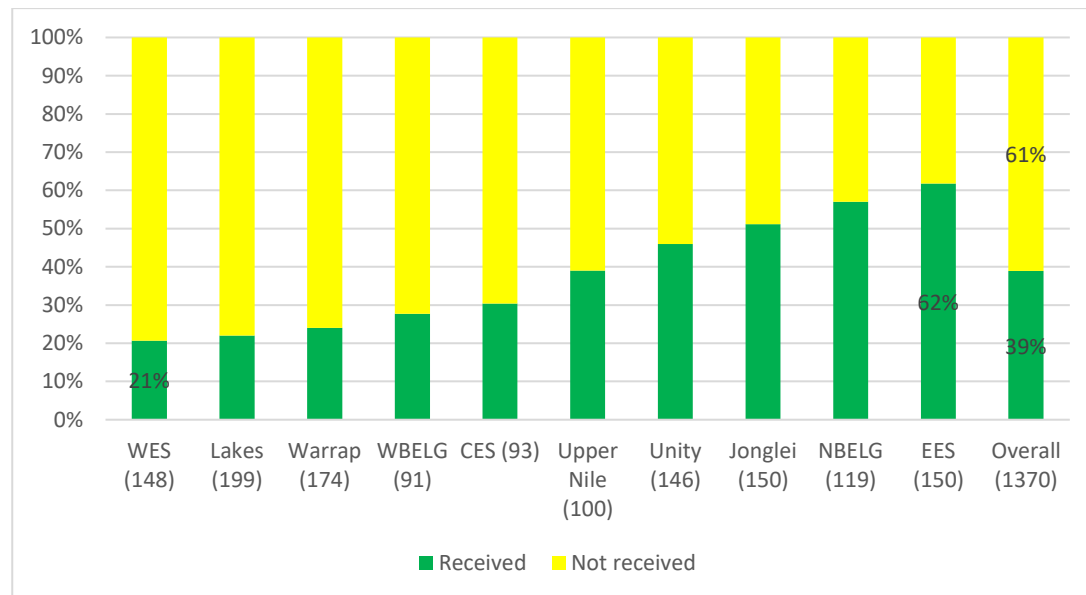


Fig. 5.9a. Percent of farm households that received seed aid in the last 5 years

Frequency of receiving seed aid: The number of times farm households received seed aid over the past five years varied across the states. Overall, 64 percent of seed aid beneficiaries received seed aid only once, while some 26 and 9 percent received the seed twice and three times, respectively. (Table 5.10). The high frequency of seed aid distribution is linked to vulnerability and disasters that affect farmers' ability to produce purchase and conserve their own seed.

Table 5.10. Number and percent of farmers received seed over the past 5 years

State	Once	Twice	Thrice	Four times	Frequency
CES	73.7%	21.1%	5.3%	0.0%	38
EES	66.4%	16.4%	14.8%	2.5%	122
Jonglei	43.8%	48.3%	7.9%	0.0%	89
Lakes	78.9%	15.8%	5.3%	0.0%	19
NBELG	85.2%	14.8%	0.0%	0.0%	27
Unity	56.5%	30.4%	13.0%	0.0%	46
Upper Nile	52.7%	32.7%	10.9%	3.6%	55
Warrap	85.7%	14.3%	0.0%	0.0%	35
WBELG	87.5%	12.5%	0.0%	0.0%	32
WES	62.1%	31.0%	6.9%	0.0%	29
Grand Total	64.4%	26.0%	8.5%	1.0%	492

5.5.2 Modality of seed distribution

The most common method of seed distribution as reported by farm households is Direct Seed Distribution (DSD), with 86 percent of distribution being accounted for by DSD. This varies by state, ranging from 52 percent in NBELG to 100 percent in Unity state. The second most important modality of distribution is the seed fairs and voucher, accounting to about 12 percent of the overall seed distribution, but with varying magnitudes across states. The states that received fairly higher percent contribution from seed fairs are NBELG, Warrap, WBELG, Lakes and Jonglei states, varying from 12 to 32 percent (Fig. 5.9b). Generally, FAO and other agencies have been prioritizing fairs and vouchers in areas that are relatively stable, and where seeds have been determined to be available.

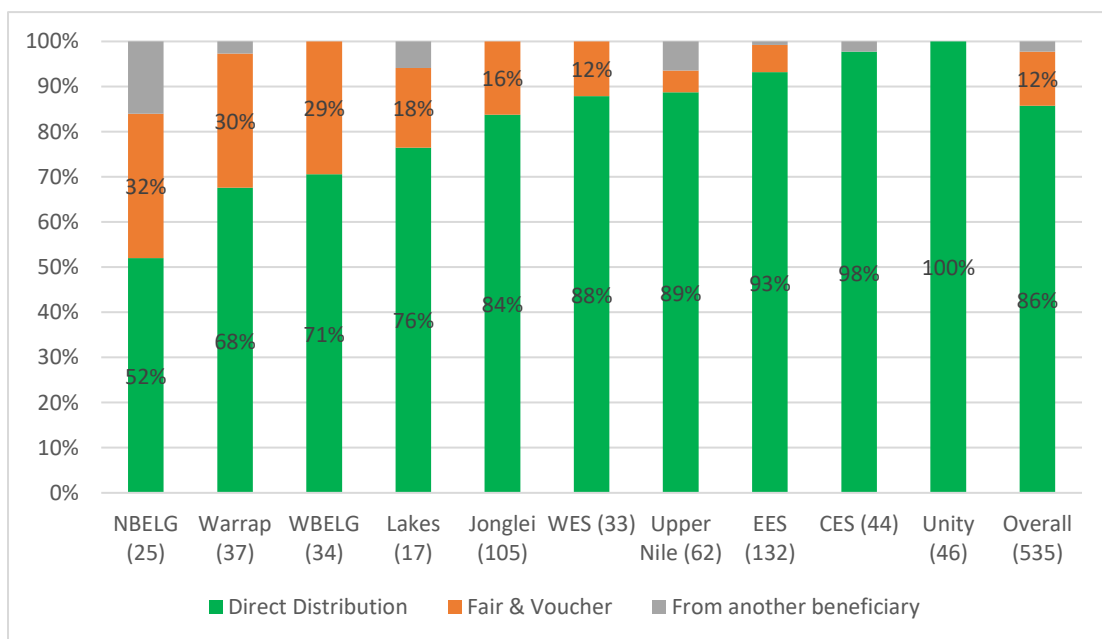


Fig. 5.9b. Modality of seed distribution

Direct distribution is normally used in the assumption that there is a very limited quantity of seeds available within the farming community to meet planting requirements, in other words when seed security is mainly constrained by seed availability. This approach provides all beneficiaries with predetermined quantities of seed irrespective of the differences among households.

Seed fairs and vouchers on the other hand are used when sufficient quantities of seed are available within the community, but the main seed security constraint for some farmers relates to their ability to access the seed. Seed fairs are a market-based approach that identifies seed vendors and provides vouchers to the beneficiaries in order to enable them to buy seeds from the vendors. It is more flexible than direct distribution in the sense that it provides beneficiaries with the ability to choose among different crops and varieties, as well as the quantities they purchase, according to their individual needs and preferences.

A greater use of seed vouchers and fairs as a mode of provision could also improve farmers' ability to choose the content of assistance, while at the same time address the primary constraints to seed security—the difficulties some vulnerable farmers face in accessing seed. Over the past few years, between 60 000 and 100 000 households received seed aid support through seed fairs on an annual basis. With the advent of relative peace, FAO has targeted more than 100 000 households to be provided with seed through seed fairs and voucher

The major crops being provided in the fairs are groundnut and sorghum with each contributing 53 and 40 percent of quantity distributed through seed fairs, respectively (Fig. 5.18b). Maize and sesame constituted just about 3 percent while other crops such as maize cowpea, green grams, millet and beans constituted just less than 1 percent in 2018. Both sorghum and groundnut are the major crops grown in NBEL and Lakes state where more beneficiaries are served (Fig. 5.9c). Moreover, there has been less civil strife in NBELG and Lakes, enabling a more conducive environment than in other states.

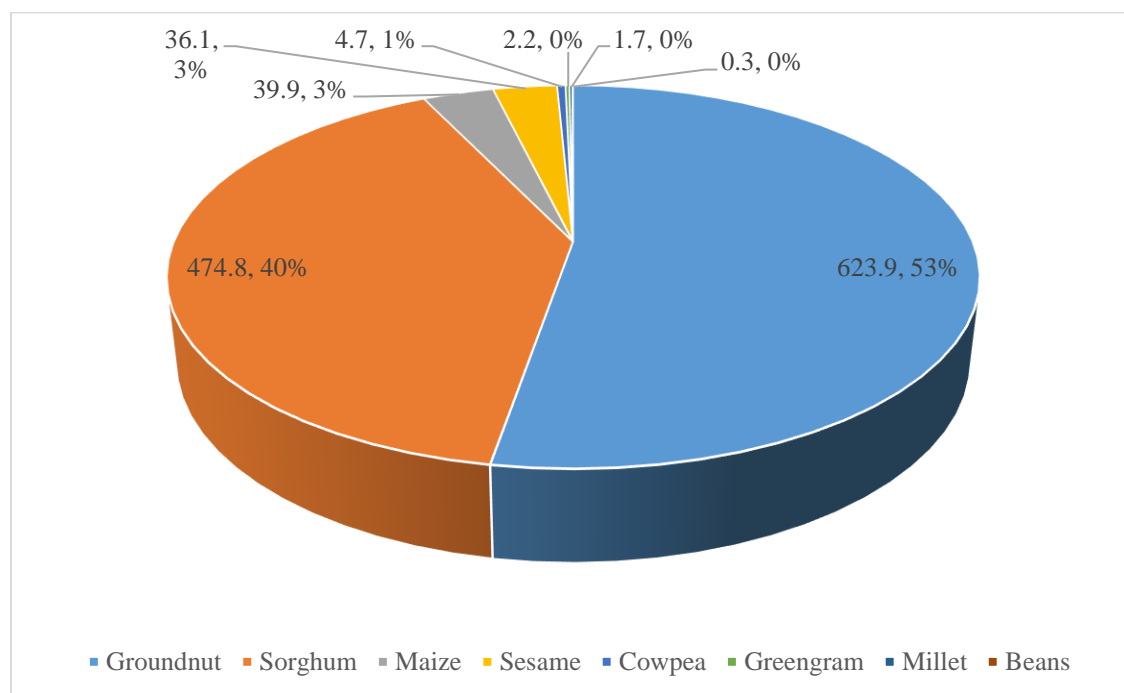


Fig. 5.9c. Quantity (tons), percent pf crop seed provided in 2018 fairs

Overall, 72 904 beneficiary households were provided with seeds through fairs, with significantly more households targeted in NBEG (27 344) and Lakes (19 229) than in other states, while the number seed vendors that participated in the fair ranges from 19 to 190 (Fig. 5.9d).

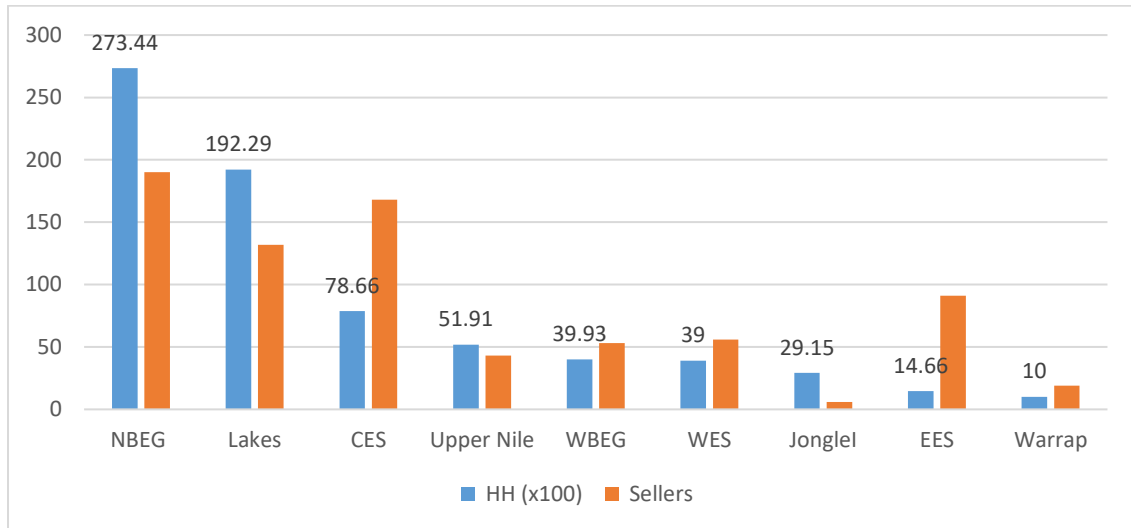


Fig. 5.19d. Fair beneficiaries HH (x100) and seed sellers across states in 2018

5.5.3 Timeliness of seed distribution

Overall, seed aid beneficiaries reported receiving the seed before (36 percent) and at the beginning (33 percent) of cropping season. At the same time, about 22 percent reported to have been given seed mid-season while 10 percent received them by the end of season. The timing of distribution varies from state to state, and farmers in the Equatoria region appear to be much more concerned (Fig. 5.9e).

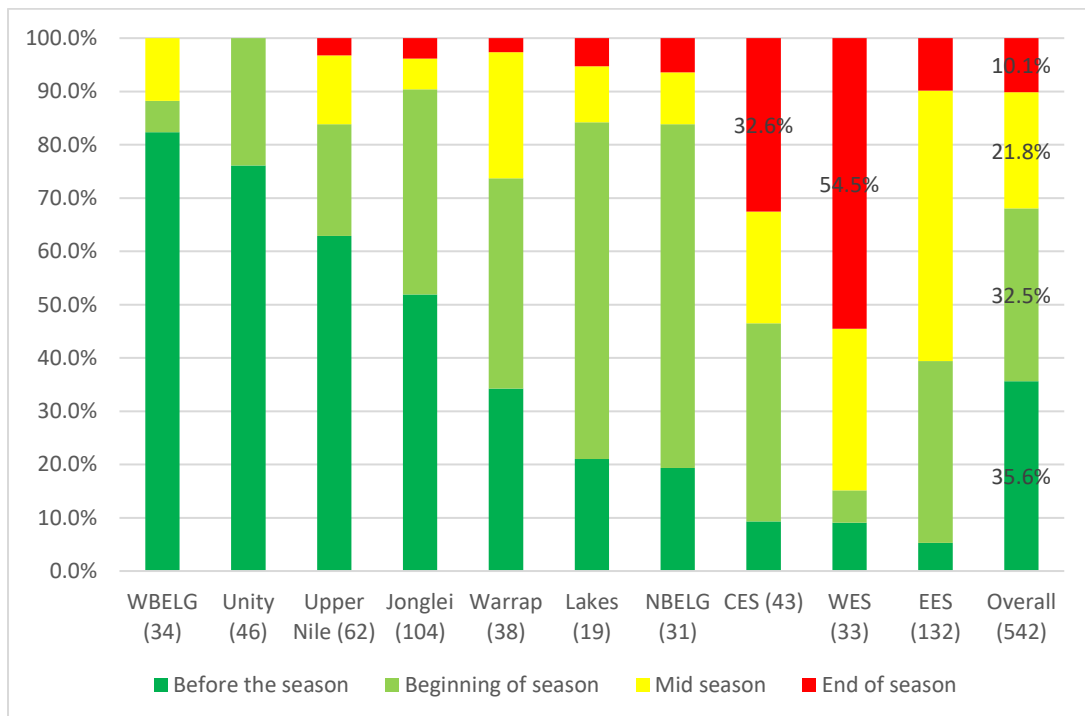


Fig. 5.9e. Seed aid recipients views of the timing of seed aid, by state

In the Equatoria region, more than 50 percent of the farmers indicated that over the last five years seeds are normally distributed mid-season or towards the end of season. In

the Equatoria region, the first rainy season normally comes early (March-April), while in the other two regions (GBEG and GUN) with only one season, rains planting normally starts around May and extends to June or July in some locations. This means that, if not well planned, seed distribution may become difficult in the Equatoria region. The challenge with distribution in the GBEG and GUN normally comes with logistics of distribution as many locations becomes inaccessible by roads and sometimes even by air.

5.5.4 General satisfaction with the seed aid

Overall, 67.7 percent of the seed aid beneficiaries indicated they were satisfied with the support provided. In Unity, WBELG and Lakes had over 88 percent levels of satisfaction with aid compared to those in Jonglei, CES, NBELG, Upper Nile, EES and Warrap WES farmers had the lowest levels of satisfaction with seed aid, with only 23.3 percent of them being satisfied (Fig. 5.9f). The low levels of satisfaction in WES could be strongly attributed to the timing of the distribution to which more than 84 percent of households indicated that seed aid normally come in mid-season or towards the end of the season. The sentiment of late provision of seed was echoed by Key Informants across a number of sites and states.

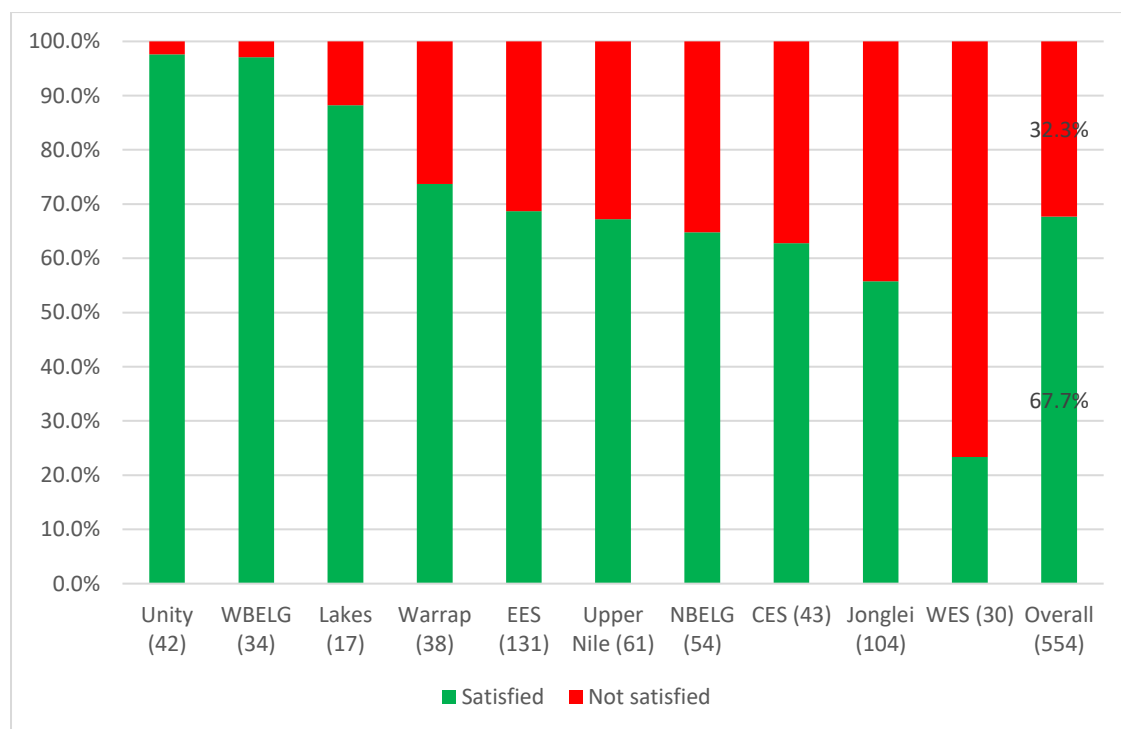


Fig 5.9f. Seed aid recipients' overall satisfaction

5.5.5 Summary

About 40 percent have received seed aid in recent years. Among aid recipients, a third have received aid more than once. Direct seed distribution (DSD) predominates, though

some were supported via seed vouchers and fairs. Generally, most seed aid reached farmers in time for the cropping season, and most farmers were satisfied with this assistance. However, there were concerns expressed by a number of farmers in several areas, particularly around the timing of seed aid.

Seed assistance could improve in a number of ways. For instance, earlier pledges from resource partners, timely preparation among providers for procurement and coordination with implementing partners could help ensure that assistance is timely, especially in Greater Equatoria.

Seed fairs and vouchers offer a better opportunity for improvement improving access to seed of adapted varieties among beneficiaries. With the current peace agreement, great potential exist for shifting from direct seed distribution to market-based approaches – fairs and vouchers.

5.6 Farmers' Training and Access to Technologies

Empowering farming communities in the use of innovative and improved production technologies is extremely important to increase production and productivity. The assessment revealed that only 15 percent of the farm households in South Sudan had received any training related to crop production over the past five years. A higher proportion of respondents received training in Eastern Equatoria and Jonglei states, followed by WBELG and WES, while the six remaining states had less evidence of farmer training.

Training areas: training for farmers focused on a number of areas, with agronomic practices being the most popular topic (43 percent), followed by training around plant protection, and soil and water management (both 14 percent). Other training topics included post-harvest handling (12 percent), and seed production (10 percent), while a few farmers received training in marketing or value-addition (Fig. 5.10).

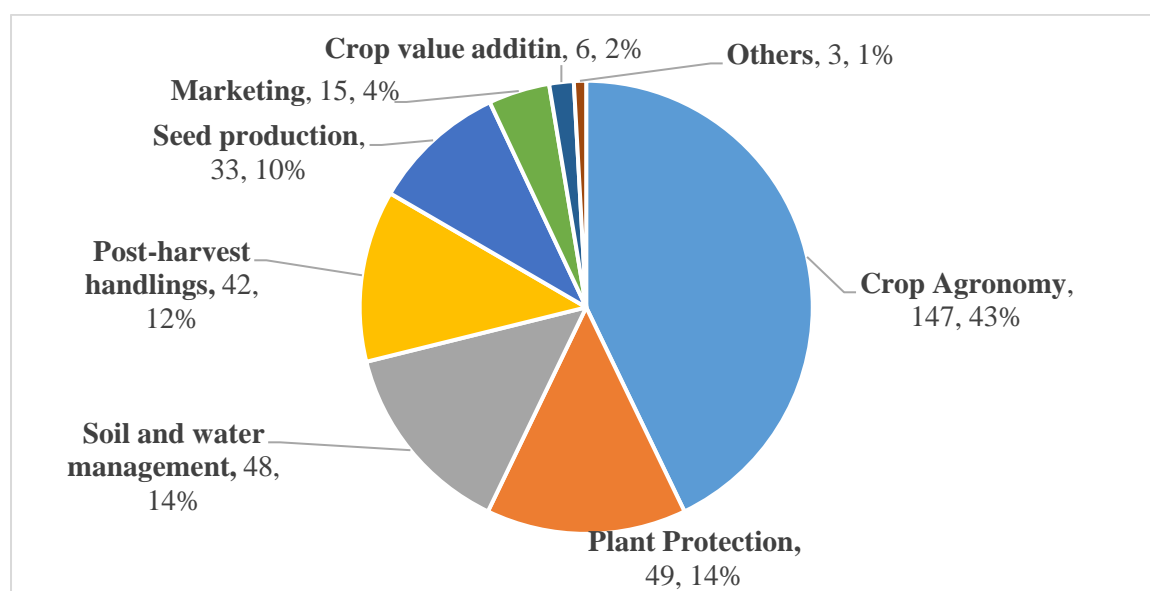


Fig 5.10. Areas of training in the last five years.

FAO, in collaboration with MAFS, trained over 600 trainers across South Sudan on Fall Armyworm (FAW). In addition, FAO ensured that most of its projects and letters of agreement with implementing partner incorporated aspects of FAW identification, management and control as part of plant protection strategy.

There are several small groups (20 – 30 members) of seed producers supported by FAO and NGOs across South Sudan. Their common objective is to produce seed-adapted crop varieties in order to supply seed markets within their communities. Major crops under seed production are sorghum, maize, groundnut and sesame. The groups (Box 5.4) are supported with inputs such as seeds, tools, tarpaulins, gunny bags, and moisture meters and sometimes with seed cleaners (manual) and seed storage structures.

Box. 5.4. Community- based seed production under World Bank funded project.

The Emergency Food and Nutrition Security projected funded by the World Bank supported a number of farmer groups across three former states (NBELG, Jonglei and Upper Nile). The assessment of performance of some of the groups are as below. Their production ranges from 2.5 to 15 tons depending of the crop type and number.

State	County	Group Name	Sorghum	Millet	G/nut	Sesame
NBEG	Aweil South	Panthou Seed group	2500		-	-
	Aweil South	Tiraliet seed group			4600	
	Aweil West	Pan-hang seed group			4500	
	Aweil West	Akek rot seed group			2500	300
	Aweil East	Yagot cooperative	5000	3000	7500	2000
Jonglei	Bor South	Dikroot seed group	3000			
	Twic East	Biong	7600			
	Twic East	Chop-chok seed group	2500			

Focus group discussion with some members of the group revealed they have training on agronomy - basic skills on line planting, and seed rates, roughing, harvest and post harvest handlings. They have very limited skills in collective marketing.

Major limitation of community-based seed production includes:

- Poor or lack of access to foundation seed, tools and ox-plough. Some of the above groups were provided with only maize seed while for other crops they have to use the seed provided during the seed fairs. Because of use of land races, the genetic purity of the variety is always questionable.
- *Limited services:* No tractor and ox-plough hire in some locations. This limits area of land put under seed production.
- *Limited skills and knowledge:* Focus group discussion with some groups revealed they have got training on agronomy - basic skills on line planting, and seed rates, but less related to seed production.
- *Lack of proper storage facility:* Since of the groups do not have storage facility, most members store their seed in individual houses or traditional granaries.

The various trainings were mainly supported and/or facilitated either by UN agencies or NGOs, who accounted for over 90 percent, while seven percent of respondents received training from the Government. A few respondents received training from private seed companies or lead farmers in the communities. Overall, the various trainings were considered satisfactory by 85 percent of those who were trained. With current situation, it is most likely that capacity of MAFS, or County-level staff to provide extension will remain low without improved funding.

5.7 Use of Productivity Enhancement Inputs

To exploit the genetic potential of a given crop variety, a seed needs to be planted in soils that have balanced nutrients and the crop protected from biotic and abiotic stresses. Most field crops thrive in well-drained soils with good water retention capacities and a good supply of nutrients. There are a number of ways that soil nutrients can be improved, and crops protected from biotic and climatic stresses. The use of mineral fertilizers and/or organic manure are key approaches for enhancing and maintaining soil fertility

5.7.1 Inorganic fertilizers

There was very limited use of inorganic fertilizers across all assessment areas, with less than 1 percent being used on major field crops in 2018. The main reasons farmers gave for not using inorganic fertilizers in South Sudan were because they were unaware of them (53 percent) or had no knowledge of their correct use (15 percent). Other reasons behind the limited use of inorganic fertilizers were their unavailability (14 percent) and the high cost (Fig. 5.11a).

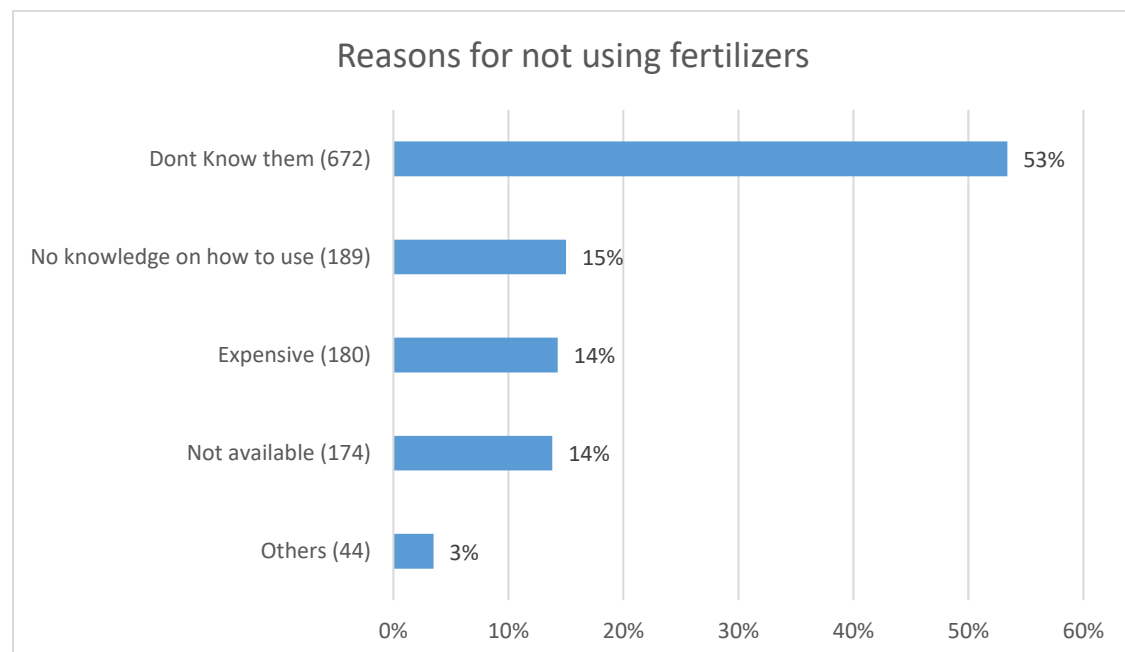


Fig. 5.11a. Reasons for not using fertilizers.

For a long time, there has been a perception among the political class that the soils in South Sudan are generally fertile and therefore have no need for fertilizers. This however, is not founded on any scientific analysis of soil fertility across the country. Although it appears that there is very limited use of fertilizers across the assessed area, there has been an increase in use of fertilizers by vegetable growers along the Nile, and a numbers of agro-input dealers in and around Juba have stock of different types of inorganic fertilizers such as UREA, DAP NPK and range of foliar fertilizers.

In other countries in the region, chemical fertilizer use has increased when other supporting factors are in place, such as access to productive varieties, value chains that incentivize investment into productive inputs, and advice and financial services. In South Sudan, the starting point for enabling farmers to invest more in productive inputs will likely be through developing value chains that benefit farmers, and decrease their exposure to risk and uncertainty. Developing value chains in South Sudan (Box 5.5) will likely need strengthened key institutions and services, whether public, private or informal.

Box 5.5. Value chain – opportunity for seed sector support

FAO Sustainable Agriculture for Economic Resiliency (SAFER) funded by the U.S. Aid for International Development, and the Emergency Food and Nutrition Security Project (EFNSP) funded by the World Bank aim at empowering over 200 crops (groundnut, cassava, sorghum and maize) producer and value addition groups. These projects are providing value addition with equipment and machines such as groundnut shellers and peanut butter machine, grinding mills, sorghum thresher and cassava chippers for value addition and processing of crop produce into various end product such as the peanut butter, high quality cassava and maize flour for market.

Machines	SAFER	EFSNP	Total
Groundnut Sheller	15	60	75
Peanut butter machine	15	-	15
Sorghum threshers		9	9
Cassava chipper	15	-	15
Grinding mills	10	9	10
Manual seed cleaners			6

These value chain initiatives are expected to stimulate demand for quality seed of suitable

5.7.2 Organic inputs

Overall, about 38 percent of farm households use some form of organic inputs to manage soil fertility on their farms. These are more commonly used in the Greater Bahr el Ghazal and Greater Upper Nile regions (Fig. 5.11b), where livestock are very common. Nationally, the most commonly used organic amendment is animal manure (72 percent of cases) (Fig. 5.11c and 5.11d).

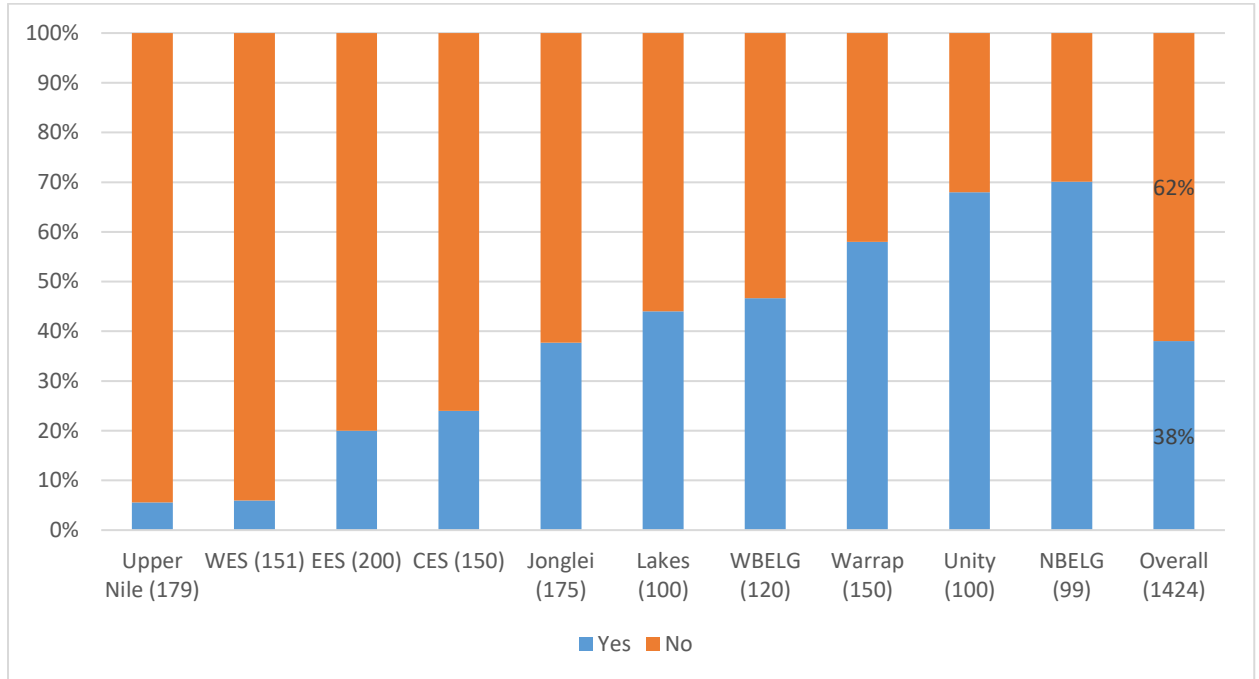


Fig. 5.11b. Use of organic soil inputs across South Sudan.

The most common practice for applying animal manure is to allow livestock (cattle) to enter crop fields during the dry season after harvest, to graze for three or four days on straw left in the field. The animals are allowed to spend nights in the field. Those who do not have cattle can hire the service from those with large herds, providing food and local brews to the herders, and sometimes cash, in exchange.

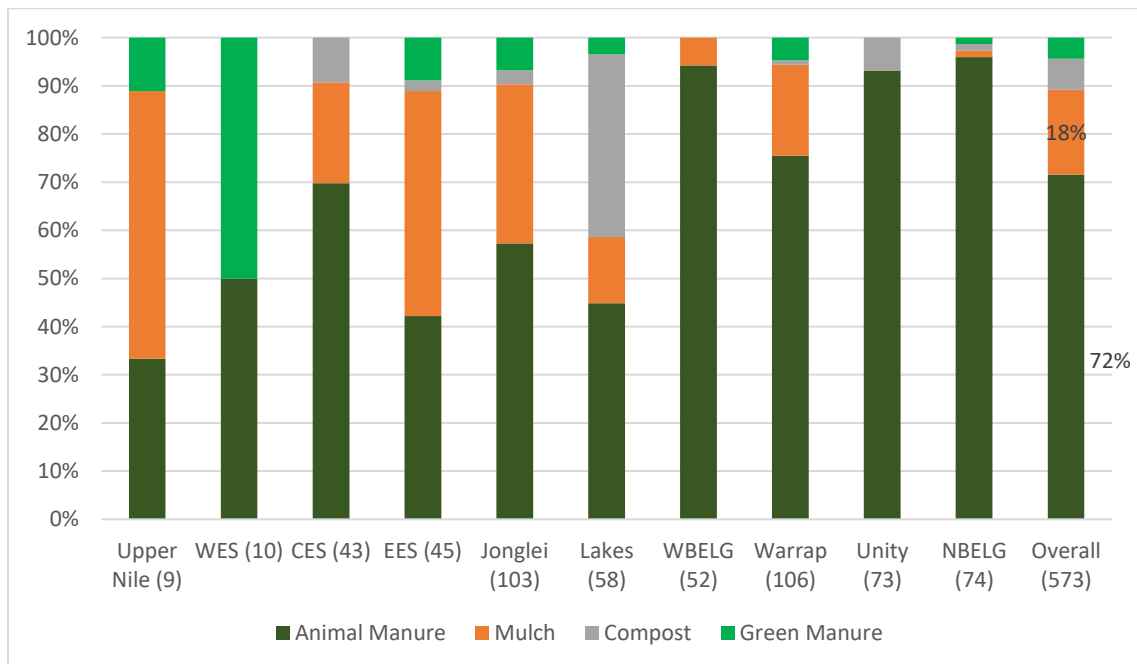


Fig. 5.11c. Types of organic soil inputs used by farmers across South Sudan



Fig. 5.11d. cattle dung in harvested sorghum field around a homestead in NBELG

For those not using organic amendments, the main reason was a lack of knowledge (60.5 percent), followed by the view that it is not necessary, and by the unavailability of materials (Fig. 5.11e).

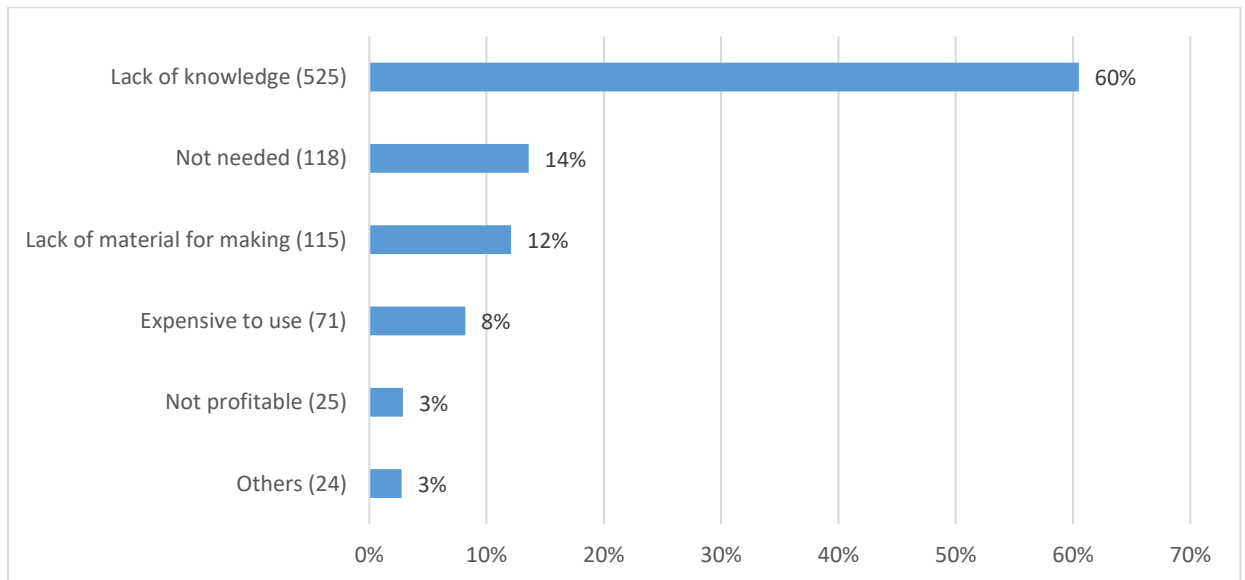


Fig. 5.11e. Reasons given by farmers for not using organic amendment

6 COMPARISON OF MAJOR FINDINGS OF 2010 AND 2018 SSSA

FAO in collaboration with MAFS and other stakeholders, carried a Seeds System Security Assessment (SSSA) both in 2010 and 2018, using similar methodologies and tools. The two assessments covered the entire South Sudan. Over an eight-year span, some aspects have remained the same while others have taken positive or negative trend (Table 11).

Table 11. Summary of key finding

Thematic area	Observations/comments	Similarities/differences	
		2000 - 2010	2011 - 2018
Research and plant breeding	The research activities have mostly limited to introduction and testing of materials from NARS and/or IARCs	No official record of variety release.	33 new varieties have been released between 2010 and 2018
	Palotaka Basic Seed Centre established in 2017	No major progress in producing basic seed	No major progress in producing basic seed
Formal Seed System and Community-based seed production support.	Large volume of certified seed being imported into the county by Humanitarian organizations.	800 to 2000 tons assorted crop seed per year between 2008 and 2010 to support returnees and IDPs.	3000 to 6000 tons per year between 2016 and 2018. The 2013 and 2016 war triggered series of humanitarian response to support the IDP and Host communities across the country
	Local seed production by companies' operation in South Sudan.	No seed company was producing seed in the country	There are about 14 registered companies carrying out local production.

Thematic area	Observations/comments	Similarities/differences	
		2000 - 2010	2011 - 2018
			Level of local seed production progressively increased from 400 tons in 2011 to 1760 tons in 2018.
	Community based seed production continues to be supported by national and international organization	About 795 tons of assorted crop seed were produced in 2010.	Statistics from FAO showed that over 1000 - 1200 tons of seed were produced between 2016 and 2018.
	Seed Certification	No Seed Certification Authority in the Yei Seed Laboratory provided seed testing services. Another Laboratory was set up in Wau but remained non-operational.	No Seed Certification Authority in the No functional laboratory at the time of compiling the report.
	National seed policy and regulatory framework.	No seed policy and regulatory framework in specific to Southern Sudan.	Draft National Seed Policy document developed. No seed law or regulatory framework
Seed supply and sourcing by farmers	The informal seed sources (own-saved seed, local market and local market) contribution over 85 percent of the seed.	Own-saved seed = 42% Local market = 22% Social network = 26 % Seed aid = 9%	Own-saved seed = 52% Local market = 21% Social network 13% Seed aid = 14%

Thematic area	Observations/comments	Similarities/differences	
		2000 - 2010	2011 - 2018
Seed quality	Farmers' perception of the quality of seed they plant.	Overall, more than 80 Percent of seed sown by farmers were considered good.	Overall, more than 80 Percent of seed sown by farmers were considered good.
Seed Stress – Planting less	Farmers may plant less area in a given year due to a number of factors or stresses, some of the reasons being seed related while majority are non-seed related	43 of the respondents indicated they planted less, and about 59 percent of them (25 % of the respondents) their reasons to none, seed factors.	In 2018, only 5 percent of respondents planted less. 64 percent of the farmers who planted less (only 3 percent of the responses) attributed their action to non-seed related factors.
Humanitarian Seed Aids	Seed aid has been a strong positive force in improving availability, access and introducing new varieties to farmers. Most households depend on seed aid as the only source of exotic vegetables seeds	About 2 000 tons of seed was distributed through humanitarian assistance, with major crop being maize, sorghum, cowpea, beans, and sesame. Most households depend on seed aid as the only source of exotic vegetables seeds Direct seed distribution (DSD) accounted for about 95 percent of the distribution, while market-based approach such as seed fairs accounted for only 5 percent.	More than 5 000 tons of seed distributed through humanitarian assistance, with major crop being maize, sorghum, cowpea, beans, and sesame. Most households depend on seed aid as the only source of exotic vegetables seeds DSD accounted for 85 percent while market-based approach such as seed fairs accounted for 15 percent.

Thematic area	Observations/comments	Similarities/differences	
		2000 - 2010	2011 - 2018
		About 50 percent of the farm households received seed aid in past 5 years.	About 40 percent of the farm household received seed aid in the past 5 years.
Use of Inorganic Fertilizers and Organic amendment	Use of inorganic fertilizers across the assessed sites, especially on field crops is minimal.	Less than 1 percent of the farm households are using inorganic fertilizers across the assessed sites.	Less than 1 percent of the farm households are using inorganic fertilizers across the assessed sites. There is increased stock of inorganic fertilizers (UREA, DAP, NPK + foliar) with agro-input dealers in Juba. Most are sold to vegetable producers.
	There is some reasonable use of organic amendment among farm households across South Sudan.	About 50 percent of households used organic amendment in their farm, and 65 percent of those who used organic amendment applied animal manure.	About 40 percent of the farm households used organic manure, and 72 percent of those who used organic amendment applied animal manure.

7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusion

The seed system in South Sudan is still highly dominated by the informal sector, contributing to more than 80 percent of the seed sources used by the farmers. Own seed, local market and social networks are the major sources of seed used planted and will continue to be so in the coming years.

Research: The formal sector is still weak, with research work limited to testing of materials from the National Agricultural Research Systems (NARS) of neighboring countries, or from International Agricultural Research Centre (IARCs). The few available released varieties have remained on-shelf of research but required concerted effort to enable farmers to access these materials. Much more work is needed to assess and promote these varieties with farmers via demonstration plots, using these also as opportunities to raise awareness among local government and development practitioners, and, once popular new varieties have been identified—sustained and sustainable approaches to multiply and market the seed.

Seed production and supplies: the level of seed production from the seed companies operating in the country is still lower than the demand, and barely exceeds 2 000 tons annually. Seed production from these companies are still riddled with carryover of the stock, highlighting the gaps in production planning and marketing; humanitarian organizations remain their main buyers, rather than farmers directly. Community-based seed production and supplies continued to provide alternative options in areas where the formal sector is absent or weak. The production is normally done by organized farmer groups or individuals supported by government, FAO and/or NGOs. The support normally comes in the form of inputs and trainings, with seeds marketed locally, and sometimes supplied to the most vulnerable households through seed fair arrangement. It is important to note that the bulk of certified seeds being used in South Sudan is from neighboring countries, with about 5 600 tons imported by FAO alone in 2018, and an estimated 8 000 tons planned for 2019.

Seed security at community level: The informal sector dominates across all crops and regions, with own-saved seed and local market as the main sources within the sector. Own-saved seed remains important in some states and for some crops; the role of own-saved seed is less. Local markets important base still for seed security, especially for legumes and sesame (though there are suggestions that markets may be disrupted in some locations).

- *Seed access* - almost half of all seeds obtained off-farm have been bought in cash or credit. Even under constrained circumstances, farmers are investing in seeds—for marketed crops such as groundnut and sesame, and for cassava as well. This suggests that, with appropriate design and support, market-based approaches could be leveraged to improve farmers' access to more diverse and

better-quality seed and planting materials of well-adapted varieties. Affordability was commonly mentioned as an issue, however, and there will remain significant groups of households who may need assistance in accessing seed.

- *Seed quality* - generally positive, with very little concern about poor quality from sources used or crops planted.
- *Varietal suitability* – the use of improved varieties is low, and some of the varieties provided by seed aid are not universally preferred.
- *Access to new varieties* – low exposure (24 percent), mostly provided by seed aid. This highlights the importance of re-establishing more sustained and sustainable mechanisms for identifying and disseminating innovations to farmers.

Seed aid: Nearly 40 percent of the households have received seed aid in the past five years. Among aid recipients, one-third has received aid more than once. Direct seed distribution (DSD) predominates, although some were supported via seed vouchers and fairs. Generally, most seed aid reached farmers in time for the cropping season, and most farmers were satisfied with this assistance. However, there were concerns expressed by a number of farmers in several areas, particularly around the timing of seed aid.

Seed assistance could improve in a number of ways. For instance, earlier pledges from resource partners, timely preparation among providers for procurement and coordination with implementing partners could help ensure that assistance is timely, especially in Greater Equatoria.

Seed fairs and vouchers offer better opportunities for improving access to seeds of adapted varieties among beneficiaries. With the current peace agreement, great potential exists for shifting from direct seed distribution to market-based approaches—fairs and vouchers.

7.2 Recommendations

7.2.1 Research and plant breeding

In order to fulfill the mission, vision and objectives of the Directorate of Research, the following considerations should be made within the short, medium and long terms.

Short-term⁶

- i. *Memorandum of Understanding (MoU) for acquisition of parent materials of released varieties as well as access lines in advanced trials:* The Ministry of

⁶ Within one year

Agriculture and Food Security (MAFS) needs to sign an MoU with the counterparts in countries where the released varieties were developed so that parent materials and foundation seed are made available.

Medium-term⁷

- ii. *Effective collaboration with IARCs and NARS:* Maintain effective collaborations with the various levels of research institutions, especially with the International Agriculture Research Centers (IARCs), particularly with the Consultative Groups on International Research (CGIAR) and National Agricultural Research Systems (NARS) within the East and Central Africa (ECA) region in order to;
 - a. access improved lines in Advanced Yield Trials (AYT) or at National Performance Trial (NPT);
 - b. germplasm collection and conservation (ex-situ and in-situ);
 - c. access to laboratory services required for identification, diagnosis and analysis of samples collected by researchers in South Sudan e.g. identification of diseases and pests unknown to researchers;
 - d. Building capacity of researchers and technicians based on gaps and identified need.

- iii. *Establishment of competitive research grants:* With the current economic crisis, the government may not have sufficient funds to support research programs. It is important that both resource and development partners set up competitive research grant schemes to fund research. The grant could focus on, but not limited to, participatory plant breeding and adaptive trials.

- iv. *Support to capacity development:* Research requires higher level of expertise, modern facilities and equipment and analytical tools. There is need for development partners to continue developing and strengthening capacity of research directorate as gate way to develop new innovations, materials and dissemination existing technologies (released varieties). Specifically, the followings capacity development areas should be done with the technical support of the Consultative Group on International Agricultural Research (CGIAR) centers.
 - a. Conduct participatory Plant Breeding (PPB) and/or Participatory Variety Selection (PVS);
 - b. On-farm trials and adaptive trials—need to support researchers in designing and setting up on-farm trials;
 - c. Data analysis using most recent versions of data analytical packages/tools such as SAS, SPSS etc.;
 - d. Training of research and laboratory technicians;
 - e. Establishment of minimum relevant laboratory infrastructure;

⁷ Within 2-3 years

- v. *Promotion of released varieties:* The majority of the farmers are not exposed to the newly released varieties, and they have no idea about these valuable research material (seeds) capable of changing their food security and livelihood status. It is therefore imperative that concerted efforts are made by all key stakeholders and development partners to reach out to farming communities and deliver these materials.
 - a. *Access to varieties on shelf:* FAO, NGOs and local seed companies work with lead contact farmers, farmer groups, contract growers and associations across all livelihood zones and agro-ecologies of South Sudan. MAFS should there for provide access to these new varieties for demonstrations and on-farm trials.
 - b. *Establishment of demonstrations on new varieties and assiated technological packages:* FAO/NGOs should work closely with the State Ministry of Agriculture and Forestry (SMAF) and County Department of Agriculture (CAD) to establish demonstrations at strategic locations near places of worship, local markets and schools, and with specific lead contact farmers and/or crop/seed groups:
 - c. *Field days and evaluation:* Every demonstration established should have a field day where farmers who have been observing and/or participating in demonstration will be given opportunity to evaluate (field performance and end use preferences) the varieties against their preferred varieties.
- vi. *Breeding for varieties with preferred end use characteristic:* In the areas, where keep large herds of livestock, crop residues are important source feed especially after harvest. Research agenda should not only consider the economic yield but also takes into account the biomass that remains after the harvest as way of meeting the needs of the communities.
- vii. *Introduction and evaluation of improved early maturing crop varieties:* Climatic variability is real and has been affecting production and productivity of crops across South Sudan. There has been a lot of pipeline varieties from neighbouring countries including Sudan and select and in one-year participatory variety selection trials.

Long-term⁸

- viii. *Cleaning of popular local varieties:* South Sudan has a rich biodiversity of sorghum varieties, and many introduced improved varieties have failed to be accepted. The research unit should strive to clean and promote some of the popular varieties of sorghum in the country.

⁸ Within 4- 8 years

- a. NGOs and FAO could make efforts to identify popular local varieties, and with the technical support from the Directorate of Research, together with lead contact farmers/seed producer embark on cleaning and production of the varieties for market.
- ix. *Varietal catalogue:* The MAFS has a list of varieties acceptable for use in South Sudan. However, there is a catalogue of these varieties that provides detailed information about their recommended agro-ecologies, agronomic practices, and performance (growth duration, yields) and end use and economic importance. The Directorate of Research, with support from the originators of these varieties, should develop and continue to update the catalogue on a yearly basis. The catalogue should include all improved varieties as well as popular local varieties across South Sudan.

7.2.2 Formal seed production and supply

Short-term

- i. *Support for the maintenance and production of foundation seed:* One of the objectives of the formal seed sector is to supply quality seed of better (improved) varieties. Such objectives can only be realized when the starter seed (foundation) is of the right genetic makeup. To do this;
 - a) AGRA in collaboration with the Directorate of Research should deliberately identify and support one or two local seed companies to produce foundation seeds based on demand.
 - b) The Directorate of Research, MAFS, focus on producing basic materials for vegetatively propagated crops (cassava, sweet potato and yams) and plantain.
- ii. *Support to seed companies:* The level of local seed production by companies is still far below the demand, and the focus is still much on maize with the dominant market being the humanitarian organizations.
 - a) *Expand geographic area:* AGRA, with the support from donors, to continue supporting old and emerging seed companies, and strategize expansion to Greater Bahr el Ghazal and Upper Nile.
 - b) *Up-scaling production:* The companies need to be supported in scaling up production and well as developing strategies for marketing. Financial institutions need to come in to provide soft agricultural loans to enable the companies to acquire machineries and equipment, and modern storage facilities.
 - c) *Seed processing:* A number of seed processing facilities and equipment appear to be idle in the country. These present opportunities for the few seed companies to improve on the quality of their seeds, and hence improved trust within various market segments. The Palotaka and Wau processing units, through an MoU

with the Government, need to be assigned to willing companies. Alternatively, these units could be privatized by the Government.

- d) *Procurement of seed for humanitarian distribution:* FAO and NGOs ought to prioritize buying seeds from local companies before looking outside the country. This will help in stimulating the development of the formal seed sector in the end.

Medium-terms

- iii. *Building up strong STASS:* The seed companies have formed and registered the Seed Trade Association of South Sudan (STASS).
 - a) AGRA in collaboration with MAFS should ensure that the young association is supported to join Africa Seed Trade Association (ASTA), and linked to other associations within East and Central Africa in order to promote better seed trade;
 - b) *Training of STASS management:* Being the youngest association within the region, many if not all of their management staff probably lack capacity to run the association as well as guide members on matters pertaining to national and international seed trade. FAO and/or AGRA through their regional and international linkages and network could provide the necessary support in training of STASS.
- iv. *Seed marketing and distribution:* innovative approaches that could be used by the seed companies include:
 - a) *Decentralized distribution system:* Companies to explore using more decentralized distribution points, such as the local shops found in rural areas (i.e. where people might go to get some cooking oil, matches or batteries) to sell seed from private companies or community production;
 - b) *Appropriate and small seed pack:* Seed companies need to adopt appropriate seed pack, taking into consideration farming practices within target agro-ecologies, particularly average land sizes and seed rates. Use of small seeds have been successfully tested elsewhere to promote new varieties and build demand;
 - c) *Demonstrations and agricultural fairs:* Within the communities where they operate, companies need to establish demonstration units for new varieties, as well as showcase in agricultural fairs.

7.2.3 Community-based seed production and supply

FAO and NGOs are promoting local seed production using outgrower schemes. Key areas that need attention and support are:

Short-term

- i. *Improving access to quality starter seeds (foundation and/or certified).* In collaboration with research, promoters (FAO and NGOs) of community-based seed production should ensure that quality starter seeds are provided on time. Wherever there is interest in producing popular local variety, the variety should be sourced from lead contact farmers with experience on producing the variety;
- ii. *Training and support to more seed producers:* on aspects of quality seed production, processing and marketing;
- iii. *Creating market linkages:* Linking seed producers through seed fairs and voucher systems. As a short-term marketing strategy, the promoter of community-based seed production and humanitarian organization providing seed aid should give first priority to local seed growers to fairs or introduce voucher system.

Medium-term

- iv. *Improve access to ox-ploughs or tractor hire services:* Some of the community-based seed groups express the need to increase the area under seed production by improving access to ox-ploughs and/or tractor hire services;
- v. *Quality assurance along production to market chain:* All the community-based seed production initiatives need to be monitored and inspected by a competent authority. Given the fact that most of these takes place at state and county levels, relevant ministries and/or departments need to be empowered to provide quality assurance to all community-based seed production activities. The state ministries technical staff need to be capacitated. Therefore, FAO and the MASF, directorate of research need to provide trainings and backstopping of the state ministries in providing quality assurances.
- vi. *Processing and storage:* Seed processing and storage are key in attaining quality and developing trust and accountability. Promoters of community-based seed production, where feasible, need to support the various groups with simple processing equipment such as manual seed cleaners, moisture meters, hematic storage bags, and where production is significant (> 50 tons), construct permanent storage structures.
- vii. *Creating market linkages:* In the medium and long terms, experienced producers should be linked to seed companies as out growers and encouraged to form associations to benefit from collective marketing approach.

7.2.4 Regulatory framework and capacity for seed quality assurance

Medium-long-term

- i. *Development of seed trade guidelines and decree:* In the absence of an approved seed policy, South Sudan remains vulnerable to unregulated seed trade as no laws could be passed by the responsible bodies.
 - a) The MAFS, in collaboration with FAO and AGRA, should support development of a guideline that facilitate seed trade, and come up with rules and regulations that shall be passed as ministerial or presidential decree or orders.
 - b) Create awareness on the guideline and decrees: Government through workshops, trainings and various mass media channels need to make key stakeholders (seed producers, traders and end users) awareness of the exiting guideline's, procedures and decree passed
- ii. *Establishment and building the capacity of National Seed Certification Authority/Services.* Currently, there is no National Seed Certification Agency. The certification services are being provided by the Directorate of Research and Plant Protection. The MAFS is understaffed and underfunded to handle this essential task efficiently. The followings need to be considered in establishing an efficient and effective seed quality assurances in South Sudan.
 - a) *National Seed Certification Authority:* FAO in collaboration with AGRA to support the MAFS in the establishment of and training of a National Seed Certification Body to provide the necessary services in certification of seed and control/inspection of import/exports;
 - b) *Recruitment of qualified staff:* The Government of the Republic of South Sudan needs to ensure that MAFS is supported to recruit adequate and qualified staff to be deployed with the NSCA/S;
 - c) *Development of seed inspection and certification guidelines and regulations:* In collaboration with FAO and AGRA, the MAFS need to develop inspection and certification guidelines and regulation for South Sudan, taking into consideration the harmonized quality standards to facilitate seed trade;
 - d) *Border post improvement:* MAFS needs to operationalize the border posts at Nimule, Nadapal and Kaya to control seeds import and export. There is a need for the Government through MAFS to deploy well trained staff with necessary tools and equipment to ensure trade of quality seed across borders;
 - e) *Seed testing laboratories:* The laboratories in Yei and Wau need to be equipped and staffed. FAO prepositioned two trainers at the MAFS to support seed testing. These containers need to be fitted with basic seeds testing kits. In addition, the containers need to be provided with running water and solar powered incubators due to the high costs to run the lab full time with generators.

7.2.5 Humanitarian seed aid

Considering that farmers predominantly use informal sources, and that availability at the community level is not the major element of concern across sites, the following issues need to be taken into consideration:

Short-term

- i. *Assessments:* needs-assessment or rapid seed availability and quality assessment with potential sources should be conducted to justify and guide the approaches to be used by the humanitarian organizations;
- ii. *Market-based approaches:* As much as possible, use market-based approaches for seed provision to directly address access, involving both commercial and community seed producers as much as possible. Humanitarian organizations should scale up use of seed fairs and vouchers where significant volume has been assessed with producers or progressive farmers. Where there is strong presence of seed companies and or agro-input dealers use of voucher could be piloted;
- iii. *Timely distribution:* The crop seed provided through aid should be well timed to coincide with the beginning of the season;
- iv. *Matching of varieties with agro-ecologies and beneficiaries needs:* Humanitarian organizations need to avoid the notion of one-size-fits-all. Only varieties well adapted to a given agro-ecology should be provided through emergencies;
- v. *Delivery and distribution:* Prompt inspection to be carried out by field staff. Many seed lots have been reported to be of low quality and should re-tested before distribution. This needs to be supported with capacity building on seed quality and inspection.

Medium-term

- vi. *Repeated seed aid cases:* where there has been repeated DSD (3 or more consecutive seasons) in the same area, this should trigger a more seeds-specific needs assessment and answer some specific question as to why DSD it is being used over the years;
- vii. *Integration of resilience-building within humanitarian context:* Wherever possible, humanitarian seed aid needs to be repackaged, and directly or indirectly linked to resilience strategies that build assets and skills, in addition to being as market-driven as possible.

7.2.6 Building resilience seed system at community level

Short-term

- i. *Provision of improved storage facilities:* farm households to be exposed and/or encouraged to adopt use of hermetic storage bags (50-100kg capacity) and grain silos (200-500kg capacity) that maintains the quality of the harvest produce and reduce on storage pest infestation. This should be accompanied by training in storage management including retraining, and IPM packages;
- ii. *Support to local market trader:* Local market contributes to about 20 percent of the seed sourcing by the farmers. However, traders need some skills in managing quality of what they sell as seed by observing good storage conditions and practices:
 - a) *Promote, encouraged and regulate use of pallet, hermetic bags (50-100kg) and grain silos (200-500kg) among grain traders:* This will maintain the quality of grain that farmers could use as grain;
 - b) *Grain/seed information:* Provide basic information to traders on grain/seed quality aspects and management through trainings, leaflets and/or radio messages.

Medium-long term

- iii. *Crop and varietal diversification:* Even within the humanitarian context, it is important to consider actions that build resilience of the seed system. Humanitarian organizations therefore need to ensure that they provide crops and varieties that are adapted to the local agro-ecologies while considering the socio-economic aspects (preferences) of the crops and varieties being provided.
 - *Cassava and Sweet potato:* In NBEG where there is low crop diversity, crops such as cassava and sweet potatoes can be promoted in the ironstone plateau (SS4);
 - *Rice:* In Greater Upper Nile (Jonglei, Unity, and Upper Nile) and Greater Bhar el Ghazal, rice production should be promoted in the flood plain (SS6 and SS07). This will reduce the risk associated with climate variability and biotic constrain.
 - *Green grams and millet:* Concerted effort should be in promoting green gram in the SS2, SS7 and SS8 livelihood zones, and most important, in the Ironstone plateau (Annex 2)
- iv. *Control and management of striga and Fall Armyworm (FAW):* Striga and FAW are major cereal pests in South Sudan. Appropriate IPM package for the management of striga need to be developed and/or promoted;

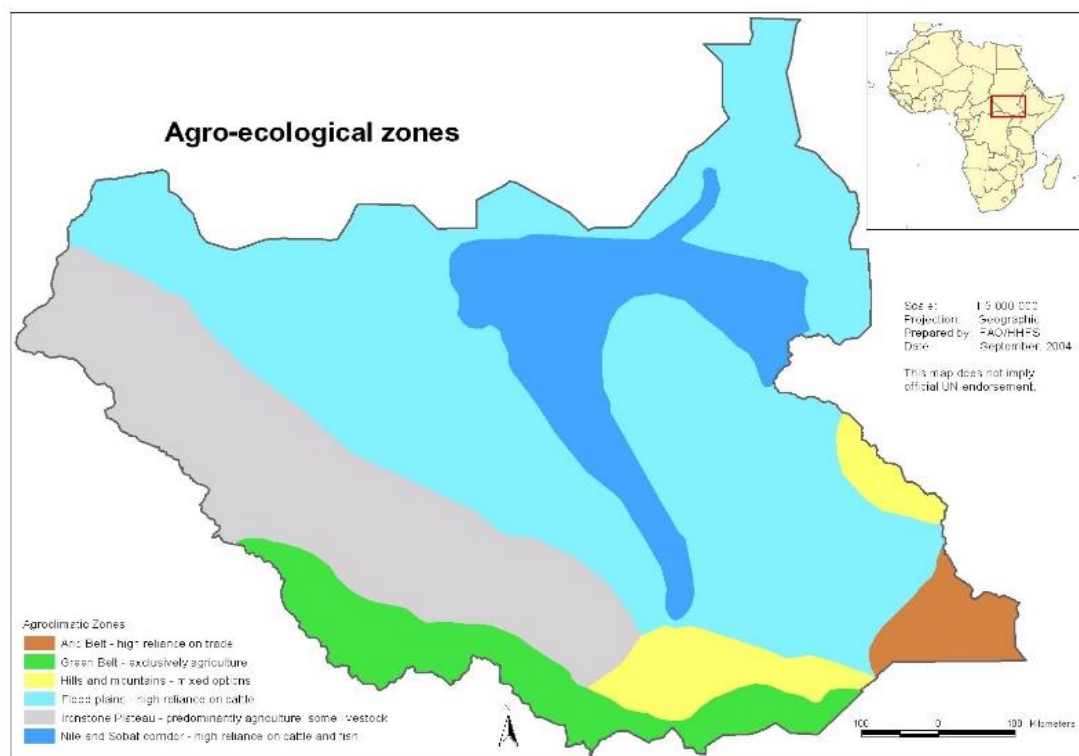
- v. *Support to seed bulking:* where there seem to chronic unavailability, development partners need to establish seed production groups, especially in areas where there are no seed companies and/or agro-input dealers. Key considerations include;
- Promote use of ox-plough technologies and/or introducing tractor hire services where applicable;
 - Explore and pilot use of cost-recovery approach in providing seed production inputs, equipment and tools. This need to be discussed and agreed upon by interested target as a way of sustainability;
- vi. *Seed banking:* In areas where there are continuous seed shortages, the community should be encouraged to have a community seed bank which serves as a reserve during crisis. This can tap into existing seed storage facilities constructed by FAO, NGOs and other development partners;
- vii. *Crop value addition and income generation:* Promotion and diversification of income through activities generation to enhance access to seeds as well as create a wider market for seed. Groundnut and maize are potential crops for value addition when turned into paste or flour, while sesame is a hot commodity in regional and international markets.

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ANNEXES

Annex 1: Agro-ecological Zones of South Sudan



Source: FAO Dynamic Atlas – September 2004

Annex 2. Number of crop varieties released between 2011 and 2018

Crop	Number of varieties released								
	2011	2012	2013	2014	2015	2016	2017	2018	Total
Sorghum	5	-	-	-	-	-	-	-	5
Maize (Hybrid)		4		2					6
Maize (OPV)	1	1							2
Rice (lowland)					2				2
Rice (upland)				3					3
Cassava	2			3					5
Soybeans		4							4
Cowpea						3			3
Groundnut								3	3
Total	8	9	0	8	2	3	0	3	33

Annex 3: Crop varieties introduced/released in South Sudan from 2011 to 2018.

S/N	Crop Types	Variety	Origin/Maintainer	Year released
1.0	Sorghum			
1.1		Macia	KALRO - Kenya	2011
1.2		Kari mtama 1	KALRO - Kenya	2011
1.3		SESO 1	NaSARRI - Uganda	2011
1.4		SESO 2	NaSARRI - Uganda	2011
1.5		SESO 3	NaSARRI - Uganda	2011
2.0	Maize			
2.1	HYBRIDS			
2.1.1	Maize Hybrids	KH500-46A	KALRO - Kenya	2012
2.1.2	Maize Hybrids	KH500-22A	KALRO - Kenya	“
2.1.3	Maize Hybrids	PALMHY – 1	MAF - Res	“
2.1.4	Maize Hybrids	PALMHY – 2	MAF - Res	“
2.1.5	Maize Hybrids	GRENNGOLD (SC0923)	SEED CO ZM	2014
2.1.6	Maize Hybrids	MAXIM (SC719)	SEED CO ZM	2014
2.2	Maize OPV			
2.2.1	Maize OPV	M45	ARC - Sudan	2011
2.2.2	Maize OPV	KDV4	KALRO - Kenya	2012
3.0	Rice			
3.1	Upland Rice			
3.1.1	Upland Rice	NERICA 1	WARDA	2014
3.1.2	Upland Rice	NERICA 4	WARDA	2014
3.1.3	Upland Rice	NERICA 10	WARDA	2014
3.2	Lowland Rice			
3.2.1	Lowland Rice	NERICA L-1	WARDA	2015
3.2.2	Lowland Rice	NERICA L-2	WARDA	2015
3.2.3	Lowland Rice	Wita 9	NaSARRI - Uganda	Due
3.2.4	Lowland Rice	Supa - 1052	Ivory Cost	Due
3.2.5	Lowland Rice	Komboka	NACRRI	Due
3.2.6	Lowland Rice	DKAP - 27	Mali	Due
4.0	Cassava			
4.1	Cassava	NASE 14	NaSARRI - Uganda	2011
4.2	Cassava	NASE 15	NaSARRI - Uganda	2011
4.3	Cassava	PAYE 1	MAF - Res	2014
4.4	Cassava	PAYE 2	MAF - Res	2014
4.5	Cassava	PAYE 3	MAF - Res	2014
5.0	Soya Beans			
5.1	Soya Beans	Maksoy 1 N	NARO - Uganda	2012
5.2	Soya Beans	Maksoy 2 N	NARO - Uganda	2012
5.3	Soya Beans	Maksoy 3 N	NARO - Uganda	2012
5.4	Soya Beans	Namsoy 4N	NARO - Uganda	2012
6.0	Cowpea			
6.1	Cowpea	AGRAC - 166	UOJ	2016
6.2	Cowpea	AGRAC - 216	UOJ	2016
6.3	Cowpea	AGRAC - 316	UOJ	2016
7.0	G/Nuts			
7.1	G/Nuts	YEPA 1	MAF - Res	2018
7.2	G/Nuts	YEPA 2	MAF - Res	2018
7.3	G/Nuts	YEPA 3	MAF - Res	2018

Annex 4 : Crop Varieties Introduced into South Sudan Before 2011

S/N	Crop Types	Variety	Origin/Maintainer	Year Introduced
1.0	Sorghum			
1.1	Sorghum	Serena	NARO/Uganda	1975
1.2	Sorghum	Seredo	NARO/Uganda	1994
1.2	Sorghum	Sekedo	/NAROUganda	1996
1.3	Sorghum	Gadam El Hamam	ARC/Sudan	2002
3.0	Maize (OPV)			
2.1	Maize (OPV)	Yellow Composite	IITA/Nigeria	1975
2.3	Maize (OPV)	TZESR	IITA/Nigeria	1975
2.4	Maize (OPV)	TZB	IITA/Nigeria	1975
2.5	Maize (OPV)	Katumani	NARO/Kenya	1976
2.6	Maize (OPV)	TZ Comp.4	IITA/Nigeria,	1997
2.7	Maize (OPV)	Longe 1	NARO//Uganda	2001
2.8	Maize (OPV)	Longe 2	NARO/Uganda	2002
2.9	Maize (OPV)	Longe 3	NARO/Uganda	2002
2.10	Maize (OPV)	Longe 4	NARO/Uganda	2002
2.11	Maize (OPV)	Longe 5	NARO/Uganda	2002
3.0	Cassava			
3.1	Cassava	Karangwa (Bitter)	Congo	1948
3.2	Cassava	Nase 1	NARO/Uganda	2000
3.3	Cassava	Nase 2	NARO/Uganda	2000
3.4	Cassava	TMS 14	NARO/Uganda	2004
4.0	Beans			
4.1		Rosecoco	KALRO/Kenya	1980
4.2		K132	NARO/Uganda	1996
4.3		French beans	KALRO/Kenya	1998
5.0	Soya Beans			
5.1	Soya Beans	Nam 1	NARO/Uganda,,	2001
5.2	Soya Beans	Nam 2	NARO/Uganda	2002
6.0	Sesame			
6.1	Sesame	Sesim 2	NARO/Uganda	2003
6.2	Sesame			
7.0	G/Nuts			
7.1	G/Nuts	Manipintar	Zambia	1975
7.2	G/Nuts	Mahulu Red	Zambia	1975
7.3	G/Nuts	Agar	ARC/.Sudan	1960s
7.4	G/Nuts	Berbet	ARC/.Sudan	1960s
7.5	G/Nuts	Red Beauty	NARO/Uganda	1975
7.6		Igola	NARO/Uganda	2001

Annex 5: Harmonized seed policies and regulations for Eastern Africa

Issues	Before ASARECA seed project	Results and agreements of the project	Implications of agreements and decisions to the seed sector	Status a	Implementation	
					Institution(s)	Other responsible remarks
1. Variety evaluation, release and registration						
a. Entering the national performance trials (NPTs)	Breeders in the countries entered materials for evaluation at national level before official approval for listing in the seed certification schedule and commercial seed producers at different stages of the variety development cycle, at advanced yield trials for Tanzania, and at national performance trials for Kenya	For both locally produced and introduced varieties, applicant will enter materials intended for release for at least one main season. These will regionally be known as variety performance trials (VPTs). Sufficient data from previous stages (advanced yield trial) will be needed.	Seed companies can do advanced multi-location testing in relevant ecological zones anywhere in East Africa and follow up entering them in VPTs. This will attract more seed companies to the region because of expanded market.	Procedural	NCAs	Implementation is immediate.
b. Variety testing procedures for release	Different in each country.	Variety testing procedures to be standardized.	This will facilitate reciprocal regional recognition of variety testing data.	Procedural	NCAs	Standards for some crops were not completed and will be done by a selected working group.

Issues	Before ASARECA seed project	Results and agreements of the project	Implications of agreements and decisions to the seed sector	Status a	<u>Implementation</u>	
					Institution(s)	Other responsible remarks
c. Number of seasons for release of varieties after they enter VPTs	In all countries the number was 3 seasons; for Tanzania and Kenya this means 3 years.	One-season performance testing for both local and foreign varieties is combined with sufficient data on previous testing from similar agro-ecological zones.	The time for new varieties to be available to the farmer has been reduced from 3 years to 1 year, implying more readily available new planting material.	Procedural	NCA's	Implementation is immediate.
d. On-farm trials	The emphasis varied across countries, being mandatory for Uganda, required for variety release in Tanzania, and optional for Kenya.	On-farm trials recommended but should be done concurrently with VPT so that trials do not claim extra time on release of varieties.	This consensus is quite positive because when on-farm trials were done independently, it implied at least 1 year more of delay in availability of varieties. The current consensus ensures more rapid availability of varieties, by at least one year.	Procedural	NCA's	On-farm trials may also help provide information to farmers about performance before formal release.
Issues	Before ASARECA seed project	Results and agreements of the project	Implications of agreements and decisions to the seed sector	Status a	<u>Implementation</u>	
					Institution(s)	Other responsible remarks

Issues	Before ASARECA seed project	Results and agreements of the project	Implications of agreements and decisions to the seed sector	Status a	Implementation	
					Institution(s)	Other responsible remarks
e. Private seed companies and breeders participating in national evaluation trials with NCA supervision for release purpose	The practice varied across the three countries from non-existent in Uganda to in the process of being considered in Kenya. In Tanzania it was already in practice.	Certifying agency will bear the overall responsibility but can accredit suitable institutions, companies or seed trade association, or individuals to carry out VPTs.	Increased acceptance of private sector role in seed evaluation and release. Because public research institutions are usually underfunded, the accreditation will help reduce the funding burden and expedite the process of availability.	Procedural	NCA's and Ministry of Agriculture	Under this agreement universities and related institutions can participate and increase the number involved in seed production.
f. Variety release committees	These committees varied in number, function, composition of membership, and frequency of meetings across the three countries.	Agreed that the certifying agency with some technical assistance from the applicant, the national seed trade association and an extension specialist will monitor and consider NPT/VPT results for consideration by the National Variety Release Committee (NVRC), which is the only committee. Composition of members to the NVRC is also standardized across the countries.	Speed up the release of varieties. Reduce cost of meetings. Increase transparency in participation. Form more technical committees. Increase participation of private sector. All these factors will make the committee more effective.	Procedural	NCA's and Ministry of Agriculture	This will help harmonize approaches to deliberations on new varieties.

Issues	Before ASARECA seed project	Results and agreements of the project	Implications of agreements and decisions to the seed sector	Status a	<u>Implementation</u>	
					Institution(s)	Other responsible remarks
g. Common variety list for the region	This did not exist.	It was agreed to establish a regional variety list/catalogue. Protocols were defined. This will provide information on available new varieties in the region.	Increased availability of information of new varieties.	Procedural	NCA's and Ministry of Agriculture	Content and organization of the catalogue were also discussed.
2. Seed certification						
a. Compulsory and voluntary certification	Differences existed in crops multiplied under voluntary and compulsory certification. This to a large extent disadvantaged farmers in seed availability.	The workshops agreed on which crops will be under compulsory and which under voluntary certification: <i>Compulsory</i> —hybrid maize, open-pollinated maize, sweet corn, common dry bean, snap bean, sorghum, wheat, rice, sunflower, Irish potato and any other crop approved by regional certifying agencies; <i>voluntary</i> —tomato, carrot, cassava, pigeon pea, cowpea, similar crops.	Commonalities on what crops are in which category will hasten seed movement and availability across borders. Doubts about seed in the voluntary class in one country and compulsory class in another are removed.	Procedural and legal	NCA's and Ministry of Agriculture	Countries are still in favour of both compulsory and voluntary certification.
Issues	Before ASARECA seed project	Results and agreements of the project	Implications of agreements and decisions to the seed	Status a	<u>Implementation</u>	
					Institution(s)	Other responsible remarks

Issues	Before ASARECA seed project	Results and agreements of the project	Implications of agreements and decisions to the seed sector	Status a	Implementation	
					Institution(s)	Other responsible remarks
			sector			
b. Field and laboratory standards	These were different in the three countries, making acceptance by outsiders and regional trade difficult.	The workshop harmonized field and laboratory standards for hybrid maize, sweet corn, open-pollinated maize, common bean, snap bean, rice, wheat.	Having rules defined increases transparency, reduces the time seed will take from one point to the next and helps increase the number of entrants into the seed industry, resulting in increased seed availability.	Procedural and legal	NCA's and Ministry of Agriculture	The proposed working group will set standards for the crops whose standards were not set.
c. Seed classes	Seed classes were different in all countries, causing considerable confusion in germplasm exchange and trade in seed.	Four seed classes were accepted across the three countries—breeders, basic, certified (first and second generations) and standard. The workshops agreed on laboratory standards for each seed class for 10 crops under compulsory certification.	The reduction from 8 to 4 seed classes helped make the seed language common and easy. This will facilitate faster movement of seed for processing and for trading and will improve seed availability across the countries.	Procedural	NCA's	Standard seed had 4 different names, which caused confusion as seed moved across borders.

Issues	Before ASARECA seed project	Results and agreements of the project	Implications of agreements and decisions to the seed sector	Status a	Implementation	
					Institution(s)	Other responsible remarks
d. Accreditation to certify seed	Only Kenya and Tanzania had a provision for accreditation of institutions and seed companies.	The workshop agreed on accrediting institutions, seed companies and individuals to carry out seed certification on behalf of national certifying agencies. The accreditation procedures were also agreed upon.	This will lead to more efficient use of human resources available in the seed sector. It will also accelerate the process of certification, making seed available faster than otherwise.	Procedural	NCAs	—
e. Common seed tag across the region	This did not exist, which led to numerous questions and delays as seed moved across borders.	The workshops agreed on a common seed tag and will design colour and content for every seed class.	This will facilitate faster movement of bulk seed and also seed for trading. With this common language, seed material will take less time to reach the intended destination.	Procedural	NCAS	—
f. Interagency certification	This did not exist.	The three countries agreed to establish an interagency certification scheme. This will facilitate movement of bulk seed across borders for final processing and certification by the cooperating certification agency.	This will allow seed companies in the three countries to move freely across borders, make use of countries in production of seed and move it in bulk across boundaries for further processing. In effect it will result in more efficient use of land and human	Procedural and legal	NCAs	The protocols for interagency certification were established as well as documentation necessary for bulk transfer of seed for interagency accreditation.

Issues	Before ASARECA seed project	Results and agreements of the project	Implications of agreements and decisions to the seed sector	Status a	Implementation	
					Institution(s)	Other responsible remarks
			resources and facilitate increased availability of seed to farmers.			
g. Informal seed sector	The three countries had different credibility, ratings, confidence, and understanding of roles of the informal seed sector.	This informal seed sector was accepted as an integral part of the wide seed sector. It has a big role in ensuring seed availability and seed choice to farmers. It was agreed it should continue to be assisted by the formal sector so that it can eventually graduate into the formal.	The built-in confidence of the role of the informal seed sector will spur availability of clean seed material to farmers.	Procedural	NCA, Ministry of Agriculture, NGOs	The working group in collaboration with ASARECA and other partners will design strategies to assist this sector.
3. Phytosanitary issues						

Issues	Before ASARECA seed project	Results and agreements of the project	Implications of agreements and decisions to the seed sector	Status a	Implementation	
					Institution(s)	Other responsible remarks
a. Basis for issuing permits	Kenya and Uganda are still using the outdated 7th Non-Legal Draft of the Plant Protection Order of 1972 proposed by the East African Technical Committee.	It was agreed to use the revised FAO pest risk analysis procedures currently in use in Tanzania.	Seed flow across borders will be faster, increasing availability of seed, which would otherwise have been restricted on non-scientific grounds.	Procedural	NCA's and phytosanitary institutions	A provision will be made for periodic updating of restricted and non-restricted pests.
b. Membership in the International Plant Protection Convention (IPPC)	Only Kenya is signatory to IPPC.	Tanzania and Uganda agreed to pursue membership in IPPC.	This will increase adoption of international practices in plant protection.	Procedural	NCA's and phytosanitary institutions	Harmonization will easily be achieved since Tanzania and Uganda already follow IPPC guidelines.
c. Quarantine pests	At the beginning of the project there were 33 quarantine pests within EAC for 10 selected crops.	Use of CABI database reduced the quarantine pests to 3 for seed of 10 selected crops.	Faster seed flow, more seed material flows, more seed choices to farmers.	Procedural	NCA's and phytosanitary institutions	The working group will proceed to verify the remaining 3 quarantine pests.
d. Common list of mid-to high-risk quarantine pests in East Africa	A common list did not exist. Each country had its own.	A common list was established based on scientific evidence.	Faster seed flows and more seed choices.	Procedural	NCA's and phytosanitary institutions	—

Issues	Before ASARECA seed project	Results and agreements of the project	Implications of agreements and decisions to the seed sector	Status a	Implementation	
					Institution(s)	Other responsible remarks
e. Pest information system in East Africa	Initially, it was voluntary and erratic-not systematized.	Workshops established a minimum pest information system based on literature, capacity in information systems, training, compulsory notification of outbreaks, and establishment and publication of pest status in the region.	Cost-effectiveness achieved in regional operations will avoid duplication of efforts across the region	Procedural	NCA's and phytosanitary institutions	—
f. Minimum facilities at high-risk entry points	Country facilities varied.	The workshop agreed to establish minimum facilities at high-risk entry points.	Increased confidence and trust among scientists and the broader seed sector in the seed material traded. They will have the confidence that the seed material has been subjected to acceptable minimum checks. This will facilitate faster inflow and outflow of seeds, resulting in increased seed trade.	Procedural	NCA's and phytosanitary institutions	—
g. Public awareness of phytosanitary issues	Countries used different methods.	The workshop agreed to use pamphlets, leaflets, posters, and farmer training along the borders, sensitize customs and immigration officers, and	This will minimize policing, pest entry and spread within the region.	Procedural	NCA's and phytosanitary institutions	—

Issues	Before ASARECA seed project	Results and agreements of the project	Implications of agreements and decisions to the seed sector	Status a	Implementation	
					Institution(s)	Other responsible remarks
		make in-flight announcements.				
h. Mandates and powers of phytosanitary inspectors	There are differences in mandates for staff overseeing the same issues across the borders.	The delegates agreed to empower entry and post entry staff to inspect and quarantine.	Harmonized functions and powers will increase efficiency in the movement of seed. They will also help traders know what to expect as they cross borders.	Procedural	NCAAs and phytosanitary institutions	The workshop agreed that efforts should be made to gradually place staff with similar qualifications at these points in the three countries.
4. Seed import and export documentation and procedures						
a. Import and export documents	The number, type and source of the documentation were different in all three countries.	Delegates agreed to standardize import and export documentation and procedures that will require plant import permit, quality certificate from source, quality certificate and customs clearance	Standardized procedures will increase the rate of seed movement, saving considerable time.	Procedural	NCAAs, plant health and quarantine institutions	Although the process will begin immediately, implementing it will take a while because forms will have to be reconstituted and offices reorganized.

Issues	Before ASARECA seed project	Results and agreements of the project	Implications of agreements and decisions to the seed sector	Status a	<u>Implementation</u>	
					Institution(s)	Other responsible remarks
b. Import tariffs and procedures	The East African countries differed in the type of tariffs, rates, and in the type of crop seeds with tariffs.	Delegates agreed to go for a uniform tariff system and procedures in accordance with the EAC Treaty article 75:1(b) and 1(c).	Uniformity in procedures will facilitate faster movement of seed across borders.	Legal	Ministries of Agriculture, Trade and Finance	Import and export procedures and requirements have become trade barriers. In some cases, the procedures are lengthy and the requirements are difficult to meet, making seed movement arduous.
5. Plant variety protection (PVP)						

Issues	Before ASARECA seed project	Results and agreements of the project	Implications of agreements and decisions to the seed sector	Status a	Implementation	
					Institution(s)	Other responsible remarks
a. Plant variety protection	Kenya has legislation on PVP. Tanzania and Uganda do not although steps towards it are in place in both countries. However, TRIPS (Trade-Related Intellectual Property Rights), to which all the three countries are signatories, requires that each country establish a PVP system by 2005.	<p>The delegates agreed on a number of issues in PVP.</p> <ol style="list-style-type: none"> 1) Establish national PVP laws to promote crop improvement by both private and public breeders and institutions. 2) Each country should develop a suitable system of PVP based on cross-referencing of international and regional PVP model law. 3) Establish a regional plant breeders' rights committee to work under EAC. 4) Establish PVP issues under the EAC's Intellectual Property Rights office. 5) Recognize and provide for essentially derived varieties concept in the national PVP laws. 	Establishing PVP laws will promote crop improvement by both private and public breeders and institutions because of the built-in reward system.	The implementation of 1), 2) and 5) is legal, of 3) and 4) is procedural.	NCA's, Ministries of Agriculture, Trade and Finance	The NCA's and the Ministry of Agriculture will handle the procedural issues. Legal issues are to be handled by the Ministry of Agriculture in collaboration with the legal instruments in and outside the ministry. The working group to be established will steer the process.

Annex 6: Household Qquestionnaire

FAO Standard
Seed Security Assessment : Household Survey (HHS)

- a. Text in blue are notes to the enumerators
 b. Figures in bracket () or = are codes for data entry

Example introduction: Thanks for agreeing to this interview. We are XX and YY. We work for the United Nations' FAO / Other. We want to learn from you about your farming methods, crops, crop varieties and seed sources . The answers we get will be shared with organizations working on in the area action.

Questionnaire number.→		Data entry number→	
------------------------	--	--------------------	--

SECTION 1: ASSESSMENT LOCATION: REGION/AGRO-ECOLOGY

- 1.1 Assessment date _____
- 1.2 Name of Enumerator: _____
- 1.3 Organization: _____
- 1.4 State (former) _____
- 1.5 County (former) _____ Payam _____
- 1.6 Boma _____ Agro-ecological zone (AEZ) _____

SECTION 2: RESPONDENT INFORMATION

- 2.1 Name of respondent: _____ (not to be entered into database)
- 2.2 Age: _____ years old; Gender Male (1) Female (0)
- 2.3 Mobile #: _____ (not to be entered into database)

SECTION 3: HOUSEHOLD DEMOGRAPHIC AND LIVELIHOOD CHARACTERISTICS

- 3.1 Head of household gender. Male (1) Female (0)
- 3.2 Head of household age category <14 years (1) 15-40 (2)
 41-60 years (3) >60 years (4)
- 3.3 Residential status of the household (HH).
 Resident (1) IDP (2) Returnee (3) Refugee (4)
- 3.4 Household size: How many people live in this household in last 6 months? _____
- 3.5 For how long have you continuously (without displacement) lived in this area?
 ≤ 1 year (1) 1-2 years (2) 3-5 Years (3) > 5years (4)
- 3.6 How many household members are involved (provide labor) in Agricultural activities?
 a) Male (>14 years) _____ b) Female (>14years) _____ c) Children (<14 years) _____
- 3.7a. Do you have livestock? Yes (1) No (0)
- 3.7b. **If Yes**, which type of livestock do you keep?
- | | | | |
|---|-------------------------------------|--|--------------------------------------|
| Type
<input type="checkbox"/> Cattle (1) | <input type="checkbox"/> Goat (2) | Type
<input type="checkbox"/> Sheep (3) | <input type="checkbox"/> Poultry (4) |
| <input type="checkbox"/> Pigs(5) | <input type="checkbox"/> Donkey (6) | <input type="checkbox"/> Horse (7) | <input type="checkbox"/> Camel (8) |
- Others (Specify) _____

.....
Enumerator: tick the type of animal owned (multiple responses applicable)

- 3.7c. **If Yes**, did you sell livestock this year. Yes (1) No (0)
- 3.7d. **If Yes**, which one did you sell most? Name _____ Or code _____ (see in 3.7b)
- 3.8a. Does your household go fishing. Yes (1) No (0)
- 3.8b. **If Yes**, how do you use the catch?
 Consume (1) Sell (2) Both (3)
- 3.9 What have been your **THREE MAIN sources** of **income** this year?
 Crop produce (1) Livestock sale (2) Fishing (3)
 On-farm daily labor (4) Livestock products (5) Hunting & gathering (6)
 Non on-farm daily labor (7) Remittances (8) Petty trade (9)
 Sale of charcoal/fuel wood (10) Salary (11) Pension (12)
 Others (specify).....

Enumerator: tick **only three** out of the many
Data clerk: enter the code (eg. 7) under the **income**

- 3.10a. Have you been able to **SAVE CASH** from any of the above income sources this year (2018)?
 Yes (1) No (0)
- 3.10b. If you wish, would you be able to **ACCESS CREDIT** from any of the sources you know?
 Yes (1) No (0)

SECTION 4: CROP PRODUCTION/ SEED SYSTEM PROFILE

- 4.1a What total area (*feddan*) of land does your household have access to for crop production?
 < 1 feddan (1) 1 to <3 feddan (2) 3 to <5 feddan (3) ≥5.0feddan (4)
- 4.1b In which season do you grow crops in a year? Main (1) second (2) Both (3)
- 4.1c What total area of land did your household CULTIVATE this year? _____ *feddan*
- 4.1d what area (of cultivatable land) did you NOT CULTIVATE this year? _____ *feddan*.
 Why did you **NOT** cultivate the area? _____
- 4.1e what crops did you plant this year (2018), irrespective of the season?
 Maize (1) Sorghum (2) Millet (3) Rice (4)
 Cowpea (5) beans (6) green grams (7) Pigeon peas (8)
 Soya bean (9) Sesame (10) Groundnut (11) Sunflower (12)
 Cassava (13) Sweet potato (14) Potato (15) Yams (16)
 Banana (17) Vegetables (18) Others (specify).....

Tick (✓) all the crops planted by the respondent.

4.2 THREE MOST IMPORTANT CROPS you planted in **2018**?

Crop production parameters (investigate crop by crop – A, B & C)	Crop A	Crop B	Crop C
a) Name (or code) of the most important crop use codes in 4.1e or specify.....			
b) In which season did you plant the main crops Codes: 1= first season; 2=second season; 3=both season			
c) What is the Main use of the crop? Codes: 1= food; 2= income; 3=fodder			

d)	What area (feddan) did you plant during the main season this year? <i>Please convert all local units to feddan when recording</i>			
e)	Land preparation method? Code: 1= minimum tillage; 2= hand tools; 3=Animal traction; 4= Tractor			
f)	Quantity of seed used (Kg) <i>convert the local unit (e.g Malwa) used by the farmer into kg, except for cassava, sweet potato, and banana</i>			
g)	Was the crop in the field rain-fed or irrigated? Codes: 1=rain-fed or 0= irrigated?			
h)	What was the cropping practice? Codes: 0=sole crop 1=mixed/intercrop; 2=Relay			
i)	Crop used in the mixed/intercrop or relay cropping <i>use codes in 4.1 or specify</i>			
j)	Actual <input type="checkbox"/> or expected <input type="checkbox"/> harvest (kg) <i>convert the local unit used by the farmer into kg, except for cassava, sweet potato, and banana</i>			
k)	How do you rate the harvest Codes: 1=poor; 2=Fair; 3=Good			

4.3 THREE MOST IMPORTANT CROPS that you will plant in **2019**?

Crop production parameters <i>(investigate crop by crop – A, B & C)</i>	Crop A	Crop B	Crop C
a) Name (or code) of the three most important crops to be planted <i>for the same crops, maintain the order as in 4.2a</i>			
b) Change in Main crop?: Code: 1=Yes 0=No <i>observe this from the responses in 4.2a and 4.3a, probe and record</i>			
c) If yes, what is your MAIN reason for changing the main crop? <i>ask and record appropriate code below</i>			
d) What area (feddan) do you expect to plant with the crop? <i>please convert all local units to hectare when recording</i>			
e) Change in area (feddan) to be planted: Codes: 0=No; 1= less; 2= More; 3=Not applicable <i>Compare 4.2c and 4.3d to see if there is a change</i>			
f) MAIN reason for change of area (planted Less or More) <i>see codes below</i>			
g) Quantity of seed expected to be planted in 2019 (kg)? <i>convert the local unit into Kg</i>			
h) For the same crop planted this year, will you plant it in the same field next year (2019)? ; Code: 1=Yes; 0=No			
i) If yes, why?			

CODES

4.3b Codes: Main ⁹ reason for CHANGE in main crop (only one to be identified)↓		
1) Weather related factors	3) Better Income opportunity	6) Lack of seed of the previous crop
2) Decline in soil fertility	4) Access to fertile land	7) Access to better variety of the alternative crop
	5) Pest and disease problem on the old crop	

4.3f Main reasons planting LESS Area (only one to be identified)↓		
1) No seed/seedlings available within the community	6) Insufficient labor	12) Poor weather- erratic rainfall and/or drought
2) No money to buy seed	7) Limited land/poor access to productive land	13) Insecurity
3) High seed prices, so I could not buy enough	8) Limited tools/farm power/ equipment	14) Lack of markets
4) Poor quality of available seed	9) Pests, diseases and /or weeds problem	15) other priorities than agriculture (e.g. have shop)
5) Lack of preferred variety within the community	10) Lack of inputs (fertilizers, pesticides herbicides) and equipment's (irrigation) and/or fuel	16) Other (specify)
	11) Low quality of other inputs: High cost of inputs and equipment	

4.4f Main reason planting MORE Area↓		
1) Availability of seed	8) Access to more labor	14) Better markets prices for crop or crop products
2) Affordable seed prices	9) Access to more fertile land	15) Emergence of new market
3) Access to credit/seed loan	10) Access to tools/tractor, other machinery to help farm	16) Others (specify).....
4) Seed aid (from organizations)	11) Access to other inputs	
5) Better quality seed	12) Good weather/rainfall	
6) Access to preferred or new variety	13) Good security	
7) Access to new variety		

4.5a Do you normally keep/have your own seed? Yes (1) No (0)

4.5b If yes, for which crops (Code or Names in 4.1e)

Crop Name→			
Storage method			
Pesticide use			
Storage codes: 1=traditional granary; 2= gunny bags; 3=metallic/plastic container;			
4=hung over the fireplce; 5= hang on a tree/frame outside ;			
Pesticide code: 0= no pesticide; 1= red pepper; 2=tobacco leaves; 3= neem extract; 4=inorganic pesticide			
5 = pesticides tried in the past have not been effective; 6=others (specify).....			

⁹ Main refers to Single most important reason

CROPS AND SEED SOURCES (2018)

5.2 What was/were your source(s) of seed for the important CROP B (.....)? In 2018 (Code or name)

- | | | |
|---|--|---|
| <input type="checkbox"/> Own seed (1) | <input type="checkbox"/> Local Market (2) | <input type="checkbox"/> Soc. Network (3) |
| <input type="checkbox"/> Seed aid (4) | <input type="checkbox"/> Agro-input-Dealer (5) | <input type="checkbox"/> Cooperative (6) |
| <input type="checkbox"/> Seed Company (7) | <input type="checkbox"/> Community Seed Producer (8) | <input type="checkbox"/> Contract Growers (9) |
| <input type="checkbox"/> Agricultural Research (10) | <input type="checkbox"/> Food aid (11) | Others (specify)..... |

Note to enumerator: Multiple responses possible (up to four provided for in the table below)

5.2.1 Assess varietal suitability, availability, accessibility and quality of crop B seed from the source(s) indicated above.

Crop B (.....) 2018	Source(s) of seed in 2018			
	Own (1)			
Seed source (Add Code for the ones ticked in 5.2)→				
a) Name of the Major variety				
b) Variety type: 1= local; 0=improved				
c) Is this the variety you wanted to plant? 1=Yes; 0=No				
d) Was there enough seed from this source? 1=Yes; 0=No				
e) What quantity of seed (kg) did you plant from this source? (convert all local units into kg - except cassava, S. potato, and banana)				
f) At what time was the seed available? 1=Before the planting season; 2= at start of the season; 3=mid-season; 4= towards the end of season				
g) Location of the seed source? 1= Within my boma; 2=Nearby boma within my payam; 3= another Payam within my county, 4= Another County with my state; 5=Another state; 6=Across the border of South Sudan.				
h) How did you acquire the seed? 1= Cash; 2= On credit; 3= bartered; 4=free (gift); 5= labour hire; 6=Seed loan				
i) How was the price or term of trade? 1= affordable; 2= expensive ; 3=very expensive (ask only those who acquired by cash, on credit or bartered only)				
j) Was the seed clean? 1= clean (no impurities, no damage); 2= fairly clean (some impurities, no damage); 3=not clean (Some impurities & damage) Note to enumerator: Damage refers to physical, pest infestation or both				
k) How was the germination of the seed? 1= Good, 2=Fair; 3=Poor				
Seed Aid: Name of the seed aid organization e.g. FAO, Action Aid, Concern etc.				
Seed Company: Name of the seed company				

5.2.2 Overall, if you consider the all the optional seed sources, was there enough seed available for crop B during the planting seasons of 2018? Yes (1) No (0)

CROPS AND SEED SOURCES (2018)

5.3 What was/were your source(s) of seed for the important **Crop C** (.....)? In **2018** (Code or name)

- | | | |
|---|--|---|
| <input type="checkbox"/> Own seed (1) | <input type="checkbox"/> Local Market (2) | <input type="checkbox"/> Soc. Network (3) |
| <input type="checkbox"/> Seed aid (4) | <input type="checkbox"/> Agro-input-Dealer (5) | <input type="checkbox"/> Cooperative (6) |
| <input type="checkbox"/> Seed Company (7) | <input type="checkbox"/> Community Seed Producer (8) | <input type="checkbox"/> Contract Growers (9) |
| <input type="checkbox"/> Agricultural Research (10) | <input type="checkbox"/> Food aid (11) | Others (specify)..... |

Note to enumerator: Multiple responses possible (up to four provided for in the table below)

5.3.1 Assess varietal suitability, availability, accessibility and quality of crop **C** seed from the source(s) indicated above.

Crop C (.....) 2018	Source(s) of seed in 2018			
	Own (1)			
Seed source (Add Code for the ones ticked in 5.3)→				
a) Name of the Major variety				
b) Variety type: 1= local; 0=improved				
c) Is this the variety you wanted to plant? 1=Yes; 0=No				
d) Was there enough seed from this source? 1=Yes; 0=No				
e) What quantity of seed (kg) did you plant from this source? <i>(convert all local units into kg - except cassava, S. potato, and banana)</i>				
f) At what time was the seed available? 1=Before the planting season; 2= at start of the season; 3=mid-season; 4= towards the end of season				
g) Location of the seed source? 1= Within my boma; 2=Nearby boma within my payam; 3= another Payam within my county, 4= Another County with my state; 5=Another state; 6=Across the border of South Sudan.				
h) How did you acquire the seed? 1= Cash; 2= On credit; 3= bartered; 4=free (gift); 5= labour hire; 6=Seed loan				
i) How was the price or term of trade? 1= affordable; 2= expensive ; 3=very expensive <i>(ask only those who acquired by cash, on credit or bartered only)</i>				
j) Was the seed clean? 1= clean (no impurities, no damage); 2= fairly clean (some impurities, no damage); 3=not clean (Some impurities & damage) <i>Note to enumerator: Damage refers to physical, pest infestation or both</i>				
k) How was the germination of the seed? 1= Good, 2=Fair; 3=Poor				
Seed Aid: Name of the seed aid organization e.g. FAO, Action Aid, Concern etc.				
Seed Company: Name of the seed company				

5.3.2 Overall, if you consider the all the optional seed sources, was there enough seed available for **crop C** during the planting seasons of 2018? Yes (1) No (0)

CROPS AND SEED SOURCES (2019)

5.4 For **2019 seasons**, where will you source seed of **CROP A** (.....) from?

- | | | |
|---|--|---|
| <input type="checkbox"/> Own seed (1) | <input type="checkbox"/> Local Market (2) | <input type="checkbox"/> Soc. Network (3) |
| <input type="checkbox"/> Seed aid (4) | <input type="checkbox"/> Agro-input-Dealer (5) | <input type="checkbox"/> Cooperative (6) |
| <input type="checkbox"/> Seed Company (7) | <input type="checkbox"/> Community Seed Producer (8) | <input type="checkbox"/> Contract Growers (9) |
| <input type="checkbox"/> Agricultural Research (10) | <input type="checkbox"/> Food aid (11) | Others (specify)..... |

Note to enumerator: Multiple responses possible (up to four provided for in the table below)

5.4.1 Assess availability and accessibility of crop **A** seed from this/these source(s).

Assess variety type, growth, liking by the farmer only if the variety was not planted last season

Crop A (.....) 2019	Possible Source(s) of seed in 2019			
	Own (1)			
Seed source [Add Code for the ones ticked in 5.7)→				
a) Name of the Major variety				
b) Variety same as last season? Codes: 1= Yes; 0=No; 2=not applicable (when crop has changed)				
c) If No, what is the Main reason for change of variety? (see codes below– No entry when crop has changed)				
d) Type of the variety Codes: 1= local; 0=improved				
e) Will there be enough seed from this source? Codes: 1=Yes; 0=No				
f) What quantity of seed (kg) will you plant from this source? (convert all local units into kg - except cassava, S. potato, and banana)				
g) At what time will the seed be available? Codes: 1=Before the planting season; 2= at start of the season; 3=mid-season; 4= towards the end of season				
h) Location of the seed source? 1= Within my boma; 2=Nearby boma within my payam; 3= another Payam within my county, 4= Another County with my state; 5=Another state; 6=Across the border of South Sudan..				
i) How will you acquire the seed? Codes: 1= Cash; 2= On credit; 3= bartered; 4=free (gift); 5= labour hire; 6=Seed loan				
j) What is your expectation for price/term of trade for seed in 2019? Codes: 1= affordable; 2= high; 3=very high (ask only those who will acquire seed by cash, on credit or bartered only)				
Seed Aid: Name of the seed aid organization e.g. FAO, Action Aid, Concern etc.				
Seed Company: Name of the seed company				
Code for reasons for change to another variety				
1) Resistance to pests and diseases;	4) resistance frost	7) short maturity period		
2) high yielding;	5) less lodging	8) tolerance to flood		
3) tolerance to drought	6) less shattering			

5.7.2 Overall, if you consider all optional the seed sources, will there be enough seed available for **crop A** during in the upcoming season of 2019? Yes (1) No (0)

CROPS AND SEED SOURCES (2019)

5.5 For **2019 season**, where will you source seed of **CROP B** (.....) from?

- | | | |
|---|--|---|
| <input type="checkbox"/> Own seed (1) | <input type="checkbox"/> Local Market (2) | <input type="checkbox"/> Soc. Network (3) |
| <input type="checkbox"/> Seed aid (4) | <input type="checkbox"/> Agro-input-Dealer (5) | <input type="checkbox"/> Cooperative (6) |
| <input type="checkbox"/> Seed Company (7) | <input type="checkbox"/> Community Seed Producer (8) | <input type="checkbox"/> Contract Growers (9) |
| <input type="checkbox"/> Agricultural Research (10) | <input type="checkbox"/> Food aid (11) | Others (specify)..... |

Note to enumerator: Multiple responses possible (up to four provided for in the table below)

5.5.1 Assess availability and accessibility of crop **A** seed from this/these source(s). **Assess variety type, growth, liking by the farmer only if the variety was not planted last season**

Crop B (.....) 2019		Possible Source(s) of seed in 2019			
Seed source (Add Code for the ones ticked in 5.8)→		Own (1)			
a) Name of the Major variety					
b) Variety same as last season? Codes: 1= Yes; 0=No; 2=not applicable(when crop has changed)					
c) If No, what is the Main reason for change of variety? (see codes below- No entry when crop has changed)					
d) Type of the variety Codes: 1= local; 0=improved					
e) Will there be enough seed from this source? Codes: 1=Yes; 0=No					
f) What quantity of seed (kg) will you plant from this source? (convert all local units into kg - except cassava, S. potato, and banana)					
g) At what time will the seed be available? Codes: 1=Before the planting season; 2= at start of the season; 3=mid-season; 4= towards the end of season					
h) Location of the seed source? 1= Within my boma; 2=Nearby boma within my payam; 3= another Payam within my county, 4= Another County with my state; 5=Another state; 6=Across the border of South Sudan..					
i) How will you acquire the seed? Codes: 1= Cash; 2= On credit; 3= bartered; 4=free (gift); 5= labour hire; 6=Seed loan					
j) What is your expectation for price/term of trade for seed in 2019? Codes: 1= affordable; 2= high; 3=very high (ask only those who will acquire seed by cash, on credit or bartered only)					
Seed Aid actor: Please indicate name seed aid organization e.g. FAO, Action Aid, Concern etc.					
Seed Company: specify the name of the company					
Code for reasons for change to another variety					
1) Resistance to pests and diseases;	4) resistance frost	7) short maturity period			
2) high yielding;	5) less lodging	8) tolerance to flood			
3) tolerance to drought	6) less shattering				

5.5.2 Overall, if you consider all optional the seed sources, will there be enough seed available for **crop B** in 2019? Yes (1)
 No (0)

CROPS AND SEED SOURCES (2019)

5.6 For **2019 season**, where will you source seed of **CROP C** (.....) from?

- | | | |
|---|--|---|
| <input type="checkbox"/> Own seed (1) | <input type="checkbox"/> Local Market (2) | <input type="checkbox"/> Soc. Network (3) |
| <input type="checkbox"/> Seed aid (4) | <input type="checkbox"/> Agro-input-Dealer (5) | <input type="checkbox"/> Cooperative (6) |
| <input type="checkbox"/> Seed Company (7) | <input type="checkbox"/> Community Seed Producer (8) | <input type="checkbox"/> Contract Growers (9) |
| <input type="checkbox"/> Agricultural Research (10) | <input type="checkbox"/> Food aid (11) | Others (specify)..... |

Note to enumerator: Multiple responses possible (up to four provided for in the table below)

5.6.1 Assess availability and accessibility of crop **C** seed from this/these source(s). **Assess variety type, growth, liking by the farmer only if the variety was not planted last season**

Crop C (.....) 2019	Possible Source(s) of seed in 2019			
	Own (1)			
Seed source (Add Code for the ones ticked in 5.9)→				
a) Name of the Major variety				
b) Variety same as last season? Codes: 1= Yes; 0=No; 2=not applicable (when crop has changed)				
c) If No, what is the Main reason for change of variety? (see codes below- No entry when crop has changed)				
d) Type of the variety Codes: 1= local; 0=improved				
e) Will there be enough seed from this source? Codes: 1=Yes; 0=No				
f) What quantity of seed (kg) will you plant from this source? (convert all local units into kg - except cassava, S. potato, and banana)				
g) At what time will the seed be available? Codes: 1=Before the planting season; 2= at start of the season; 3=mid-season; 4= towards the end of season				
h) Location of the seed source? 1= Within my boma; 2=Nearby boma within my payam; 3= another Payam within my county, 4= Another County with my state; 5=Another state; 6=Across the border of South Sudan..				
i) How will you acquire the seed? Codes: 1= Cash; 2= On credit; 3= bartered; 4=free (gift); 5= labour hire; 6=Seed loan				
j) What is your expectation for price/term of trade for seed in 2019? Codes: 1= affordable; 2= high; 3=very high (ask only those who will acquire seed by cash, on credit or bartered only)				
Seed Aid actor: Please indicate name seed aid organization e.g. FAO, Action Aid, Concern etc.				
Seed Company: specify the name of the company				
Code for reasons for change to another variety				
1) Resistance to pests and diseases;	4) resistance frost	7) short maturity period		
2) high yielding;	5) less lodging	8) tolerance to flood		
3) tolerance to drought	6) less shattering			

5.6.2 Overall, if you consider all optional the seed sources, will there be enough seed available for **crop C** in 2019? Yes (1)
 No (0)

SECTION 6: NEW VARIETIES

6.1 Have you ever received /obtained a new variety in the last 5 years?

	Yes(1)	No(0)
a) New Variety?	<input type="checkbox"/>	<input type="checkbox"/>
b) If yes, how many?		[REDACTED]

6.2 **If Yes**, please specify the crop, name the variety, seed source and year acquired. Is the variety still in use? please give the main reason why you are still using the variety?

Crop Name	Variety Name	Seed Source	Year acquired	Variety in use		Main reason for																																					
				Yes(1)	No(0)	Yes	No																																				
A.	1.			<input type="checkbox"/>	<input type="checkbox"/>																																						
	2.			<input type="checkbox"/>	<input type="checkbox"/>																																						
B.	1.			<input type="checkbox"/>	<input type="checkbox"/>																																						
	2.			<input type="checkbox"/>	<input type="checkbox"/>																																						
C.	1.			<input type="checkbox"/>	<input type="checkbox"/>																																						
	2.			<input type="checkbox"/>	<input type="checkbox"/>																																						
<p>Seed Source codes</p> <table border="0"> <tr> <td>Local Market (2)</td> <td>Social Network (3)</td> <td>Seed aid (4)</td> </tr> <tr> <td>Agro-input-Dealer (5)</td> <td>Cooperative (6)</td> <td>Seed Company (7)</td> </tr> <tr> <td>Community Seed Producer (8)</td> <td>Contract growers (9)</td> <td>Agricultural Research (10)</td> </tr> <tr> <td colspan="3">Others (specify).....</td> </tr> </table> <p>Main reason for USE (Yes):</p> <table border="0"> <tr> <td>Resistant to pests and diseases (1)</td> <td>High yielding (2)</td> <td>Tolerant to drought (3)</td> </tr> <tr> <td>Tolerant to flooding (4)</td> <td>Short maturity period (5)</td> <td>Less shattering (6)</td> </tr> <tr> <td>High market value (7)</td> <td>Good taste/cooking value (8)</td> <td>Good storability (9)</td> </tr> <tr> <td colspan="3">Others (specify).....</td> </tr> </table> <p>Main reason NOT USE (No):</p> <table border="0"> <tr> <td>susceptible to pests and diseases (1)</td> <td>Less yielding (2)</td> <td>Less tolerant to drought (3)</td> </tr> <tr> <td>Less tolerant to flooding (4)</td> <td>Long maturity period (5)</td> <td>high shattering (6)</td> </tr> <tr> <td>Low market value (7)</td> <td>poor taste/cooking value (8)</td> <td>poor storability (9)</td> </tr> <tr> <td colspan="3">Others (specify).....</td> </tr> </table>								Local Market (2)	Social Network (3)	Seed aid (4)	Agro-input-Dealer (5)	Cooperative (6)	Seed Company (7)	Community Seed Producer (8)	Contract growers (9)	Agricultural Research (10)	Others (specify).....			Resistant to pests and diseases (1)	High yielding (2)	Tolerant to drought (3)	Tolerant to flooding (4)	Short maturity period (5)	Less shattering (6)	High market value (7)	Good taste/cooking value (8)	Good storability (9)	Others (specify).....			susceptible to pests and diseases (1)	Less yielding (2)	Less tolerant to drought (3)	Less tolerant to flooding (4)	Long maturity period (5)	high shattering (6)	Low market value (7)	poor taste/cooking value (8)	poor storability (9)	Others (specify).....		
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Others (specify).....																																											

SECTION 7:EMERGENCY SEED AID (AAP)

Note to the enumerators: All those who indicated seed aid as their source of seed (Section 5) already have information for last and current season- Just transfer the information from section 5. Others who have not indicated seed aid as source of seed in section 5 could still provide information on seed aid in the previous years (below the current year).

7.1a Have you ever received emergency seed aid in the past five years? Yes No

7.1b If Yes, **HOW MANY TIMES** have you receives emergency seed aid in the last five years? _____

7.1c If Yes, How did you get the seeds (distribution method, modality of access)? **(Multiple choices possible)**

Modality of seed distribution			If Yes				
Modality	Yes(1)	No(0)	Access	Timing	Organization	Satisfaction	
						Yes(1)	No(0)
a) Direct distribution	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
b) Seed fairs and voucher	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
c) Seed voucher	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
d) From another beneficiary	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
Access (codes)			Free (1)		Cash (2)	Cost shared (3)	
			Cost recovery (4)		Seed recovery (5)		
Timing (codes)			Before the season begun (1);		at the start of planting season (2)		
			Middle of planting season (3);		towards the end of the planting season (4)		
Organization (codes)			Government (MAFS, SmoAF, CAD) (1)			NGO (2)	
			FAO (3)			Other (specify).....	

7.2a Did you ever receive a variety totally new to you from the aid? Yes (1) No (0)

7.2b If Yes, were you provided information on new the variety? Yes (1) No (0)

7.3 Overall, were you satisfied with the seeds aid?
 Very satisfied (1); Satisfied (2); Not satisfied (3); Very unsatisfied (4)

7.4 Give comment/advice about seed aid in your area?

SECTION 8: USE OF OTHER AGRICULTURAL INPUTS

8.1a Did you use any **INORGANIC** fertilizer this year (2018)? Yes (1) No (0)

8.1b **If Yes**, what type of **INORGANIC** Fertilizers, and on which crops? Were you satisfied with the effect on improving crop performance?

INORGANIC Type	If Yes, on which crops was it applied?			Satisfaction			
	Yes (1)	No (0)	Crop 1	Crop 2	Crop 3	Yes (1)	No (0)
a) NPK	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
b) UREA	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
c) DAP	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
d) NPS	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
e) Unkwon type	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
f) Others (pecify).....						<input type="checkbox"/>	<input type="checkbox"/>

8.1c **If No**, what is the MAIN reason **(only one)** for not using **INORGANIC** fertilizers?

- | | | |
|---|---|--|
| <input type="checkbox"/> They are expensive (1) | <input type="checkbox"/> I don't need them (5) | <input type="checkbox"/> They burn crop (9) |
| <input type="checkbox"/> Not available in the market (2) | <input type="checkbox"/> I don't know them(6) | <input type="checkbox"/> They are bulky (10) |
| <input type="checkbox"/> Poor quality on the market (3) | <input type="checkbox"/> No knowledge how to use (7) | |
| <input type="checkbox"/> Lack of application equipment(4) | <input type="checkbox"/> Not profitable on crops I grow (8) | |

Other (Specify).....

8.2a Did you use any **ORGANIC fertilizer** this year (2018)? Yes (1) No (0)

8.2b **If Yes**, what type of **ORGANIC Fertilizers**, and on which crops? Were you satisfied with the effect of named organic fertilizers on improving crop performance?

ORGANIC Type	If Yes, on which crops was it applied?			Satisfaction			
	Yes (1)	No (0)	Crop 1	Crop 2	Crop 3	Yes (1)	No (0)
a) Compost	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
b) Animal manure	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
c) Mulch	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
d) Green manure	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
e) Others (pecify).....						<input type="checkbox"/>	<input type="checkbox"/>

8.2c **If No**, what is the MAIN reason **(only one)** for not using **ORGANIC fertilizers**?

- | | | |
|--|---|--|
| <input type="checkbox"/> They are expensive to make (1) | <input type="checkbox"/> I don't need them (5) | <input type="checkbox"/> They burn crop (9) |
| <input type="checkbox"/> Materials for making not available(2) | <input type="checkbox"/> I don't know them(6) | <input type="checkbox"/> They are bulky (10) |
| <input type="checkbox"/> Poor quality materials (3) | <input type="checkbox"/> No knowledge how to use (7) | |
| <input type="checkbox"/> Lack of equipment(4) | <input type="checkbox"/> Not profitable on crops I grow (8) | |

Other (Specify).....

8.3a Did you use any **PESTICIDE/HERBICIDE** this year (2018)? Yes (1) No (0)

8.3b **If Yes**, what type of **PESTICIDE/HERBICIDE**, and on which crop(s)? Were you satisfied with the effect of on controlling weeds and/or pests (insect/fungi)?

Pesticide/Herbicide	If Yes, on which crops was it applied?			Satisfaction			
	Yes (1)	No (0)	Crop 1	Crop 2	Crop 3	Yes (1)	No (0)
a) herbicide	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
b) Field insecticide	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>

c) Field fungicides	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
d) Storage pesticides	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
e) Organic pesticide	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
f) Unknown type	<input type="checkbox"/>	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/>
g) Others (pecify).....						<input type="checkbox"/>	<input type="checkbox"/>

8.3c **If No**, what is the MAIN reason **only one** for not using **PESTICIDE/HERBICIDE**,?

- | | | |
|---|---|--|
| <input type="checkbox"/> They are expensive (1) | <input type="checkbox"/> I don't need them (5) | <input type="checkbox"/> They burn crop (9) |
| <input type="checkbox"/> Not available in the market (2) | <input type="checkbox"/> I don't know them(6) | <input type="checkbox"/> They are bulky (10) |
| <input type="checkbox"/> Poor quality on the market (3) | <input type="checkbox"/> No knowledge how to use (7) | |
| <input type="checkbox"/> Lack of application equipment(4) | <input type="checkbox"/> Not profitable on crops I grow (8) | |

Other (Specify).....

SECTION 9: AGRICULTURAL TRAININGS

9.1a Have you ever attended any agricultural training? Yes (1) No (0)

9.1b **If yes**, what type of agricultural training have you attended?

Trainings attended?	Trainings attended?		Year	If, Yes					
	Yes(1)	No(0)		Organization v				Satisfactionv	
	v	v		1	2	3	4	Yes(1)	No(0)
a) Crop agronomy	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) Soils and water management	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c) Plant protection	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d) Seed production	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e) Post-harvest handling	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f) Value addition	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g) Marketing	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h) Others (specify).....								<input type="checkbox"/>	<input type="checkbox"/>
Orgnaization	Government (1)			UN/NGO extention staff (2)					
	Private company (3)			Another farmer (4)					

9.2 What other agricultural training would you like to attend?

- a) b) c)

10.0 Is there any question you would like to ask me?

.....

Thanks for all the information you have provided