SEED SYSTEM SECURITY ASSESSMENT SOUTHERN SUDAN NOVEMBER–DECEMBER 2010

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These are exciting times for Southern Sudan. We hope the assessment results can be used to strengthen and further develop seed systems to serve the needs of all its farmers.

Acronyms

AAH-I	Action Africa Help International
ACROSS	Association of Christian Resource Organizations Serving Sudan
ACTED	Agency for Technical Cooperation and Development
ADRA	Adventist Development and Relief Agency
AMURT	Amanda Magra Universal Relief Team
ANLA	Annual Needs and Livelihood Assessment
AWG	Agriculture Working Group
CAD	County Agriculture Department
CARE	Cooperation for Assistance and Relief Everywhere
CBG	Community-based group
CBO	Community-based organization
CDOT	Catholic Diocese of Torit
CES	Central Equatoria State
CFSAM	Crop and Food Supply Assessment Missions
CGIAR	Consultative Group on International Agricultural Research
CIAT	International Center for Tropical Agriculture
CIMMYT	International Maize and Wheat Improvement Center
CIP	International Potato Center
COBAMA	Community-based market-oriented seed production
CMV	Cassava Mosaic Virus
CPA	Comprehensive Peace Agreement
CRS	Catholic Relief Services
DRC	Danish Refugee Council
DSD	Direct seed distribution
DTP	Diphtheria toxoid, tetanus toxoid and pertussis vaccine
EES	Eastern Equatoria State
EPI	Expanded Program on Immunization
FAO	Food and Agriculture Organization of the United Nations
FFS	Farmer field school
FFT	Food for training
FGD	Focus group discussion
FmoH	Federal Ministry of Health
GAM	Global acute malnutrition
GDP	Gross domestic product
GOS	Government of Sudan
GoNU	Government of National Unity
GoSS	Government of Southern Sudan
HH	Household
IARCs	International agricultural research centres
IAS	International Aid Sweden
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IDPs	Internally Displaced Persons
IFP	Inpatient feeding programme
IITA	International Institute of Tropical Agriculture
INGOs	International non-governmental organizations
IOM	International Organization for Migration
KARI	Kenya Agricultural Research Institute
KMPFG	Kogbo Multipurpose Farmer Group

MAF-GoSS	Ministry of Agriculture and Forestry, Government of Southern Sudan
MASRA	Magwi Action for Self Reliance Association
MDER	Minimum dietary energy requirement
NARO	National Agricultural Research Organization
NARS	National agricultural research system
NBEG	Northern Bahr el Ghazal
NBHS	National Baseline Household Survey
NGOs	Non-governmental organizations
NCA	Norwegian Church Aid
NCASP	Norwegian Church Aid Sudan Program
NPA	Norwegian People's Aid
NRTC	Natural Resources Technical Committee
NSCC	New Sudan Council of Churches
ODA	Overseas Development Administration, UK (now Department for International Development, DFID)
OPV	Open-pollinated varieties
PDU	Project Development Unit
PVS	Participatory variety selection
QDS	Quality Declared Seeds
RADD	Rumbek Agricultural Development District
RDCs	Rural development centres
RDF	Relief and Development Foundation
SCC	Sudan Council of Churches
SD	Standard deviation (in tables)
SDG	Sudanese pounds
SFP	Supplementary feeding programme
SHHS	Sudan Household Health Survey
SIFSIA	Sudan Institutional Capacity Programme: Food Security Information for Action
SMoA	State Ministry of Agriculture
SNV	Netherlands Development Organization
SPLA	Sudan People's Liberation Army
SPLM	Sudan People's Liberation Movement
SSARTO	Southern Sudan Agricultural and Research Technology Organization
SSCCSE	Southern Sudan Centre for Census, Statistics and Evaluation
SSRRC	Southern Sudan Relief and Rehabilitation Commission
SSSA	Seed system security assessment
SSWC	South Sudan Women Concern
SVF	Seed vouchers and fairs
TFP	Therapeutic feeding programme
UN	United Nations
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
UNFPA	United Nations Population Fund
UNOCHA	United Nations Office for the Coordination of Humanitarian Affairs
UNS	Upper Nile State
USAID/OFDA	US Agency for International Development / Office of Foreign Disaster Assistance
WP	Warrap
WBEG	Western Bahr el Ghazal
WES	Western Equatoria State
WFP	World Food Programme
WOTAP	Women Training and Promotion
WVI	World Vision International
YARS	Yambio Agricultural Research Station

Executive Summary

A Seed System Security Assessment (SSSA) was carried out across Southern Sudan in November–December 2010. It reviewed the functioning of the seed systems farmers use, both formal and informal, and assessed whether farmers could access seed of adequate quantity and quality in the short and medium term. The work covered 8 states and 16 counties, chosen to anticipate the range of possible seed security constraints. Field research encompassed 885 farmer interviews, seed/grain market analysis, interviews with 70 traders, over 25 focus group discussions (including discussions with women's groups), and key-informant sessions. Background papers were also commissioned on: a) the formal breeding sector's structures and processes; b) the formal seed sector's structures and processes; and c) current decentralized seed multiplication and distribution initiatives. This is among the more comprehensive agricultural and seed security assessments carried out nationwide, across Southern Sudan, in many decades.

The rationale for conducting the SSSA at this time is threefold:

- The five years of relative peace after the Comprehensive Peace Agreement, as well as the period of Referendum, suggest it is a critical time to look ahead to the dynamics of seed security and possibilities for sustainable seed system development.
- There have been over ten years of repeated emergency seed aid, with more than 2 000 tonnes given annually. These practices, and the assumptions guiding them, are in need of review.
- Determinations of the seed security situation in Southern Sudan have, implicitly or explicitly, been based largely on the Annual Needs and Livelihood Assessment (ANLA), the Crop and Food Supply Assessment Missions (CFSAMs), and certain other needs assessments. These tools do not contain a seed security component and most often conclude that a food deficit implies a seed deficit. Targeted, more comprehensive methods now exist to determine the short- and medium-term seed security situation.

For a better understanding of the dynamics of seed security in Southern Sudan, the FAO, MAF-GoSS, CIAT and a range of government and development partners – SMoA, AAH-I, ACTED, ADRA, AMURT, CRS, DRC, NPA, and UEA-Dev – have joined together to conduct this seed system security assessment.

Selected findings are highlighted below. Key chapters include more detailed summaries.

I. ACUTE SEED SECURITY FINDINGS

Multiple and diverse indicators suggest the seed security of Southern Sudanese farmers is currently good.

For the 2010 main growing season, farmers increased the overall amount of seed they sowed by 17 percent over 'normal amounts sown', across all crops. Internally displaced persons (IDPs), returnees and refugees also sowed more seed for the same season, increasing the amount by 3.6 percent.

1. Seed quality, across crops, was assessed as quite good, with 98 percent of farmers saying they will re-sow what they already have. However, concerns were raised about cowpea and pumpkin seed (the latter having been given to the IDPs).

2. For the 2010 main season, over 90 percent of the seed planted came from local channels for the full sample of farmers as well as for the potentially vulnerable population of IDPs, returnees and refugees. Outside aid, both developmental and emergency, provided between 9 and 10 percent of the seed sown. Hence, farmers were largely able to rely on functioning local seed channels and even expand cultivated land area.

3. Farmers cultivating smaller land holdings (less than 1 feddan) did not show markedly different sowing trends from those sowing larger areas (1-3 feddans and more than 3 feddans) in terms of expanding or decreasing planted area. The only exception was sorghum cultivation, where the decline in seed use was slightly greater among small farmers – if there was a decline. Similarly, larger farmers who expanded use of sorghum and cassava seed/planting materials did so at a higher rate than smaller farmers. It is these two crops in particular in which larger farmers are investing. So, overall, those cultivating smaller holdings are not more stressed than those cultivating larger holdings.

4. The reported plans of farmers for the 2011 main season show more of the same. Over 70 percent of farmers plan to maintain or increase the amounts sown across crops, and by significant margins. In the overall sample, farmers report they will expand sowing amounts by almost 80 percent across crops, and even the group of IDPs, returnees and refugees reports plans to increase sowing amounts by over 60 percent. These statements of intention suggest Southern Sudanese farmers are moving fast to expand land area and intensify production.

   Trends are positive, then, with multiple indicators suggesting that seed security is good overall and will continue to be good, even though farmers aim to expand growing areas. Seed security, and meeting seed needs in Southern Sudan, are a dynamic target. In 2010, farmers met most of their seed needs through local channels. They project they can meet needs for 2011, again largely through local channels, despite their ambitious plans for expansion.

Focus on the potentially vulnerable

Attention to what is going well should not obscure what appear to be particular areas under stress.

5. In parts of Upper Nile State (particularly within Nasir, an agro-pastoral area) and in parts of NBEG (Aweil centre and east), farmers are accessing significant quantities of seed from aid agencies and also are sowing less than normal. In these areas, the reason most commonly given by farmers for sowing less is 'lack of seed'. Overall, across regions, about 15 percent of farmers gave this rationale for their sowing reduced quantities. Targeted aid to give farmers better access to seed should be considered.

6. In addition to specific geographical areas of stress, there is also an important and more scattered subgroup of vulnerable people. Overall, farmers in 2010 planted reduced surfaces in 43 percent of the crop cases monitored. Some of this reduction is directly linked to seed issues, but in the majority of cases it is not. Farmers may have seed, but they also have significant problems preventing them from engaging in their normal agriculture. Almost 60 percent of the reasons farmers gave for sowing less than normal were not directly tied to 'lack of seed' per se. Labour constraints, health problems and lack of disposable income were three important stresses hindering farmers' production potential. Lack of markets also discouraged certain producers (those who do have the potential to sow more but who choose not to do so).

These detailed observations suggest that agricultural assistance, even in the short term, requires a major reorientation. It has to move well beyond helping farmers access seed, based on recognition that giving free seed will not help farmers solve agricultural problems in the majority of cases documented by the SSSA. The needs of most of the vulnerable farmers must be met in very targeted ways. Vouchers, for example, might be able to alleviate some of the income-related challenges. In addition, labour constraints need to be addressed, as well as enduring health problems. In the medium term, market development will surely also spur increased seed use, especially for production of maize, vegetables and fruits, according to Southern Sudanese farmers.

Rural women and agriculture: special Issues

7. Female-headed households represent almost half (47 percent) of the SSSA sample and, in the particular case of Warrap State, account for 80 percent of surveyed households. Such households cultivate markedly less land than male-headed ones and, unlike male-headed households, tend to keep their land under cultivation at the same level. Higher agricultural production by female-headed households seems key to increasing food security across Southern Sudan.

8. Rural Southern Sudanese women engage in a range of activities to generate income but none has been documented as being unusually lucrative. Vegetable production has been tried as one avenue for professionalizing agro-enterprise initiatives among groups of women.

9. Of special note are the distinct labour constraints on female-headed households: they tend to lack capacity for certain heavy, pivotal tasks, including opening/clearing new land, fencing existing farmland to keep out predators, and cutting central poles for house construction.

10. Little analysis of rural Southern Sudanese women's needs, opportunities and constraints has been done. Gender-related work has tended to focus on protection issues such as post-trauma problems (after the civil war) and the risk of violence faced specifically by girls and women exposed to conflict.

Anticipating the immediate future tied to the Referendum

Seed security projections for the near future are best based on an understanding of actual seed system trends and practices already unfolding on the ground. Several items are of note:

11. Traders interviewed (N = 70) indicate that the pre-Referendum period is already changing business, with a large majority (94 percent) reporting promising changes. They have expanded the range and volume of goods they sell; roads have been improved (for instance, land between Wau and Raja); and several traders have started to process agricultural products into commercial goods such as flours, pastes and alcohol. They are investing in a positive future.

    Given the nature of seed flows across regions, it is unlikely that possible border insecurity will affect such flows on any significant scale. While border closings and decreased north–south trade could affect food security, the same projections cannot be applied to seed security because much seed is acquired locally.

    The SSSA reports in detail a key potential problem site: Aweil. In the case of food, both red and white sorghum flow into Aweil, from areas of El Obeid and Khartoum. Some sorghum also comes in from Nyala. From Aweil, traders send commodities north: hibiscus, gum Arabic, sesame, groundnut, honey, animal skins and some timber.

    However, seed flows are markedly different. For the regions around Aweil, the lion's share of seed, across crops, is sourced locally. The only real exception is groundnut, which is sometimes obtained from El Dein. This is because El Dein has a slightly later growing season, with harvests in November and December, resulting in slightly fresher groundnut seed for April plantings.

    So while food flows might be disrupted, disruption of seed flow is very unlikely.

12. The most recent wave of returnees, since late 2010, totals about 215,000 (IOM/OFDA personal communication). This figure is somewhat below former projections.

All in all, current signs 'for the future' are quite promising. While some of those returning to the South and those displaced will require assistance, this aid should be targeted on clearly defined populations, with the type of aid given tailored to real needs.

II. CHRONIC SEED SECURITY ISSUES AND EMERGING OPPORTUNITIES

The review of medium-term trends (since CPA) in seed security in Southern Sudan shows surprising, positive moves forward as well as staggering bottlenecks.

Positive moves forward

1. In a short five years (and for many farmers, only five seasons), there have been overall significant changes in seed sources for a range of crops – from heavy reliance on outside sources (NGOs, selling labour for seed, and high use of markets), towards high use of farmers' own stocks and hence greater self-sufficiency.

2. New variety access has been impressive, with over 50 percent of households (51.1 percent) indicating they accessed a new variety in the period 2005–2010, principally of sorghum, maize, groundnut, sesame, okra and common bean. While it was not possible to confirm whether these new materials are 'modern varieties' or new local varieties, the rate of introductions is remarkable – and about 89 percent have been varieties retained for continuing use.

3. Organic fertilizers (compost/manure) have been employed by slightly more than half the population (53 percent), although use varies greatly by state. A large majority of households use compost/manure in Western Equatoria, Northern Bahr el Ghazal and Warrap States. About half use compost/manure in Central Equatorial and Eastern Equatoria. Very few households use compost/manure in Western Bahr el Ghazal, Jonglei and Upper Nile. Many households that do not use compost/manure stated that they 'do not know' about these organic fertilizers – that is, they were unaware they could be applied or were unaware of the techniques for using them.

4. Farmers are eager for market development and in some states they have decided not to expand areas to key crops until such markets are strengthened (e.g. for maize). Some traders also suggest that the market for horticultural crops from Southern Sudan is already expanding quickly, e.g. for eggplant, onions and okra.

Mixed factors: positive and negative

5. Outside seed aid – namely free distribution of seed – has been a key positive force for introducing new varieties. When this has been done in a developmental context, there have been possibilities for much needed follow-up and access to technical advice. In some cases, new varieties have been introduced in an emergency context, which is less prudent. New variety use has to be monitored and ultimately verified, and such novel introductions during an emergency can expose farmers to unwarranted risk.

Negative and ongoing stresses

6. There is very little agricultural processing in rural communities – the production of flours, pastes and beer, but not much more. This means that farmers have been unable to reap the benefits of value addition to raw agricultural products. For instance, the SSSA identified only two groundnut oil processors in all of NBEG.

7. Transport problems, especially because of lack of roads, are well known. Figures from Mugwo suggest that a farmer loses 56 percent of her potential profit during transport and storage, that is, even before she has a chance to put her produce up for sale.

8. Inorganic (mineral) fertilizers are used by less than 1 percent of the population. They are currently perceived as costly, unavailable and often not necessary.

9. Seed aid, that is free distribution of seed as part of emergency response and development initiatives, has been conducted on a large scale, with half the Southern Sudanese population having received such aid a mean of 1.8 times since the CPA. Such aid can promote dependency. Some households have received seed assistance 12 times since 2005.

All in all, there has been a great deal of positive dynamism in seed and farming systems over the past five years. However, it is time for key agricultural and marketing bottlenecks to be alleviated, particularly those affecting the development of markets and transport infrastructure. It is notable that interest in market and value chain development is high. The SSSA collected more than 10 value chain analyses during the fieldwork period on crops such as tomato, groundnut, sesame, vegetables and sorghum (see References).

III. FORMAL PLANT BREEDING, FORMAL SEED SECTOR, AND DECENTRALIZED SEED MULTIPLICATION

Formal plant breeding

1. The SSSA included detailed reviews of germplasm collection, introductions and crop improvements from 1937 onwards. This was done crop by crop, listing specific varieties and their origin. The overall historical review was divided as follows: plant breeding before the war (1974–80); plant breeding during the peak of the war (1987–2005); and crop introductions by international non-governmental organizations (INGOs) during the war. The review encompasses information on at least 14 crops.

2. The current structures for plant breeding are also outlined. They are still very basic, mainly organized by relief agencies (INGOs and FAO) and to a lesser extent by the Ministry of Agriculture and Forestry (MAF-GoSS). Most efforts have centred on the introduction of improved crop varieties from private seed companies registered in neighbouring Uganda and Kenya.

3. A comprehensive table details the existing crop varieties grown by farmers in Greater Bahr el Ghazal, Equatoria and Upper Nile Regions. This can serve as a guide for crops that could be promoted and those that need further investigation for improvement.

4. Constraints on, and opportunities for, public sector plant breeding support are presented, according to MAF-GoSS priorities.

Formal seed sector production

5. Prior to 2005, seed production was concentrated in the Project Development Unit (PDU), the Sudanese Council of Churches and a set of INGOs (especially the Norwegian Council of Churches).

6. The formal seed sector is in the process of being reconstructed. A basic seed centre has existed in Palotaka since 2007, and a seed laboratory in Yei functioned at some level during the period 2006–2010.

7. A set of clear priorities for guiding formal seed sector development is described, according to MAF-GoSS priorities.

8. During the period 2000–2010, no formal seed company has gone on record as being a seed multiplier in Southern Sudan. Formal seed sector operations in Southern Sudan have been limited to seed importation by relief, rehabilitation and development organizations. However, within the rehabilitation and development context, a number of development partners in collaboration with MAF-GoSS have been supporting multiplication and bulking of some crops across different agro-ecologies within Southern Sudan.

Seed multiplication and distribution

Decentralized seed production and distribution currently takes place through several means: a) multiplication by on-farm trials; b) the seed distribution-multiplication-recovery approach; c) community-based seed multiplication and supply; and d) evaluations and multiplication of basic seeds. A current seed multiplier inventory (to be updated on an ongoing basis) suggests that at least 15 organizations are multiplying seed. The majority of seed multiplication sites (71 percent) are located in the Green Belt, while others are distributed, by zone, as follows: Hill and Mountain (12 percent), Ironstone Plateau (13 percent) and Western Flood Plains (4 percent).

9. In 2010, some 795.4 tonnes of seed were produced by farmer groups, supported by national and international organizations.

10. Base seed for multiplication was generally locally sourced (that is, very little of the base material was certified), and multiplication included both local and modern varieties of a large range of crops. At present in Southern Sudan there are no facilities for seed grading, treatment and packaging.

IV. THE INFORMAL SEED SECTOR

1. The informal sector is currently the backbone of Southern Sudan's seed supply, providing upwards of 99 percent of the seed sown. Farmers' own stocks supply roughly 40-45 percent of the total seed sown, with local markets providing another 20-25 percent. Social networks (kin, neighbours, friends) serve as a third important source, particularly for planting material of the vegetatively propagated crops such as cassava and banana.

2. The single exception is horticultural crops. For these, certified seed and formal outlets are sometimes used, although horticultural seed is also sometimes sold in open market stalls.

3. Local markets analysis shows that much of the seed/grain trading business is quite new in Southern Sudan, with 76 percent of traders having started their enterprise since 2005 (the oldest trading business in the sample dates to 1983). Most traders have some sort of transport, especially cars or bicycles, but storage facilities are few.

4. Traders clearly describe a range of methods by which they distinguish seed from grain. Most commonly, they recognize different varieties and insist on fresh stocks when procuring seed. Similarly, there are strong signals from farmers that they buy seed (and not just grain) and that they employ a number of procedures to ensure their purchases are of higher quality. (Of course, when assessing market seed, farmers cannot distinguish the germination rate or know of latent disease.)

5. The informal sector is an important and dynamic force in Southern Sudan: local markets are the channel for 20 percent of the new introductions accessed by farmers.

Opportunities for strengthening and professionalizing the informal seed sector – systematically introducing varieties, raising seed quality, and promoting more specialized seed businesses – might be pursued with vigour.

V. RECOMMENDATIONS

The SSSA presents a set of recommendations applicable across the regions assessed. These include not only recommendations related to possible emergency response, but also, well beyond, recommendations that address chronic stress concerns and developmental opportunities.

- Overall, there are few emergency seed security problems, aside from those anticipated for IDPs, returnees and refugees. There are potential exceptions, however. Given that some farmers in certain areas (NBEG and UNS) planted less in 2010, apparently because of a 'lack of seed', ways to enhance their immediate access to seed might be addressed. Other farmers, including a large group of female-headed households, are planting less due to labour, health and income problems – which most often can be considered chronic stresses. Finally, some farmers are planting less because of poorly developed markets for their production. Here the problem is one of unfulfilled development potential**. Generally, in Southern Sudan, there should be a move away from the emergency focus in agriculture.**

- Short- and medium-term developmental actions now need prime attention. The findings of the SSSA suggest **immediate and significant investment is needed in small-farmer-driven variety development, seed production and distribution, and agricultural marketing systems. Comprehensive efforts to alleviate labour shortages/constraints and general depressed buying power (through income generation) should also be given priority.**

Recommendations are made in the following thematic areas: 1) emergency seed aid; 2) variety introduction; 3) sustainable seed production and agro-enterprise models; 4) formal/informal outlets and local markets for agricultural outputs; and 5) rural women and seed security.

I. EMERGENCY SEED AID

Emergency seed assistance should be planned and delivered only if a) it is assessed to be needed, and b) it maximizes benefits and minimizes risks to farmers.

This season

1. Because the seed security situation is, on the whole, very promising, any aid given should be limited, focused on enhancing farmer access to seed, and clearly targeted on:
   - specific regions (parts of Upper Nile State and Northern Bahr el Ghazal), and
   - 'special groups' such as a subset of IDPs and returnees.

2. New varieties should not be introduced in an emergency situation. Before their introduction, there should be clear evidence that they can perform in a given agro-ecological site and that they meet farmers' wants and needs.

In the next few seasons

3. In zones where emergency seed aid is being repeatedly implemented (three seasons in a row), donors, MAF-GoSS and implementers should programme a formal review as to the necessity of the aid.

4. Emergency seed assistance guidelines should be developed for Southern Sudan. These should include good-practice guidance for the range of possible seed-security-related responses: direct seed aid, vouchers, cash, seed loans and other mechanisms. Guidelines should be concise and easy to understand.

5. Assessments that are used to influence seed-related responses should contain an explicit seed security assessment component. In this vein, a specific component on seed security assessment should be added to the Crop and Food Supply Assistance Assessment (CFSAM) and the Annual Needs and Livelihoods Analysis (ANLA) if these exercises are to make any recommendations on seed security.

6. Preferably, separate and focused seed security assessments should be conducted whenever seed security-related actions are being contemplated.

General advice for more effective emergency seed assistance in Southern Sudan

7. In areas where seed may be available (e.g. often the Green Belt) but where access is difficult for some groups such as IDPs and returnees, input trade fairs (ITFs) and vouchers should be used to increase access. This will help provide markets for those who have the seed to sell, at the same time increasing access to the seed needed by the target beneficiaries. Priority could be given to seed-producing groups and local agro-dealers to participate in the fair.

8. In areas where both access to, and availability of, seed of a given crop are problems, priority should be given to local seed collection from areas with a similar agro-ecology or areas of Southern Sudan where the same crop varieties are grown.

9. Where the use of imported seed is inevitable, MAF-GoSS has to take the lead in providing clear guidance on acceptable crop varieties and locations to which they are adapted. The seed quality of any imported varieties must be rigorously checked and all necessary documents (import permit issued by GoSS, phytosanitary certificates, etc.) provided. An independent body must be used to certify the quality before shipment; additional quality checking by the responsible government body at border posts should be made mandatory; at state level, the agency importing the seed, in collaboration with the state ministry of agriculture, should conduct the final quality check before seeds are distributed to the target beneficiaries.

10. Extra efforts should be made by the agencies or organizations involved in the importation of emergency seed to ensure that farmers are provided with the necessary agronomic information on the imported seeds. Regular field monitoring should be done in areas where imported seeds have been distributed.

II. VARIETY INTRODUCTION

There is a generalized need, across regions of Southern Sudan, to develop and identify varieties that are adapted, meet farmer preferences, and respond to dynamic market needs.

11. The GoSS/SSARTO should make public a list of already recommended varieties. This should include those already performing well in Southern Sudan. Methods for fast-tracking such releases should be employed to address the backlog.

12. The Directorate of Research of MAF-GoSS should develop guidelines for variety release and seed production inspection to enhance the release of varieties and production of seeds. The guidelines should be operationalized through ministerial order (Seed Act, Seed Policy and Regulations).

13. Multi-locational sites might be quickly established for screening 'best bets' from elsewhere. Neighbouring national research systems as well as CGIAR centres might be well placed to advise on 'best bet' entries and help to provide initial seed stocks.

14. To facilitate decentralized screening within agro-ecological zones, the present research centres at Yei, Palotaka and Halima, along with universities (Juba, Upper Nile, John Garang Memorial College), NGOs (AAH-I, WVI, NPA, CRS, etc.) that deal with agriculture, and selected progressive farmers groups, might establish a temporary network of testing sites. All screening would be coordinated by the Directorate of Research, MAF-GoSS.

15. All variety screening should allow for end-user evaluation. Participatory variety selection (PVS), mother-baby trials, and garden variety trials are among the well established variety screening formats that allow for intensive farmer and trader/market evaluations.

16. Specific efforts should be made to enhance national capacity for variety maintenance and early-generation seed multiplication. These should include activities for quickly scaling up both breeder and basic seed production – responsibilities that rest squarely with GoSS/SSARTO.

17. Seed testing facilities should be established at the regional level (as a first priority). This would include Greater Bahr el Ghazal, Greater Upper Nile and Greater Equatoria. (In Greater Equatoria the existing laboratory needs to be staffed appropriately.) GoSS/SSARTO would be best positioned to take the lead here.

18. Collections of local germplasm should be planned for the near future (next one to three years). This will facilitate much needed plant breeding efforts as well as help conserve important landrace material.

Key to all variety screening are that a) local adaptation be confirmed; b) farming communities be engaged to ensure performance and cooking/taste acceptability; and c) traders/private sector companies be involved to anticipate market acceptance. Top-down models that fail to stimulate local innovation should be avoided.

III. SUSTAINABLE SEED PRODUCTION AND AGRO-ENTERPRISE MODELS

Current decentralized seed production is limited, geared to institutional buyers (development and relief) and not reaching smallholder farmers as effectively as possible. Sustainable decentralized production models need to be confirmed. In general, seed programmes should only be promoted if they are:

- geared to meeting small-farmer client needs;
- tied to continuing new sources of germplasm;
- contain an explicit delivery (and, where appropriate, marketing) component; and
- economically viable for the producers involved in such enterprises.

19. Seed production efforts should focus on new varieties with high market-demand potential, as well as those crops for which seed/planting material might be difficult for farmers to manage – for example, groundnut seed and cassava planting material.

20. Efforts should be made by those supporting or engaged in seed multiplication to ensure that seed used in their multiplication programme is obtained from reliable and trusted sources. Basic seeds of modern varieties should be sourced from research organizations. Where the intention is to produce Quality Declared Seeds (QDS), seed may be sourced from seed companies.

21. Artificial markets, including those geared to seed for emergency distribution (e.g. contract growers tied to relief agencies), should be discouraged. If emergency seed is needed, it should be procured locally from seed producer groups and local agro-dealers (for vegetable seed).

22. Links have to be catalyzed for feeding farmer-acceptable, market-preferred crops into seed production initiatives. Efforts such as farmer field schools (FFS) and the end-user evaluation mechanisms mentioned above (#15) might all help to raise awareness of and access to new, needed varietal materials.

23. Improved storage methods should be investigated and promoted, particularly to deal with storage constraints of crops such as groundnut and cowpea. Use of metal silos and triple bagging options might be tested. Rigorous post-harvest loss assessments should be conducted to determine the degree and geographic scope of loss.

Value-added seed production, processing and marketing should be supported and encouraged among seed-producing groups or associations. Processing activities such as mechanized cleaning, grading, packaging and labelling will help consumers (farmers) clearly distinguish between grain and seed on the market. This will also help producers sell their products at a premium.

More generally, seed production has to be routinely tied to agro-enterprise possibilities. As first steps, we suggest the following:

24. The wealth of existing value chain studies should be brought together and synthesized.

25. Market information systems that farmers can trust need to be reviewed and further developed. This includes ensuring that market information – currently being collected by GoSS/SIFSIA/WFP – is accessible and user-friendly, even to ordinary farmers.

26. Diverse business and organizational models need to be tested so as to help farmers organize into effective production, processing and marketing groups (e.g. farmer field schools or specialized producer groups or collectives).

In brief, we recommend the development of a market-driven decentralized seed production system, which scales up foundation seed and then decentralizes seed production in multiple zones country-wide. Supply has to respond to demand, meaning that hard-to-produce crops (e.g. groundnut and cassava) and new desired varieties have to drive the production process.

IV. FORMAL/INFORMAL OUTLETS AND LOCAL MARKETS FOR AGRICULTURAL INPUTS

Farmers need regular access to outlets that can provide them with the varieties and quality seed they desire. Currently there are few such outlets and these are located only in major town centres.

Specialized formal outlets

27. The only formal input shops identified during the SSSA were in Yei, Wau and Aweil. Selling mostly horticultural crop seed, shop owners asked for a) better technical advice on crop varieties, b) training in business/marketing skills, and c) more ongoing links to the research that provides new varieties. Shop owners assess that business will grow substantially as Southern Sudan starts to produce its own array of fruits and vegetables, especially onions, eggplant and tomatoes which are already in demand in town centres. These fledging formal sector outlets need to be more systematically supported.

Expansion of informal outlets

Most farmers continue to obtain a significant proportion of their seed, and also new varieties, from various types of local markets. We recommend that creative initiatives be taken to tie the supply of new varieties and quality seed to the multiple venues where farmers routinely make purchases. Three initial methods for making new varieties more accessible might be tested:

28. Trials might be initiated whereby the seed of new varieties is sold in open markets throughout rural areas via a network of licensed vendors. Vendors would have to be trained to provide farmers with the technical advice needed to guide informed seed choices and management.
29. Seed fairs, whether in the context of emergency aid or development programmes, might be systematically linked to sources of new varieties and quality seed.

30. Seed loan schemes that allow farmers to obtain seed of new varieties on credit should be tested and include monitoring mechanisms to determine the quality of the seed returned by farmers and their real repayment rates.

    Seed sales through the above-mentioned informal outlets can be facilitated if high-quality seed is sold in small quantities in sealed plastic packs. Experience elsewhere suggests this should be done in quantities acceptable to farmers (perhaps 100-200 g), with labels reporting varietal characteristics.

31. Farmer-focused, small-pack sales models might be tested in the range of venues where farmers routinely buy seed and other goods. (See recommendations 28-30.)

If implemented smartly, these suggestions for broadening seed sale venues and sale formats should stimulate the creation of a broad customer base, focusing directly on producers (small-scale farmers) and reducing reliance on large institutional buyers. Building on the varied local market channels that these farmers already regularly use should also minimize transaction costs.

V. RURAL WOMEN AND SEED SECURITY

Half the households surveyed in the Southern Sudan SSSA are female-headed, with women playing a key role by promoting food security, seed security and general well-being. Even in male-headed households, women are often responsible for seed and grain storage at the household level, as well as limited marketing so as to obtain essential household supplies such as tea, sugar and oil.

32. Women's groups that were contacted during the SSSA carry out a range of activities such as providing seed storage during critical post-harvest periods, processing products (groundnut and sesame pastes, maize, cassava and sorghum flours), setting up nurseries and selling vegetables. Such groups, rather than individuals, should be considered as important entry points for development and investment support. Precedents for collaborative work already exist, e.g. the Tiwu ku Yupet (Kajokeji County) and Abulometa (Mugwo) women's groups.

33. More generally, little research has been carried out on gender dynamics in Southern Sudan's agricultural systems and rural economy. The government and development organizations should invest in focused study of women's participation in agricultural activities to determine appropriate entry points for women in key value chains, seed security and food security initiatives.

I. Introduction

RATIONALE FOR SSSA IN SOUTHERN SUDAN

Southern Sudan is endowed with abundant natural resources such as fertile land capable of supporting diverse agricultural activities. Over 80 percent of households in Southern Sudan depend on agriculture for their livelihood, on a subsistence basis.

More than two decades of civil conflict between the north and south, which ended with the signing of the Comprehensive Peace Agreement (CPA) in 2005, negatively affected agricultural production and productivity. This was mainly the result of human displacement and loss of labour and production assets, including some staple food crop genetic resources. During the conflict, and after the CPA, many efforts have been made by relief, rehabilitation and development partners including the Government of Southern Sudan (GoSS) towards rejuvenating and restoring agricultural production and productivity. Relief efforts have emphasized the provision of food, shelter, basic health services and basic agricultural inputs such as crops seeds and hand tools to vulnerable and affected populations, mainly returnees, IDPs and refugees.

Five years after the CPA, seed aid has continued to flow within Southern Sudan on a yearly basis, mainly to support returnees, IDPs and other vulnerable resident communities. Annually, more than 2 000 tonnes of seed aid are being distributed in Southern Sudan. This aid is normally provided on the assumption that the seed of staple crops is unavailable or that the target beneficiaries have poor access to it.

Determinations of the seed security situation in Southern Sudan have largely been based, implicitly or explicitly, on the Annual Needs and Livelihood Assessment (ANLA), the Crop and Food Supply Assessment Missions (CFSAMs), and other needs assessments. The ANLA normally reviews a broad scope of needs, setting the general trends, while the CFSAMs looks more specifically at the food security situation with a strong focus on cereal production with respect to supply and deficits. Both the ANLA and the CFSAMs have limited scope in looking at seed security and/or the dynamics of seed systems. The food supply/deficit scenario normally leads relief, rehabilitation and development partners to conclude in most cases that 'seed is needed' within the areas of deficit food supply, and this may be misleading in some instances.

With over ten years of repeated or continuous seed aid in Southern Sudan, and now relative peace after the CPA, the dynamics of seed security needs to be looked at critically in order to develop a more sustainable seed system. For better understanding of the seed security situation in Southern Sudan, FAO in collaboration with the GoSS Ministry of Agriculture and Forestry (MAF), CIAT and other development partners carried out a seed system security assessment (SSSA). This SSSA was designed to hone technical insight and to train professionals in the fast-evolving areas of seed security assessment and intervention-design methodology.

AIMS AND STRUCTURE OF THE REPORT

Chapter II gives background information on the seed security concept and on current options for seed-related aid response. It also introduces the SSSA methodology, reviews the methods actually used in Southern Sudan, and presents the rationale for the choice of sites. Chapter III summarizes the context of the assessment, sketching salient political, economic and health trends, giving an of overview of agriculture and crop production, and reviewing food and seed-related assistance over the past decade. Chapter IV describes current formal plant breeding structures and processes, while Chapter V reviews how the formal and informal seed sectors are organized and currently function in Southern Sudan. An extensive section describes decentralized seed multiplication and distribution. The chapter also includes a short introduction to gender issues as theses are linked to food and seed security.

Chapter VI presents key field findings. It first analyzes the current seed security situation (for 2010, but looking ahead to the first season of 2011), then focuses on chronic seed security/agricultural concerns, as well as emerging opportunities. Chapter VII presents the recommendations of the SSSA. These are intended to lead to specific actions in a range of areas: emergency seed aid; variety introduction; decentralized seed production and agro-enterprise development; and rural women and commerce.

The report ends with a set of references. Annex I comprises the main field research instruments, namely forms to direct farmer and community group interviews and for inventorying seed multipliers.

Within the report, boxes highlight key experiences and raise issues for further discussion.

This is not an academic report. The fieldwork was carried out relatively quickly to help partners plan for the upcoming agricultural seasons. Nevertheless, the assessment team has aimed for considerable rigour, including the use of multiple methods, triangulation of results (with quantitative and qualitative data), and research drawing on substantial sample sizes.

II. Background to Seed System Security Assessment

This chapter presents the necessary background to interpret this SSSA. It introduces the concept of seed security and the different types of seed aid approaches that might be matched to diverse seed security problems (and opportunities) encountered on the ground.[1]

THE CONCEPT OF SEED SECURITY

Farm families are seed secure when they have access to seed (and other planting material) of adequate quantity, acceptable quality, and in time for planting. Seed security is best framed within the broader context of food and livelihood security. Helping farmers to obtain the planting materials they need enables them to produce for their own consumption and sale.

Achieving seed security is quite different from attaining food security, despite their obvious links. One can have enough seed to sow a plot but lack sufficient food to eat, for example during the 'hungry season' prior to harvest. Conversely, a household can have adequate food but lack access to appropriate seed for planting. Despite these important differences between food security and seed security, determinations of seed security are normally based, implicitly or explicitly, on food security assessments. This results from a lack of appreciation and understanding of seed security issues.

The Dimensions of Seed Security: a Framework

The concept of seed security embodies several fundamental aspects. Differentiating among these is crucial for promoting those features that foster seed security as well as for anticipating the ways in which such security might be threatened.

Table 2.1 outlines the fundamental elements of seed security: seed has to be available, farmers need to have the means to access it, and the seed quality must be sufficient to promote good production.

Table 2.1: **Seed security framework: basic elements**

Parameter	Seed Security
Availability	Sufficient quantity of seed of adapted crops is within reasonable proximity and in time for critical sowing periods.
Access	People have adequate income or other resources to purchase or barter for appropriate seeds.
Quality	Seed is of acceptable quality: • 'healthy' (physical, physiological and sanitary quality) • adapted and farmer-acceptable varieties

Source: Remington *et al.,* 2002.

Availability is defined narrowly as whether a sufficient quantity of seed of target crops is present within reasonable proximity (spatial availability) and in time for critical sowing periods (temporal availability). It is essentially a geographical parameter, and so is independent of the socioeconomic status of farmers.

1 This section draws on Sperling *et al.,* 2008.

Seed **access** is a parameter specific to farmers or communities. It largely depends upon the assets of the farmers or households in question: whether they have the cash (financial capital) or social networks (social capital) to purchase or barter for seed.

Seed **quality** includes two broad aspects: seed quality *per se*, and variety quality. Seed quality consists of physical, physiological and sanitary attributes (such as germination rate and the absence or presence of disease, stones, sand, broken seed or weeds). *Variety quality* consists of genetic attributes, such as plant type, duration of growth cycle, seed colour and shape, and palatability.

In situations of stress, it is rare to have constraints in all three seed security features at the same time. The challenge is to identify the real problem and then target actions to alleviate that problem.

Acute and Chronic Seed Insecurity

Analysis of seed security requires consideration of the duration of the stress: whether it is 'acute' or 'chronic' (recognizing that the divisions are not absolute).

Acute seed insecurity is brought on by distinct, short-lived events that often affect a broad range of the population. It may be spurred by failure to plant, loss of a harvest, or high pest infestation of seed in storage. While in normal times households may have various degrees of seed security, all may be affected by an acute event, such as a flood.

Chronic seed insecurity is independent of an acute stress or disaster, although it may be exacerbated by it. It may be found among groups who have been marginalized in different ways: economically (for example, due to poor, inadequate land or insufficient labour); ecologically (for example, in areas of repeated drought and degraded land); or politically (in insecure areas, or on land with uncertain tenure arrangements). Chronically seed-insecure populations may have ongoing difficulties in acquiring off-farm seed due to lack of funds; or they may routinely use low-quality seed and unwanted varieties. The result is households with built-in vulnerabilities.

Acute and chronic seed insecurity often exist together in emergency contexts. Indeed, in cases where emergencies recur – in drought-prone areas, for example – acute problems are nearly always superimposed on chronic problems rooted in poverty.

More Refined Analyses Leading to More Targeted Responses

Table 2.2 gives examples of how identification of a specific seed security constraint should lead to a targeted response, as we are aiming for in this Southern Sudan assessment. So, for example, if 'seed availability' is assessed as the problem in the short term, seed-based interventions, such as seed importation (for acute shocks) may be appropriate. (Seed availability problems rarely persist over the long term.) In contrast, a diagnosis of a problem of 'seed access' might wisely trigger a holistic analysis of livelihood strategies. In the acute phase, providing farmers with cash or vouchers to get their desired seed might be effective. However, an identification of access problems on a chronic basis should lead practitioners to look well beyond seed and seed security constraints. The inability to access certain necessary goods on a repeated basis is usually equated with problems of basic poverty. Initiatives to help farmers generate income and strengthen their livelihoods would be essential. Seed quality problems, whether they relate to concerns with the varieties or with seed health *per se,* are rarely short-term. Responses usually require significant development programmes, linked to plant breeding or seed quality initiatives, depending on the specific constraint identified.

Table 2.2: **Types of seed security problems and broadly appropriate responses**

Parameter	Acute	Chronic
Unavailability of seed	Direct distribution of seed	(Happens rarely or never)
Farmers lack access to available seed	Vouchers and cash (sometimes with seed fairs)	Income generation activity Agro-enterprise development
Poor seed quality • poor varieties • unhealthy seed	Limited introductions of new varieties	Introduce new varieties and give technical support Variety selection / breeding Development of seed enterprises linked to new varieties and other quality enhancements

CURRENT MAJOR RESPONSE OPTIONS BEING USED IN EMERGENCY

Various seed-related interventions are currently being implemented in emergency and chronic stress contexts in different parts of the world. Two broad categories can be distinguished: those that deliver direct forms of aid (and generally assume 'lack of available seed') and those that are market-based and give recipients cash or vouchers to procure seed themselves (and hence assume 'lack of access' as the driving need). Responses might also focus on seed quality issues, both varietal quality and seed quality *per se* (health, germination rates and purity), although these tend to be medium- or longer-term interventions (Table 2.3).

Within the emergency seed assistance field, direct seed distribution (DSD – also known as "Seeds and Tools") has dominated seed aid response for many years. It is, by far, the most common seed-related response in Southern Sudan (over 95 percent of interventions). DSD often promotes modern varieties as their central 'emergency' element. Emergency DSD in Southern Sudan has, in fact, been more important than normal research and development (R&D) channels as a way to get new varieties to farmers (see Chapter VI), although this extension function might better be served by development agencies that can also provide technical advice and field follow-up.

The provision of vouchers as a type of seed-related assistance has been promoted globally mostly within the last three years, and began to be used in Southern Sudan about 2008 (see CRS, 2002). This approach assumes that seed *is* available in a given context, and that farmers simply need enhanced means to buy it (i.e. that their problem is one of access).

In theory, each approach currently in use carries with it a set of assumptions as to what specific seed security problem is being addressed (availability, access, seed/varietal quality) and whether this problem is short-term or long-term (Table 2.3). In practice, these approaches are almost always used in the absence of any real diagnosis of the seed security problem and are chosen for reasons disconnected from on-the-ground analysis. For example, one implementer might always favour DSD and only knows how to deliver this type of assistance, while another might always prefer cash, as this coincides with his/her institutional philosophy. This indiscriminate use of seed-related responses is making the seed aid field much less effective than it might otherwise be.

Table 2.3: **Typology of current seed system interventions**

	Description / Rationale	Constraints on which they should be targeted
Direct aid		
1. Direct seed distribution Emergency seed provision 'Seeds and tools'	Procurement of quality seed from outside the agroecological region, for delivery to farmers. The most widely used approach to seed relief.	Short-term response to address problems of seed availability especially in situations of crop failure and/or long-term displacement of farmers. Response sometimes also used to introduce new crops or varieties usually supplied by the formal sector.
2. Local procurement and distribution of seed	Procurement of quality seed from within the agroecological region, for delivery to farmers. A variant of 1.	Short-term response to address problems of seed access or highly localized problems of seed availability.
3. Food aid 'Seed aid protection ration'	Food aid is often supplied during emergencies along with seed aid so that farmers do not need to consume the seed provided. Where local seed systems are functioning, but the previous harvest was poor, food aid can help protect farmers' own seed stocks.	Short-term response accompanying direct seed distribution to address problems of seed availability.
Market-based aid		
4. Vouchers / cash to farmers	Vouchers or cash can provide poorer farmers with the means to access seed where it is available, from local markets, or the commercial sector. Vouchers or cash enable farmers to access crops and varieties of their choice.	Short-term response to address problems of seed access especially in situations of local seed shortages; local markets or farmer-to-farmer barter normally used. Can also be used to link farmers with agro-dealers.
5. Seed fairs	Seed fairs provide an *ad hoc* market place to facilitate access to seeds, or specific crops and varieties, from other farmers, traders and the formal sector. Usually used with vouchers to provide poorer farmers with purchasing power.	Short- or medium-term response to address problems of seed access especially for subsistence crops, and where local markets normally used. Increasingly used to give farmers access to new varieties as well.
Seed production and varietal development		
6. Seed production Community-based, local seed production	Farmers are trained and/or contracted to produce seed, often on formal seed standards. Some approaches focus on improving quality attributes, others are designed to move new improved varieties, still others are conceived as basically income-generating enterprises.	Medium- or long-term response to address problems of seed quality (of local materials) or of access to, or availability of, new varieties.
7. Provision or development of better varieties through small packets, varietal selection, or plant breeding	Important where farmers need access to new genetic material.	Medium- or long-term response to address problems of seed quality (genetic/varietal attributes).

Source: modified from Sperling *et al.*, 2008.

SEED SYSTEM SECURITY ASSESSMENT: METHODS, SITES, SAMPLE

An SSSA reviews the functioning of the seed systems farmers use, both formal and informal. It asks whether seed of adequate quality is available and whether farmers can access it. The SSSA also promotes strategic thinking about relief, recovery or the development vision needed. For instance, during a period of stress, should efforts aim to restore the seed system to its former state, or should they aim to strengthen it? Should efforts focus on crops for food, income or both? Should interventions be linked to crops important to the most vulnerable (e.g. women)? (See Sperling, 2008 for a description of the SSSA method http://webapp.ciat.cgiar.org/africa/pdf/sssa_manual_ciat.pdf.)

The task of conducting an SSSA in Southern Sudan was particularly challenging. There were few baselines that could be used to describe the 'normal' situation since in recent years only a modest amount of research and monitoring has been done in rural areas and Southern Sudan has seen very rapid developments since the CPA in 2005.

Methods Used

The themes and methods used in the Southern Sudan SSSA are sketched out in Table 2.4. They include a range of qualitative and quantitative methods and draw on the insights of multiple stakeholders. Of special note is that the sample sizes were relatively big for a quick assessment: 885 individual farmer interviews, over 20 focus group discussions (FGDs) often with 30 people or more, and 70 seed/grain trader interviews. The annex presents the main field instruments used.

Table 2.4: **Investigative thrusts and methods used in the SSSA Southern Sudan, December 2010**

Type of Investigation	Commentary
Background information collection	Commissioning of specific documents on: • plant breeding • formal sector seed supply trends • decentralized seed multiplication
Database utilization	Use of GoSS/SARTO and FAO databases
Key informant interviews	State government officials, agro-dealers civil society project personnel, seed producers
Focus group discussions (> 25) Community-based Women's groups	Separate community and women-only FGDs, discussing: • agricultural and variety use and trends • seed source strategies, by crop • women's crop/seed constraints/opportunities • livelihood/coping strategies
Farmer interviews (N = 885)	Topics covered: • seed source patterns and manure/fertilizer use • seed aid and new variety access
Seed/grain market analysis (N = 70 traders)	Assessment of: • crop and variety supplies on the market • sourcing areas and pricing patterns • seed quality management procedures

Site Choice

Sites were chosen so as to link assessment to action, and also to allow for some extrapolation of findings nationwide. Areas of assessment were chosen so as to highlight different types of possible seed security scenarios tied to the following factors:

- Key agroecological zones
- High versus low crop potential
- High versus low security risk
- High versus low environmental risk
- Border versus non-border areas (to assess seed-related effects of cross-border markets)
- Partner priorities

In the final choice, 16 counties in 8 states were chosen as sites for the assessment. These are listed in Table 2.5, with Figure 2.1 showing their relative locations.

Household Sample

Households were sampled in an unbiased manner, with county choices being 'pulled from a hat' and, households selected on the ground, by interviewing those in every third or fourth dwelling (depending on rural population density), moving out in different directions from a central village point. The resulting sample parameters appear below (Table 2.6).

Of special note is that almost half (46.9 percent) of households are headed by females, and in one State, Warrap, the proportion was 80 percent (Figure 5.8, Chapter V). IDPs, returnees and refugees (who might be clustered as a potentially vulnerable group), accounted for about 16 percent of the sample. Finally, households were categorized by the amount of land they cultivate, in feddans: less than 1, 1–3, and over 3. This variable of 'cultivated area' may be used as a lose proxy for wealth, but with some caution. Some households may cultivate small amounts of land, but have substantial herds (and hence may be fairly well-off). Other households may cultivate large land areas, but because soils are poor and rainfall erratic, these holdings are not very productive.

Figure 2.1: **Geographic location of zones of assessment in Southern Sudan, 2010**

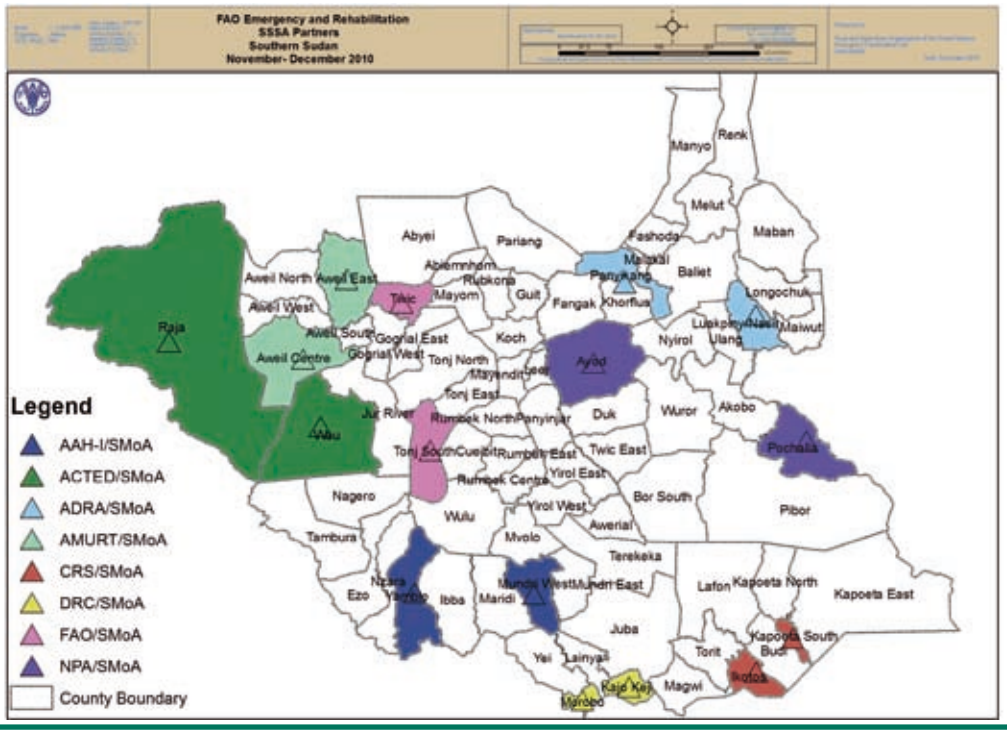


Table 2.5: **SSSA assessment zones, November–December 2010**

State	Site (County)	Organization
Jonglei	Ayod	NPA/SMoA
	Pochala	NPA/SMoA
Upper Nile	Panyikang	ADRA/SMoA
	Nasir	ADRA/SMoA
Central Equatoria	Morobo	DRC/SMoA
	Kajokeji	DRC/SMoA
Eastern Equatoria	Ikotos	CRS/SMoA
	Kapoeta South	CRS/SMoA
Western Bahr el Ghazal	Wau	ACTED/SMoA
	Raja	ACTED/SMoA
Northern Bahr el Ghazal	Aweil East	AMURT/SMoA
	Aweil Centre	AMURT/SMoA
Warrap	Tonj South	FAO/SMoA
	Twic	FAO/SMoA
Western Equatoria	Yambio	AAH-I/SMoA
	Mundri West	AAH-I/SMoA

Table 2.6: **SSSA Southern Sudan household (HH) sample characteristics (N = 885)***

Feature	Description	% of sample
Type of household	Resident	84.1
	IDP	5.31
	Returnee	9.2
	Refugee	1.4
Household head	Male	53.1
	Female	46.9
Marital status	Single	2.7
	Married	86.2
	Widowed	11.9
	Divorced	0.2
Age of household head	Mean (SD) = 39 (12.5)	
Household size	Mean (SD) = 7.4 (4.2)	
Area cultivated	< 1 feddans	22.2
	1-3 feddans	61.4
	> 3 feddans	16.4

* While the full sample size is 885 households, some data are missing for selected features. Hence, percentages refer to the portion of reported entries.

III. The Context

THE POLITICAL-ECONOMIC AND SOCIAL CONTEXT

Emerging from War, CPA, Referendum

The signing of Sudan's Comprehensive Peace Agreement (CPA) in 2005 marked the end of Africa's longest civil conflict (21 years) and opened the way to peace in Southern Sudan. This historic event and the subsequent formation of the Government of Southern Sudan (GoSS) triggered a number of socio-economic changes and created the conditions for the return of an estimated 1.44 million people (IOM, Juba). Since the signing of the CPA, large numbers of returnees have resettled in areas that were inaccessible during the years of conflict. Although overall security has greatly improved, pockets of insecurity still exist because and intra- and inter-tribal conflicts and the activities by the Lord's Resistant Army (LRA), particularly in Western Equatoria State. Other affected States where internal displacement of people remains a problem are Jonglei, Warrap, Eastern Equatoria and Upper Nile.

Although there has been significant progress since the signing of the CPA, the future of Southern Sudan is seen to be closely tied to the Referendum of 9 January 2011. Many Southern Sudanese have been hoping for a peaceful Referendum on separation or unity with the North. The high expectation of separation triggered the return of over 500 000 people to Southern Sudan, mainly from the north where the future of Southern Sudanese was considered uncertain. The return of hundreds of thousands of refugees and IDPs, and the recurrent displacement of people in Southern Sudan, have significant humanitarian implications.

With peace now prevailing and impending nationhood within the framework of the just-concluded Referendum, Southern Sudan has enormous potential for future investment in agriculture and other sectors. Key areas for investment include mechanized farming, value addition and marketing.

The Economy

Sudan is classified among the least developed countries, with very poor socio-economic indicators. UNDP's 2005 *Human Development Report* ranked the country 141st out of 177 countries. Despite data limitations, coverage and controversies, national-level proxy data estimates suggest conditions of endemic hunger and significant malnutrition.

In recent years Sudan has experienced an economic upturn, characterized by a long positive episode of growth and relatively low inflation. The growth of the Gross Domestic Product (GDP) was 8.4 percent in 2008, but this was projected to slow to about 5.0 percent in 2009 reflecting the impact of the global financial crisis (NBHS, 2009). The exploitation of oil reserves and "the peace dividend" were the main drivers of this economic success.

Agriculture is the backbone of the country's economy, with over 80 percent of the population depending on it for their food security and livelihoods. The sector contributes one-third of GDP (32.6 percent) and accounts for more than half (57 percent) of Sudan's labour force. There are no official statistics on GDP composition in the areas of Southern Sudan affected by the conflict, but agriculture is considered the most important sector.

Fifty-one percent of the population of Southern Sudan is considered to be living below the poverty line. Although poverty varies greatly with specific location, 55 percent of people in rural areas are classified as poor, compared with 24 percent in urban areas. The poverty level also varies greatly across the ten states with highest rate, 76 percent, recorded in Northern Bahr el Ghazal and the lowest, 26 percent, in Upper Nile (SSCCSE, 2010).

Average per capita consumption in Southern Sudan is estimated at 100 Sudanese Pounds (SDG) per person per month. This varies with wealth status as well the area where people reside. Average per

capita consumption among the poor is 39 SDG per person per month, while for the non-poor it is 163 per person per month. In urban areas, average consumption is 168 SDG per person per month compared with 88 SDG in rural areas.

Health and Nutrition

Improving the health and nutritional status of the people of Sudan is a priority for the Federal Government of Sudan (FMoH, 2005) and is vital to the country's development. While Sudan has enormous potential in terms of natural and human resources (FAO, 2005), it is not on track to meet the UN Millennium Development Goals by 2015 (UNICEF, 2006).

Infant mortality, a key health indicator, is estimated at 102 per 1 000 live births. The under-5 mortality rate is 135 per 1 000 live births. The lowest level, 82, is in Jonglei State, the highest, 192, in Western Equatoria state (FMoH, 2006). In Southern Sudan, the under-5 mortality rate is 250 per 1 000 live births (UNFPA, 2007).

In Southern Sudan, routine Expanded Program on Immunization (EPI) services are not functional. Most EPI services are actually carried out by NGOs, supported by WHO and UNICEF. A five-year EPI plan for Southern Sudan was developed in June 2005 and it estimates present DTP1 coverage in the South to be 22 percent, with a DTP3 coverage of 11 percent. According to the planning document, there was little or no advocacy for routine EPI. Southern states often run out of vaccine. Supervision of routine EPI services and of vaccine management appears to be weak (FMoH, 2005).

The fertility rate per woman in Southern Sudan is 6.7 while life expectancy at birth is 42 years compared with 56.6 in the northern part of the country (UNFPA, 2007). Gender-related health risks are common. The proportion of births attended by skilled health staff is also among the lowest (13.6 percent) in the world and the maternal mortality rate is 2 054 per 100 000 live births A wide range of 'tropical' diseases that are controlled elsewhere are endemic in Southern Sudan; many of these are also referred to as 'neglected diseases'.

Nutritional indicators from the Sudan Household Health Survey (SHHS) found that almost one in three children under the age of 5 (31 percent) were underweight and almost half (48 percent) were stunted; 18.1 percent of children under 5 suffered from moderate or severe acute malnutrition. Global acute malnutrition (GAM) rates are chronically well above the emergency threshold of 15 percent. SHHS results showed an average GAM rate of 20 percent in Southern Sudan with higher-than-average figures in some states such as Northern Bahr el Ghazal, Jonglei, Upper Nile and Warrap (SHHS, 2006).

Food Security

According to the 2009 National Baseline Household Survey on food insecurity, the prevalence of food deprivation for Sudan was 33 percent, and the highest level (51 percent) was recorded in Southern Sudan. Levels of food deprivation varied significantly across Southern Sudan with significantly higher levels in Western Bahr Al-Ghazal State (74 percent), followed by Unity State (72 percent), Upper Nile (69 percent), Warrap (62 percent), Lakes (54 percent), Jonglei (48 percent), NBEG (44 percent), CES (41 percent), EES (24 percent) and WES (23 percent). On average, a food-deprived person in Southern Sudan is short 427 Kcal in meeting his/her minimum dietary energy requirement (MDER) of 1 775 Kcal per day, an equivalent of 125 g of cereal per day.[2] The NBHS (2009) pointed out that people's own production was not a major source of calories in the entire country since on average it accounted for only 7.6 percent of dietary consumption. However, this share was fairly high in southern states (23.9 percent) where agriculture is the major source of livelihoods (SSCCSE and SIFSIA, 2010).

AGRICULTURAL OVERVIEW

In Southern Sudan, agriculture provides a livelihood for over 80 percent of the people and its potential to expand to the commercial scale is tremendous. About 90 percent of the total land area is considered suitable for agriculture, 50 percent (about 105.6 million ha) of which is classified as prime agricultural land. Currently, less than 2 percent (1.3 million ha) of the total area is utilized for production (CFSAM, 2011).

2 Food deprivation refers to the condition of people whose food consumption in terms of energy is continuously below a minimum dietary energy requirement.

Agriculture in Southern Sudan is predominantly rainfed with annual rainfall increasing from north to south and from east to west. The range is from less than 500 mm/year in the semi-arid lands of Eastern Equatoria to around 1 800 mm/year in the Green Belt zone. Farming is still mostly at subsistence level, comprising traditional livestock rearing, crop production, fishing, wild food collection and game hunting. Various combinations of these elements make up specific household economies depending on the livelihood zones.

Natural Livelihoods Zones

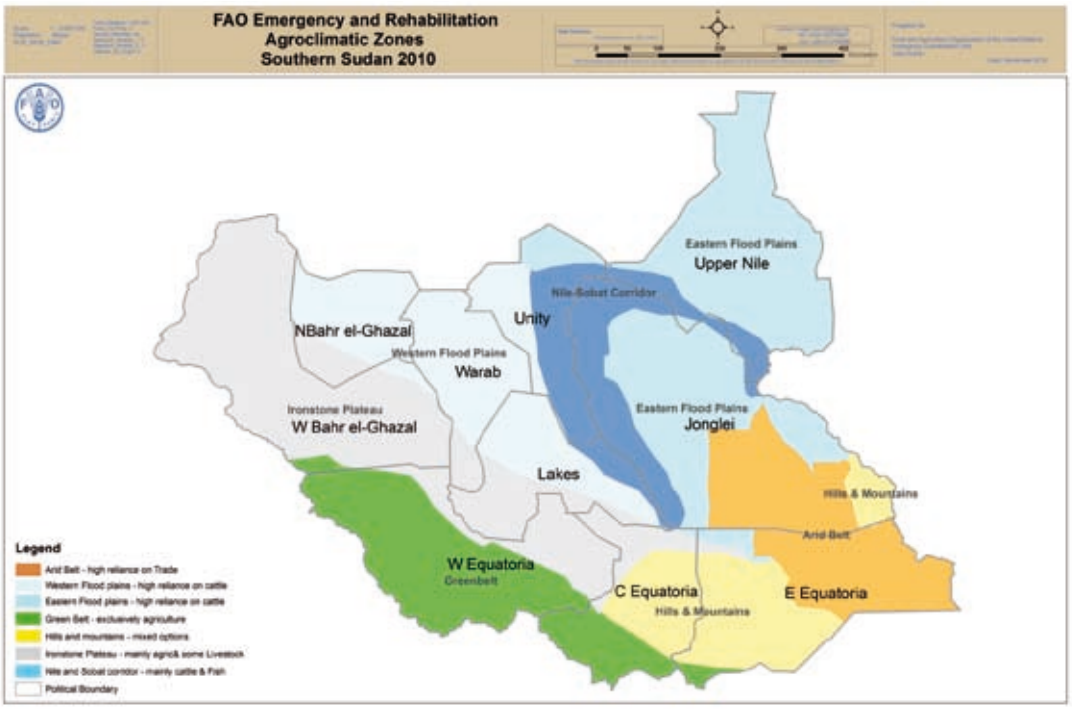
Southern Sudan has been broadly classified into seven major livelihood zones, each cutting across at least two states (SSCCSE, 2006). These are: the Green Belt, Ironstone Plateau, Hills and Mountains, Arid/Pastoral, Nile-Sobat Rivers, Western Flood Plains and Eastern Flood Plains (Figure 3.1).

In the wetter southwestern areas of Green Belt, households rely almost exclusively on agriculture to meet their food needs. Here, surplus production is common and households cope with bad years by increasing their dependence on root crops and exchange. In the Arid Zone, which occupies the southeastern tip of the country, households practice a nearly pure form of pastoralism and there is almost exclusive reliance on livestock and livestock trade for food. Seasonal migrations in search of both water and pasture provide opportunities for substantial trade and exchange with neighbouring communities.

The Hills and Mountains Zone falls in between the two extremes (Green Belt and Pastoral Zone) with more reliance on cattle, trade and root crops in difficult years. In the Western Flood Plains Zone, livestock and crop agriculture, supplemented by fish and wild foods, are the main food sources. Similar food sources are available in the Eastern Flood Plains Zone, but with an additional option of game hunting. Households in the Ironstone Plateau Zone are heavily dependent on crop production and are well placed to access surpluses in the neighbouring Green Belt. Apart from crops and livestock, wild foods and fish contribute significantly in the Nile and Sobat Rivers Zone. Fish and wild foods are collected in varying quantities depending upon the season and location.

The importance of livestock to the majority of Southern Sudanese households, particularly in

Figure 3.1: **Rural livelihood zones of Southern Sudan**



Source: FAO emergency and rehabilitation coordination unit.

the Pastoral/Arid zone, Western and Eastern flood plains, and Hills and Mountain, can not be understated. Livestock are the basis of long-term wealth, status and social networks, as well as serving as a critical source of milk and meat.

The success or failure of livelihood systems in Southern Sudan depends on factors such as the ability of people to move and trade. Mobility allows people to take advantage of the seasonal availability of food in different areas, such as fish and wild foods. It is also crucial for the survival of livestock, which depend on regular migration between dry- and wet-season grazing areas. Trade increases wealth and capital, helping to off-set localized production failures in years of poor rainfall.

Crop Production Overview

Agricultural production in Southern Sudan is predominantly at subsistence level and therefore depends heavily on rainfall. Over 95 percent of farming is rainfed with weather variability being a major determinant of yields. In lowland areas, floods are a normal occurrence, but variability of the water levels affects harvested area and yields. Farmers normally use rudimentary hand tools such as hoes, malodas, pangas and sickles, which greatly limit the area of land that can be cultivated by farm households. On average, only 0.82 ha is cultivated per household (CFSAM, 2010).

The potential to increase the area under production and ease field operations lies with the use of animal traction. Efforts are being made by the GoSS, FAO and NGO-based extension agents to promote animal traction on a small scale in Central Equatoria, Western Equatoria, Lakes, Warrap and Bahr el Ghazal States. However, social and cultural barriers, lack of spare parts and skills to maintain mouldboard ploughs, and the lack of adaptability of ploughs to local soil conditions are still hindering progress. Mechanized farming is practised mainly in the Upper Nile counties of Renk, Melut and Wadakona and to a limited extent in Malakal and Bentiu in Unity State.

Crops grown

A wide range of crops is cultivated in Southern Sudan. The specific importance attached to each depends on the agro-ecologies or livelihood zones where they are grown. Generally, the Green Belt is much richer in crop species and varietal diversity than the dry pastoral zone.

Table 3.1: **Major and minor crops grown in Southern Sudan**

Crop category	Major	Minor
Cereals	Sorghum, maize	Millet, pearl millet, rice
Oil seeds	Groundnut, sesame	Sunflower, soybean, oil palm
Pulses	Cowpea, beans	Green gram, pigeon pea
Roots and tubers	Cassava, sweet potato	Yam, cocoyam
Plantain	Banana	
Vegetables	Okra	Tomato, eggplant, cabbages, onion, kale, amaranths
Plantation crops		Sugarcane, coffee
Fruit trees	Mango, citrus, pineapple, pawpaw	Avocado, passion fruit, jack fruits

Cereals: Sorghum and maize are major staple food crops in Southern Sudan. Sorghum is the main staple in all lowland states of greater Bahr el Ghazal (WBEG, NBEG, Warrap and Lakes states) and greater Upper Nile (Jonglei, Upper Nile and Unity states), while maize is the main staple within the Green Belt of Greater Equatoria (Central and Eastern Equatoria states). In Greater Bahr el Ghazal, sorghum is often intercropped with sesame while maize is normally cultivated in limited areas, close to homesteads and often used for fresh consumption. In some locations where the pressure of quelea quelea birds is particularly high, such as in Upper Nile, maize is cultivated in large plots, instead of sorghum, provided the soil is suitable. Minor cereal crops such as bulrush millet, finger millet and upland rice are also cultivated in certain locations.

Roots and tuber crops: Cassava is an important root crop in the Green Belt of Greater Equatoria as well as in the Ironstone Plateau, particularly in Western Bahr el Ghazal state. Within the Green Belt, cassava is considered a hedge against hunger. The prominent feature of cassava, which makes it much preferred as the main food security crop, is its diverse uses. The roots can be boiled, fermented and made into flour to make bread and/or brewed into alcoholic products. The leaves are normally cooked into a favourite vegetable dish. Other prominent futures include tolerance to drought and the ability to grow in the wild. Sweet potato is also widely grown around many households in the Green Belt and Ironstone Plateau. Cultivation of root crops in the rest of the zones, which are predominantly inhabited by agro-pastoral communities, has been limited by their susceptibility to destruction by livestock, by soil types and by cultural factors.

Oil seeds: Groundnut is cultivated on sandy soils in most locations and makes an important contribution to the household diet. It is the main cash crop, contributing to farming household income at certain periods of the year. Sesame, grown across many states and agro-ecologies, is also an important income earner.

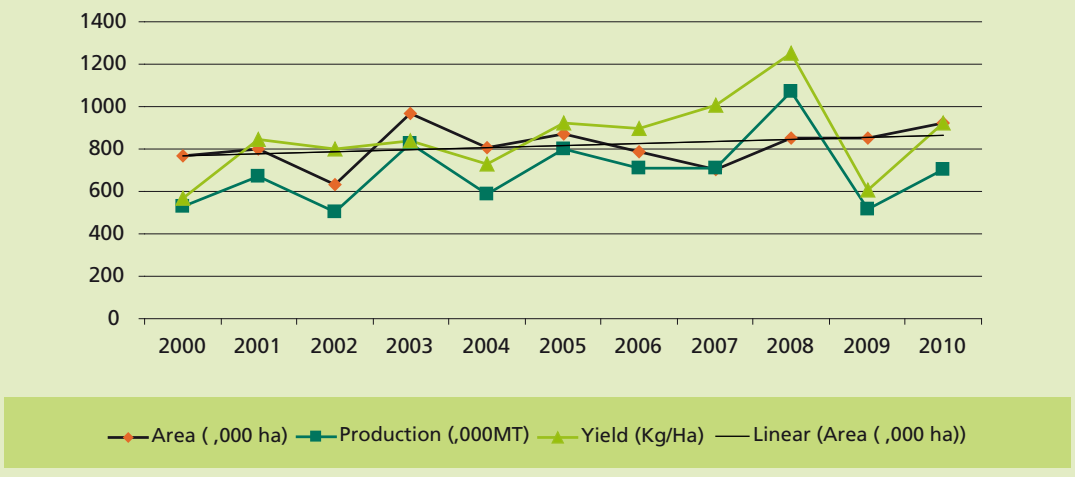
Other crops: In parts of Central and Western Equatoria, coffee, mango and papaya are commonly grown. Okra, cowpea, green gram, pumpkin and tobacco are also widely grown around homesteads. Vegetables such as onions and tomatoes are not commonly grown in rural areas, but are increasingly cultivated near cities to supply urban markets.

Cereal production

In Southern Sudan, cereals (sorghum and maize) production accounts for about 50 to 75 percent of the total household production (FAO Post-Distribution Assessment, 2010). In the absence of a permanent agricultural statistics programme, the FAO/WFP Crop and Food and Supply Assessment Mission (FAO/WFP CFSAM) has been using the proxy indicators of estimated number of farming households and estimated average planted area under cereals per farming household to estimate the total area under cereal production. The estimate of total area along with estimates of average cereal yield are then used to estimate the final cereal production.

Over the past few years, the FAO/WFP CFSAM has been providing fairly acceptable estimates of annual cereal production with insights into surplus/deficit scenarios across all the ten states of Southern Sudan. Although the yield and overall production have been fluctuating over the past 10 years, the area under cereal production is considered to be on the increase (Figure 3.2). The fluctuations in yield and production are attributed mostly to the compounded effects of weather, particularly as regards rainfall distribution and amount in a given year. For example, the poor performance in 2007 was attributed to widespread flooding as a result of too much rain (FAO/WFP, 2008), while the poor performance in 2009 was attributed to widespread drought.

Figure 3.2: **Cereal total area, net production and average yield trend in Southern Sudan**



Source: CFSAM, 2000–2010.

Although the general trend in area cultivated appears to be upward, the cereal deficit is also on the increase (Figure 3.3). This can be attributed partly to the increase in population over time. The signing of the CPA in 2005 resulted in a continuous inflow of people to Southern Sudan. For example, between October 2010 and January 2011, about 190 000 people retuned from the north (UNOCHA, 2011). The increased population will have to depend on the limited production, hence contributing to the widening cereal gap over time.

In general, even though Southern Sudan has enormous agricultural potential, it is failing to reach self-sufficiency in the sense of being unable to meet its domestic annual food needs. The key underlying factors limiting agricultural production and productivity in Southern Sudan include: threats to and pressures on stability; the absence of a clear policy on land and natural resource use; weak institutional and labour capacity; poor and inadequate rural infrastructure; inadequate research and extension systems; lack of inputs and input supply channels; lack of processing technology and marketing facilities; unmanaged natural resources and environmental damage; and lack of agricultural data and information flow (Ogoto *et al.,* 2010). The low level of production combined with the deficit scenario have been used by the international community, particularly the food security and livelihoods sector, to appeal for and justify provision of food aid in Southern Sudan.

AID IN SOUTHERN SUDAN

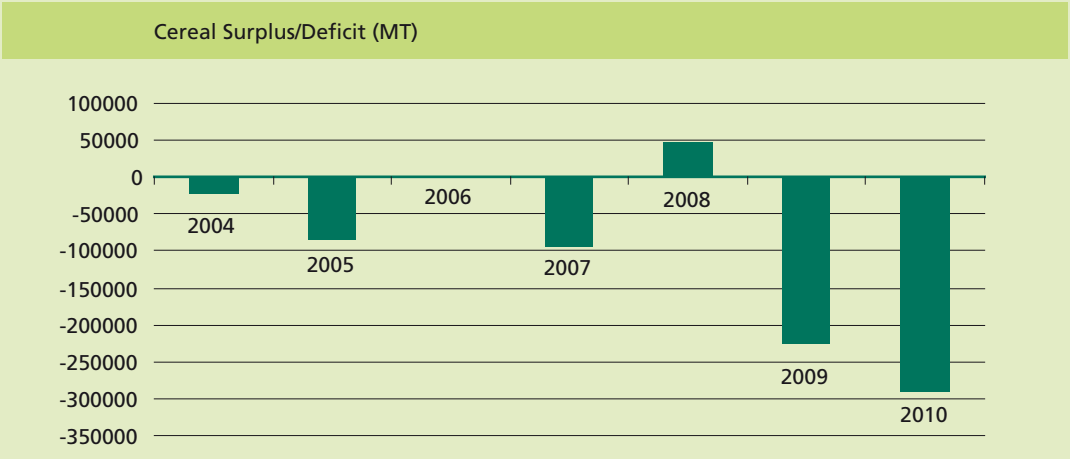
The long civil conflict and recurrent inter- and intra-tribal clashes, exacerbated by poor weather and natural disasters (floods and drought), have made Southern Sudan highly vulnerable to humanitarian crises. This part of the world is no stranger to humanitarian aid and, even with the CPA, such assistance continues to be provided. Key among the humanitarian efforts is the provision of food, seeds and tools, water and sanitation, and health and nutrition services.

The reintegration of returnees, and support to them and host communities, have been part of the UN and partners' activities. The strategy targets the delivery of humanitarian assistance to vulnerable conflict-affected populations and the introduction of programmes that enable the timely transition towards a more sustainable level of national recovery and development.

Food Aid in Southern Sudan

Food aid continued to flow into Southern Sudan, with programmes to assist the IDPs and returnees re-integrate into their communities, build their livelihoods, and plan for the future. The World Food Programme (WFP) has been the major player in providing food aid in Southern Sudan, targeting over 3 million people with different types of food assistance. Food aid is provided in two major ways:

Figure 3.3: **Cereal surplus/deficit scenario in Southern Sudan**



Source: CFSAM, 2004–2010.

Direct food distribution: Provision of a three-month re-integration package for people returning to the South from displacement camps in other parts of Sudan and neighbouring countries.

Rehabilitation and development food aid: Food assistance for rehabilitation and sustainable development, which includes food for education, food for training, food for recovery, food for work, an inpatient feeding programme, a therapeutic feeding programme and a supplementary feeding programme.

Seed Aid in Southern Sudan

FAO and other relief and development partners have been active in supporting needy populations through interventions such as emergency provision of agricultural inputs, technical assistance and coordination of food security and livelihood projects. The general objective of seed aid is to contribute to the restoration of food security and livelihoods by supporting the resumption of the agricultural sector and by improving self-reliance of returnees, IDPs and host communities in Southern Sudan. Seed aid is normally provided to target beneficiaries in two major ways:

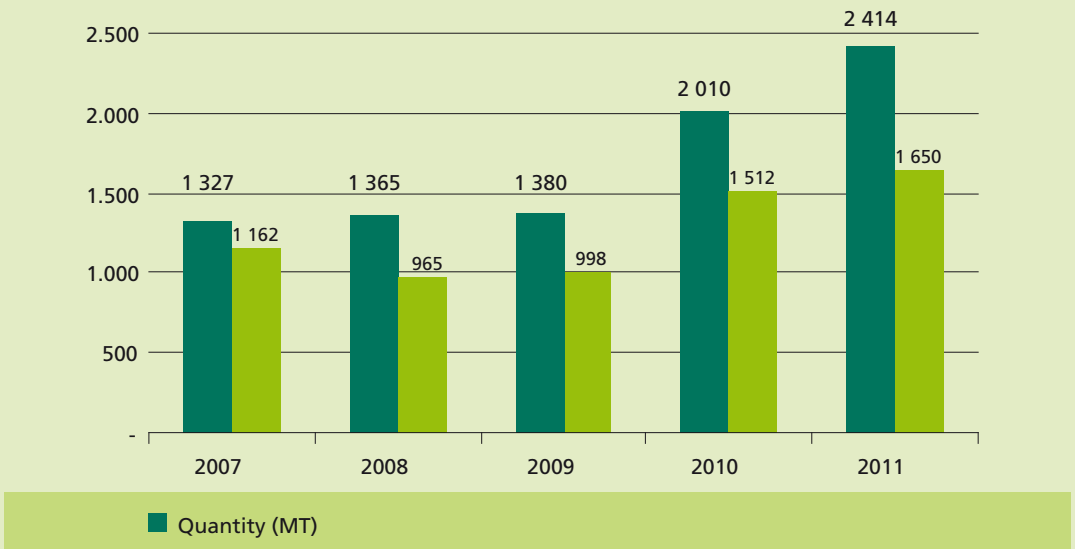
a) Direct seed distribution: This is normally used in areas where seed is considered unavailable and access is difficult.

b) Seed fairs and vouchers: A seed fair is a specialized market whereby vendors and buyers (beneficiaries) meet to conduct agricultural business on an agreed date. In an emergency, the beneficiaries are normally provided with vouchers[3] to buy agricultural inputs of their choice during the fair. Seed fairs normally assume availability of seed within some sections of the community, with the target beneficiaries assumed to have no access to the seed available.

c) Seed for bulking and multiplication: Indirectly, seed aid is being provided by relief, rehabilitation and development partners via their support for multiplication and seed bulking in Southern Sudan.

Like food aid, seed aid has continued to be provided to Southern Sudan for over a decade. Between 2007 and 2010, FAO and its implementing partners alone distributed slightly over 6 000 tonnes of assorted crop seed to a total of 463 700 returnees, IDPs and vulnerable households (Figure 3.4). The

Figure 3.4: **Quantity (tonnes) of seed aid and beneficiaries supported by FAO and NGO partners**



3 The vouchers are the 'money of the fair' and are used as if they were money. The vouchers can only be used to buy seed and authorized agricultural inputs at the fair. They have no value outside the fair.

year 2010 saw an increase of about 46 percent (630 tonnes) in the volume of seed aid compared with 2009. This was the result of widespread drought in 2009.

The current appeal for 2011 food security emergency response targets 165 000 households with 2 414 tonnes of seed aid worth $3.6 million. This appeared to be the biggest volume of seed aid brought in by the food security and livelihood cluster compared with previous years. The large volume was due to the anticipated high return of people from the north and neighbouring countries during and after the Referendum.

IV. Formal plant breeding in Southern Sudan[4]

INTRODUCTION

Plant breeding can be defined as the art and science of plant improvement. The root of the word art is 'doing' and the root of the word science is 'knowing'. Together they imply that 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).

Although Tothill (1948) and ODA (1954) recorded considerable achievements in germplasm collection, introductions and crop improvement in Southern Sudan between 1937 and 1955, May and West (1977) noted that records of pre-1975 varietal trials were incomplete and insufficient for detailed interpretation. Though some success was achieved during this early period, it was limited in the case of many crops by the lack of special seed production farms. Moreover, improved varieties introduced or selected locally during that period were quickly lost among the mass of indigenous planting materials. The accessions registry was only started in 1976, hence the precise origin of some plant materials imported before that date was not known. An IBRD scoping study noted that "very little experimental work was done on staple food crops in southern Sudan, nor has any improved seed been imported or produced locally" and emphasized the need for a coordinated approach to the improvement of food crop production throughout Southern Sudan.

The research station at Yambio (the only one in the south) was established in 1948. Although it closed temporarily in 1964 due to the civil war, it re-opened in 1975. It was established mainly to support the Nzara cotton scheme (Azande scheme). Other crops including maize, groundnuts and upland rice were tested but the records of the trials are nowhere to be found. From all indications, it is apparent that the composition of scientists who worked in Yambio Research Station had not included plant breeders. Most of the work was carried out by agronomists and plant protectionists giving little consideration to actual plant breeding or to records of introduced genotypes during those days.

Plant breeding in Southern Sudan between 1970 and 2010 can be accredited to the work of the Project Development Unit (PDU) and 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 Equatoria (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.

OVERVIEW OF PLANT BREEDING BEFORE THE WAR (1974–1979)

PDU Breeding Research Programmes: Crops research included work on sorghum, maize, pearl millet, finger millet, upland rice, paddy rice, groundnuts, soybeans, various peas and beans, cassava, yams, Irish potato, sesame, sunflower, pineapple, citrus, avocado, cotton, and pasture and fodder plants. Plant materials from East, Central and West Africa proved most relevant, whereas materials from the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and northern Sudan were found to be too short for the long season and also susceptible to pests and diseases common in Southern Sudan. The imported maize variety, Katumani, groundnut varieties Manipintar and Makulured, and some genotypes of soybeans showed immediate advantages. However, introduced sorghum, sesame, upland rice and finger millet were found to be inferior to the local varieties. When importing and introducing genotypes, PDU placed emphasis on adapted genotypes that

4 This chapter was written by Dr. Silvestro Kaka Meseka and is part of a large background report prepared for this SSSA. The citation for the full report is as follows: Meseka, Silvestro Kaka and Joseph Okidi: Plant breeding and formal seed sector + Seed multiplication and distribution channels. Juba, Southern Sudan: MAF/GoSS and FAO.

could be bulked locally so that farmers could grow their own seed through contract and group farming. Although hybrids were also tested, the main emphasis was on open-pollinated varieties (OPVs) that were further subjected to selection under local conditions. Collections were made of local varieties of sorghum, sesame, cassava and to a lesser extent upland rice and finger millet as the basis for breeding programmes (PDU, 1979).

NCA/SP Research Programmes: The NCA/SP agricultural project started in January 1975 with the objective of assisting the local population (of Eastern Equatoria) in becoming self-sufficient in food crops (Slaymaker, 2000). The NCA/SP, through its rural development centres, carried out research, including plant breeding trials on sorghum, maize, pearl millet, groundnuts, cowpea and cassava. Different crop varieties were provided by PDU but some local varieties of sorghum, maize, groundnuts and cowpea were also included in the breeding trials. New varieties were also introduced from ICRISAT.

Halima Research Station Breeding Programme: A breeding programme at Halima was established in 1976 with main objective of identifying and selecting higher yielding lines from the local late-maturing variety, Mabior, while maintaining grain and pest-resistance qualities. The results suggest that Mabior was highly adapted to specific niches and sensitive to variations in growing conditions at different sites. Other sorghum varieties, including Bende collected from different parts of Southern Sudan, were compared with Mabior. Bende was found to be less sensitive to environmental changes than introduced varieties and its yields were equal to or exceeded those of the early-maturing introduced Serena.

Crop trials at Halima/Wau were informally coordinated with those of PDU and the station was eventually formally incorporated into the PDU programme in 1980. The annual reports of Halima research station (1975–1979) catalogue a broad programme of crop experimentation prior to its incorporation into PDU in April 1980. Many improved crop varieties were screened. Cassava, groundnuts and sweet potato were successful.

Introduced sorghum varieties were disappointing except for late-maturing types introduced from Nigeria that were found to be well adapted and were recommended for the breeding programme. An introduced sorghum variety, Serena, was found to have much wider pest and disease resistance, and was a useful additional component to farming systems although it required dry planting conditions.

Sweet potatoes were found to yield extremely well but the problems of planting material seemed to limit its spread to new areas.

The Flood Plain Programmes: In Malakal and Bor, crop trials were conducted by the Lutheran World Federation and ILACO Pengko Plains Pilot Project funded by the Dutch Government. In 1975, ILACO conducted research on the vast Pangko plain for large-scale agricultural production but was later rejected as a site due to unfavourable growing conditions (water logging, stem borers and birds). However, at Renk, progressive farmers from northern Sudan introduced several sorghum varieties, including Wad Ahmed and Gadam El Hamam that were high-yielding. Many local farmers also adopted the new varieties in their localities.

Specific Breeding Efforts towards Food Crops Improvement before the War (1974-1980)

Sorghum: The first analyzable sorghum data emerged from PDU Yei in 1974. Among the several sorghum varieties from Serere Agricultural Research Station, Uganda, Lulu tall, 9DX5/51/1 and Serena were provisionally identified as most promising. No local variety was included for comparative purposes during the 1974 crop trials. The screening process was gradually expanded and improved between 1975 and 1977, introducing more sorghum varieties for comparison with established Serere composites and local varieties. Lulu dwarf lost favour but Serena and 5DX and 9DX composites were found to consistently out-yield local varieties. However, during this period, substation results were much less complete and datasets revealed little about geographical variation in sorghum performance.

The long-maturing sorghum varieties in Southern Sudan were found to consistently out-yield improved dwarf varieties when planted early in the season, provided there was sufficient rain (Bennett, 1979). The local sorghum varieties were also found to be tolerant to diseases and pests. Bennett (1979) reported that introduced quick-maturing sorghum varieties were favoured in urban areas as a second crop after groundnuts had been lifted. However, PDU considered Yei to be unsuitable for work on sorghum and other crops of drier areas because the season was too

long and wet. The sorghum breeding programme was therefore somewhat fragmented among different substations.
Given the poor performance of introduced materials, PDU initiated a breeding programme in 1978, based on the collection and selection of local crop varieties. It aimed to identify varieties with the highest and most reliable yields as possible, over a wide range of ecologies. Over 100 local varieties of sorghum were collected from Eastern and Western Equatoria and Lakes states. A varietal improvement programme for medium- and late-maturing sorghum varieties in Southern Sudan was proposed via selection from locally occurring landraces. Selection programmes were initiated on three medium- and late-maturing sorghum varieties at the end of 1978. Through this program Serena and 9DX7/11 were identified as superior and were bulked for release.

The breeding programme proposed the collection of landraces of promising sorghum varieties and suggested selection be based on head-rows to produce improved local varieties. Introduction of late-maturing sorghums from Ethiopia and Nigeria (Bennett, 1979) was also encouraged. During this era, local sorghum varieties with high-yield potential were: Medium (5-6 months) Mabior (only adaptable in Wau), Mukwa, Nadok, Kabir, Macika, Labalua, Werekasi, Malual and Nyarango. All produced high yields at the majority of testing sites. Selection programmes were initiated on Kec, Jeri and Nyarango, the dominant sorghums of Rumbek, Yei and Mundri districts, respectively, with the most promising 10 percent of lines retained for further evaluation and selection. Late-maturing Kec and Arumroor showed the greatest promise, although they were low-yielding but do well as ratoons.

Maize: PDU introduced Western Yellow, TZB and Katumani maize varieties in the 1970s. The three varieties showed high-yield potential as demonstrated by multi-location trials in Equatoria Region. Consequently Katumani was released in 1977 (YADD, 1984).

Cassava: Cassava was introduced by the Zande from the French and Belgian Congos and spread northwards and eastwards from the southwest/Western Equatoria. The common variety of bitter cassava (Bazomangi) was found to be susceptible to cassava mosaic virus (CMV), while Karangba (bitter) and sweet varieties were introduced from French Equatorial Africa show resistance to CMV (Slaymaker, 2001). NCASP initiated a cassava campaign in Torit and Kapoeta in early 1980s, promoting cassava as a valuable source of carbohydrates and key drought resistant crop for food security. The NCASP continued this programme on a reduced scale long after most other relief agencies had left. (Unfortunately detailed data are unavailable for the post-1983 period.)

Sweet potato: Not much was done on this crop during the PDU era. However, in 1975, PDU introduced a bunch-type variety of sweet potatoes in the Equatoria Region that had very good yield potential and adaptability.

Sunflower: In 1970, an individual introduced the black and white striped sunflower variety into Equatoria and Upper Nile Regions. The second introduction of the same variety in Equatoria was by PDU in 1977 and the crop had excellent yield performance.

Sesame: PDU introduced a white and early-maturing sesame variety to Equatoria Region in 1975. The crop performance was rated as very good. Many local varieties grown by farmers were identified in Equatoria and Bahr El Ghazal Regions.

Groundnut: During the 1960s individuals and missionaries introduced three varieties of groundnuts: Agar, Barbit and Mr. Lake in Bahr El Ghazal Region (RADD, 1983). In the early 1970s individuals also introduced the Atizo groundnut variety in Equatoria. Manipinta, Makulu Red and Red Beauty varieties were introduced by PDU in the mid-1970s.

PLANT BREEDING DURING THE PEAK OF WAR (1987–2005)

During the peak of war, international non-governmental organizations (INGOs) and UN agencies took the lead in agricultural interventions in Southern Sudan, including breeding (Oyiki, 2005). The breeding programme concentrated on the introduction of improved crop varieties from neighbouring countries, in collaboration with some IARCs. World Vision International (WVI), Catholic Relief Service (CRS), Action Africa Help International (AAH-I), Norwegian Peoples Aid (NPA), and International Aid Service (IAS) were involved in the research activities. The USAID-funded Natural Resource Technical Committee (NRTC) of the Sudan People's Liberation Movement (SPLM) also conducted some research, including mapping of introduced crops varieties in Southern

Sudan. Coverage of the research interventions was not uniform; it was affected by, among other things, donors' unwillingness to fund research during wartime, NGO interests, and, above all, the security situation (Oyiki, 2005). During the war, there was no mechanism in place to coordinate and monitor agricultural research in Southern Sudan. Many agricultural research reports were confined to the archives of NGOs, which are not easily accessible to the public.

During the 21 years of war, and even after the signing of the CPA, INGOs and UN agencies continued to deliver various crop types and varieties into Southern Sudan as part of the relief services (relief seeds). In some areas, the relief seeds deliveries have become an annual event while in others they have been irregular (Oyiki *et al*., 2004). As the NGOs frequently operated independently, there are no clear records of which crop varieties went where and their potential yields. Nevertheless, some farmers remember what they received and planted in their fields.

In early 2004, the Agriculture Working Group (AWG), under SPLM's Natural Resource Technical Committee, made an effort to collect secondary data on the introduced crop varieties from NGOs in both Nairobi and Lokichogio but had limited cooperation from the NGOs. Most of the data found were extracted from relief seeds distribution records. The AWG also undertook surveys in randomly selected counties in the three regions of Southern Sudan (Bahr el Ghazal, Equatoria and Upper Nile) to map out the crop varieties introduced mainly during the war period. But the study fell short of covering all the introduced crops.

From the AWG's study (Oyiki *et al.*, 2004), it was realized that INGOs, UNICEF, WFP and FAO had introduced most of the crops. To a lesser but significant extent, Catholic priests, traders and individual farmers also contributed to these introductions. The results showed that the performance and adaptability of the introduced crop varieties were largely influenced by livelihood patterns and agro-ecological zones. In general, most of the introduced and indigenous crops performed better in Equatoria Region than in Bahr El Ghazal and Upper Nile. In most instances, the same crop varieties introduced by different INGOs performed differently. The disparities in crop performance were attributed to (a) the levels of follow-up by the INGOs and UN agencies; (b) the mechanisms put in place by the concerned INGOs to monitor crop performance; (c) seed quality control; and (d) extension services provided by the concerned INGOs and UN agencies. Comparatively, seeds introduced by PDU (1974–1980) through multi-location trials, monitored by effective extension services, performed better than those introduced by the INGOs and UN agencies.

Most of the introduced crop varieties during the war originated from commercial seed companies registered in Uganda and/or Kenya. However, after each harvest, farmers kept their own seeds. Hence, present generations of the introduced crop varieties being grown in Southern Sudan are mixtures rather than varieties (Oyiki *et al.*, 2004).

Crop Varieties Introduced by INGOs, UN Agencies and Individuals During the War

Sorghum: The Government of Sudan (GoS), WFP and UNICEF introduced Dabar, Gadam El Hamam and Maharik from northern Sudan. These varieties are early-maturing compared with the local ones of Southern Sudan. However, Dabar and Maharik were poor yielders. In 1994, AAH-I and UNICEF re-introduced Serena, which showed high grain yields in most parts of Southern Sudan. Other INGOs, including CRS, NPA and WVI, also introduced Seredo and Sekedo, which yielded above the average yield of the local types.

Maize: In 1997, WVI introduced TZ, which performed above average. Later, Longe varieties 1, 2, 3, 4 and 5 were introduced from Uganda by different INGOs and dominated during late 1990s and early 2000s. These varieties had varied yield potentials but Longe-5 was the best. In 1998, NPA introduced a hybrid maize variety but because of its intensive labour and input requirements (which were beyond the capacity of the average farmer in Southern Sudan), it performed poorly. During the war, comparatively more maize varieties were introduced in Equatoria, followed by Upper Nile and Bahr el Ghazal.

Rice: In 2004, NPA introduced two new upland rice varieties: NERICA-1 and NERICA-2. Bahr el Ghazal leads in the introduction of rice.

Cassava: In 1993, UNICEF introduced two cassava varieties, Nase-1 and Nase-2, to Upper Nile Region where the two showed good root yields. CARE re-introduced the same cassava varieties in Equatoria and Upper Nile Regions in 1995. The crops performed fairly in Equatoria Region but better in Upper Nile Region. CARE also introduced TME-14 cassava variety in Equatoria Region

where it yielded well. It was interesting to note that AAH and NPA re-introduced the Nase-1 and Nase-2 varieties in Equatoria Region in 2000 and their performance was excellent. This significant difference in the performance of the same crop varieties, under different NGOs and in different agro-ecological zones and cultivation seasons, calls for more serious follow-up on crop introduction and technology transfer techniques.

Sweet potatoes: UNICEF and individuals introduced a bunch type of sweet potato (formerly introduced by PDU in 1975) in Upper Nile in 1993 and 2000 respectively. The materials introduced by UNICEF performed better than the ones introduced by individuals. In 2004, NPA introduced two sweet potato varieties, White and Yellow, in Bahr el Ghazal. The performance of both was rated as very good.

Beans: In 1996 and 1998, AAH, IAS and NPA introduced bean variety K20 in Equatoria Region. It performed more poorly than Janjaro, a variety introduced by PDU in the 1970s. UNICEF (1993) and CARE (2001) introduced the same bean variety in Upper Nile. The seed lot brought by UNICEF performed better than those brought by CARE. Other bean varieties introduced in Equatoria Region between 1996 and 2001 included K131, K132, French bean and MCM. The variety K131, introduced by NPA, and AAH CONCERN performed well.

Soya bean: Two soya beans varieties, Nam 1 and Nam 2, were introduced between 1997 and 2002, by NPA, AAH, WVI and CRS in Equatoria Region, by CARE in Upper Nile, and by NPA in Bahr el Ghazal. On average, these varieties had excellent performance in Equatoria Region, very good in Upper Nile and poor in Bahr el Ghazal.

Sesame: In 2001 and 2002 AAH-I introduced a white variety of sesame, Ware, from Uganda which performed very well in Equatoria Region. NPA introduced the white sesame variety in Upper Nile in 1998 and 2001, but in both cases the crop performed poorly. Traders introduced a mixed white and black variety in Upper Nile in 1987 and 1993 and the crop had very good seed yield. The black sesame variety introduced by traders in Upper Nile in 1993 and 1996 and by GOS and NPA in 2003 also had good performance.

Sunflower: In 1997 and 2000, the black and white striped sunflower variety was introduced to Equatoria again by CARE and AAH-I respectively. The crop performance was good. CARE also introduced the same variety to Upper Nile in 2002 where it had very good seed yield. CRS, NPA and IAS introduced a black sunflower variety in Equatoria in 1999 where it performed very well.

Groundnut: Variety Red Beauty introduced by PDU in 1970s was also re-introduced by UNICEF, NPA, CRS and CARE during the war period and the variety performed above average in all three regions of Southern Sudan. In 2000, 2001 and 2004, AAH and NPA introduced three varieties: Serenut 1, 2 and 3 in Equatoria and Bahr el Ghazal Regions that showed good performance across the two regions. NPA and AAH-I also introduced Egola 1 in both Equatoria and Bahr el Ghazal in 2000, 2001 and 2003. The performance of Igola1 was similar to that of Red Beauty.

Onion: Red Creole was first introduced to Southern Sudan, in Equatoria Region, by PDU, in 1975 and in 1980 by GOS in Bahr el Ghazal Region where it performed very well. The same variety was re-introduced in all three regions in 2000–2002 by CARE, ACROSS, IAS, Tear Fund, traders and some Catholic priests. The variety had consistently very good yield performance across the three regions. Another variety, Bombay, was introduced in Bahr el Ghazal Region by RDF and ACROSS in 2000 and in Equatoria Region by AAH and IAS in 2002. In both cases Bombay Red had low yields compared with Red Creole.

Tomato: UNICEF (1993), some Catholic priests and traders (1993, 1996, 2002), CRS (2001), IAS and Tear Fund (2002), CRS (1998), NPA (1998) and GOAL (1998, 1999, and 2000) introduced four varieties of tomatoes, Money Maker, CAL-J, Banador and Roma to all three regions of Southern Sudan. These varieties were first introduced by PDU in 1975. Except for Roma, these had good yields across the three regions.

Cabbage: Two cabbage varieties, Drumhead and Copenhagen, were introduced in all three regions of Southern Sudan. Drumhead was introduced by NPA (1996) and NSCC (2001) in Equatoria, and by CARE (1998, 2004) in Upper Nile. Its performance was rated as good across the two regions. In 2002, AAH and IAS introduced Copenhagen in Equatoria Region, while CARE and NPA introduced it in Upper Nile and Bahr el Ghazal, respectively. In all three regions Copenhagen had consistently high yields.

Okra: Two varieties of okra, Spineless and Pusa Sawani (introduced by PDU [YADD, 1984]), were reintroduced in Equatoria Region by AAH, NPA and CRS during the war, in 2000. The performance of both varieties in Equatoria Region was rated as excellent. UNICEF (1993), CARE (1998 and 2004), some Catholic priests and traders (1993, 1996 and 2003) introduced the two varieties in Upper Nile Region. The performance of the two varieties introduced by UNICEF, some Catholic priests and traders was very good, while the performance of those introduced by CARE and individuals was relatively poor.

PLANT BREEDING SINCE THE SIGNING OF THE COMPREHENSIVE PEACE AGREEMENT (2006–2010)

Although MAF-GoSS involved itself in supply of relief seed after the signing of the CPA starting in 2006, INGOs, UN agencies and individuals have continued to provide the greatest proportion of seeds to different parts of Southern Sudan. FAO and partners supply the greatest quantities of seed, by either importing from neighbouring Kenya and Uganda or buying from local farmers (particularly from the Green Belt areas, part of NBEG, Warrap and Upper Nile). The crop varieties such as Longe-5 (maize), Serenut-2 (sesame) and TME-14 (cassava) that were introduced during the war were being imported in large quantities and distributed to local farmers and the returnees. New organizations such as FARM-SUDAN/USAID have launched a US$55 million project for farming as a business in the Green Belt (Greater Equatoria). This project aims to enhance the production capacity of the local farmers through training and provision of agricultural inputs (seeds, fertilizers, etc.). The MAF-GoSS, in partnership with Wageningen University, launched a participatory variety selection project in Central and Eastern Equatoria in 2010 to improve local varieties and empower local farmers in the seed business.

Current Structures of Plant Breeding in Southern Sudan

The current procedures of plant breeding are still very basic, mainly organized by relief agencies (INGOs and FAO) and to lesser extent by MAF-GoSS. Most of the efforts are centred on introduction of improved crop varieties from private seed companies registered in neighbouring Uganda and Kenya. The vast majority of the farmers use informal seed channels to obtain their seeds (about 99 percent of seed). Farmers and most INGOs are still far from keeping good records of introduced varieties. There has been mixing (mechanical, physical, genetic) of introduced varieties with local types, leading to low yields and lack of progress in breeding efforts.

In order to stimulate formal plant breeding structures in Southern Sudan, a clear set of priorities should be addressed (Box 1), based on the following:

Vision: Develop crop varieties with high yield, good resistance and valuable nutrient composition.

Mission: This mission will be accomplished through collection and characterization of germplasm, introduction and testing of improved varieties (from NARS and IARCs) for adaptation and yield potential, and development of superior crop varieties. New plant breeders and technicians need to be trained to carry out breeding programmes.

BOX 1: **MAF-GoSS priorities for re-stimulating plant breeding structures**

1. Formulation of agricultural research policy to help restructure research strategies; establishment of functional research stations and programmes in Southern Sudan;
2. Willingness of GoSS to fund research programmes including plant breeding programmes;
3. Development of variety testing and release procedures for Southern Sudan;
4. Creation of linkages with national agricultural institutions in neighbouring countries and international agricultural research centres through fellowships and visiting and collaborative research programmes;
5. Collection, characterization and conservation of local crop germplasm as a base for a sustainable plant breeding programme in Southern Sudan;

(Continued next page)

6. Introduction of improved genotypes from national agricultural institutions in neighbouring countries and international agricultural research centres for adaptation and yield potential;
7. Acquisition of breeder and basic seed of adapted productive varieties such as Longe-5 (public goods) introduced from other countries by research centres and seed production by contracted farmers. Local varieties with high yield potential should be subjected to registration and release;
8. MAF-GoSS develops guidelines for variety release and seed production inspection. The guidelines should be operationalized through ministerial order (as Seed Act, Seed Policy and Regulations take time to pass through national assembly);
9. Demonstration sites at State and/or County levels to be used as a way of disseminating and popularizing varieties with high yield potential among farmers;
10. Varieties identified to combine yield potential with stability to be disseminated through mother-baby and/or on-farm trials at specific but strategic sites as a way of putting them at farmers' disposal for quick adoption;
11. Multi-location sites to be quickly established for testing the "best bets" from elsewhere. At the outset, the present research centres at Yei, Palotaka and Halima, universities (Juba, Upper Nile, John Garang Memorial College), and the facilities of INGOs (AAH-I, WVI, NPA, CRS, FARM-USAID) dealing with agriculture and of selected progressive farmers groups will be used as testing sites, all under the supervision of the Directorate of Research of MAF-GoSS.

Priorities for Human Resource Development

The educational background of the limited number of plant breeders in Southern Sudan is often inadequate to allow them to cope effectively with their research responsibilities. Training of new plant breeders is needed to update and sharpen their skills and knowledge and to enable them to apply new breeding techniques and methodologies in their fields of specialization. The long-term training of plant breeders (M.Sc., Ph.D., fellowships) is a major investment that the MAF-GoSS Directorate of Research should actively schedule. The agricultural research institutions of Southern Sudan should focus on training workshops, visiting scientists and fellowships to enhance the capacity of the breeders. The institutions should facilitate in-country courses for plant breeders including proposal development, scientific writing, data management and analysis, and field trial implementation techniques.

Technicians and technologists are indispensable research support personnel. One of the major constraints to research in Southern Sudan has been the inadequate number of well trained and skilled research support staff. This situation often leads to erroneous field designs and data collection, spurious results, and wasteful spending of funds. MAF-GoSS should recruit research technicians both locally and outside the country and train them in field design, trial management, data collection and the establishment of demonstrations.

Introducing Varieties Derived from Public and Private Research Programmes outside the Country

The extent to which plant breeding is done by public or private agencies varies with the economic importance of the crop, the resources of the industry, and the potential for sales of the improved variety. For crops with large recurrent sales of seed, such as hybrid maize and hybrid sorghum, private breeders have developed breeding programmes to a much greater extent than with other crops (sesame, rice, pearl millet, cassava, beans). The publicly supported plant breeding projects are usually conducted by public agricultural research institutes under a designate ministry, while the privately supported breeding programmes are conducted by seed companies (local and foreign).

New crop varieties can be developed either from the introduction of improved varieties or inbred lines from other agricultural research institutions, or from collection of germplasm subjected to crossing, evaluation and selection. In Southern Sudan, however, there has been no gene bank to draw on and little documentation of germplasm collected by earlier researchers during the time of PDU and NCA. To date, no formal collection and preservation of local germplasm has been undertaken. However, some of the local varieties like Nyarango and Akworachot, identified during

the days of PDU, are still being kept by farmers on their farms (*in situ* conservation). Such varieties can help in the development of new varieties in Southern Sudan.

Improved varieties developed by the agricultural research institute are considered public property. The institute gives exclusive marketing rights to private seed companies for the purpose of obtaining royalties to support plant breeding research and to improve upon the distribution of the variety. The released variety is protected by the Plant Variety Protection Act. This act gives the breeder/originator exclusive right to control the sales of seed of sexually reproduced varieties. This also encourages private seed companies to invest in breeding programmes. Nevertheless, it is in the public interest that new crop varieties developed by the agricultural research institute be multiplied rapidly and distributed in an orderly manner. This calls for the involvement of progressive farmers contracted as seed growers and the formation of a national seed growers' association, responsible for seed multiplication, distribution and marketing.

Seed supply of new varieties developed through public breeding programmes has centred on a series of steps. The breeder turns over seed of a new variety to the seed grower, and the procedures ensure that pure seed of the new varieties is multiplied, distributed and certified. Seed of new varieties developed through private breeding programmes is normally multiplied by private seed companies conducting the breeding research programme and is distributed through the originator's marketing channels.

The testing of potential varieties, approval for naming new varieties, and procedures for maintaining purity are supervised by the research institute. Varieties may be marketed as seed only after testing and approval by the research institute. This will apply to both publicly and privately developed varieties.

Before a variety is released for distribution from the public or private breeding programmes, it will be tested for at least two years in the ecological zone where it originated and where it is intended for distribution. Through zonal programmes, the variety will be tested in different agro-ecologies. The results of these tests will assist the breeder in making final decisions regarding the release and recommendations about the area of adaptation of the new variety. Crop varieties introduced through private seed companies are being subjected to thorough testing by the public research institute and the data are used by the private company for popularizing the variety.

CROP VARIETIES COMMONLY GROWN BY FARMERS IN SOUTHERN SUDAN

Table 4.1 serves as a variety list for crops grown by farmers in Southern Sudan. It is a good guide for crops that could be promoted and those that need further investigation for improvement.

Table 4.1: **Crop varieties grown in Greater Bahr El Ghazal, Equatoria and Upper Nile Regions**

Crop	Variety	Origin	Region of adaptation	Date of release
Maize	Katumani	Kenya	Equatoria, Upper Nile, Bahr El Ghazal	1977
	TZB	IITA	Equatoria	1978
	TZSR	IITA	Equatoria	Not released
	Western Yellow	IITA	Equatoria	Not released
	TZBCOMP.4	IITA	Equatoria, Upper Nile	Not released
	Afro 329	IITA	Equatoria	Not released
	Longe-5	Uganda	Equatoria, Upper Nile, Bahr El Ghazal	Not released
	Longe-4	Uganda	Equatoria, Upper Nile	Not released
	Longe-3	Uganda	Equatoria, Upper Nile	Not released
	Longe-2	Uganda	Equatoria, Upper Nile	Not released
	Longe-1	Uganda	Equatoria, Upper Nile	Not released
	Longe-8	Uganda	Equatoria	Not released
	Longe-10	Uganda	Equatoria	Not released
	Mugtama-45	N. Sudan	Bahr El Ghazal, Upper Nile	Not released
Sorghum	Serena	Uganda	Bahr El Ghazal, Equatoria, Upper Nile	1977
	Ketmani	Uganda	Bahr El Ghazal, Equatoria	
	Wad Ahmed	N. Sudan	Bahr El Ghazal, Equatoria	Not released
	Kec	Wau, Sudan?	Bahr El Ghazal	Local type
	Mabior	Wau, Sudan	Bahr El Ghazal	Local type
	Bende	Wau, Sudan	Bahr El Ghazal	Local type
	Nyarango	Mundri, Sudan	Equatoria, Bahr El Ghazal	Local type
	Akhorachowot	Ethiopia?	Equatoria, Upper Nile	Not released
	Gadam El Hamam	N. Sudan	Bahr El Ghazal, Equatoria, Upper Nile	Not released
	Dabar	N. Sudan	Bahr El Ghazal, Upper Nile	
	Maharik	N. Sudan	Bahr El Ghazal, Upper Nile	
	Arfagadamak	N. Sudan	Bahr El Ghazal, Upper Nile	

(Cont)

Table 4.1: **Crop varieties grown in Greater Bahr El Ghazal, Equatoria and Upper Nile Regions** *(Cont)*

Crop	Variety	Origin	Region of adaptation	Date of release
	Seredo	Uganda	Equatoria	
	Sekedo	Uganda	Equatoria	
	Go'do	Yei, Sudan	Equatoria	Local type
	Nuer type	Bor, Sudan	Upper Nile	Local type
	Merese	Torit, Sudan	Equatoria	Local type
	Diri	Mundri, Sudan	Equatoria	Local type
Pearl millet	Serere composite II	Uganda	Equatoria	Not released
	MCV 221	Uganda	Equatoria	Not released
	Pese-1	Uganda	Equatoria	Not released
Finger millet	Nyangole	Yei, Sudan	Equatoria	Local type
	Bilingi	Yei, Sudan	Equatoria	Local type
	Patopato	Yei, Sudan	Equatoria	Local type
	Abubunia	Yei, Sudan	Equatoria	Local type
Rice	NERICA-1	Uganda	Bahr El Ghazal, Equatoria, Upper Nile	Not released
	NERICA-2	Uganda	Bahr El Ghazal, Equatoria, Upper Nile	Not released
	NERICA-4	Uganda	Bahr El Ghazal, Equatoria	Not released
	Lowland rice	Uganda	Bahr El Ghazal, Upper Nile	
Sesame	Promo	N. Sudan	Upper Nile, Equatoria	Not released
	Gedaref	N. Sudan	Upper Nile, Equatoria	Not released
	Kinena-1	N. Sudan	Upper Nile, Equatoria	Not released
	Kinena-2	N. Sudan	Upper Nile, Equatoria	Not released
	Amiro	Yei, Sudan	Equatoria	Local type
	Marijeje	Yei, Sudan	Equatoria	Local type
	Majaka	Yei, Sudan	Equatoria	Local type
	Black seeded	N. Sudan	Upper Nile, Bahr El Ghazal	Not released
	White seeded (Ware)	Uganda	Equatoria, Bahr El Ghazal	Not released
Cassava	Bazumangi (bitter)	DR Congo	Equatoria, Bahr El Ghazal	Local type
	Karagba (bitter)	DR Congo	Equatoria, Bahr El Ghazal	Local type
	Mavonde (sweet)	DR Congo	Equatoria, Bahr El Ghazal	Local type

(Cont)

Table 4.1: **Crop varieties grown in Greater Bahr El Ghazal, Equatoria and Upper Nile Regions** *(Cont)*

Crop	Variety	Origin	Region of adaptation	Date of release
	TME-14 (sweet)	IITA	Equatoria, Bahr El Ghazal	Not released
	TME-12 (sweet)	IITA	Equatoria	Not released
	NASE-1	Uganda	Equatoria, Bahr El Ghazal, Upper Nile	Not released
	NASE-2	Uganda	Bahr El Ghazal, Upper Nile	Not released
	Oreste (sweet)	Magwi, Sudan	Equatoria	Local type
	Ex-Karagba (sweet)	DR Congo	Equatoria	Not released
	Bokolisa (sweet)	DR Congo	Equatoria	Not released
	Akulu	DR Congo	Equatoria	Not released
	Baragya	Yei, Sudan	Equatoria	Local type
	Marango	Yei, Sudan	Equatoria	Local type
	Aleale	Yei, Sudan	Equatoria	Local type
	Lobonya	Lainya, Sudan	Equatoria	Local type
Sweet Potato	Bunch type	Uganda?	Bahr El Ghazal, Equatoria, Upper Nile	Not released
	Senja moko	DR Congo	Equatoria	Not released
	Kajamingi	DR Congo	Equatoria	Not released
	Apanalipa	Uganda	Equatoria	Not released
	Kandolo	Yei, Sudan	Equatoria	Local type
	Kormojo	Uganda	Equatoria	Not released
	Malimali	Yei, Sudan	Equatoria	Local type
Bush beans	Janjaro	Kenya	Equatoria,	Not released
	K20	Uganda	Equatoria, Upper Nile	Not released
	K131	Uganda	Equatoria	Not released
	K132	Uganda	Equatoria	Not released
	MCM	(Kenya?)	Equatoria	Not released
	French bean	Kenya	Equatoria	Not released
Groundnut	Manipintar	Zambia	Bahr El Ghazal, Equatoria, Upper Nile	1978
	Makulu red	Zambia	Bahr El Ghazal, Equatoria	1976
	Atizo	DR Congo	Equatoria, Bahr El Ghazal	Not released

(Cont)

Table 4.1: **Crop varieties grown in Greater Bahr El Ghazal, Equatoria and Upper Nile Regions** *(Cont)*

Crop	Variety	Origin	Region of adaptation	Date of release
	Agar	N. Sudan	Bahr El Ghazal,	Not released
	Berbiton	N. Sudan	Bahr El Ghazal	Not released
	Mr. Lake	Rumbek?	Bahr El Ghazal	Not released
	Red Beauty	Uganda	Bahr El Ghazal, Equatoria, Upper Nile	1975
	Serenut-1	Uganda	Bahr El Ghazal, Equatoria	Not released
	Serenut-2	Uganda	Bahr El Ghazal, Equatoria	Not released
	Serenut-3	Uganda	Bahr El Ghazal, Equatoria	Not released
	Igola-1	Uganda	Bahr El Ghazal, Equatoria	Not released
	Lako more	Yei, Sudan	Equatoria	Local type
	Lako mosala/ makaraka	Yambio, Sudan	Equatoria	Local type
	Lokoya	Liriya, Sudan	Equatoria	Local type
Soya bean	Nam-1	Uganda	Equatoria, Upper Nile, Bahr el Ghazal	Not released
	Nam-2	Uganda	Equatoria, Upper Nile, Bahr el Ghazal	Not released
Onion	Red Creole	Kenya/ Uganda	Equatoria, Upper Nile	Not released
	Bombay Red	Kenya/ Uganda	Equatoria	Not released
	White onion	N. Sudan	Equatoria	Not released
Tomato	Money maker	Kenya/ Uganda	Equatoria, Upper Nile	Not released
	CAL-J	Kenya/ Uganda	Upper Nile	Not released
	Banador	Uganda?	Equatoria	Not released
	Roma	Kenya	Equatoria	Not released
Okra	Long Spineless	Kenya/ Uganda	Equatoria, Upper Nile, Bahr El Ghazal	Not released
	Short Pusa Suwani	Uganda	Equatoria, Upper Nile, Bahr El Ghazal	Not released
	Khartoumia	N.Sudan	Equatoria, Bahr El Ghazal	Not released
	K-S-8	N.Sudan	Equatoria	Not released
	K-S-9	N.Sudan	Equatoria	Not released
Pumpkin	Large Cheese	S. Africa	Equatoria, Upper Nile	

(Cont)

Table 4.1: **Crop varieties grown in Greater Bahr El Ghazal, Equatoria and Upper Nile Regions** *(Cont)*

Crop	Variety	Origin	Region of adaptation	Date of release
Cabbage	Drum head	Kenya/ Uganda	Equatoria, Upper Nile, Bahr El Ghazal	Not released
	Copenhagen	Kenya/ Uganda	Equatoria, Upper Nile, Bahr El Ghazal	Not released
Eggplant	Black beauty	Kenya/ Uganda	Equatoria, Upper Nile, Bahr El Ghazal	Not released

The Most Preferred Modern Crop Varieties Adopted by Farmers in Southern Sudan

Maize: The most preferred varieties that combine high yield potential with adaptation and that have been adopted by farmers are Longe-4 and 5. This is evident in the Greater Equatoria and Upper Nile Regions. However, new varieties (Longe-8 and 9 and Yei-2) showed high yield potential in demonstration trials during the 2010 season in Central and Eastern Equatoria States.

Sorghum: The most widely adopted sorghum variety with consistently high grain yield across the three regions of Southern Sudan is Serena. However, farmers in different agro-ecologies have adopted different local varieties. For example, Nyarango is commonly grown by farmers in Western and Central Equatoria, whereas Go'do is being grown only in Central Equatoria. New varieties such as Gadam El Hamam and Wad Ahmed that have demonstrated high yield potential are being grown by some farmers across the three regions of Southern Sudan.

Rice: Although NERICA-1 and NERICA-2 are adopted by farmers in Bahr el Ghazal and Upper Nile Regions, NERICA-4 is the most preferred by farmers across the three regions of Southern Sudan. The latter has high grain yield and good cooking qualities and taste.

Cassava: Among the cassava varieties Nase 1, Nase 2, TME-14 and Oreste are the most preferred and adopted by farmers in vast parts of Southern Sudan. TME-14 and Oreste have shown tolerance to cassava mosaic virus (CMV) disease.

Sesame: Like sorghum, farmers have varied preferences for sesame. For example, in Equatoria Region farmers preferred the white early-maturing variety (Ware from Uganda). Other new introductions such as Promo (from northern Sudan) have started to gain popularity among farmers in Upper Nile and Equatoria Regions.

Groundnuts: Red Beauty, Serenut-1, Serenut-3 and Serenut-4 are commonly grown by farmers across the three regions of Southern Sudan. However in Lakes State, farmers prefer Mr. Lake. In Yei and Lainya Counties, farmers prefer the early-maturing local variety, Lako More.

Okra: Spineless and Pusa Sawani are the two okra varieties that have been adopted by farmers. They are grown across the three regions of Southern Sudan. Both record high yields and stability in most areas of Southern Sudan.

The Role of Local Varieties in Boosting and Stabilizing Agricultural Production

A good number of local varieties of crops are being grown by farmers in Southern Sudan, especially for sorghum, maize, groundnut, sesame and cassava. Generally, most of the varieties are stable either across two or more agro-ecologies or to specific niches. The breeding programme should be designed to collect those crop varieties commonly grown by farmers and subject them to minimum selection (for two seasons) to attain purity.

The selected families/lines that proved true to type and that combine yield potential with stability can be used for seed production. Since there are few or no registered emerging local seed companies in Southern Sudan, some progressive farmers can be trained and contracted to produce seeds locally. These can then be distributed to specific locations and sold to local farmers at reasonable prices. This will cut down expenses on crop seeds that are not well adapted to Southern Sudan and also reduce untimely delivery of seeds by INGOs, UN agencies and MAF-GoSS to farmers.

Currently, MAF-GoSS and the Center for Technical Development, Wageningen University, in the Netherlands are taking the initiative to empower local farmers' groups in Central (Yei) and Eastern (Torit, Magwi, Pajok, Owingbul, Panyikwara) Equatoria States to produce seeds of local and adapted introduced crops through farmers' groups. The activities of this initiative started well before May 2010 and are still on-going. The programme focuses on participatory variety selection (PSV) and community-based market-oriented seed production (COBAMA). PVS is intended for screening and selecting adapted and high-yield varieties of selected crops (sorghum, maize, sesame and cassava) in farmers' fields with the participation of the researchers. Under this project, five sorghum varieties, seven varieties of maize and four varieties of sesame introduced from the Agricultural Research Corporation (ARC) of the Sudan have been tested in replicated trials at Torit, Yei, Pamyikwara, Pajok and Owingbul. Two varieties of adapted cassava (TME-14 and Oreste) have been tested only at Panyikwara, Pajok and Owingbul, all in Eastern Equatoria State.

Although the trials were not properly managed and the PVS exercises not carried out as planned, some farmers' groups were able to identify and select crop varieties that they appreciated. Most of the farmers ranked Bashayer, an introduced sorghum variety from ARC, as high yielding followed by Tabat and Wad Ahmed. Other farmers who grow sesame chose Promo, also introduced from ARC. Observations during cassava trials indicated that TME-14 was preferred by most farmers' groups. Information on maize trials had not been delivered by the time of this report writing. Early observations indicate that Longe-8, Longe-5 and YEI-2 were among the best performers.

With regard to COBAMA, the Mangaa farmers' group in Yei County planted more than 10 feddans to maize and sorghum for seed bulking. A similar activity was carried out at Budi County in Eastern Equatoria but has yielded few results due to lack of proper management.

This initiative, if properly managed, will not only promote and boost seed production of local crop varieties but also empower the local farmers to open up seed markets and distribution in Southern Sudan.

PUBLIC SECTOR PLANT BREEDING: CONSTRAINTS AND OPPORTUNITIES

Constraints on Support for Public Sector Breeding

In its attempts to rehabilitate agricultural research in Southern Sudan, MAF-GoSS is faced with many challenges, ranging from the need for sustainable funding to the lack of qualified research personnel. In Southern Sudan, the government has yet to understand the need and importance of agricultural research in generating improved seeds and other agricultural technologies. The government (GoNU, GoSS), INGOs and UN agencies (FAO, WFP) and development partners have shown little interest in funding agricultural research programmes in Southern Sudan over the last five years (2005–2010). Also, INGOs, FAO and MAF-GoSS are involved in seed relief supply, spending a lot of money and time on importation of improved seeds from neighbouring Kenya and Uganda – seeds of varieties that often are not adapted to the local environment. This partly explains why the public breeding programme in Southern Sudan is stagnating.

Some constraints on public breeding in Southern Sudan are technical. These include lack of an operational research policy, a variety development and release act, and a seed law. These are key for advancing breeding programmes. Also, the absence of registered seed companies, coupled with the lack of a functional public research institution, pose threats to the advancement of public breeding programmes.

Opportunities for Public Sector Plant Breeding Support

The opportunities for the public plant breeding sector in Southern Sudan are enormous. There are national, regional and international agricultural research centres that have shown interest in initiating and supporting plant breeding programmes in Southern Sudan. These include Uganda's National Agricultural Research Organization (NARO), the Association to Strengthen Agricultural Research in Eastern and Central Africa (ASARECA), ICRISAT, CIAT, CIMMYT, IITA and others. Crop varieties introduced from these agricultural institutions can be traced to a particular originating centre and breeder seed / foundation seed obtained for quick seed bulking and distribution to farmers. Public plant breeding can be made more efficient by a flexible strategy whereby genotypes from a range of sources are tested, but with a shift from national testing and release to regional approaches.

The MAF-GoSS has the opportunity to recruit qualified Southern Sudanese scientists currently working in the north, as well as those in the diaspora, to carry out breeding research on different crops. Since the south has a diversity of crop types, recruitment of experienced breeders will help in mapping and collecting the existing crop varieties (local and introduced genotypes) for characterization and improvement. Some scientists are already linked to regional and international agricultural centres through collaborative research programmes. Their involvement in the breeding research programmes of Southern Sudan will add value to both research materials and funding.

The presence of UN agencies (FAO, WFP), FARM-Sudan/USAID, and INGOs involved in agricultural programmes, along with emerging local seed companies and foreign seed companies that are showing an interest in operating in Southern Sudan, present yet another window of opportunity for public breeding support. The resources of these organizations can be pooled by MAF through a collaborative research programme. Such an arrangement will help not only to support breeding programmes but also to supply much needed improved seeds to local farmers across Southern Sudan.

The public breeding sector has the opportunity to support itself by earning revenues through the sale of their products and services. One way of earning revenues can be through the commercialization of breeding products by collecting royalties for public varieties and through the sale of breeder and foundation seeds to seed growers and companies.

Summary: Formal Plant Breeding in Southern Sudan

This chapter has provided a detailed review of germplasm collection, introductions and crop improvement dating from 1937 onwards. This has been done crop by crop, listing specific varieties and their origin.

Broadly, the historical review is divided by theme: plant breeding before the war (1974-80); plant breeding during the peak of the war (1987–2005); and crop introductions by INGOs during the war. It encompasses information on at least 14 crops.

The current structures for plant breeding are also outlined. They are still very basic, mainly organized by relief agencies (INGOs, FAO) and to lesser extent by the Ministry of Agriculture and Forestry (MAF-GoSS). Most of the efforts are centred on the introduction of improved crop varieties from private seed companies registered in neighbouring Uganda and Kenya.

A comprehensive table details the existing crop varieties grown by farmers in Greater Bahr el Ghazal, Equatoria and Upper Nile Regions. This can serve as a good guide to those crops that could be promoted and to those that need further investigation for improvement.

The chapter ends with a discussion of the constraints on, and opportunities for, support of public sector plant breeding.

V. The Formal and Informal Seed Sectors[5]

Smallholder farmers use several kinds of channels to procure seed. These channels fall within formal and informal seed systems, the latter sometimes labelled local, traditional or farmer seed systems.

The formal seed system involves a chain of activities leading to certified seed of named varieties. The chain usually starts with plant breeding and promotes materials towards formal variety release. Seed marketing takes place through officially recognized seed outlets, either commercially or by way of national agricultural research systems (Louwaars, 1994). Formal sector seed is also frequently distributed by seed relief agencies.

The informal system embraces most of the ways farmers themselves produce, disseminate and procure seed: directly from their own harvest; through gifts and barter among friends, neighbours and relatives; and through local grain markets or traders. Farmers' seed is generally selected from harvests or grain stocks, rather than produced separately. Local technical knowledge, standards and social structures guide informal seed system performance (McGuire, 2001). In developing countries around the world, somewhere between 80 percent and 90 percent of the seed sown comes from the informal seed system (DANAGRO, 1988; FAO, 1998), although this varies by crop and region. Note that modern varieties can be moved through the informal system.

The current assessment suggests that in Southern Sudan upwards of 99 percent of seed comes from informal systems. Formal sector outlets are few, with the SSSA finding such stores mainly in Yei, Wau and Aweil. Farmers seek certified seed at open market stalls, mainly for horticultural crops. Vegetables are a special case when it comes to the use of modern varieties and certified seed.

Figure 5.1 depicts the formal and informal seed systems (and component channels) and how they may interact.

The next section gives details of the current state of formal seed sector development in Southern Sudan. Assisted seed multiplication (sometimes called integrated formal/informal seed multiplication) and distribution channels are then considered. Insights follow on current informal sector functioning, with a special focus on local markets. General issues linking gender and food/seed security are highlighted at the end of the chapter.

FORMAL SEED SECTOR IN SOUTHERN SUDAN

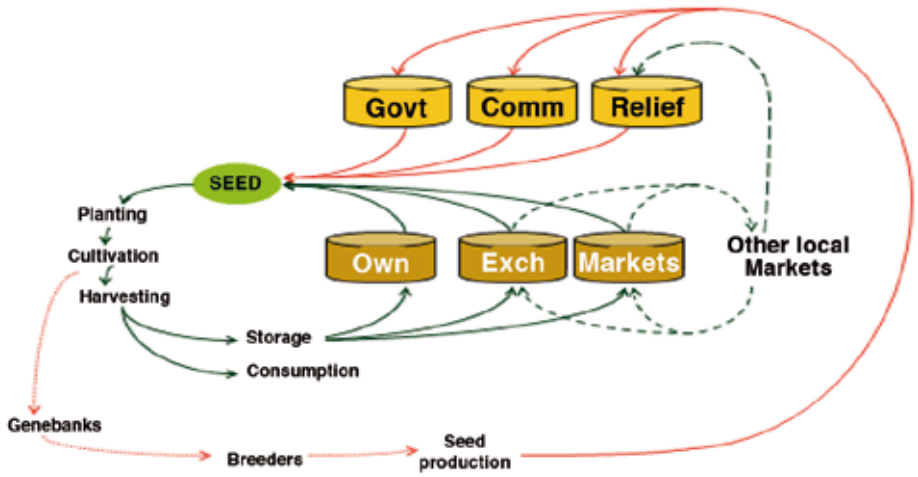
Introduction

Seed production during the last 40 years was carried out by either PDU or INGOs and individuals. Generally, there are no set standards and regulations for guiding for seed production in Southern Sudan.

During the PDU era, seeds were either purchased from contract farmers (seed growers) or produced at PDU's farm in Yei. The seed production programme concentrated mainly on improved groundnuts (Makulu red and Manipintar) and sorghum (Serena and 9DX 7/11). The purchased seeds were passed through the seed section for certification before distribution and sale as improved, certified seeds to farmers in project locations (Yei, Kajokeji, Mundri, Maridi, Rumbek and Wau) and to Commissioners of the three regions of Southern Sudan (Bahr El Ghazal, Equatoria and Upper Nile) and other agencies for distribution and sales elsewhere (PDU main report, 1984).

5 Parts of this chapter were specially commissioned. Dr. Silvestro Kaka Meseka wrote the section on the formal seed sector. Dr. Joseph Okidi led the work on seed multiplication and distribution. Both contributions are part of a large background report prepared for this SSSA, entitled: Meseka, Silvestro Kaka and Joseph Okidi: Plant breeding and formal seed sector + Seed multiplication and distribution channels. Juba, Southern Sudan: MAF-GoSS and FAO.

Figure 5.1: **Channels through which farmers procure seed**



Channels are depicted by the cylinders: Farmers' own seed stocks, exchange with other farmers, and purchase through local grain markets constitute 'informal' channels, while commercial seed stockists, government or research outlets, and relief supplies constitute formal channels. The arrows indicate the flow of seed in the 'informal' and 'formal' sectors respectively. Adapted from Almekinders and Louwaars (1999).

PDU imported vegetable seeds for trials and sale to interested farmers. It kept a close liaison with both the Yambio Agricultural Research Station (YARS) and the Sudan Council of Churches (SCC) which were involved in vegetable research and vegetable seed procurement and distribution, respectively.

Similarly, NCA worked closely with PDU and carried out seed bulking and distribution of both local and improved seeds from PDU. Seed bulking was increasingly carried out by contract farmers/growers and by the early 1980s contract growing by local farmers of sorghum, groundnuts, beans, millets and maize proved highly successful (Slaymaker, 2000). During this period NCA became the most important source of seeds for farmers in Eastern Equatoria. The NCA seed production programme through contract farmers proved a good way to disseminate new varieties to local farmers. In early 1989, the whole of Eastern Equatoria fell into the hands of the Sudan People's Liberation Army (SPLA); NCA agricultural activities shifted to procurement and distribution of seeds and agricultural tools to the IDPs of Eastern Equatoria living in Juba.

Current Structures and Status of Formal Seed Production

Formal seed structures involve institutions with well defined research agendas, working together to produce seed and to supply farming communities through market channels. Institutions central to seed production are the public agricultural research centre/organization, seed production centre, laboratory for seed testing, and markets. Currently in Southern Sudan, public agricultural research is still in its formative stages and therefore little output is expected for the time being. MAF-GoSS set up a basic seed centre at Palotaka in 2007, but little progress has been made so far. This is partly due to the lack of a functional public agricultural research organization to supply the centre with foundation seed and/or the lack of skilled technicians to run the centre. Similarly, a seed testing laboratory was established with the support of FAO in Yei in 2006. However, the activity of the laboratory was limited to testing only for germination and moisture content of seeds acquired and imported by FAO and other relief and development organizations. Moreover, the technician employed with support of FAO in late 2006 to run the laboratory left in March 2010 and was not replaced. Another seed laboratory supported by FAO was established in Wau, Western Bahr El Ghazal State. This laboratory is a one-room structure with little seed testing equipment, run by a trained seed technician. Due to lack of activities and a well focused programme, the technician left in April 2010 and has become a member of parliament in Warab State. However, plans are under way to train and recruit at least two technicians to run these seed laboratories. Since there are no formal seed market/distribution centres in Southern Sudan, seeds bulked locally by progressive farmers are bought by NGOs, FAO and individuals directly from farmers.

For functioning formal seed production, certification procedures have been developed to ensure the seed meets a high standard of purity and quality. Classes of seed recognized by seed certification agencies are as follows: breeder seed; foundation/basic seed; and certified/commercial seed.

Breeder Seed. The first step in seed production is to produce breeder seed. This is the source of the unique genetic code associated with a given open-pollinated variety (OPV) or hybrid (Poehlman and Sleeper, 1995). The breeder seed is the final product of a breeding programme, and is normally produced under the supervision of the plant breeder. Commercial seed producers rely on a breeder's final product and purchase the breeder seed to start seed production. Breeder seed differs from the final product, whether it is OPV or hybrid. In the case of OPV, the multiple copies of the genetic code contained in the breeder seed are identical to the original breeder seed; in the case of hybrids, the copies represent specific combinations of genetic codes contained in the seed parents (inbred lines, hybrids, or OPVs). Although it is the ultimate source of the unique genetic code needed to produce a particular OPV or hybrid, breeder seed is rarely available in sufficient quantities to serve as an input into commercial seed production.

The breeder seed of OPVs must be clean, genetically pure and "true to type". With careful management, breeder seed of OPVs can be reproduced for several years without significant reduction in genetic purity. The genetic purity is ensured by planting seed plots in isolation to avoid contamination, rogueing (removing) plants that do not conform to the morphological traits of the variety, and selecting for harvest only plants that are true-to-type. The breeder seed for producing hybrids consists of clean, genetically pure seed of the parents. In the case of single-cross hybrids, the parents are inbred lines; in the case of double-cross hybrids, three-way-cross hybrids, and varietal cross (nonconventional) hybrids, the parents are inbred lines, single-cross hybrids or OPVs. The breeder seed of the parents can be produced from national breeding programmes, international agricultural research centres or university breeding programmes, purchased from private seed companies.

Foundation/Basic Seed. Foundation seed (parent seed stock) is produced by multiplying (bulking up) breeder seed. In the case of OPVs, breeder seed, foundation seed and commercial seed/certified seed are genetically identical, although they differ in their level of genetic purity. Little difference is generally found in the way the three are produced, except that seed multiplication takes place on a progressively larger scale.

In the case of some hybrids, production of foundation seed involves an additional step after the initial supply of breeder seed is acquired: producing single-cross parent seed. The seed increase is normally done under controlled conditions to maintain genetic purity at maximum levels. Parent inbred lines should be multiplied in well isolated blocks/nurseries (for cross-pollinated crops an isolation distance of 200–300 m is desirable). Single-cross hybrids to be used as parents should be produced in isolated blocks.

Commercial/Certified Seed. This seed is destined for distribution to farmers. It is normally managed in a special way (inspection, seed testing) so that it conforms to the standards of genetic purity established and enforced by the official seed certification authority. Growing a commercial seed crop is similar to growing a crop of ordinary market grain. The main difference is that, with the seed crop, a high level of management is vital for ensuring seed is healthy, viable and genetically uniform.

Other Ways to Introduce High-Quality Seeds

The procedures developed to ensure seed has a high standard of purity and quality are seed certification and seed-quality assurance. The production, conditioning and marketing of certified seed are the exclusive responsibility of the seed grower. The responsibility of the seed improvement organization is to verify that the grower follows the regulations set by the seed certification agency and that the seed meets set standards for certification of a particular crop (Box 2).

Box 2: **MAF-GoSS steps in certification and seed-quality assurance and control**

Certification

1. The seed grower must plant foundation seed of an approved variety.
2. The seed must be planted on clean ground. The field should not have been planted in the previous year to another variety of the same crop, or to other crops that might volunteer and affect the purity of the crop being certified. Noxious weeds should be removed before harvest, and borders clipped where necessary to maintain seed purity.
3. In the case of cross-pollinated crops such as maize and sorghum, isolation of the seed-producing field is required, either by planting a specific distance (200–300 m) from other fields of the same crop or by planting a specified number of pollinator rows around the border of the field to reduce the opportunity for cross-pollination with other cultivars planted in neighbouring fields.
4. Off-type plants and mixtures are rogued by the growers before harvest in the case of self-pollinated crops, or before flowering in the case of cross-pollinated crops.
5. Field inspections are made by representatives of the seed certifying agency to check on the purity of the cultivar, freedom from other crop plants, freedom from noxious weeds, amount of disease that might affect certification, and general conformity by the grower to the seed certification rules. Inspections are conducted when purity and disease can best be observed (before flowering and at physiological maturity).
6. Seed inspection is carried out by trained seed technicians and the directorate of crop protection as necessary to observe and supervise the harvesting, grading, conditioning, bagging and other processing operations. Representative samples of seed are drawn by the inspector(s) from each lot of seed after it has been conditioned, bagged and prepared for sale. The seed samples are tested for impurities, germination and other factors affecting seed quality according to the particular crop. Only seed meeting or exceeding minimum standards is accepted for certification.
7. Official tags are supplied by the seed-certifying agency and sealed on the bags of seed approved for certification. The tag is labelled to show that the seed meets the specific standards for the crop and the seed laws.

Seed-quality assurance and control

Quality assurance (checks to ensure freedom from weeds, insects and moisture, as well as germination tests) and control (laws and regulations covering seed movements) of seed from each farmer's fields are carried out by seed certification agency specialists to avoid distribution of substandard seed. Information regarding germination, vigour and purity should be obtained and made available to help farmers judge the quality of seed. Seed laws and regulations ensure that seed in the market or imported from other places meets certain quality standards.

The Need for Formal Public Seed Production Structures

If formal public seed production is to operate smoothly, there must be a functional agricultural research institution and well designed breeding programme to feed into research programmes leading to the development of new varieties. The basic requirements for public seed production structures are prioritized in Box 3.

Box 3: **MAF-GoSS needs for public seed production structures**

1. A functional agricultural research institute/organization;
2. Breeding programme designed to feed breeding materials and products into research programmes;
3. Seed maintenance (breeder and foundation seed);
4. Well equipped seed quality control centre and laboratory for testing seeds;
5. Highly trained and experienced seed technicians and equipment maintainers;
6. Seed companies to increase, condition, distribute and market seeds;
7. Seed facilities (machines) for drying, processing and storing;
8. Financial support from the government, UN agencies, INGOs and entrepreneurs;
9. Seed laws and regulations to control quality and movement of seed and breeding materials;
10. Seed inspection agency to regulate the standard of seed produced by seed growers/ companies.

SEED MULTIPLICATION AND DISTRIBUTION CHANNELS IN SOUTHERN SUDAN

Seed multiplication provides an opportunity to increase the availability of desired crop varieties and to improve access to and quality of desired crop varieties. This section reviews seed multiplication efforts in Southern Sudan over the past ten years. It looks at the approaches taken, organization involved, and profiles of the crops and varieties, as well as the quantities being multiplied; seed processing, storage and distribution; seed quality control; and the challenges involved.

From 2000 to 2010, no formal seed company has gone on record to multiply seeds in Southern Sudan. Formal seed sector operation is limited to seed importation by relief, rehabilitation and development organizations. However, within the rehabilitation and development context a number of development partners in collaboration with MAF-GoSS have been supporting multiplication and bulking of some crops across different agro-ecologies.

Seed Multiplication and Distribution Approaches

Seed multiplication and distribution can be broadly classified into four major categories: a) multiplication through on-farm trials; b) seed distribution-multiplication-recovery approach; c) community-based seed multiplication and supply; and d) evaluations and multiplication of basic seeds. These broad categories have some minor variations depending of the organization undertaking it. Between 2000 and 2005 there were efforts towards introducing some modern varieties from IARCs and NARS through on-farm trials and multiplication. The period immediately after the CPA saw some effort towards recovery and rehabilitation and a number of development partners supported multiplication of adapted crop varieties on a recovery basis. Recent efforts have been directed towards supporting community-based seed production and supply schemes.

Seed multiplication through on farm trials

In the early 2000s, CRS, WVI and AAH-I, in collaboration with IITA-Uganda, CIP-Uganda, ICRISAT-Malawi, NARO and KARI, were able to introduce modern varieties of crops such as cassava, sweet potato, groundnut and rice. Here farmers evaluated the varieties and multiplied the varieties through on-farm participatory evaluation. The adoption of some modern varieties of cassava, sweet potato, groundnut and rice is attributed to these earlier efforts. Evaluation of cassava and sweet potato production in Nimule indicated increased access and production as a result of the introduction of disease-resistant and high-yielding varieties (CRS, 2003). The adoption of a groundnut variety (ICGV12991 or Serenut II) introduced by CRS in Ikotos and multiplied using farmer field schools (FFS) was considered high. The high adoption was due its good yield, flavour, nut appearance and sprouting habit (Nyeko, 2007). In Western Equatoria where WVI introduced over 10 varieties of rice from the National Rice Board of Kenya, farmers selected the introduced Basmati I as the most

preferred variety due its good aroma and low breakage during hulling which makes it compete favourably with imported rice in the market arena. As a result, adoption and production of the variety spread as far as the Democratic Republic of Congo (DRC).

The approach to multiplication of these introduced varieties has involved the establishment of mother gardens for multiplication where members of the selected group manage the fields and later access the materials for use in individual fields.

Strengths

- Seeds are obtained from reliable sources.
- Farmers are presented with a range of varieties to chose from.

Weaknesses

- Limited quantities of basic seeds and planting materials are provided by the research organizations for testing.
- Few groups are used to test and multiply; hence the rate of dissemination across farming communities is slow.

Seed multiplication on recovery basis

This appears to be the simplest form of seed multiplication to support recovery and rehabilitation within communities that have lost certain crop seeds. Immediately after the CPA, many development partners used this approach to quickly multiply some adapted crop varieties. Here progressive farmers or groups are selected in consultation with the local leaders, given some basic training on seed multiplication, and provided with seeds to multiply. After harvest, and with the help of local leaders, the farmers who received the seed are required to pay back the seed in kind, either the same amount or with a certain percentage agreed upon before receiving the seed. The recovered seed is then given to another group of identified farmers and the chain continues throughout the project life. The success of this scheme depends strongly on the willingness of the selected farmers as well weather conditions. Important considerations in the implementation of this scheme include:

- *Group formation:* Establishment of functional groups and/or committees at village level to ensure proper follow-up of farmers who receive seeds.
- *Prior agreement with the farmers on the modalities of seed recollection:* The farmers must be willing to participate as a group and abide by the set rules and regulations.
- *Contact farmers establishment:* Establishment of contact farmers with the assistance of local leaders can ease monitoring and recollection of seeds from other farmers where no groups exist.

Strength

- It provides an opportunity for accelerated multiplication of some crop varieties during recovery and rehabilitation.

Weaknesses

- Limited to only a few crop varieties with diverse seed sources.
- Bad weather could easily hinder the recovery progress and hence interrupt the distribution-multiplication-recovery cycle.

The community-based seed production and supply initiatives

In 2007, FAO in collaboration with SSARTO and other development partners initiated the community-based seed production and supply scheme. The initiative focuses on empowering progressive farmers and/or seed groups to produce quality seed for their own use as well as for the market. The progressive seed growers/groups are provided with basic knowledge on seed multiplication, processing, storage and marketing. They are then supported with 'basic seeds' and other inputs and the establishment of a community-based seed store. They are also given assistance to access markets, particularly through seed fairs and/or seed recollection for direct seed distribution. The seed fair approach, though used in an emergency context, was intended to create linkages between

the seed growers/sellers and buyers/beneficiaries as well as stimulate local seed demand within the communities in the target locations.

Strengths

- It empowers the community to produce seed for their own use as well as for market.
- It offers an opportunity for the development of indigenous private seed companies.
- It encourages collective storage and marketing with better bargaining power.

In order to enhance efforts to promote community-based seed production and supply, a deliberate and concerted effort is necessary by GoSS to develop mechanisms to enhance the development of public-private seed enterprises and create sustainable linkages among the different players in the seed sector. Note that a number of community-based enterprises are eager for closer links (Box 4).

Box 4: **Madhol, Seed (Koth) Producers' Group: how to professionalize local multiplication efforts**

Their seed may not be certified but the growers certainly aspire to have a high-quality product. With 25 members, the Madhol Seed Producers group produced 3 000 sacks (each 90 kg) of sorghum and 3 500 sacks (each 50 kg) of groundnut in the 2009 agricultural season. Members say it is distinctly *seed* and very different from what local traders may be selling. They have good varieties, select carefully during harvest, and have several concrete fumigated storage facilities to help maintain a certain level of quality. The price, members say, suggests the difference: local market sorghum seed goes for 5 SDG for 1 malwhal (about 3 kg); theirs sells for 10 SDG.

Constraints are many. In the case of transport, they own one truck but rent three more plus a tractor. They need options to expand their market, but do feel the opportunities are great.

A question they pose: Can FAO buy from them locally, rather than source aid from outside the region?

Basic seed evaluation and multiplication

In 2007, the Southern Sudan Agricultural Research and Technology Organization (SSARTO) opened up the Basic Seed Centre at Palotaka, Magwi County, Eastern Equatoria State. This facility evaluates advanced germplasm from IARCs and NARS, in addition to multiplying some modern varieties currently being grown in Southern Sudan. The centre is currently evaluating a number of sorghum, maize and cowpea advanced lines. It intends to provide basic seeds to those interested in seed bulking and multiplication in Southern Sudan in the near future.

Current Efforts in Seed Multiplication

Organizations supporting seed multiplication

Although there is no formal seed company in Southern Sudan, a number of development partners in collaboration with MAF-GoSS/SSARTO/CAD have been supporting seed multiplication (Table 5.1) among communities across the different agro-ecologies. The scale and approach to implementation vary from organization to organization and from location to location, depending on the project design.

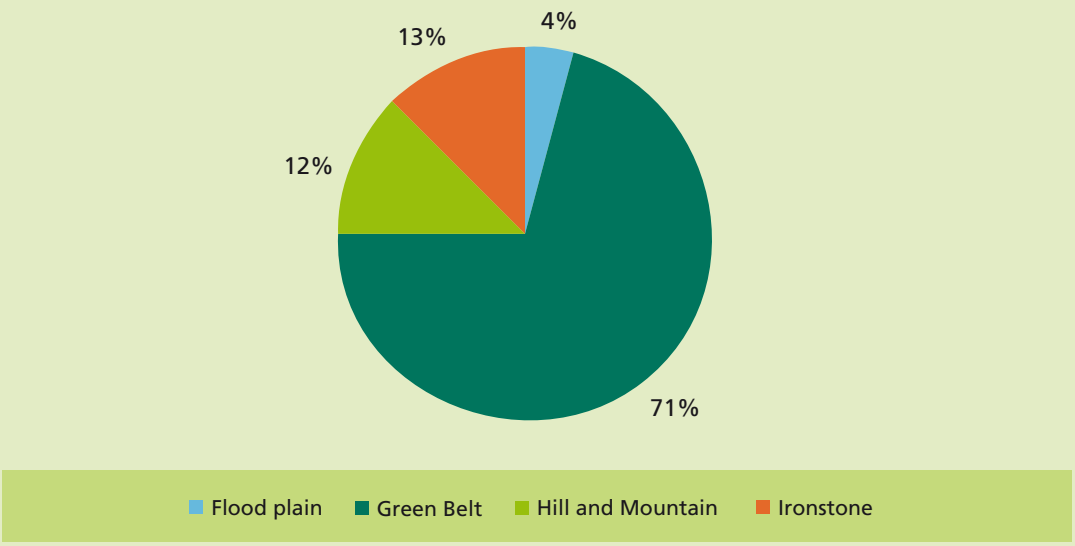
Table 5.1: **Some of the organizations supporting seed multiplication in Southern Sudan (2010)**

State	County	Payam	Organization
Eastern Equatoria	Magwi	Magwi	MASRA/CDOT/FAO/SARTO
	Ikotos	5 payams	CDOT/CARITAS/SNV
		Imotong	CRS
	Torit	Itiyala	CRS, SSARTO
			CDOT/CARITAS/SNV
Central Equatoria	Yei	Otogo	KMFG/FAO NPA/SSARTO
		Mugwo	KMFG
	Morobo	Gulumbi	DRC
	Lainya		DRC
	Kajokeji	Kangapo II	SSWC
Western Equatoria	Yambio	Yambio	WVI/FAO
	Nzara	Nzara	WVI
	Ezo	Ezo and Nandi	WVI
	Ibba	Nanikakara	WVI
	Tambura	Tambura	WVI
	Mundri West		OXFAM
WBEG	Wau	Bagari, Besia and Besselia	WOTAP/FAO
NBEG	Aweil East		AMURT/TEARFUND/IAS
	Aweil Centre		DRC
Warrap	Twic	Pamjok, Akoc, Ajackwac Aweng, Turalei, Wunrok,	Mercy Corps
Lakes	Rubek East	Cuecok, Maleng and Atiaba	ACROSS/FAO

Seed production zones

Although a number of organizations support seed multiplication in Southern Sudan, apparently the Green Belt has the highest share (71 percent) of seed multiplication sites in Southern Sudan. This is followed by the Ironstone Plateau (13 percent), Hills and Mountain (12 percent), and the Western Flood Plains (4 percent) (Figure 5.2). The high percentage of multiplication sites in the Green Belt is probably due to favourable climatic factors such as two rainy seasons per year and a more reliable rainfall of up to 1 200 mm per year. The region experiences less environmental shock than other livelihood zones in Southern Sudan. In addition, the majority of the households in the Green Belt do not keep livestock. Apart from external aggression from the Lord's Resistance Army (LRA) in Western Equatoria State, the region has no major inter-tribal conflicts compared with the cattle-raising zones such as the drier pastoral zone and Western and Eastern flood plains where no or very limited seed multiplication is taking place or being supported.

Figure 5.2: **Relative % of seed production sites across livelihood zones in Southern Sudan, 2010**



Sources of seed for multiplication

The organizations supporting seed multiplication in Southern Sudan rely heavily on locally sourced seed (Figure 5.3). In relative terms, locally sourced seed accounts for 74 percent of the total seed sourced. The other seed sources are certified seed (13 percent), seed from Uganda (11 percent), seed from Kenya (1 percent), and quality-declared seed (13 percent) from Uganda.

The use of locally sourced seeds raises many concerns about the genetic purity of the crop seeds multiplied from this source. Although there is a basic seed centre at Palotaka, access to these seeds is still very limited. Extra effort is therefore needed to ensure that the centre is empowered to provide the much needed basic seeds of different crop varieties for multiplication.

Figure 5.3: **Current sources of seed used for multiplication, Southern Sudan, 2010**

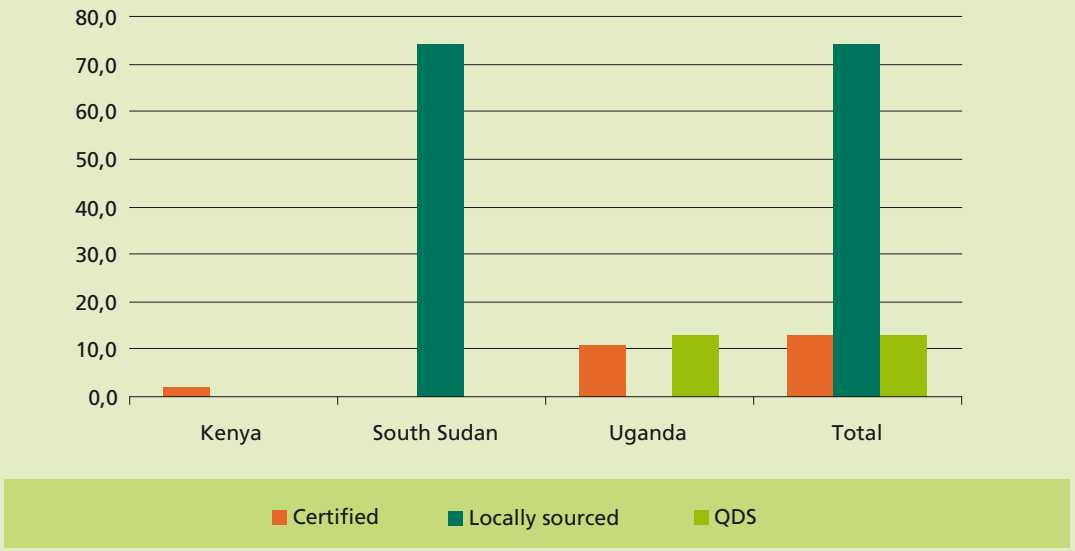
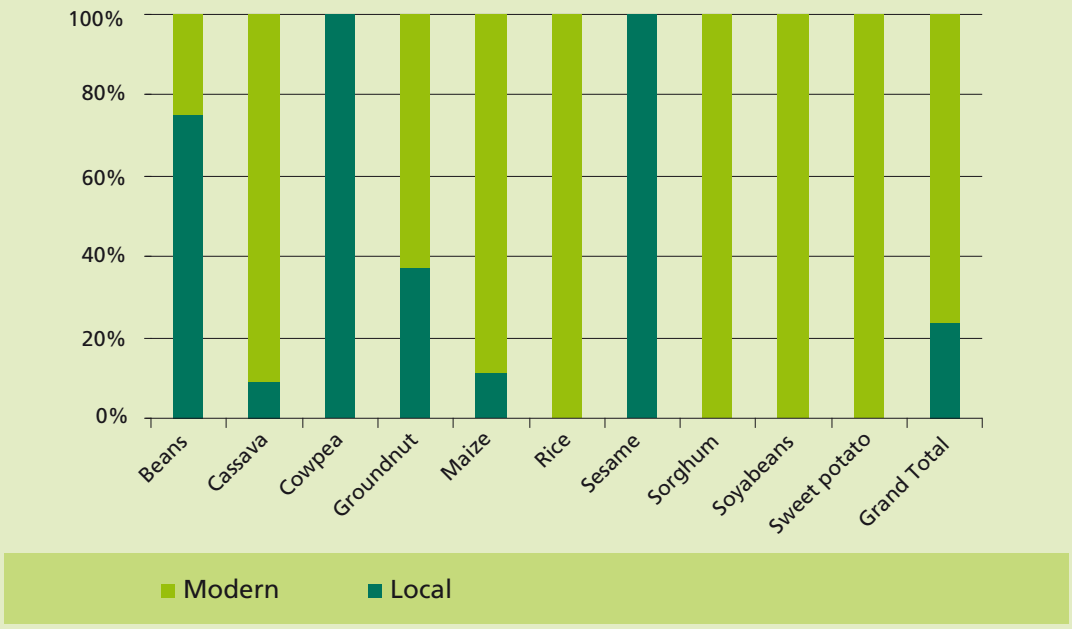


Figure 5.4: **Proportion of modern and local crop varieties under multiplication**



Crop and varieties under multiplication

A range of staple crops is being multiplied in Southern Sudan. These include both modern and local varieties (Table 5.2). Modern varieties account for about 70 percent of the varieties under multiplication. This, however, varies from crop to crop. More than 50 percent of the varieties of sorghum, soybean, sweet potato, cassava, groundnut and maize are modern varieties while more than 70 percent of beans, cowpeas and sesame are local landraces (Figure 5.4). The organizations carrying out these multiplication activities tend to focus on improved varieties, with little attention to the source of the mother seed. The idea of sourcing for improved varieties locally is therefore illogical for pollinated crops since cross fertilizations may have occurred over time, hence reducing the genetic purity (true-to-type) of the variety.

Table 5.2: **Some crop varieties targeted for multiplication in Southern Sudan**

Crop	Variety	Organization	State
Beans	Balangiti*	DRC,/KMFG/FAO	CCES
	K132**	KMFG/FAO	CES
	Bunyeba*		CES
Cassava	TME 12**	WVI	WES
	TME 14**	DRC, MARSA, CRS, NPA/ YATC	CES, EES
	Karangba*	KMFG	CES
	MH 12**	WVI	WES
	Akena (I92/0067)**	CDOT/CARISTAS	EES
	TME 5**	CRS	EES
	TME 12**	CRS	EES

(Cont)

Table 5.2: **Some crop varieties targeted for multiplication in Southern Sudan** *(Cont)*

Crop	Variety	Organization	State
Cowpea	Monojaloro*	KMFG	CES
	Lubia*	WOTAP	WBEG
Groundnut	Red beauty**	DRC, NPA/YATC, SSWC	CES
	Azira*	WVI/FAO	WES
	Lokomerek*	DRC/FAO	CES
	Serenut II**	MASRA/FAO, SSWC	EES
	Serenut IV**	WVI/FAO, CDOT/CARITAS	WES, EES
	Abuitnien*	WOTAP/FAO	WBEG
	Abutalata*	WOTAP/FAO	WBEG
	Manipinta*	WOTAP/FAO	WBEG
	Mr. Lake*	ACROSS	LAKES
	Sodari*	WOTAP/FAO	WBEG
	Egola**	SSWC	EES
Maize	Longe V**	DRC, NPA/YATC, CDOT CARITAS	EES, CES
	Longe IV**	WVI, DRC, KMFG YATC/NPA	CES, WES
	BH04**	YATC/NPA	CES
	Badari*	WVI	WES
Rice	Basmati II**	WVI	WES
Sesame	Local*	Mercy Corps	Warrap
	Yei*	DRC, MASRA	CES, WES
Sorghum	Nyangjang*	Mercy corps	Warrap
	Serena**	DRC	CES
	Sekedo**	DRC, SSWC	CES
Soybeans	Namsoy**	CDOT/CARITAS	EES
Sweet potato	Naveto**	CRS	EES
	SPK**	CRS	EES
	Kemplo**	CRS	EES

*Local varieties; ** Modern varieties

Area and quantity of crop seed produced, 2010

Many organizations appear to have limited information on the actual area planted and quantities of the seed produced by progressive seed growers and/or groups over the years. This may be due to limited capacity for monitoring production and maintaining a good database. Despite the limitations, a few had records of production (Table 5.3), though these represent just a fraction of the total area and quantity of seed being produced in Southern Sudan.

Table 5.3: **Crop seeds produced by farmers with organizational support in Southern Sudan (2009)**

Crop	Area (feddans)	Production (tonnes)	Organization involved
Beans	47	28.2	DRC
	92.6	38.5	FAO/KMFG/DRC/MASRA
	69	41.4	SSWC
Cassava	26	70.2	DRC
	20.0	259.8	FAO/MASRA/DRC/KMFG
Cowpea	20.8	3.0	FAO/KMFG/WOTAP
Groundnut	50	30	DRC
Groundnut	389.0	153.9	FAO/WOTAP/ACROSS/WVI/CDOT
Maize	188.1	85.6	FAO/DRC/WVI/KMFG
Sesame	33.3	4.9	FAO/MASRA
Sorghum	28.6	10.0	FAO/DRC
Sorghum	100	70	SSWC
Total	1064.5	795.4	

Seed processing, storage and marketing

Although a number of community-based seed storage facilities are being put up in Southern Sudan with the help of development partners (Figure 5.5, Table 5.4), there are still no advanced processing facilities for seed grading, treatment and packaging. Progressive seed growers perform the basic operations of sun drying, cleaning and sorting. As with grain bagging, seed bagging is normally done in any suitable bag available. This makes it difficult to distinguish clearly between seed and grain in the markets. Seed processing, cleaning, grading, treatment and appropriate packaging normally offer producers the advantage of being able to sell at a premium price in a given market. Development partners therefore need to look critically at seed processing and marketing as multiplication activities in need of support.

Figure 5.5: **Community-based seed store constructed by FAO/WVI in Gitikiri**

Table 5.4: **Some community-based seed storage facilities in Southern Sudan (2009-2010)**

State	County	Payam	Boma	Village	Size	Organization
WES	Yambio	Yambio	Bazungua	Gitikiri	Medium	FAO/WVI
EES	Magwi	Magwi	Oboo	Palotaka	Medium	FAO/CRS
	Magwi	Magwi	Owinykibul	Owinykibul	Medium	FAO/MASRA
Lakes	Rumbek East		Atiaba	Atiaba	Medium	FAO/ACROSS
Warrap	Twic	Turalei			Small	SUVAD
		Aweng			Small	SUVAD
		Wunrok			Small	SUVAD
CES	Yei	Yei		Lobore	Small	YATC/NPA
	Kajokeji	Kangapo II	Jalimo	Jalimo	Small	SSWC

Seed quality control

Supervision of most seed production activities is normally done by NGOs and CAD extension staff most of whom have limited capacity to monitor seed production activities. Ideally what is being produced in Southern Sudan should be referred to as quality declared seeds (QDS). However, there is no formal body on the government side responsible for declaration of these seeds.

Immediately after the CPA, FAO in collaboration with MAF-GoSS/SSARTO established a seed testing facility at Yei Agricultural Research Centre (ARC). In 2007, with support from the Japanese Government, FAO in consultation with MAF-GoSS constructed a modern seed laboratory and installed the necessary seed testing equipment. The laboratory was operational from 2006 until early 2010, providing basic services such as testing for seed germination and analyses of purity and moisture content. In 2009 alone, about 400 seed samples from NGOs, farmers (community-based seed-production groups) and FAO were analyzed. The seed testing laboratory in Yei has the capacity to handle more than 1 500 seed samples annually.

In early 2010, the laboratory technician resigned and the lab remained inactive throughout the year. In 2011, FAO in consultation with MAF-GoSS recruited another seed lab technician to continue providing seed quality services.

Major Challenges for Seed Multiplication

The major challenges to seed multiplication in Southern Sudan include poor access to foundation seed; bad weather (drought or flood); damage by pests; insecurity; labour constraints; poor access to credit and other services; and difficulties associated with marketing seeds locally.

Poor access to basic or foundation seed: Production of high-quality seed starts with the acquisition of good basic or foundation seed. Although the GoSS through SSARTO has established a basic seed centre at Palotaka, many of the progressive seed growers are still using locally sourced seed. This raises many questions about the quality (genetic and phytosanitary) of the seed being produced in Southern Sudan.

Inadequate capacity for seed quality control: Currently in Southern Sudan, there is no formal body responsible for quality checks on the seed being produced. Both the government and development partners lack adequate capacity to supervise and control seed quality.

Pests and diseases: High incidence of, and damage by, both field and storage pests and diseases are some of the concerns at the field level. With the GoSS restriction on the use of inorganic pesticides, farmers generally find it difficult to control both field and storage pests and diseases. Hence, the phytosanitary quality of the seed being produced in Southern Sudan is not being systematically checked.

Insecurity: The presence of the Lord's Resistance Army (LRA) and the inter- and intra-tribal conflicts in many parts of Southern Sudan will continue to limit seed multiplication in some states such as Western Equatoria, Lakes, Warrap, Jonglei and Upper Nile.

Labour constraints: The labour requirements of producing both food and seed at the household level are another limiting factor in seed production. Many progressive seed farmers find it difficult to expand production due to the prohibitively high labour cost in Southern Sudan.

Poor access to credit and other services: In Southern Sudan, many progressive seed growers still rely on the limited support provided by GoSS/SSARTO, FAO, NGOs and CBOs. Many financial institutions are still sceptical about giving loans for agricultural production in Southern Sudan.

Lack of seed processing facilities: In Southern Sudan, there is still no seed processing facility for grading, treatment, and packaging of seeds. Most seed growers only clean and sort their seeds. This has made it difficult to clearly distinguish between seed and grains in markets.

Underdeveloped seed market: The seed market is still underdeveloped and most seed farmers tend to think of the organization providing seed aid as the immediate market. Apart from the few vegetable seed shops, there are no specialized seed markets for field crops such as beans, groundnut, cowpea, maize and sorghum. Lack of reliable seed markets in Southern Sudan can be linked to the lack of a commercial agricultural orientation in general, as well as the lack of investment capacity for seeds and inputs specifically.

Weak farmers' associations: Although there exist a number of groups/associations or cooperative societies in Southern Sudan, most of them are still weak and rely on government and/or development partners for their survival.

Poor road access: Generally, the problem of poor feeder roads is a challenge not only to the GoSS, but also its development partners and farming communities. Poor roads limit movement of people with their commodities.

Summary: Formal Seed Sector and Decentralized Seed Multiplication and Distribution

The chapter reviews the history of formal seed production as well as current structures. Prior to 2005, seed production was concentrated in PDU, the Sudanese Council of Churches, and a set of international NGOs (especially the Norwegian Council of Churches).

The formal seed sector is in the process of being reconstructed. A basic seed centre has existed in Palotaka since 2007 and a seed laboratory in Yei functioned at some level in the period 2006–2010. A set of clear priorities for guiding formal seed sector development is described.

Note that during the period 2000–2010, no formal seed company was on record as having multiplied seeds in Southern Sudan. Formal seed sector operations have been limited to seed importation by relief, rehabilitation and development organizations. However, within the rehabilitation and development context a number of development partners in collaboration with MAF-GoSS have been supporting multiplication and bulking of some crops across different agro-ecologies.

Decentralized seed production and distribution currently takes place through a number of means: a) multiplication through on-farm trials; b) the seed distribution-multiplication-recovery approach; c) community-based seed multiplication and supply; and d) evaluations and multiplication of basic seeds. A current seed multiplier inventory (to be updated on an ongoing basis) suggests that at least 15 organizations are multiplying seed, with the majority located in the Green Belt (71 percent) and others spread out in the Hill and Mountain (12 percent), Ironstone Plateau (13 percent) and Flood Plain zones (4 percent).

In 2010, some 795.4 tonnes of seed were produced by farmer groups, supported by national and international organizations. Base seed for multiplication was generally sourced locally (that is, very little of the base material was certified), and multiplication included both local and modern varieties of a large range of crops. At present in Southern Sudan, there are no seed processing facilities for seed grading, treatment and packaging. Challenges for strengthening a decentralized multiplication network are outlined in some detail.

INFORMAL SEED SECTOR IN SOUTHERN SUDAN

The informal seed system includes a range of inter-linked channels that produce, disseminate and procure seed. These include farmers' own stocks, other farmers and friends, and local markets. For farmers' priority crops – sorghum, maize, groundnut, sesame and common bean – the informal system dominates seed supply, accounting for more than 99 percent of the seed sown. Only seed for horticultural crops (commercial vegetable F_1 hybrids) is purchased mainly from formal channels such as agro-dealer shops.

In Southern Sudan, farmers' own stocks supply roughly 40–45 percent of all seed sown, with local markets providing another 20–25 percent of the total seed sown. 'Other farmers' (kin, neighbours and friends) serve as a third important source, particularly for the vegetatively propagated crops such as cassava and banana (see Table 6.1).

Box 5, using an example from Western Equatoria State, gives insights into how farmers may weigh the use of these various sources. No one source is perfect.

Box 5: **How a community in Western Equatoria reflects on the advantages and disadvantages of a seed source**

These reflections may vary by crop:

Source	Advantages	Disadvantages
Own saved seed	Trusted quality, particularly in reference to germination Ensures timely planting as seed is readily available	(none)
Seed, through labour	Trusted source, therefore quality is not questioned (in terms of germination) Brings social unity among community members as neighbours contribute to the livelihoods of one another	Sometimes brings social fatigue as the recipient of seed may be viewed as poor Sometimes the owner plants first, so the recipient delays his/her own planting
Market	Availability of different crops in the market Can facilitate timely planting	Can be disappointing in terms of germination Uncertain disease status of crop
Seed aid	Access to new varieties of some crops	No information about seed type Poor germination of some crops such as maize, beans, sesame Unrealistic quantity, particularly groundnut seed (2–5 kg/household). To plant a feddan, a household needs about 8 basins of unshelled groundnuts

The Importance of Markets for Seed

Local markets provide at least one-quarter of the seed Southern Sudan farmers sow across all their major crops. They are even more important as a source of common bean and groundnut, which are difficult crops to store, as well for sesame (40–55 percent of the seed sown) (Table 6.1). Furthermore, local market channels have been important for giving Southern Sudanese farmers access to new varieties, whether 'modern varieties' or local varieties brought in from elsewhere (particularly Uganda and Ethiopia). About 20 percent of the new varieties that farmers accessed between 2005 and 2010 came through local market channels (Figure 6.8). So farmers use local markets in a number of ways: to top off stocks; to get new varieties; to hedge the risks of storing seed themselves. Within the SSSA, sample, market use for seed was pervasive for seed, but also varied somewhat by state (Table 5.5).

Table 5.5: **Seed (% of total sown) being sourced from local markets, by state, 2010**

% of total seed sown coming from local markets	CES	WES	EES	WBEG	NBEG	WP	JO	UNS
	26.7	12.4	13.1	21.0	21.2	38.2	12.4	27.6

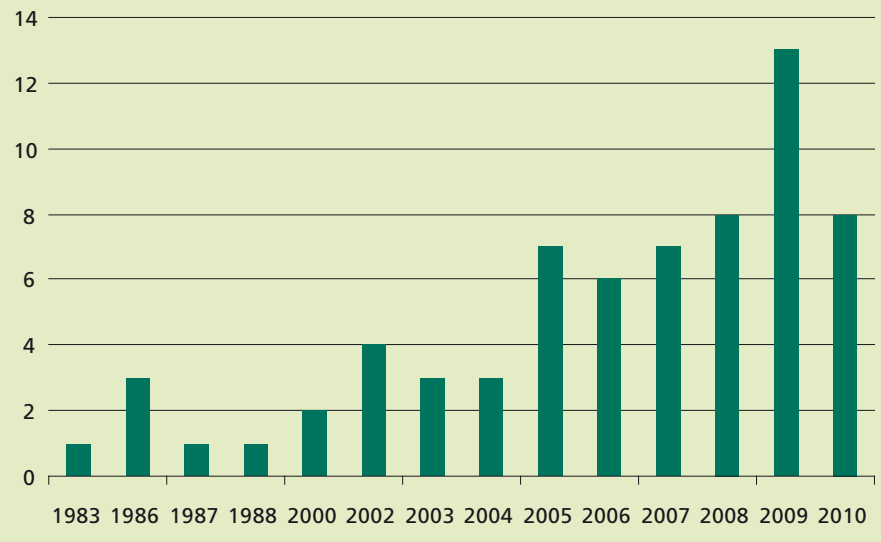
As an important seed source for Southern Sudanese farmers, local markets merit special attention. These markets sell grain and other essentials, and vary from weekly rural markets to more permanent ones in larger centres.

There is growing information about markets in Southern Sudan (www.southsudan-climis.org) as well as a large range of market value chain studies (see References). Yet how local markets work to buy and sell seed to farmers is still poorly understood. These markets are also often misrepresented, through claims that buyers and sellers never distinguish seed from grain, or statements that farmer seed purchases from local markets are always risky, desperate acts. This negative view of local markets ignores how farmers and some traders often treat seed *distinctly* from grain. Better understanding of these actions helps to build a more balanced appraisal of the contribution local markets make to seed security in Southern Sudan and can suggest new approaches to strengthen informal seed systems.

Profile of Seed/Grain Traders

The assessment team interviewed 70 traders in 13 separate markets spread across Southern Sudan. Most of those trading were relatively new to their business: slightly more than one-quarter (26

Figure 5.6: **Year traders started business (SSSA sample)**



percent) had been trading since before the CPA, but all the rest had started business within the last five to six years (Figure 5.6). So, overall, the trading sector is astonishingly new and fast-growing.

Table 5.6: **Markets visited during SSSA 2010**

State	Market
Upper Nile	Nasir
	Tonga
Eastern Equatoria	Ikotos
	Kapoeta
Western Bahr el Ghazal	Raja
	Wau
Central Equatoria	Kajokeji (Wudu)
	Morobo
Northern Bahr el Ghazal	Jow
Warrap	Wunrock
	Turalei
	Thiet
	Tonj town

In terms of their commitments to trading as a business, and their facilities, most interviewed are full-time traders and have some kind of transport (car or bicycle). But few have really large trucks with which to transport substantial goods, and less than half have access to storage facilities (either their own or rented). The use of boats to transport agricultural goods (in UNS, Nasir and Ajaya markets) suggests how challenging the trading business may be in several parts of the country. (See Table 5.7.)

Table 5.7: **Attributes of seed/grain traders interviewed during the SSSA, 2010 (N = 70)**

Trader Attributes	
Time commitment to trading	**% traders**
• Full-time trader	65
• Trader most of the time + some agricultural work	21
• Trader most of the time + some non-agricultural work	13
• Farmer who occasionally trades	2

Having transport facilities?	% traders
No	31
Yes	69
Of those with transport	
Car	54
Bicycle	26
Truck	8
Motorboat	4
Unspecified	9

Having storage facilities?	% traders
No	57
Yes	43

Source: SSSA Southern Sudan 2010, market interviews.

Do traders distinguish seed from grain?

Farmers often buy seed at the local markets, but do traders themselves actively distinguish seed from grain? This question was asked to the 70 traders, crop by crop. For all major crops, the large majority of traders (generally over 80 percent except for maize which is lower) say 'yes' they do actively distinguish seed from grain within their stocks).

Table 5.8: **Do traders manage their stocks of seed versus grain differently? (N = 70 traders)***

Crop	Is potential seed managed differently from grain?	
	Yes (%)	No (%)
Sorghum (N = 43)	84	16
Maize (N = 26)	69	31
Groundnut (N = 22)	91	9
Sesame (N = 14)	93	7
Common bean (N = 13)	92	8

* Numbers in right column indicate traders who sell a specific crop.

It is important to emphasize that not all traders are the same. Scale, in particular, may affect how different traders manage their agricultural stocks, and how they might view seed versus grain. Smaller-scale local traders often know the names of key local varieties, areas of adaptation, and planting times. Most traders at this scale are themselves farmers or belong to farming households, and are involved in selecting seed from their harvested grain. Larger traders, and those who are divorced from farming, might not have the same level of seed-specific knowledge or management skill.

Minimally, the SSSA found that traders generally keep varieties separate (especially for sorghum) and that they know when their stocks were harvested (which means they can comment on their freshness). Some traders claim that they go much further. This more refined management is described in Box 6. Except for groundnuts, which remain unshelled for seed, the general principles for management are broadly the same across crops.

Box 6: **How traders indicate they distinguish between seed and grain in Southern Sudan**

Issues of Variety Quality

- **Variety type:** Specific varieties sometimes sought by traders (e.g. yellow, fast-growing beans). Different varieties also kept separate. Groundnuts kept in shell.
- **Defined, proven sources (provenance):** Crops considered to have 'seed potential' are generally sourced locally. Beyond agro-ecological zone, traders aim to source from 'best' seed farmers.

Issues of Seed Quality

- **Visual appearance (physical properties)**: Seed should look mature, not broken, not attacked by insects/pests, or discoloured. Where demanded, traders seek seeds of a specific size or shape or colour. Depending on crop, traders look for shiny ones. Traders indicate they regularly 'grade' stocks.
- **Selection before sale:** Remove inert matter (such as dirt, pebbles).
- **Seed treatments:** Apply fungicides and treatments against insects/weevils/rats. Use of neem.
- **Germination tests:** Very limited, but done by some traders, especially with maize. (Sometimes they bite stocks to assess moisture content, and also smell their stocks.)
- **Conditions of storage:** 'Good' storage condition. Ventilation, not too hot.
- **Length of storage: Focus on 'new' harvest.**

Do traders know when farmers are buying seed?

To further determine whether there is a real seed/grain distinction, traders were asked to focus on their customers and describe signals showing a buyer was seeking seed. The signals seem to be well known and occur across markets at sowing time (Box 7). Important to emphasize is that farmers do not buy just 'anything'. They carefully cross-check quality of seed, asking about the producer, conditions of storage, and variety characteristics, and then carefully inspect and sort the physical products on hand (Box 7).

Box 7: **How a trader knows that a farmer is buying/wants seed (versus grain)**

Customer:

- directly asks for seed;
- asks about the provenance of the varieties, whether they are locally adapted and whether they have been directly procured from farmers; sometimes asks for specific seed grower's name;
- asks about the performance, in terms of maturity and yield;
- sorts out, carefully, from the bins, the specific varieties he/she wants;
- demands a specific variety, by name, known for performance;
- asks for 'modern' seeds;
- requires seed from most recent harvest (or asks about exact harvest date);
- requires that the batches be 'pure' of a single variety;
- inquires about storage conditions;
- asks about germination; bites and smells the seed to look at freshness and moisture content;
- buys a small amount, in a 'sowing size' tin.

Traders were split over whether farmers are willing to pay a price premium for seed: some said yes, but others disagreed. Most recognize that there is a sharp spike in price for certain crops and varieties at sowing time, but it was not clear if this rise is due to a) overall scarcity of the product due to the 'hunger period'; b) demand for quantities of seed, generally; or c) demand linked to specific desired varieties. An example of price data from Western Equatoria State appears below, aiming to compare sowing versus non-sowing periods. There are marked price shifts upwards.

Table 5.9: **Price trend of agricultural commodities in Western Equatoria State, 2010**

Crop	Time of sowing	Price/unit non-sowing period	Price/unit sowing period	Increase
Groundnut	March/August	20 SDG/basin	30 SDG/basin	50%
Maize	March/August	3 SDG/gallon	5 SDG/gallon	66.7%
Sesame	April	2 SDG/cup	3 SDG/cup	50%
Rice	April	5 SDG/gallon	7 SDG/gallon	40%

Traders' reflections on future trends

Traders do not see into the future any more clearly than the general population, but the SSSA team did solicit their views about their immediate business prospects, and whether the upcoming Referendum was already having an influence on their business (November/December 2011).

Half the traders (N = 35) indicated that their business had already been modified, with the rest indicating no change (29 percent) or simply not responding (21 percent).

Among those who cited changes that had already taken place, the vast majority (94 percent) assessed these as positive: The traders had expanded the range of goods they sell and the volume of trade; roads had been improved (for instance between Twic and Wau, and between Wau and Raja); and several had started to process agricultural products into commercial flours, pastes and alcohol. The three farmers who viewed patterns negatively mentioned that prices were rising, that the flow of goods from the north had lessened, and that pastoralists moving across north/south borders had done extensive damage to agricultural crops.

Again, most of the traders saw positive changes in their business practice during the last months of 2010.

Seed flows versus grain flows

Drawing on refined trader knowledge, should one expect disruptions in the ability of markets to supply seed if borders between the north and south become less fluid? This issue is important not just for the present but also for being able to model seed security trends in the future, whether it be during stress or non-stress periods.

The issue of 'seed flows versus food flows' is demonstrated using refined trader knowledge in the region of Aweil, a border area in Northern Bahr el Ghazal, and among those areas that could be most seriously affected should the security situation deteriorate.

Traders clearly understand how their various products move. In the case of food, both red and white sorghum flow into Aweil, from areas of El Obeid and Khartoum. Some sorghum also comes in from Nyala. From Aweil, traders send products north: hibiscus, gum Arabic, sesame, groundnut, honey, animal skins and some timber.

Seed flows have a markedly different pattern. For the regions around Aweil, the lion's share of seed, across crops, is sourced locally. The only real exception is groundnut, which is sometimes obtain from El Dein. This is because El Dein has a slightly later growing season, with harvests in November and December, resulting in slightly fresher groundnut seed for April plantings.

Figure 5.7 shows these flows of food (yellow arrow) and seed (blue arrow and area). Even if the north/south border were to become harder to traverse, there would be relatively little impact on access to seed. The only possible exception is certified vegetable seed, which traders indicate is currently stocked largely from Khartoum. So, overall, seed flow patterns look quite stable.

Summary: The Informal Seed Sector

The informal sector is currently the backbone of Southern Sudan's seed supply, providing around 99 percent of the seed sown. Farmers' own stocks supply roughly 40–45 percent of total seed sown, with local markets providing another 20–25 percent. Social networks (kin, neighbours and friends) serve as a third important source, particularly for planting material of vegetatively propagated crops such as cassava and banana.

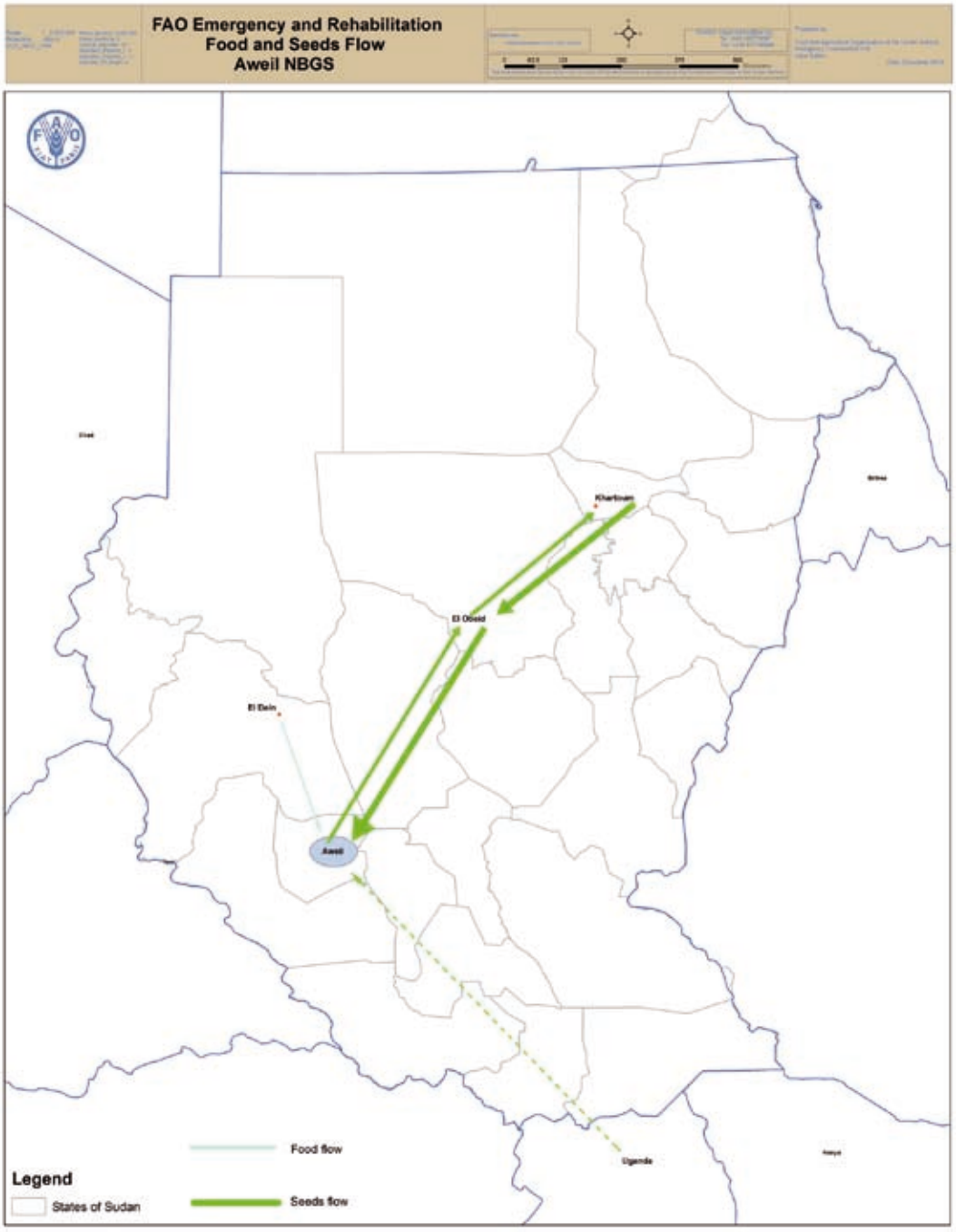
The single exception is horticultural crops. For these, certified seed and formal outlets are sometimes used, although horticultural seed is also sometimes sold in open market stalls.

Local markets analysis shows that much of the seed/grain trading business in Southern Sudan is quite new, with 76 percent of traders having started their enterprise since 2005. The oldest in the sample dates to 1983. Most traders have some sort of transport, especially cars and bicycles, but storage facilities are few.

Traders clearly describe a range of methods by which they distinguish seed from grain but, most commonly, they recognize different varieties and insist on fresh stocks when procuring seed. Similarly, there are strong signals from farmers that they buy seed (and not just grain) and that they employ a number of procedures to ensure their purchases are of higher quality. (Of course, when assessing market seed, farmers cannot see germination percentage or know of latent disease.)

Traders interviewed (N = 70) indicate that the pre-Referendum period had already changed the business environment, with the majority seeing promising trends. Roads and security are being improved and most traders in the SSSA sample are responding by increasing the volume and range of goods they sell.

Figure 5.7: **Seed and food flows to and from Aweil**



Given the nature of how seed flows across regions (much of the seed being procured locally), it is unlikely that any border insecurity would affect seed flows on an important scale. While border closings and decreased north–south trade might be projected to affect food security, the same projections cannot be applied to seed security because much seed acquisition is very local.

Finally, the informal sector is an important and dynamic force in Southern Sudan. As Chapter VI will show, it is the route through which 20 percent of new varieties are introduced to farmers. Opportunities for strengthening and professionalizing the informal seed sector – by systematically introducing varieties, raising seed quality, and promoting more specialized seed businesses – might be pursued with vigour.

GENDER ISSUES: FOOD AND SEED SECURITY

We end this overview chapter on Southern Sudanese seed systems with some comments on women. Seed security assessment and food/seed security interventions are not necessarily gender neutral. These comments should serve as a reminder that gender concerns should help shape the forms of assessment and subsequent actions taken.

Women in developing countries often take the lead in managing seed system processes, especially in terms of seed selection, storage and exchange (Sperling, 2001). In Southern Sudan, there are other issues to be highlighted around rural women, especially because an unusually large number of the households (surveyed by the SSSA) are headed by females. In particular, Southern Sudanese farmers are aiming to expand farming areas quite dramatically, which means female-headed households will also need to be dynamic, and not just maintain cultivated areas.

To date, there has been little analysis of the role and needs of rural women in Southern Sudan, or of the contraints they face and opportunities open to them. Much of the gender-related work focuses on urban sectors and protection issues such as post-trauma problems stemming from the civil war and the risk of violence faced specifically by girls and women exposed to conflict. Harnessing more knowledge about gender-linked rural concerns is an urgent priority for those involved in development and emergency initiatives.[6] Below, we give a short overview of the status of female-headed households, then focus on possible women's crops, labour constraints, and promising models to support women.

Rural Women in Southern Sudan: Initial Insight

Southern Sudan is unusual in terms of the extent of female-headed households. The figure is 47 percent within the overall SSSA sample, with a much higher rate, over 80 percent, observed in the Warrap State sample. Civil war, emigration and the continuing phenomenon of split households (some family members staying in the north) suggest it is not clear how long this relatively unbalanced situation will last.

The SSSA also found that female-headed households cultivate less land than male-headed ones (Table 5.10). Hence, understanding the agricultural constraints on female-headed households would seem to be a key priority for being able to increase production in Southern Sudan.

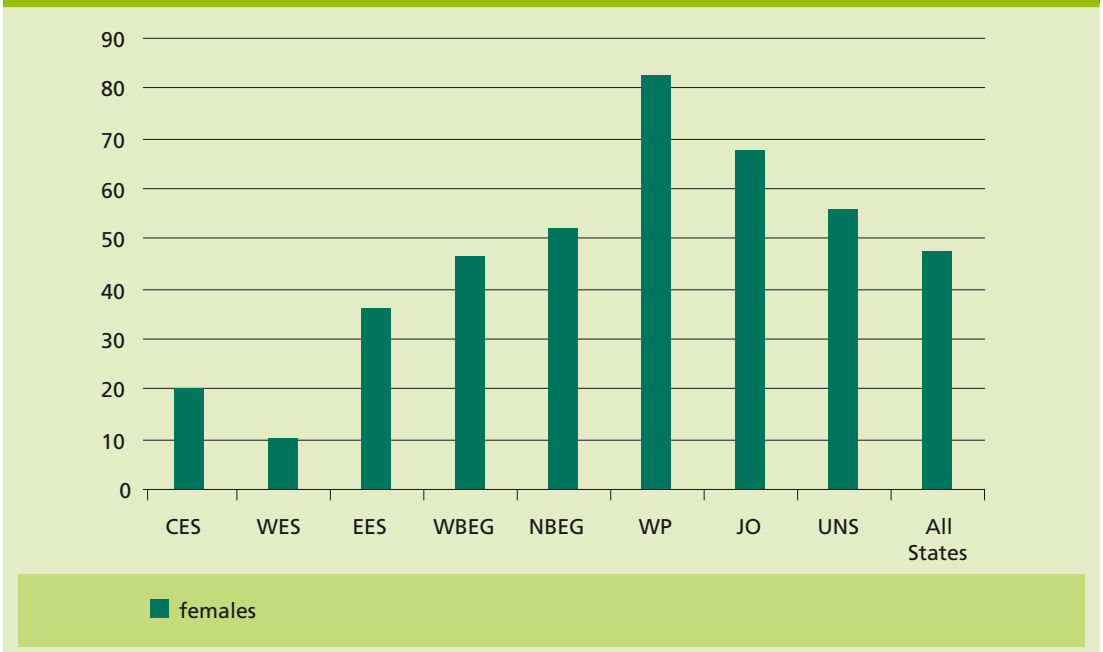
Table 5.10: **Land area cultivated by female- and male-headed households, 2010**

Gender of HH head	N	<1 feddan	1–3 feddans	> 3 feddans	Total*
Females	373	27.6%	60.1%	12.3%	100%
Males	409	16.6%	63.3%	20.1%	100%

* P-value 0.0001

6 For an informative recent overview of gender-related issues in agriculture, see the FAO publication (2011) Women in Agriculture: Closing the gender gap for development. http://www.fao.org/publications/sofa/en/

Figure 5.8: **Percentage of female-headed households in the SSSA sample, by state**



Land is not a constraint in Southern Sudan, even for women. Women have access to their own plots and are able to sell produce to meet the immediate food security needs of their households. In certain states, women are even able to buy land outright (source: WES, focus group discussion, November 2010). Labour, rather than land, may be a major constraint on women being able to expand agricultural activity (see section below, Labour constraints specific to female-headed households).

Women's focus group discussions also suggested that female-headed households profoundly lack bargaining power. This is particularly evident in the case of bride-price. Female heads of household stated they get markedly less for their daughters than do male heads of household (source: focus discussion groups in both Aweil and Ikotos). This bias has to be added to an overarching decline in the size of dowries. Among the Dinka, the bride-price has declined in the last five years from 11 cattle to 5, 4 or even 3, with this drop attributed to a shortage of potential husbands.

Are there women's crops?

In Southern Sudan the division of labour – and subsequent control of the harvest – seems to vary greatly by ethnic group and state. This merits much closer attention. In certain zones, men concentrate on livestock raising and women take charge of crop agriculture in its entirety. In other zones, women tend to be associated most closely with crops necessary for household food security. In some zones (such as Mugwo) even women specialize, so one garden might be managed for family consumption while another is geared to generating cash to pay education and health fees.

An example from Western Equatoria State (Box 8) serves to show how crops and the control of harvest might be managed in a given area.

Box 8: **Who controls the harvest within a household?**

In WES, control was described as follows in a mixed community focus group. Women normally have unlimited access to harvested cereals, legumes, oil seed crops, roots and tubers, when these are intended for household consumption. The sale of these crops is most often controlled by men, with women allowed to sell not more than a basin (about 15 kg) on a local market day. The resulting cash is used only to pay for domestic needs such as soap, salt, plates and cups. An average woman might earn 20 to 40 SDG per week, which is somewhat limited by the number of market days she attends. Apart from the major town, where public market places are open throughout the week, most rural markets are held not more than twice weekly, hence limiting women's opportunities for agricultural sales.

It is also well recognized within this WES community that vegetables are women's crops at the household level and rarely do men engage in vegetable production. A woman who does not have a garden around her home is considered lazy. Popular vegetable crops around homesteads are okra, amaranth and pumpkin. Vegetables such as tomato, cabbage, onion and eggplant are normally grown for commercial enterprise, though okra is also highly marketable. Therefore, opportunities for empowering women likely lie within support to vegetable production as a key income-generating business.

Excerpt from WES site-specific report

Income-generating activities

Scrambling for money is an ongoing challenge in Southern Sudan. So women take charge of a range of opportunities, each very important but, on its own, not very lucrative.

Rural women may:

- cut and sell grasses (for thatch, fodder) and bamboo
- cut and sell firewood
- sell vegetables
- do casual labour for seeds
- dry and sell okra
- make and sell local brew made from maize, cassava, sorghum and sesame
- make and sell flours (sorghum, cassava and maize) and pastes (sesame, groundnut).

Labour constraints specific to female-headed households

In all of the above, labour is a major constraint for women, and particularly for female-headed households. Simply put, a number of tasks demand a lot of labour, especially physically demanding labour.

Here are a few of the special difficulties facing female-headed households:

- opening new land
- fencing their farms to keep out livestock and other predators
- steering away wild animals including snakes
- cutting the large house poles that form the central support of their thatched huts.

Women without husbands or elder sons claim that male-headed households are simply not willing to let their men lend a hand. Some female mutual support labour networks appear to have been formed, but their extent and efficacy have not been verified within the SSSA.

Promising models to support women

A number of special women's groups have started, most often catalyzed by NGOs. They tend to specialize in income-generating activities such as vegetable production, poultry raising and bee-keeping. The challenges most face seem to be similar: how to get capital, transport and marketing expertise. The Abulometa women's group was among the large ones encountered during the SSSA (Box 9).

Box 9: **Abulometa women's group eager for empowering assistance**

The Abulometa women's group started in 2007 and currently has some 40 members, including 3 men! They have joined together to reduce costs, help each other (for instance with school fees) and to market their produce jointly so as to increase their bargaining power. As a group, they have a formal certificate from the government, a bank account and even a logo.

Abulometa sells crops such as onions, tomatoes, sweet potatoes and cassava, but would welcome more access to horticultural seed such as eggplant and cabbage, which are found only in Yei, about 31 km away. Technical advice is also high on their wish list: they have had some training in common bean seed production, but not much more.

Their vision is to move to agribusness, if transport challenges can be alleviated (see Box 14), and to build a local store. This outlet would sell salt, saucepans and the like to a surrounding population of some 2 000 who are now virtually unserved.

Most of all they want help that empowers them, particularly loans and technical advice. Enough with emergency aid! They are organized and eager for change.

Summary: Gender Issues, Seed and Food Security

Female headed-households represent almost half (47 percent) of the SSSA sample, yet cultivate markedly less land than male-headed ones. Boosting their production potential would seem to be key to increasing food security across Southern Sudan.

Women are known for specializing in seed selection and storage, although the division of labour varies greatly by ethnic group and State. For instance, in agro-pastoral zones, women may take the burden of *all* crop agriculture, while men specialize in livestock raising.

Rural Southern Sudanese women engage in a range of activities to generate income, but none has been documented as being unusually lucrative. Vegetable production has been tried as one avenue for professionalizing agro-enterprise initiatives among groups of women.

Of special note are the labour constraints on female-headed households: they tend to lack the capacity for heavy labour that is needed for a number of pivotal tasks, including the opening of new land and fencing existing farmlands to keep out predators. As female-headed households, their production potential is being hindered.

Finally, relatively little analysis of rural women's needs, opportunities and constraints has been done. To date, much of the gender-related work has focused on the urban sector and gender-linked violence. Specialized study of the rural female realm is urgently required.

VI. Field Findings: Across Sites

This chapter reviews the field findings of the SSSA across the various sites, including 16 counties in 8 states (Table 2.5). The choice of sites offers good coverage of Southern Sudan's smallholder agricultural regions and the varied seed security situations one might encounter.

The fieldwork for the SSSA took place in November and December 2010, at the end of the main growing season across regions. Overall, rain and crop conditions were considered good for 2010. Rains started on time (April, May), levels were normal to above normal, and rain was generally well distributed in most parts of Southern Sudan. Localized dry spells ranging from two to four weeks did occur in Upper Nile, Unity, Warrap and Jonglei States; and localized floods affected crops and settlements in Unity, Upper Nile, Jonglei, Warrap and Lakes States. The CFSAM estimated that the area under cereals in 2010 increased by 8 percent as compared with 2009 and that cereal yields increased 16 percent as compared with 2009 (to 0.95 tonnes/ha from 0.82 tonnes/ha). Key to the 2010 season were the events associated with the January 2011 Referendum. Significant returnees were anticipated from the north (estimates of 300 000–500 000), possibly requiring both food and seed supplies. While the Referendum itself did not raise major security concerns, rebel activities (associated with the Lord's Resistant Army), tribal armed conflicts and tensions over borders affected farming and husbandry activities to some degree (see CFSAM, 2010).

Note that the relatively good 2010 season followed a poor 2009 agricultural year. Late and sporadic rains led to crop production constraints in many parts of Southern Sudan and resulted in significant re-planting, a virtual loss of the first crop in areas of bimodal rainfall, and poor yields in many areas. Estimates suggested the 2009 harvest to be 50 percent below that of 2008 (CFSAM, 2009), with livestock production also dipping substantially. Agricultural production in 2009 was further hampered by an increase in civil insecurity which was characterized by unprecedented levels of cattle raiding, escalating tribal conflict, and incursions by the LRA.

Hence, the SSSA unfolded in a relatively good year (2010), but was proceeded by a year of poor agricultural production. (See Chapter III, Figures 3.2 and 3.3 for more specific and longer-term crop production data.)

The assessment considered two major themes. It analyzed the short-term, acute seed security situation, focusing on the main 2010 season (ending in the period September–November) and the 2011 upcoming season (generally starting April–May 2011). This included monitoring immediate seed procurement strategies and analyzing crop profiles and land use. As the second thrust, the SSSA considered medium-term trends, including possible chronic seed security problems and emerging opportunities. Issues under consideration included the importance of seed/grain markets, agricultural product transformation, and access to modern varieties.

Findings are indicated below by these two major themes: a) acute seed security findings; and b) possible medium-term chronic seed system stresses and emerging opportunities. Note that overview tables are presented in the main text to indicate the trends across sites, that is nationwide. The complete site-by-site tables are available in partner site-specific reports. Some findings by site are presented below to highlight differences among states or counties.

ACUTE SEED SECURITY FINDINGS, 2010/2011

Issues of seed security were first scrutinized for the short term: how and where did farmers obtain seed for the main 2010 season? Did they plant as 'normal' in terms of quantity and quality of planting material? What do they assess as their seed security strategy and prospects for the 2011 season? (Note: seed system stability and resilience are assessed by looking at multiple seasons in a row.)

Seed sources and quantities planted, 2010

All farmers: sources and quantities of seed, 2010

Table 6.1 and Figure 6.1 show the sources and quantities of seed actually planted by farmers for the main 2010 season. Information is given in both table and graph form so as to make highly visible the relative use of sources and the scale of seed use. Several features are of note.

Overall, over 90 percent of the seed farmers sowed came from local channels, including their own stocks, the local market, or through social networks of neighbours, friends and relatives. This suggests the importance of informal seed systems as the core seed sources.

A closer look reveals that farmers' own stocks were the number one source for four of the seven major crops. For the other three, sesame and the two legumes (groundnuts and common beans), local markets were key for sourcing seed. (Note: in many countries local markets are especially important for obtaining legume seed because of the high cash value of legumes, as well as storage constraints.)

Neighbours, friends and relatives (abbreviated 'neighbour' in the table) were especially important as a seed source for the vegetatively propagated crops, banana and cassava. The strong use of such 'social network' channels to obtain cuttings has implications for designing initiatives to multiply cuttings as well as for efforts to introduce new material such as varieties resistant to cassava mosaic virus.

Farmer seed producers, those community-based groups most often mobilized by the government, FAO or certain development projects, provided 0.3 percent of the seed sown (mostly for rice and cowpea) in the sample. This suggests they do have a presence, but are at a fledging stage. It should, however, be noted that most seed producers are supported by development organizations (FAO, NGOs and CBOs) who in turn collect the seed produced and channel it into their emergency responses, hence limiting direct access of the seeds by farming households. The rationale and current capacity of farmer seed producers were addressed in Chapter IV. Ultimately such seed producers will become viable only if their seed production is tied to an explicit marketing strategy and if the varieties on offer remain desired by farmers, traders and agro-enterprises.

Agro-input dealers, the classic formal commercial channel, provided a very small proportion of the seed farmers sowed, only 0.1 percent. (Note that vegetable seed was bought from local market channels, not established, specialized stores.) The low use of agro-dealers was most likely a function of their near absence, as the SSSA team found established agro-dealers only in Wau, Yei and Aweil Center.

Finally, **seed aid**[7], which here includes both developmental and emergency aid, provided slightly under 10 percent of the total seed sown in the main 2010 season. In terms of the major crops, it was particularly important for sweet potato (22.9 percent of cuttings planted). While sample sizes are relatively smaller, developmental seed assistance seems of note for specialty crops, such as okra, millet and rice.

7 The disaggregation of seed aid between NGOs/CBOs and FAO in many tables and figures does not give a completely accurate representation of source as FAO seeds are distributed in partnership with NGOs and sometimes with SMoAs. A farmer/beneficiary may know only the organization that directly provided him/her with the seed but not who brought in the seed originally.

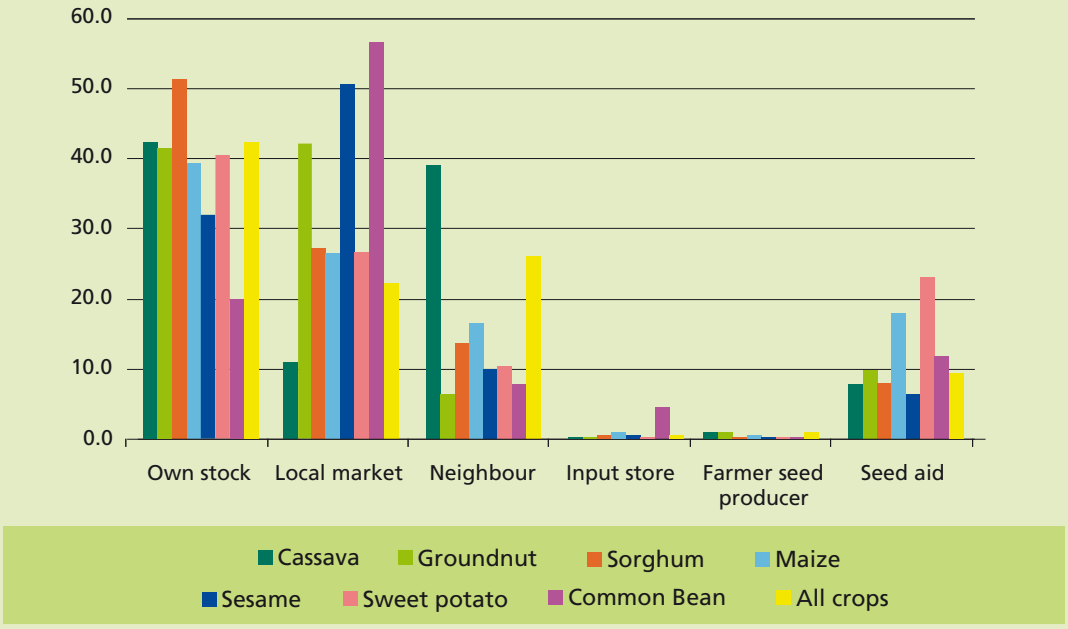
Table 6.1: **Seed (kg) planted and sources farmers used, 2010 main season, by crop, across all sites (N = 3571 responses)**

		Sources of seed (%)									
Crop	**Total kg**	**Own stocks**	**Local market**	**Agro-input dealer**	**CBG**	**Neighbour**	**Gov't**	**NGO**	**FAO**	**Unspecified sources**	**Total[a]**
Cassava	36322.05	42.1	10.8	0.0	0.3	39.0	0.9	6.5	0.3	0.0	100
Groundnut	14492.52	41.6	42.1	0.0	0.3	6.2	0.0	9.1	0.7	0.0	100
Sorghum	7852.94	51.2	27.2	0.1	0.0	13.5	0.7	5.5	1.7	0.0	100
Maize	5335.65	39.1	26.3	0.4	0.1	16.3	2.6	13.5	1.7	0.0	100
Sesame	1007.38	31.8	50.5	0.2	0.0	10.0	0.1	5.4	0.7	1.3	100
Sweet potato	905.55	40.3	26.6	0.0	0.0	10.3	0.0	22.9	0.0	0.0	100
Common bean	680.30	19.8	56.5	4.4	0.0	7.6	0.3	11.4	0.0	0.0	100
Okra	413.35	8.7	20.2	0.0	0.1	29.8	0.0	39.7	1.5	0.0	100
Millet	312.50	15.7	13.4	0.0	0.0	26.1	1.1	43.7	0.0	0.0	100
Banana	210.00	14.3	4.8	0.0	0.0	52.4	0.0	28.6	0.0	0.0	100
Cowpea	203.95	42.9	28.0	0.0	3.9	7.6	0.0	13.2	4.4	0.0	100
Rice	187.04	12.6	37.2	0.0	1.6	1.6	0.0	47.1	0.0	0.0	100
Vegetables	53.13	0.2	97.9	0.0	0.0	0.8	0.0	0.6	0.6	0.0	100
Pumpkin	34.23	23.8	4.4	0.0	0.0	70.2	0.0	1.5	0.0	0.0	100
Yam	15.00	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100
Tomato	8.10	0.0	1.2	0.0	0.0	86.4	0.0	6.2	6.2	0.0	100
Orange	2.00	75.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100
Coffee	1.00	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100
Cabbage	0.52	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100
Onion	0.42	0.0	28.6	0.0	0.0	0.0	0.0	71.4	0.0	0.0	100
All crops	**68038**	**42.1**	**22.2**	**0.1**	**0.3**	**26.0**	**0.8**	**8.4**	**0.2**	**0.02**	**100**

NB: In all tables, CBG means community-based groups.

[a] Difference from 100% is due to normal rounding variability.

Figure 6.1: **Sources farmers used (% of total seed sown) for 2010 main season, seven major crops**

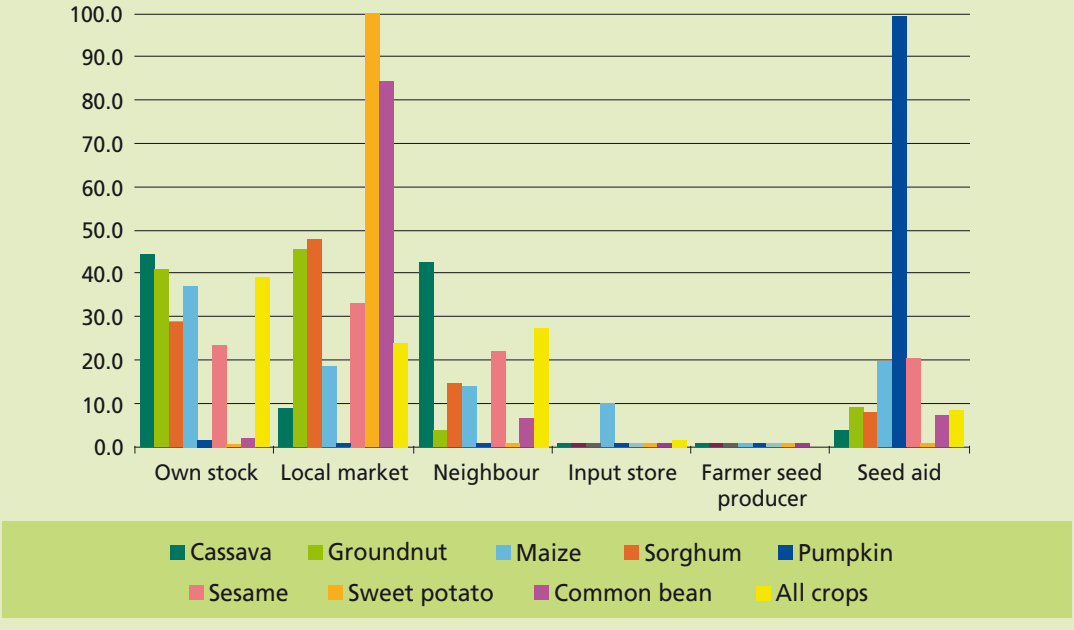


IDPs, returnees, refugees: sources and quantities of seed 2010

Were the seed sources used by IDPs, returnees and refugees (taken as a single group) comparable to those used by the overall farmer sample? Normally, one would hypothesize that this potentially vulnerable population would depend more heavily on different types of outside help.

Table 6.4 and Figure 6.2 show that **IDPs, returnees and refugees generally sourced seed for the 2010 main season in the same way as the full sample, with over 90 percent of their sowing material coming from local channels, especially their own stocks and local markets.**

Figure 6.2: **Sources IDPs, etc. used (% of total sown) for 2010 main season, major crops**



Overall seed aid, from UN, government and NGO sources combined, accounted for slightly under 9 percent of the seed sown by this group of people (with this varying by crop). For sorghum, the main staple across Southern Sudan, this group obtained 8 percent of its sowing material from seed aid. Aid was mainly the first source of seed for specialty crops such as pumpkin, which suggests that this was developmental rather than emergency aid.

One clear conclusion here is that farmers' own channels provide the lion's share (over 90 percent) of seed sown, even in the case of the potentially vulnerable.

This does not mean that outside aid is not important. In 2010 it seems to have had a dominant role mainly for specialty crops , but not for subsistence crops.

Table 6.2: **Seed (kg) planted and the sources IDPs, etc. used for the 2010 main season, by crop, across all sites (N = 433)**

		Sources of seed (%)								
Crop	**Total kg**	**Own stock**	**Local market**	**Agro-input dealer**	**CBG**	**Neigh-bour**	**Gov't**	**NGO**	**FAO**	**Total**
Cassava	4457	44.6	9.1	0.0	0.0	42.6	0.0	3.7	0.0	100
Groundnut	1813	40.9	45.9	0.0	0.0	3.9	0.0	9.3	0.0	100
Sorghum	771	29.1	48.1	0.0	0.0	14.7	0.0	8.1	0.0	100
Maize	403	37.4	18.7	9.9	0.0	14.2	0.0	18.2	1.6	100
Pumpkin	171	0.4	0.0	0.0	0.0	0.0	0.0	99.5	0.0	100
Sesame	103	23.8	33.5	0.0	0.0	22.3	0.0	18.4	1.9	100
Sweet potato	101	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100
Common bean	100	1.5	84.3	0.0	0.0	6.7	0.0	7.5	0.0	100
Rice	30	5.1	50.8	0.0	0.0	10.2	0.0	33.9	0.0	100
Okra	18	22.7	22.7	0.0	0.0	50.3	0.0	4.3	0.0	100
Cowpea	9	0.0	24.3	0.0	0.0	10.8	0.0	64.9	0.0	100
Millet	8	43.8	0.0	0.0	0.0	56.3	0.0	0.0	0.0	100
Tomato	1	0.0	0.0	0.0	0.0	0.0	0.0	100.	0.0	100
All crops	**7985**	**39**	**24**	**0.5**		**27**		**8.6**	**0.11**	**100**

State-by-state analysis: sources and quantities of seed, 2010

State-by-state analysis gives additional insight into possible patterns of seed sourcing and seed security. Of particular note is that seed obtained from NGO sources was of unusual importance in three states: Eastern Equatoria, both Ikotos and Kapoeta north; Northern Bahr el Ghazal, especially Aweil East; and Upper Nile State, especially Nasir (SSSA partner site-specific tables). Whether farmers were unusually stressed in these areas, or whether these zones have been targeted for developmental actions needs to be pursued further (and we do look at stress issues in the section "Are farmers seed-stressed?" below). As an example of the variation in seed sourcing, we post the seed acquisition data for Ikotos county in Table 6.3.

Table 6.3: **Seed (kg) planted and the sources IDPs, etc. used for the 2010 main season in Ikotos county (N = 231)**

		Sources of seed (%)								
Crop	**Total kg**	**Own stock**	**Local market**	**Agro-input dealer**	**CBG**	**Neighbour**	**Gov't**	**NGO**	**FAO**	**Total**
Cassava	3496	13.2	5.7	0.0	0.0	35.8	9.7	35.6	0.0	100
Maize	583	21.9	19.6	0.0	0.0	11.7	19.6	27.2	0.0	100
Sweet potato	545	19.3	25.7	0.0	0.0	17.1	0.0	38.0	0.0	100
Sorghum	408	21.2	15.1	2.4	0.0	12.3	10.6	38.3	0.0	100
Millet	220	0.0	2.0	0.0	0.0	34.4	1.6	61.9	0.0	100
Common bean	43	11.8	64.7	0.0	0.0	0.0	0.0	23.5	0.0	100
Groundnut	38	37.3	2.7	0.0	0.0	13.3	0.0	46.7	0.0	100
Cowpea	13	81.5	3.7	0.0	0.0	0.0	0.0	14.8	0.0	100
Sesame	13	0.0	40.0	0.0	0.0	0.0	0.0	60.0	0.0	100
Okra	1	0.0	0.0	0.0	0.0	90.9	0.0	9.1	0.0	100
Coffee	0.3	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	100
Total	**5360**	**15.1**	**10.3**	**0.2**	**0**	**28.8**	**9.4**	**36.2**	**0.0**	**100**

Quality of seed sown, 2010

In supplementing information here about the sources of seed, we add insights on the quality of seed sown, as assessed by farmers themselves. Overall, and across crops, farmers seem pleased with the quality of seed they sowed, and this is evidenced by both their ratings (good, average, poor) and statements about whether they would sow the seed again (Table 6.4). There were specific concerns expressed about cowpea and pumpkin. It is Important to stress here that the quality standards are local ones and might not correlate with what formal seed sector specialists would label as 'quality seed'.

Table 6.4: **Farmers' assessment of the quality of seed sown, 2010 main season, by crop, all states**

Crop	N	Seed quality			Sow it again?	
		Good (%)	Average (%)	Poor (%)	Yes (%)	No (%)
Sorghum	1068	83.2	11.6	5.1	98.0	2.0
Maize	753	82.1	13.4	4.5	98.8	1.2
Millet	39	87.2	12.8	0.0	100.0	0.0
Rice	26	38.5	57.7	3.8	100.0	0.0
Cassava	306	83.3	14.1	2.6	97.4	2.6
Groundnut	538	73.6	20.3	6.1	96.5	3.5
Common bean	131	78.9	20.3	0.8	98.5	1.5
Cowpea	77	67.5	11.7	20.8	94.8	5.2
Sesame	330	76.3	17.3	6.4	96.1	3.9
Okra	123	82.9	5.7	11.4	98.4	1.6
Tomato	8	100.0	0.0	0.0	100.0	0.0
Green vegetables	52	100.0	0.0	0.0	100.0	0.0
Pumpkin	28	53.6	14.3	32.1	96.4	3.6
Sweet potato	16	81.3	12.5	6.3	93.8	6.3
All crops	**3518***	**80.2**	**14.3**	**5.5**	**97.7**	**2.3**

* This figure includes 23 farmer responses related to several minor crops not reported individually in the table.

Are Farmers Seed-Stressed? Are Amounts Sown in 2010 More, less or Same as Usual?

2010 sowing amounts, compared with normal amounts, by crop

To understand better any possible vulnerability, the SSSA team also asked farmers to compare the quantities of seed they sowed, by crop, with what they would normally sow in the same season and at the same time each year. Basically, the question was this: Were the 2010 patterns 'normal' or 'different' from what farmers usually do, as gauged by the farmers themselves?

For all five major crops (that is, those with major sample sizes), farmers reported they significantly expanded sowing amounts in 2010, ranging from 9 percent for maize to 56 percent for cassava. Also, across all 20 crops considered, farmers increased their sowing amounts by some 17 percent in 2010 (Table 6.5). While such an increase in sowing amounts can only loosely be correlated with increases in sowing areas, the data suggest an important positive trend. Qualitative statements by farmers also reinforce this finding of sowing area expansion. Their message is that they are quickly opening new land areas and some are intensifying production, especially for market.

Note that problem areas might be investigated further for certain crops, especially cowpea and possibly vegetable seed (although the sample size for the latter is too small to reach a firm conclusion).

Table 6.5: **Comparison of quantities sown in 2010 main season with quantities normally sown, by crop, all farmers**

Crop	Number of farmers	% households			Total %	% change in seed quantities for all growing the crop	
		More	Same	Less		Mean	SD
Sorghum	676	33	23.7	43.3	100	13.6	106.7
Maize	504	31.9	22.8	45.2	100	9	92.8
Groundnut	459	32.9	23.1	43.8	100	31.6	236.9
Sesame	290	24.8	34.8	40.3	100	12.2	141.5
Cassava	209	45	19.1	35.9	100	56.1	367.5
Okra	115	20	38.3	41.7	100	-5.4	67.3
Common bean	96	34.4	31.3	34.4	100	23.5	77.2
Cowpea	69	11.6	24.6	63.8	100	-25.3	52.4
Millet	27	37	25.9	37	100	21.7	75.5
Pumpkin	26	19.2	34.6	46.2	100	16.4	183
Vegetables	23	13	26.1	60.9	100	-26.7	53.4
Rice	19	26.3	26.3	47.4	100	-17.7	39.6
Sweet potatoes	10	30	0	70	100	-8.4	46.1
Tomato	8	25	50	25	100	-0.75	57.7
Onion	6	33	16.7	50	100	-16.7	70.7
Banana	3	33.3	66.7	0	100	-0.63	58.6
Butter leaves	2	100	0	0	100	50	
Cabbage	2	0	50	50	100	-25	35.4
Eggplant	1	100	0	0	100	50	
Coffee	1	100	0	0	100	100	
All crops	**2547**	**31.4**	**25.5**	**43.1**	**100**	**17.1**	**171.3**

Note: The same analysis of seed use in 2010 versus 'normal' was done for the IDPs potentially vulnerable group. There, across crops, farmers had increased sowing amounts by some 3.6 percent.

2010 sowing amounts, compared with normal amounts, by crop and land size

To explore even further possible vulnerability, sowing amounts were reviewed according to the land area cultivated by farmers. Did those who cultivated smaller areas (<1 feddan) show different patterns (and stress) than those who were able to cultivate larger areas (1–3 feddans or > 3 feddans)?

For the entire sample, Table 6.6 shows that **farmers were generally increasing the seed volumes sown regardless of the area of land under cultivation** – which is quite positive news. More refined results emerge from a crop-by-crop examination. Larger farmers were generally increasing sowing amounts to a higher degree than smaller farmers in the case of two crops, sorghum and cassava; but no major differences were observed for other crops. The magnitude of the difference is largely due to a handful of larger farmers who posted very dramatic relative increases (100 percent or

more) in sorghum and cassava cultivation. Such a set of progressive leaders might merit more focused attention.

Trying to further understand possible vulnerability, we present information in Table 6.7 on farmers at the extremes – those with the smallest land areas under cultivation and those with the largest. Significantly, farm size was *not* a factor in the magnitude of increase or decrease in seed use, except for sorghum where the declines among small farmers were slightly higher than among larger ones (although this trend is weak).

What Table 6.7 does show is a great deal of dynamism. **Considering all crops, farmers who chose to increase sowing amounts more than doubled their usual rates, on average**. These mean increases were, however, quite variable and differed by crop (e.g. groundnuts had larger relative increases than maize or sorghum). **For those who decreased sowing amounts in the 2010 main season, sowings were reduced by 40–48 percent on average, compared with their normal rates**. Obviously farmers have important constraints and opportunities which need to be explored further. (See section below, Focusing on potential problems.)

Table 6.6: **Mean percentage change in seed volumes planted this season, by area cultivated and crop (pooled sample, those planting more, the same and less)**

Crop	Area cultivated	N	Mean	SD	F
Sorghum	<1 feddan	147	2.6	69.9	3.16*
	1–3 feddans	373	12.2	118.9	
	>3 feddans	105	24.5	72.9	
Maize	<1 feddan	92	1.3	72.5	0.94
	1–3 feddans	286	2.9	63.4	
	>3 feddans	85	28.6	167.4	
Cassava	<1 feddan	45	5.1	54.8	2.83^
	1–3 feddans	114	32	117.3	
	>3 feddans	28	226.5	924.8	
Groundnut	<1 feddan	101	10.7	134.7	0.63
	1–3 feddans	245	26.2	187.1	
	>3 feddans	67	75	454.5	
Sesame	<1 feddan	62	9.1	100.4	0.91
	1–3 feddans	174	19.7	166.3	
	>3 feddans	37	10	66.2	
All crops	**<1 feddan**	**511**	**5.6**	**96.7**	**4.8****
	1–3 feddans	**1443**	**12.1**	**129.6**	
	>3 feddans	**374**	**45.4**	**333.6**	

NB: The symbols **, * and ^ denote significant at 1 percent, 5 percent and 10 percent respectively.

Table 6.7: **Mean percentage change in the seed volumes planted in 2010, by area cultivated and crop (stratified sample, those planting more and less)**

Crop	Area cultivated	Mean % change in seed quantities planted this season							
		Less than Usual				More than Usual			
		N	Mean	SD	F-value	N	Mean	SD	F-value
Sorghum	<1 feddan	64	-47.4	21.6	2.86^	39	87.7	79.5	1.24
	1–3 feddans	167	-40.4	19		114	99.2	184.8	
	> 3 feddans	34	-42.1	20.1		51	78.5	67.5	
Maize	<1 feddan	42	-46.6	18.2	1.15	25	83.2	92.6	0.01
	1–3 feddans	141	-41.8	17.8		83	81	61.7	
	> 3 feddans	32	-44.5	23		31	124.2	249.3	
Groundnut	<1 feddan	45	-48.7	18.4	0.22	25	130.7	230.8	1.11
	1–3 feddans	116	-47.1	22.8		71	167.4	302.5	
	> 3 feddans	30	-45.3	23		24	265.9	729.4	
All Crops	**<1 feddan**	**224**	**-47.8**	**20.5**	**1.12**	**130**	**104.4**	**146.4**	**0.17**
	1–3 feddans	**657**	**-45.5**	**20.6**		**407**	**116.2**	**206.4**	
	> 3 feddans	**143**	**-45.8**	**21.5**		**141**	**166.9**	**520.9**	

The ^ symbol denotes significant at 10%.

Note on method: The individual % data were explored and found to be skewed to the right. The data were first divided into two groups, each with three farm size categories. The first group represented the negative change from usual volumes and the second group was the subsample of positive changes from the usual volumes. Although more than 25% of all farmers did not change seed quantities from their usual rates, they were not included in this first analysis. After the stratification, and transformation of data to ensure normal distributions, an analysis of variance examined whether the magnitude of increase, or decrease, varied significantly by the area cultivated. This was carried out for sorghum, maize and groundnut only, as these crops had sufficient observations to support valid statistical inference.

Sowing amounts 2010: female-headed and male-headed households

Did female-headed and male-headed households within the SSSA sample show similar or differing patterns of seed use, with respect to whether they increased, decreased or maintained sowing amounts for various crops?

Important first to note is that female-headed households tend to cultivate smaller areas than male-headed ones: that is, female household heads were more likely to cultivate < 1 feddan and less likely to cultivate > 3 feddans compared to men (Chapter V, Table 5.8). Within the 2010 SSSA, **women tended to maintain their previous quantities of seed sown** (Table 6.8).

Table 6.8: **Overall sowing patterns of female- and male-headed households in 2010 main season, compared with normal years**

Sowing pattern	N	Female-headed Households (%)	Male-headed Households (%)	Total* (%)
More	772	41.1	58.8	100
Same	631	56.9	43.1	100
Less	1026	46.0	54.0	100

*P value 0.0001

State-by-state comparisons of 2010 sowing amounts

Finally, we compare sowing trends state by state. Table 6.9 shows there are quite important differences among states, in both positive and negative directions. **Farmers in Eastern Equatoria were generally more likely to have increased their volumes of seed sown in the 2010 main season while those in Upper Nile, Central Equatoria and Northern Bhar el Ghazal were more likely to have reduced volumes. The overall % change in seed quantities also confirms negative seed sowing trends in Upper Nile State and Northern Bhar el Ghazal.** Farmers in these two states (in the samples monitored) seem to be experiencing special stress. The kinds of stress are examined specifically in the section below, Focusing on potential problem areas.

Table 6.9: **Comparisons of volumes planted 2010 main season on with normal volumes, and mean percentage change in seed volumes, by state, across crops**

State	% of households				% change in seed quantities for all crops
	N	More	Same	Less	
Central Equatoria	353	24.7	17.3	58.1	6.3
Western Equatoria	344	43.9	23	33.1	41.1
Eastern Equatoria	305	64.3	11.8	23.9	47.5
Western Bhar el Ghazal	302	39.1	13.3	47.7	32.5
Northern Bhar el Ghazal	285	6.7	43.5	49.8	-10.2
Warrap	436	26.8	39.5	33.7	10.2
Jonglei	291	37.8	33	29.2	39.2
Upper Nile State	271	16.2	17.3	66.4	-23.1
All States	**2587**	**32.6**	**25.3**	**42.1**	**17.4**

NB: Chi2 464.8, significant at 1%, P-value 0.0001. Analysis by crop was only valid for sorghum and hence only analysis aggregated for all crops is reported.

Seed Sources and Quantities Projected to be Planted in 2011

Farmers across Southern Sudan were asked the same questions on actual seed sources and quantities to be planted for the next major season, April/May 2011, which was four to five months away at the time of the SSSA.

While 'planned seed sources' are not proven 'hard' data, they are a good indicator of whether farmers expect stress or trouble. Furthermore, given that many of the interviews were conducted by former aid providers, farmers answering this question could have also shown bias by trying to

elicit seed aid help. In contrast, the results below show a strong trend toward self-sufficiency – and away from asking for seed-related aid.

All farmers: projecting 2011 season

Farmers in the full sample stated that they expected their sources for the upcoming 2011 season to be basically the same as for 2010. Figure 6.3, far from revealing stress, shows that for the 2011 season, farmers aim to source upwards of 90 percent of their seed from local channels and are counting on 'outside help' for about 10 percent of their seed. **This stated strategy for near self-reliance is in spite of their intentions to increase surface areas planted in 2011 by a large amount, 80 percent** (see section below, Are farmers seed-stressed?).

IDPs, returnees and refugees projecting sources and quantities of seed for 2011 season

Among the group of IDPs returnees and refugees, farmers state they are counting on outside aid for about 5 percent of their seed in 2011 (Figure 6.4). They aim to source 95 percent of their seed from local channels. As in the case of the full sample, **the IDP group aims to significantly increase planted area in 2011, by a projected 60 percent or more** (see section below, Are farmers seed-stressed?). Of special note is that all the eggplant to be planted as a major crop in 2011 is with the IDP sample.

State by state: sources and quantities of seed, 2011

The patterns of seed sources state by state parallel those of the overall sample. Zeroing in on the potential stress areas, we report below what farmers are expecting in terms of outside assistance, that is, direct aid from GoSS, NGOs, FAO or a combination of those sources. As Table 6.10 shows, expectations are relatively high in Eastern Equatoria and Upper Nile states. It is not clear if these expectations are linked to emergency or more developmental needs. Also, in some cases, farmers may be expecting what have become routine handouts. It is only when we compare areas to be sowed with the normal situation that we can start to discern where real zones of potential stress may lie.

Figure 6.3: **Planned sources for cropping seasons 2011, all farmers**

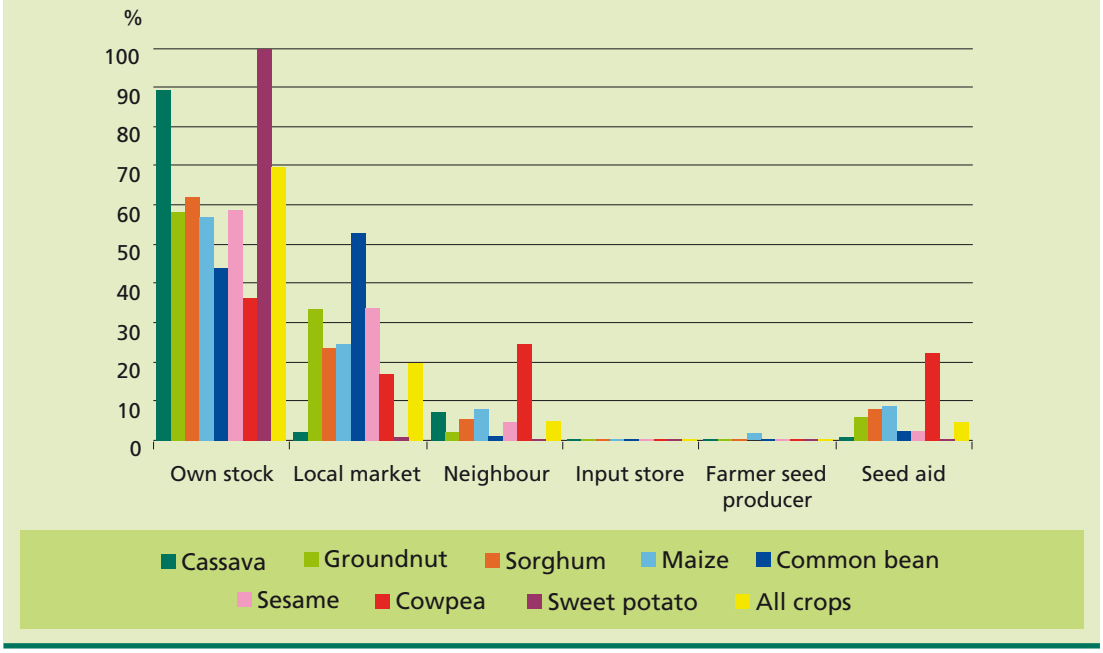


Figure 6.4: **Seed sources (%) IDPs, etc. are planning to use in 2011 season**

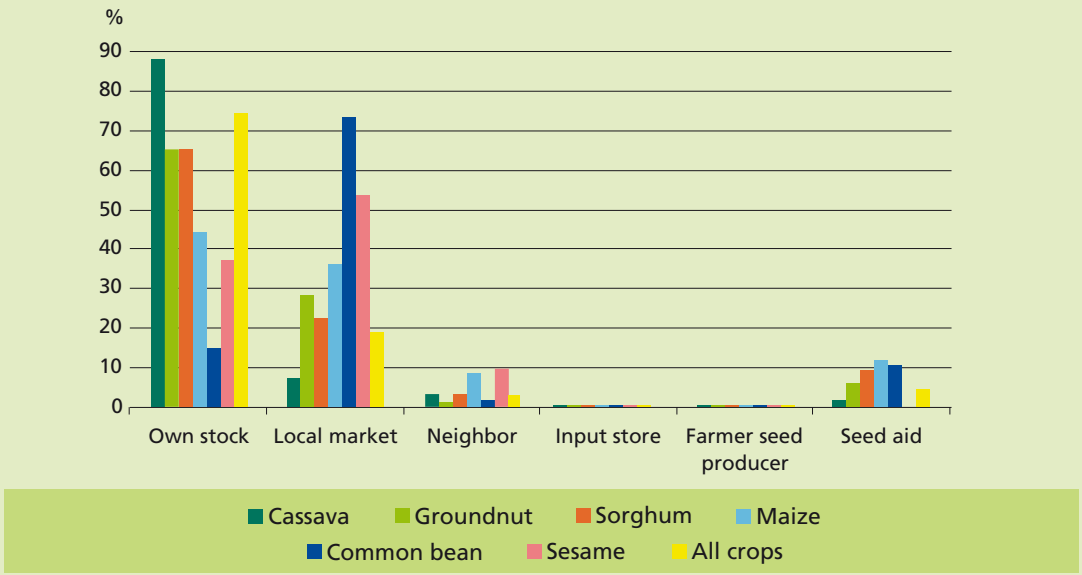


Table 6.10: **Farmers' expectations for seed aid (% of seed sown) for the projected season, 2011**

State	N	Farmers expectations for seed aid (%)	Main crops cited for aid
Central Equatoria		0.6	Maize
Western Equatoria		4.9	Rice
Eastern Equatoria		15.9	Maize, common bean, millet, okra
Western Bahr el Ghazal		3.0	Maize
Northern Bahr el Ghazal		16.5	Okra, sorghum, maize, groundnut
Warrap		0.6	
Jonglei		7.1	
Upper Nile State		12.9	Pumpkin, common bean, sorghum, sesame
All States		**4.9**	

Are Farmers Seed-Stressed? Are Projected Amounts to be Sown in 2011 More, Less or the Same as Usual?

To complement the analysis, we compared farmers' projections for 2011 planting with what they assess as normal amounts of seed; that is, we looked at whether they are planning to plant more, less or the same?

2011 projected sowing amounts, as compared with normal season: by crop, all farmers and IDP group

Remarkably, over 70 percent of farmers plan to maintain or increase the amounts they sow in 2011, the planned overall increases in sowing amounts being almost 80 percent (Table 6.11). For the main crops, only cowpea and okra have more than one-third of farmers intending to decrease sowing – an issue to be explored further which may possibly be related to seed availability.

Table 6.11: **All farmers: comparison of quantities planned for 2011 with those normally used, by crop**

CROP	# farmers	% households			Total	% change in seed quantities for all growing the crop	
		More	Same	Less		Mean	SD
Sorghum	568	48.1	19.7	32.2	100	70.8	397
Maize	437	51.5	20.6	27.9	100	58.9	230.7
Groundnut	382	49	22	29.1	100	79.5	253.3
Sesame	106	56.6	29.3	14.2	100	77.2	171.5
Cassava	91	42.9	26.4	30.8	100	267.3	2108
Common bean	49	44.9	28.6	26.5	100	63.4	185.5
Okra	35	37.1	28.6	34.3	100	42.5	120.7
Cowpea	16	37.5	18.8	43.8	100	-6.93	47.9
Millet	13	53.9	38.5	7.7	100	23.8	39.6
Rice	8	50	25	25	100	29.7	60.9
Vegetables	7	57.1	28.6	14.3	100	592.4	982.5
Tomato	4	50	0	50	100	31.3	85.1
Pumpkin	4	0	75	25	100	-12.5	25
Cabbage	3	0	100	0	100	0	0
Sweet potato	2	100	0	0	100	19.2	22.4
Onion	2	0	50	50	100	-16.7	23.6
Eggplant	1	0	0	100	100	-49.9	0
Banana	1	100	0	0	100	0	0
Coffee	1	0	100	0	100	0	0
All crops	**1730**	**49.1**	**22.3**	**28.5**	**100**	**79.5**	**563.9**

The group of IDPs, refugees and returnees show the same broadly optimistic pattern: two-thirds will maintain or increase volumes sowed. Across crops, the intention is to increase relative volumes by over 60 percent (Table 6.12). So the farmers themselves anticipate quite an optimistic seed security scenario for 2011.

Table 6.12: **IDP group: comparison of quantities planned for 2011 with quantities normally used, by crop**

Crop	# farmers	% households			Total	% change in seed quantities for all growing the crop	
		More	Same	Less		Mean	SD
Sorghum	83	40	28.2	31.8	100	82.7	297.2
Groundnut	63	34.9	19.1	46	100	21	140.1
Maize	47	46.8	25.5	27.7	100	87.3	348.7
Cassava	17	29.4	29.4	41.2	100	2.4	63.2
Sesame	13	53.9	23.1	23.1	100	83.3	192.2
Okra	6	50	33.3	16.7	100	129.2	179.2
Common bean	5	60	40	0	100	73.8	99.6
Eggplant	1	0	0	100	100	-49.9	
Tomato	1	100	0	0	100	100	
Vegetables	1	100	0	0	100	60	
Cabbage	1		100		100	0	
All crops	**238**	**41.1**	**25.3**	**33.6**	**100**	**61.8**	**253.1**

Focusing on Potential Problem Areas and Spurring Production

Potential problem areas

The overall positive picture for both 2010 and the projected 2011 should not obscure that there are still vulnerable populations and regions where farmers are stressed. **Across the full sample, 43.4 percent of households stated they were planting less of particular crops in 2010. In parallel, 23.3 percent of the group of IDPs, returnees and refugees reported they were sowing less of certain crops in 2010.**

To understand more clearly the nature of the stress, farmers were asked to explain why they were planting less of a given crop in 2010. Many and diverse reasons were given. These reflect both extreme stresses – "I ate all my seed due to starvation" (a reason that emerged in Warrap) – and emerging opportunities – "I opened my own shop and do not have much time for agriculture."

Table 6.13 summarizes the reasons for farmers' decreasing seed use in 2010, and summarizes a large qualitative data set (1 641 responses). **Slightly over 35 percent of reasons given for planting less seed have to do with lack of seed**. (This means 35 percent of the 43.4 percent who planted less, or 15 percent of the whole sample). Unfortunately, lack of seed is a vague answer on which to gauge action, as one may lack seed for many reasons (e.g., seed losses during storage, or sale of seed to buy a cow). Some specificity was given for cassava cuttings and vegetable seed, which a number of farmers had difficulty obtaining.

The other 60 percent of responses are also of interest as they were not directly tied to lack of seed, or, most often, to seed issues at all. Farmers are sowing less because of labour shortages or other labour problems, health problems, and general income concerns. Also of interest is the fact that more than 3 percent of farmers say they plant less of a crop because the market is just not well enough developed or lucrative enough – 'So why plant?'

In the majority of cases cited by farmers as to why they planted less of a given crop, direct seed aid might not have helped since issues other than lack of seed triggered the decrease (Box 10).

Table 6.13: **Reasons farmers cited for planting less of a given crop in 2010 (N = 1641 responses)**

Reason for planting less than normal 2010	#	% of responses
Lack of seed: general statement (not specified)	394	24.0
due to storage problems	3	0.2
due to poor harvest	158	9.6
due to starvation (seed eaten)	26	1.6
	581	**35.4**
Lack of seed and manpower (combined reasons)	89	5.4
Labour problems	208	12.7
Income (money) problems	151	9.2
Health problems	124	7.6
Market not good	56	3.4
Weather (late rains)	52	3.2
Timing constraints on planting (IDPs arrived late in their own fields)	41	2.5
Lack of land	40	2.4
Personal events (e.g., births, deaths)	35	2.1
Pests (birds, monkeys, other wild animals, termites, cows)	33	2.0
Insecurity (army attack, Lord's Resistance Army)	31	1.9
Lack of fertile soils	28	1.7
Aid did not come (waited and had not planned)	23	1.4
Other priorities	21	1.3
Sold seeds to cover purchases or payments: livestock, school fees	20	1.2
Seed quality issues	9	0.6
Crop not adapted or non-preferred variety	6	0.4
Lack of tools, tractors, equipment	6	0.4
Factors others than 'lack of seed'	**973**	**59.3**
Misc.	21	1.3
Not specified	66	4.0
	87	**5.3**
Total	**1641**	**100**

Box 10: **Planting less does not always mean that seed is needed: smart aid options**

Some farmers planted less than normal in 2010. Sometimes this reduction was linked to 'lack of seed'; more often, it was tied to other kinds of concerns – and sometimes opportunities.

Here is a sampling of reasons Southern Sudanese farmers gave for planting less in the main season of 2010. Addressing these challenges will require targeted, smarter aid responses.

- My husband bought many cows, and that is where he now puts his time. I am alone in tending the crops.
- I (husband speaking) am busy in my small shop.
- I had lots of other crops and gave less priority to this one.
- I have only sweet varieties of cassava, and animals eat this.
- The rains just came too late.
- Problems with the Lord's Resistance Army.
- My body (woman speaking) is weak due to old age and I lack income to expand the area.
- I (woman speaking) just started a new farm and had difficulty clearing the land.
- This maize just does not sell well; the market is small.

Note: in none of the above cases will seed assistance solve the issue of why farmers are planting less.

Table 6.14 presents reasons for planting less, differentiated by the gender of the head of household. While the constraints cited are broadly similar, the degree of stress seems to vary slightly. Female-headed households within the SSSA sample have relatively more concerns about income, health and overall lack of seed. Men complain more about poor market development and actually may have 'other priorities' (such as shop management).

Although both groups cited labour problems, access to labour emerged as relatively more difficult for female-headed households. Focus group discussions suggest that female-headed households are at a distinct disadvantage when it comes to performing key agricultural tasks (Box 11).

Finally, to understand stress better we focus on those states where farmers, overall, planted less in 2010: Northern Bhar el Ghazal and Upper Nile State. In both cases, the answer 'lack of seed' is cited as the main (vague) reason (Table 6.15), with harvest failure mentioned in Upper Nile.

Table 6.14: **Reasons cited by farmers in female- and male-headed households for planting less of a given crop in 2010**

Reason for planting less than normal 2010	% responses Female HH	% responses Male HH
Lack of seed: general statement (not specified)	25.9	24.2
due to storage problems	0	0.3
due to poor harvest	12.2	10.0
due to starvation (seed eaten)	2.8	1.5
	40.9	**36.0**
Lack of seed and manpower (combined reasons)	5.7	5.7
Labour problems	13.0	14.2
Income (money) problems	12.6	8.4
Health problems	9.5	6.3
Market not good	2.8	3.7
Weather (late rains)	3.2	3.5
Timing constraints to planting (IDPs arrived late in their own fields)	0.8	3.4
Lack of land	1.8	2.6
Personal events: births, deaths	3.0	2.1
Pests (birds, monkeys, wild animals, termites, cows)	1.5	2.4
Insecurity (army attack, Lord's Resistance Army)	1.9	2.1
Lack of fertile soils	0.1	2.7
Aid did not come (waited and had not planned)	0.4	1.0
Other priorities	0.0	2.2
Sold seeds to cover purchases or payments: livestock, school fees	1.1	1.4
Seed quality issues	0.4	0.3
Crop not adapted or non-preferred variety	0.3	0.2
Lack of tools, tractors, equipment	0.1	0.5
Factors other than 'lack of seed'	**58.2**	**62.7**
Misc.	1.1	1.2
Total	**100**	**100**

Box 11: **Female-headed households have extraordinary labour concerns**

War, emigration and split families (some members staying in the north) translate into high rates of female-headed households: almost half (47 percent) the SSSA sample.Do female-headed households face the same constraints as male-headed? Women especially give an emphatic no!

Female-headed households have greatly reduced capacity to do the really heavy work – tasks crucial at this point in Southern Sudanese agriculture. They find it very hard to:

- open new land (much of which is covered with trees, bushes and years of overgrowth);
- fence the perimeters of their farming areas to keep out livestock and wild predators;
- cut the large, thick poles needed as the central support in house/hut construction.

Households with strong males do not easily lend out their labour so novel labour arrangements need be devised.

Table 6.15: **Reasons farmers cited for planting less of a given crop in two possibly stressed states, 2010**

Reason for planting less than normal 2010	**% responses NBEG**	**% responses UNS**
Lack of seed: general statement (not specified)	55.6	32.4
due to storage problems	-	0.3
due to poor harvest	1.0	36.6
due to starvation (seed eaten)	-	0.3
	56.6	**69.6**
Lack of seed and manpower (combined reasons)	7.7	-
Labour problems	10.2	4.1
Income (money) problems	6.1	1.7
Health problems	12.8	1.0
Market not good	-	0.3
Weather (late rains)	-	3.5
Timing constraints to planting (IDPs arrived late in their own fields)	-	0.7
Lack of land	-	0.7
Personal events (e.g., births, deaths)	5.6	-
Pests (birds, monkeys, other wild animals, termites, cows)	-	0.7
Insecurity (army attack, Lord's Resistance Army)	0.5	9.3
Aid did not come (waited and had not planned)	-	1.0
Other priorities		1.0
Sold seeds to cover purchases or payments: livestock, school fees	-	-
Seed quality issues, crops not adapted, lack of tools, poor soils	-	-
Factors others than 'lack of seed'	**42.9**	**24**
Misc. or not specified	0.5	6.2
Total	**100**	**100**

Spurring production

To complete this analysis of the rationale for planting decisions, we end on a positive note: why those who planted more in 2010 did so (Table 6.16). Farmers expanding seed use generally see this as a positive period, and are aiming to increase food security and income, with an important subgroup also gearing their production to take advantage of new and expanding market opportunities (i.e. some 16.6 percent of responses). Many households in 2010 also reported they had more seed available and were able to access more labour and to expand land areas cultivated. Desire to expand garden areas, for horticultural crops, was cited multiple times as the reason for opening new land – and for tying households more closely to market-driven production strategies.

Table 6.16: **Reasons farmers cited for planting more of a given crop in 2010 (N = 1325 responses)**

Reason for planting more than normal 2010	No. of responses	% of responses
Aiming to increase production and income and seize market opportunities		
for food security	115	8.7
for food security and increased income	190	14.3
to take advantage of new and expanded markets	220	16.6
	525	**39.6**
Seed: have seed available (general statement)	167	12.6
have seed: through NGOs/FAO	35	2.6
through market	23	1.7
through friends/relatives	16	1.2
viable seed	5	0.4
have stakes (cassava)	8	0.6
	254	**19.1**
Generally good conditions of production in place (with factors specified below)		
specific good crop or variety	87	6.6
increased labour	93	7.0
increased land	90	6.8
increased multiple factors (mostly land, labour, isolated money, seed)	91	9
fertile soils/access to manure	15	1.1
good rain	61	4.6
	437	**33**
Other: (each less than 0.5% of responses)		
security good		
this is the preferred season	36	2.7
health good		
moved to new location		
used tractor		
misc.		
Not specified	73	5.5
Total	**1325**	**100**

Summary: Acute Seed Security Findings

Multiple and diverse indicators suggest that the overall seed security of Southern Sudanese farmers is good.

1. For the 2010 main season, farmers increased their seed use 17 percent over 'normal amounts sown', across all crops. IDPs, returnees and refugees, for the main 2010 season, reported increased seed use of 3.6 percent over normal rates, across all crops.

2. Seed quality, across crops, was assessed as quite good, with 98 percent of farmers saying they will re-sow what they already have. However, there were specific concerns raised with regard to cowpea and pumpkin seed (the latter given to the IDPs).

3. For the 2010 main season, over 90 percent of the seed planted came from local channels for the full sample of farmers as well as for the potentially vulnerable population of IDPs, returnees and refugees. Outside aid, both developmental and emergency, together provided between 9 and 10 percent of the seed sown for all crops. Hence, farmers were largely able to rely on their cultivated areas and even expand them, drawing on functioning local seed channels.

4. Farmers cultivating smaller land holdings (< 1 feddan) did not show markedly different sowing trends than those sowing larger areas (1–3 and > 3 feddans) in terms of their expanding or decreasing areas planted. The only exception was for sorghum, where small farmers' seed use declined at slightly higher rates than those of large farmers – if there was a decline. Similarly, larger farmers who expanded seed use of sorghum and cassava did so at a greater rate than smaller farmers. It is mainly in sorghum and cassava production that larger farmers are investing. Overall, then, those cultivating smaller holdings are not more stressed than those cultivating larger holdings.

What the data do show, overall, is a lot of dynamism. On average, farmers who increased sowing amounts in 2010 more than doubled their usual rates (> 100 percent). On average, those who decreased sowing amounts reduced sowing over usual rates by 40–48 percent.

5. Male- and female-headed households differ somewhat in seed use strategy. In 2010, female-headed households tended to maintain 'normal' sowing amounts rather than increase or decrease amounts of particular crops (so less dynamism here). It is important to signal that female-headed households overall cultivate less land.

6. The reported plans of farmers for the 2011 main season show more of the same. Over 70 percent of farmers plan to maintain or increase amounts sown across crops, and by significant margins. In the overall sample, farmers report that they will expand sowing amounts by almost 80 percent across crops, and even the IDPs, refugees and returnees as a group report they plan to increase sowing amounts by over 60 percent. These statements of intentions suggest that Southern Sudanese farmers are moving fast to expand land area and intensify production.

Hence, in terms of the positive trends, multiple indicators suggest that seed security overall is good – and projected to be good – even though farmers aim to expand growing areas. Seed security, and meeting seed needs in Southern Sudan, is a dynamic target (Box 12). Farmers met most of their seed needs through local channels in 2010, despite an impressive expansion. They project they can meet needs for 2011 largely through local channels – despite ambitious plans to significantly increase sowing areas.

However, attention to what is going well should not obscure the fact there seem to be some areas of stress.

7. In parts of Upper Nile State (within Nasir in particular, an agro-pastoral area) and in parts of NBEG (Aweil centre and east) farmers are accessing major quantities of seed from aid initiatives and also are sowing less than normal. In these areas, farmers' stated reason for sowing less is most often a 'lack of seed'. Also, overall, across regions, 15 percent of farmers are planting less of a particular crop for a stated reason of 'lack of seed'. Targeted aid to give farmers better access to seed might be considered. Cowpea seed, cassava cuttings, and okra and vegetable seed were among the materials most often mentioned as posing constraints.

8. There is also an important subgroup of vulnerable people who do have seed but who have other significant problems preventing them from engaging in their normal agriculture. Almost 60 percent of the reasons farmers gave for sowing less than normal were not directly tied to 'lack of seed' *per se*. Labour constraints, health problems, lack of disposable income were three important stresses hindering farmers' production potential. Lack of markets also discouraged certain producers (who have potential to sow more but choose not to). All these sharpened insights mean that agricultural assistance – even in the short term – requires a major re-orientation. It has to move well beyond helping farmers access seed, based on the recognition that giving free seed will not help farmers solve agricultural problems in the majority of cases documented by the SSSA. The needs of most of the vulnerable farmers must be met in very targeted ways. Vouchers, for example, might be able to alleviate some of the income challenges. But, in addition, labour constraints as well as enduring health problems have to be addressed. (Are there possibilities for labour and medical vouchers? For vouchers for tractors or ox-ploughs?) (Box 13). In the medium term, market development will surely also spur increased seed use, especially for maize and vegetables, according to Southern Sudanese farmers.

Box 12: **Seed security in Southern Sudan – a moving target**

Attaining seed security in Southern Sudan is so very different from the challenge in most other African countries: the target is a dynamic one, ⟶ on a fast track forward.

Farmers in Southern Sudan are expanding the areas they cultivate and increased the amounts of seed used by 17 percent in 2010 (over normal years). Projected increases for 2011 are on the order of 80 percent. This means that 'having enough seed now' may be very different from 'having enough seed in the future.'

Elsewhere in Africa, any gap in seed need is often linked to poverty. In Southern Sudan it may just as likely be linked to perceived shortfalls in expansion potential. Land is abundant, all across the country.

A vision of how to strengthen Southern Sudanese seed supply systems needs to be as dynamic as the farmers themselves. Production and delivery should be able to respond to moving demand; farmers should seen as entrepreneurs, rather than as victims or beneficiaries.

Box 13: **Promoting animal traction as an appropriate labour-saving technology for Southern Sudan**

Among the key challenges in increasing agricultural production and productivity in Southern Sudan is to overcome the lack of labour and/or high labour costs. On the other hand, Southern Sudan agricultural land with its low gradient or flat topography is well situated for mechanized farming. With about 9.85 million head of cattle, the potential for increasing the area as well as productivity of agricultural land through promotion and adoption of draft animal power (DAP) is enormous.

Although DAP was introduced in Southern Sudan in the early 1970s, its adoption was greatly hindered by the 21 years of conflicts. Since the signing of the CPA, significant gains have been made in animal traction promotion and adoption. For example, by 2007 about 38 percent of households in Lakes, 22 percent in NBEG, 14 percent in Eastern Equatoria, 12 percent in Unity, and 10 percent in Warrap were reported to own ox-ploughs (ANLA, 2007). Today, there are 20 000–30 000 ox-ploughs in use.

Progress made in the use of animal traction/ox-ploughs positively influences area cultivated (CFSAM, 2010). The impact of this can be traced from the increase in household field sizes and level of production. Farmers who adopted animal traction have been able to increase their area under cultivation by 100–400 percent (4–8 feddans). The adoption of animal traction has also boosted local supplies of crops and seed supply as evidenced by the situation in some areas where agencies involved in seed re-collection and input trade fairs/seed fairs access significant quantities of grain/seeds.

The success of animal traction in reducing labour constraints and boosting agricultural production and productivity will, however, depend on a number of factors, among which the following are key:

- Increasing access to appropriate ox-plough models suitable for the different soil types as well as ensuring availability of spare parts (such as the ploughshare and landslide which wear out quickly).
- Creating mass awareness of the use and benefits of animal traction in boosting production and productivity.
- Introducing appropriate animal-drawn weeders to further reduce labour constraints associated with opening up large pieces of land.
- Introducing conservation agriculture (CA) and animal-drawn implements such as rippers and cultivators to mitigate the environmental impact associated with continuous or repeated use of conventional moldboard ploughs.

It is therefore imperative that more effort be put into promoting animal traction for increased production and productivity in Southern Sudan.

CHRONIC SEED SYSTEM CONCERNS AND EMERGING OPPORTUNITIES

We now move to examining more systemic trends in Southern Sudan's agricultural and seed security. Community-level assessments were conducted in all 8 sites and 16 counties and involved a range of methods: community meetings, special focus groups with women, market analyses, and key informant interviews with government leaders, business people, NGO staff and others. These varied methods allowed for cross-verification and opened possibilities for assessing medium-term trends. The following topics are highlighted below: dynamism in use of seed sources, crop diversification, processing and transport constraints, seed aid delivery, access to new varieties and the use of inorganic and organic fertilizers. The chapter ends with comments on the situation of rural women.

Seed System Sourcing: Dynamic Trends

Community mapping of seed sources served to trace general trends in seed source strategies. Groups mapped seed sources for a particular crop and compared current sources with those used during the

previous five years. Overall, there has been remarkable positive dynamism in seed sources in that period. Several seed mapping samples appear below, with similar patterns evident at most sites.

The map for Aweil sorghum (Figure 6.5) shows substantial evolution in the way local farmers source this crop. Five years ago, the main source of seed was the local market, followed by NGOs who were helping farmers re-establish themselves just after the CPA. In 2010 the lion's share of sorghum seed was obtained through farmers' own stocks, with about one-third coming from the local market. Relatives and NGOs sometimes provided specific varieties.

The map for maize seed in Mugwo shows a similar but even more dramatic trend. Five years ago many had nearly no resources. So they obtained maize seed first by working for others (a direct exchange) and later, with local cash purchases, topped off their needs.

In brief, there has been remarkable dynamism in Southern Sudan's local seed systems in the last few years. This has occurred during a period when travel and security for trading have been less than optimal. Farming communities have generally moved from more dependent strategies to more self-sufficient ones.

Crop Diversification and (Few) Value-Added Products

Communities provided overviews of major crops sown in their area, and rated their respective importance for food consumption, income, and possible transformation of raw agricultural goods into value-added products geared to increasing revenue margins. As examples Tables 6.17 and 6.18 sketch the results of two community meetings in Kapoeta North (Eastern Equatoria) and Panyikango (Upper Nile State). Trends found here were representative of trends found in all sites, across eight states.

Tables 6.16 and 6.17 show that a fair range of crops is grown in each zone, with a good number routinely sold to generate income, especially the vegetables and varied fruits. However, transformation levels overall are low, although a number of major crops could potentially be further processed into saleable products (Box 14 and 15 as examples). Flours, pastes and beer were noted,

Figure 6.5: **Aweil: sorghum seed sources, community mapping**

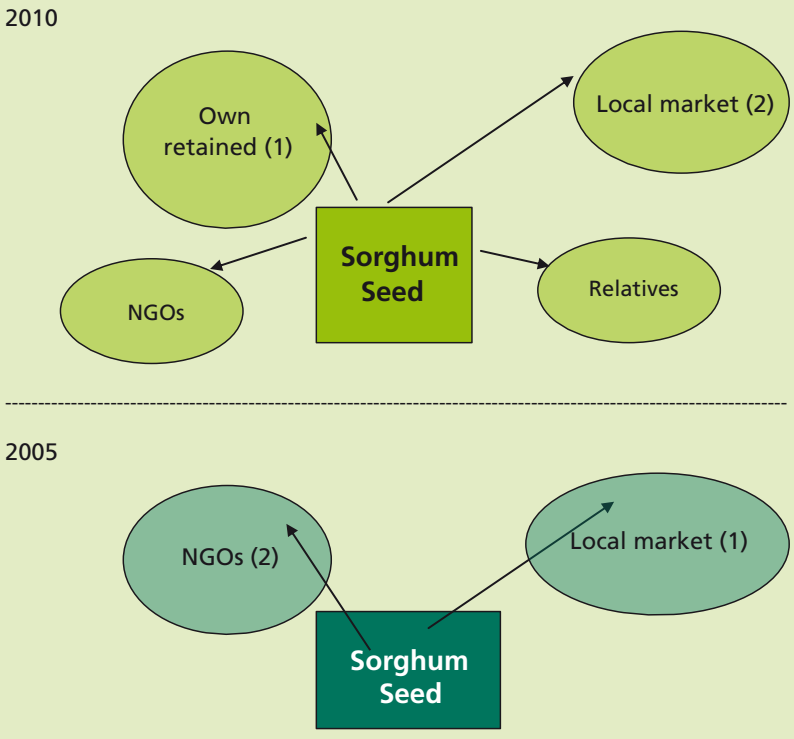
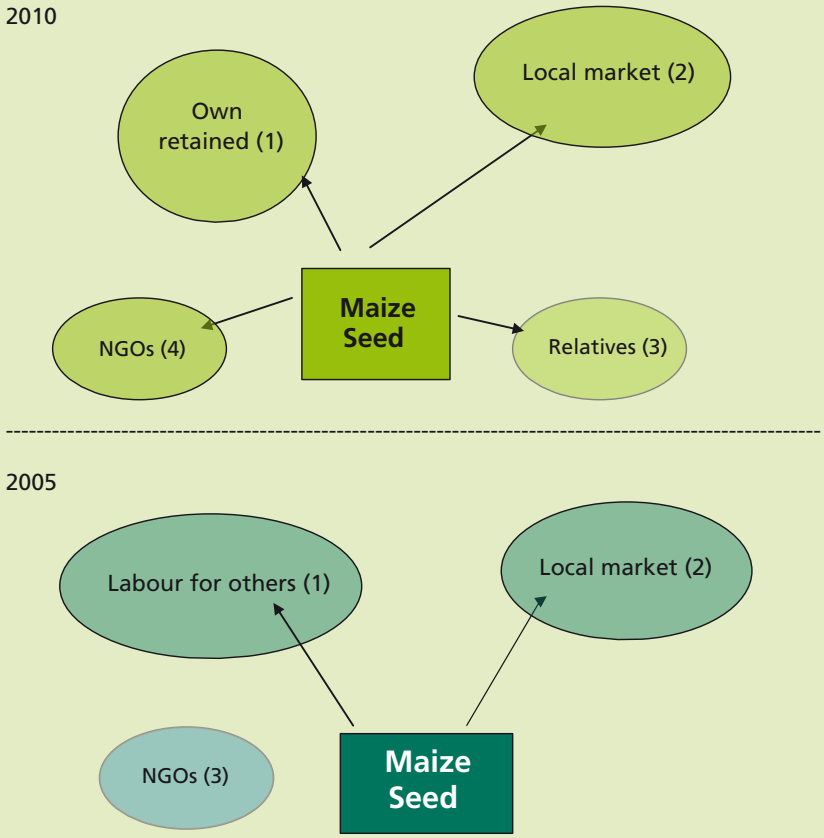


Figure 6.6: **Mugwo: maize seed sources, community mapping**



but not much more. The growing of an expanding array of horticultural crops is a promising sign – if farmers can find reliable ways of transporting to market. Traders assessed as 'very promising' the future demand for horticultural products because returnees/consumers from the north value foods such as eggplant, onions and okra.

Table 6.17: **Community assessment of crop portfolios: Najie Payam (Kapeota North, EES)**

Crop	Food	Income	Transformation
Sorghum	+++	+	Beer, flour
Maize	+++	+	Beer, flour
Groundnuts	+++	+	Paste
Okra	+++	++	
Pumpkins	+++	+	
Bulrush millet	++	+	Beer, flour
Sesame	+++	++	Paste
Cowpeas	+++	++	
Jews mallow	++	+++	

+ indicates relative levels of importance, with more +'s being relatively more important

Table 6.18: **Community assessment of crop portfolio: Tonga Payam (Panyikango, UNS)**

Crop	Food	Income	Transformation
Sorghum	+++	+	Flour
Maize	+++	+	Flour
Cowpeas	++	+	
Beans	++	+	
Sesame	++	+	Oil
Vegetables	++	+++	
Fruits	++	+++	

+ indicates relative levels of importance, with more +'s being relatively more important

Box 14: **Why not an Aweil-based groundnut oil enterprise?**

Ismael M. has a vision: groundnut oil can and should be produced locally! Coming from Darfur in 2007, he is one of only two processors in all of Northern Bhar el Ghazal state.

Ismael works day and night to produce his 20 jerry cans (20 L each) of oil a day but senses that his product quality is high and the oil demand unmet. He also exports the groundnut chaff/ cakes to Sinar in the north, for additional revenue.

But Ismael's constraints in expanding the business are formidable. He needs to organize better middlemen to collect from the countryside and his shelling machine is still waiting for the repair person.

Whatever the scale, this Aweil venture is an important sign of agro-enterprise start-up.

Box 15: **Enhancing adoption of improved cassava varieties through appropriate processing technology**

In the Green Belt of the Equatoria region of southern Sudan, cassava is considered a key crop. It is important not only for food security, but also as a source of income. It is highly valued for its drought resistance, ability to grow unattended even in the jungle and, more important, its potential to provide sauce (leaves as vegetable), food (fresh roots and flour), and alcoholic products.

Both bitter and sweet cassava varieties are grown in the Equatoria region. Introduction of modern (improved) varieties in the early 2000s by relief and development organizations such as WVI and AAH-I tended to include a lot of sweet varieties such as MM95/0414, TME 14 and TME 5, with an emphasis on processing for food and income generation. The principal cassava processing machines promoted were graters and chippers, both manual and motorized. With the introduction of these labour-saving machines, many famers became more interested. In time, however, famers started abandoning these machines as they were not technologically adapted to local needs.

It is important to note that the predominant and most preferred cassava products in local markets are fermented cassava flour and chips. The introduced processing technology, however, did not take into account an important aspect of product development: fermentation. The traditional method is to soak fresh cassava roots in a stream for two to three days, peel and chop/grate, then dry. Although this gives the much preferred taste of the fermented cassava product, the quality is of low grade. The improved processing technology can be adapted to meet the required fermented taste by leaving and covering the grated or chipped product in a clean container for two to three days, then drying it using an appropriate solar dryer. In this way the technology will not only save labour and improve quality, but also improve the taste as required by local markets.

In a nutshell, tying the introduction of disease-free, high-yielding modern cassava varieties to appropriate processing technology adapted to local needs will enhance the adoption of improved varieties and help create demand not only for the product but also for the cassava planting materials.

Crippling Transport Costs

Opening fresh produce markets will depend heavily on establishing conditions for efficient produce transport and sale. While the challenges of transport are well known and often repeated in Southern Sudan, the degree to which they stifle even small-scale commerce merits note. A women's group in Abulometa gave a graphic example (with similarities found on the back roads of nearly every village in Southern Sudan.) Abulometa women's group is located in Mugwo, only 19 miles (31 km) from Yei, one of the biggest cities in Southern Sudan. Despite the group's proximity to a major urban centre, its transport costs absorb at least 56 percent of potential profits, here demonstrated for potatoes (Box 16).

Box 16: **How transport costs cripple even small-scale agricultural business**

A sack of potatoes sold at Yei market fetches 75 SDG. The costs to get this produce to Yei, 31 km away, are as follows:

Costs to take to market	
transport sack	15
transport person	10
loading/offloading	10
storage/per day	2
market fees	5
	42 SDG

The vendor loses 56% of sale gains before actually selling her produce.

Note that delivery costs rise further if produce is not sold on the same day as transport because the vendor has to pay a lodging cost.

Seed Aid

Seed aid has been an important form of assistance in Southern Sudan (see Chapter III for overall scale). Here we include both emergency assistance and developmental aid, as farmers themselves often cannot make the distinction.

Frequency of delivery

The SSSA results show that about half the total population (49.5 percent) received seed aid between 2005 and 2010. In this period, they received it a mean of 1.8 times, or two out of every five to six years. Some farmers received aid up to 12 times in this period.

Seed aid has been significant across all states, with larger proportions of farmers reached in Upper Nile and Eastern Equatoria (Table 6.19). Also, female- and male-headed households have received such aid with similar frequency (Table 6.20).

Table 6.19: **Farmers obtaining seed aid, 2005–2010, by state**

State	# Farmers	Obtained seed aid (%)			# of times seed aid obtained among recipients				
		Yes	No	Total	# obtaining seed aid	Mean	SD	Min	Max
CE	117	35.0	65.0	100	41	1.5	0.81	1	4
WE	116	46.5	53.5	100	54	1.2	0.54	1	4
EE	105	76.2	23.8	100	80	3.1	1.53	1	6
WBEG	104	49.0	51.0	100	51	1.4	0.71	1	4
NBEG	101	40.6	59.4	100	41	1.2	0.41	1	2
WP	151	41.7	58.3	100	64	1.1	0.35	1	2
JO	100	37.0	63.0	100	37	1.8	0.97	1	4
UNS	91	78.0	22.0	100	71	2.1	1.6	1	12
All crops	**885**	**49.5**	**50.5**	**100**	**439**	**1.8**	**1.2**	**1**	**12**

Table 6.20: **Farmers obtaining seed aid, 2005–2010, by gender of household head**

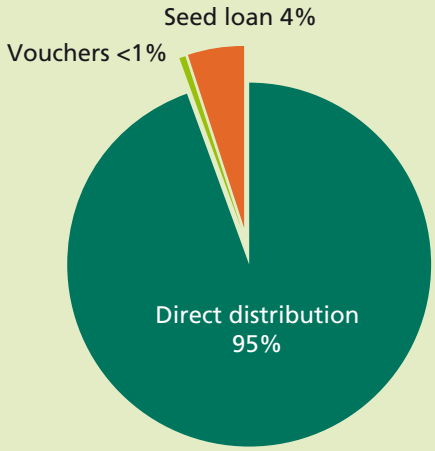
Gender*	N	Obtained seed aid (%)		N obtaining seed aid	# of times seed aid received	
		Yes	No		Mean	SD
Female	396	46.7	53.3	185	1.8	1.1
Male	435	51.5	48.5	224	1.8	1.3

* The gender variable had missing observations for 54 cases.

Type of seed aid delivery

Direct seed distribution, or DSD, has been, by far, the most common form of aid (Figure 6.7) with sorghum, maize, groundnut and sesame being the crops most frequently given.

Figure 6.7: **Means of delivery of seed aid, 2005–2010 (% of cases)**



New Varieties

In the context of assessing seed security, it is especially important to consider access to new varieties because these can be an economical way to increase production quickly. Table 6.21 shows new variety use over the period 2005–2010, across crops and states.

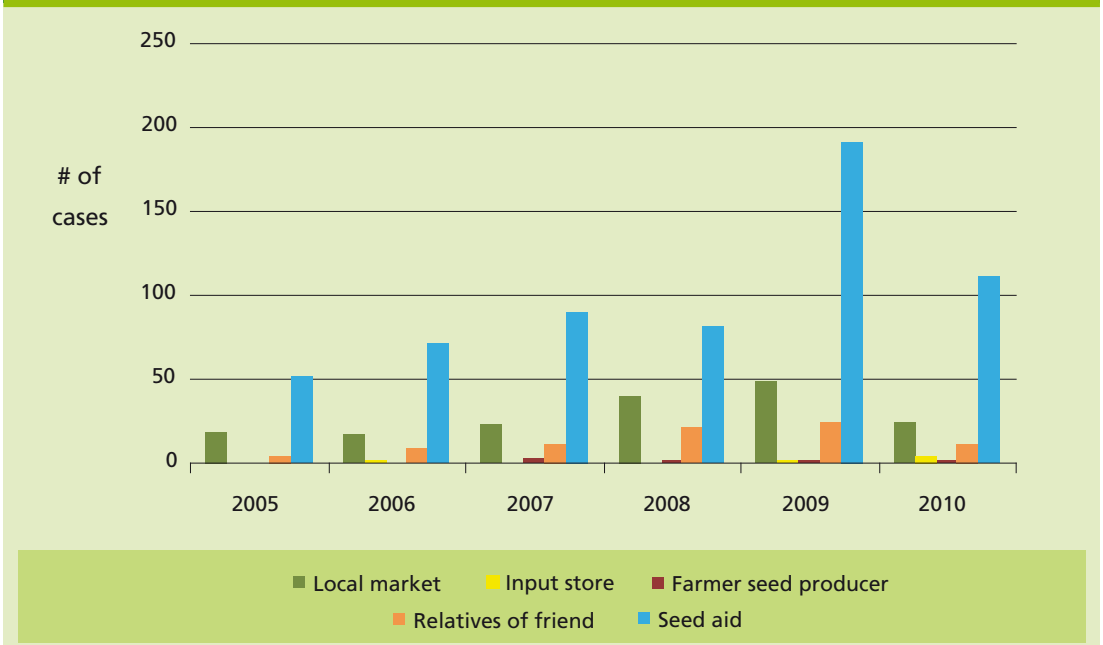
Frequency of new variety use

The patterns of farmers gaining access to new varieties closely parallel seed aid patterns. Over half of farmers have obtained new varieties over the last five years. It is not possible to determine whether these are 'modern varieties' or new local varieties to which farmers have not previously had access. In both cases, the rate of new acquisitions is remarkable.

Table 6.21: **Farmers obtaining new varieties, 2005–2010, by state, across crops**

State	# farmers	Obtained New Varieties (%)		
		Yes	No	Total
Central Equatoria	116	51.7	48.3	100
Western Equatoria	115	33.9	66.1	100
Eastern Equatoria	103	88.4	11.7	100
Western Bhar el Ghazal	102	26.5	73.5	100
Northern Bhar el Ghazal	100	47.0	53.0	100
Warrap	150	52.6	47.3	100
Jonglei	100	30.0	70.0	100
Upper Nile State	91	82.4	17.6	100
All states	**877**	**51.1**	**48.9**	**100**

Figure 6.8: **Farmers' sources of new varieties, 2005–2010, across crops, all states**



Sources of new varieties

NGOs, FAO and GoSS have been the major source of these new varieties, accounting for over 70 percent of new introductions. Local markets are an important secondary source, with a 20 percent share (Figure 6.8). Introductions have taken place steadily, at least since the CPA.

Types of new varieties accessed and retention rates

Table 6.22 shows the range of crops for which farmers obtained new varieties in the period 2005–2010. The focus has been on staple crops, especially sorghum, maize, groundnut, sesame and cassava. However, a good range of horticultural crops have been promoted through new varieties – for example eggplant, onion and tomato. Retention rates seem unusually high, almost 89 percent, although it is important to remember that the majority of the introductions are recent, within the last two years.

Overall, the extent to which farmers have accessed new varieties has been impressive. However, at this point, aid seems to be more important than routine research and development (R&D) in exposing farmers to novel crops and varieties. This is understandable given the limited resources available to GoSS/SSARTO, state ministries and other government agencies for both R&D and travel in rural areas over the last five years.

However, it is legitimate to ask whether emergency initiatives should make novel introductions at all, as emergency personnel might not be able to provide farmers with needed technical advice and multi-season follow-up. Also, introducing new varieties during crisis periods creates risks for farmers (Box 17).

Now might be the time to shift varietal introduction and varietal R&D more generally into a developmental context only. The interest of farmers in seeking out new varieties is high. They now need routine (non-emergency) channels through which new varieties can be moved on an ongoing basis.

Table 6.22: **Farmers obtaining new varieties, 2005–2010, and retention rates**

Crop	# variety introductions	Still growing (%)
Sorghum	268	89.2
Maize	199	90.5
Groundnut	96	83.3
Cassava	58	98.3
Sesame	67	83.6
Okra	59	93.2
Common bean	44	79.5
Cow pea	28	85.7
Tomato	23	87.0
Onion	10	100.0
Sweet potato	9	100.0
Eggplant	12	66.7
Vegetables	7	100.0
Millet	6	83.3
Banana	2	100.0
Water melon	1	100.0
Rocket	1	100.0
Total	**890**	**88.7**

Box 17: **Introducing new varieties in crisis periods? Advice on reducing risk and maximizing gain**

Regardless of the potential of new varieties to improve smallholder productivity, it is important to question the legitimacy of introducing them during crises. In periods of emergency and prolonged stress, small farmers are already at levels of increased risk; they need to have some confidence that the next planting season will produce an acceptable harvest.

Outside aid should, as a minimum, put on offer products or processes at least as good as those already in farmers' hands. While formal sector varieties are referred to as 'improved' and the quality of the seed is certified, these varieties can sometimes yield poorly in smallholder cropping systems. They may not be adapted to the local agro-ecological conditions or farmers may not have the management inputs (for example, fertilizers and pesticides) crucial for their growth. So an 'improved variety' does not mean that performance is guaranteed.

If the introduction of new varieties during a period of stress is to be considered, a set of well defined steps should be followed:

1. **Work with farm communities and other informed personnel to choose possible new varieties.**

   Is there sufficient evidence that the varieties:
   - are adapted to the specific agro-ecological zones?
   - meet farmers' acceptability criteria (e.g. for post-harvest home consumption and market use)?
   - can be successfully used under farmers' own management conditions (e.g. without fertilizer)?

2. **Design introductions so as to minimize risk and maximize farmers' informed choice.**
   - Offer 'test size' packets: introductions should be small-scale.
   - Give farmers choices to use the variety or not; if possible, put several varieties on offer.
   - Provide sufficient accompanying information to allow farmers to make wise variety choices and management decisions (planting time, levels of input use, crop associations).

3. **Build in explicit monitoring and evaluation of new varieties.**
   - Do they perform well?
   - For whom? Where?

4. **Count on a multi-year process.**
   - Can the new introductions be successfully integrated into stressed farming systems?
   - If yes, is further fine-tuning needed?

Source: modified from Sperling *et al.*, 2006

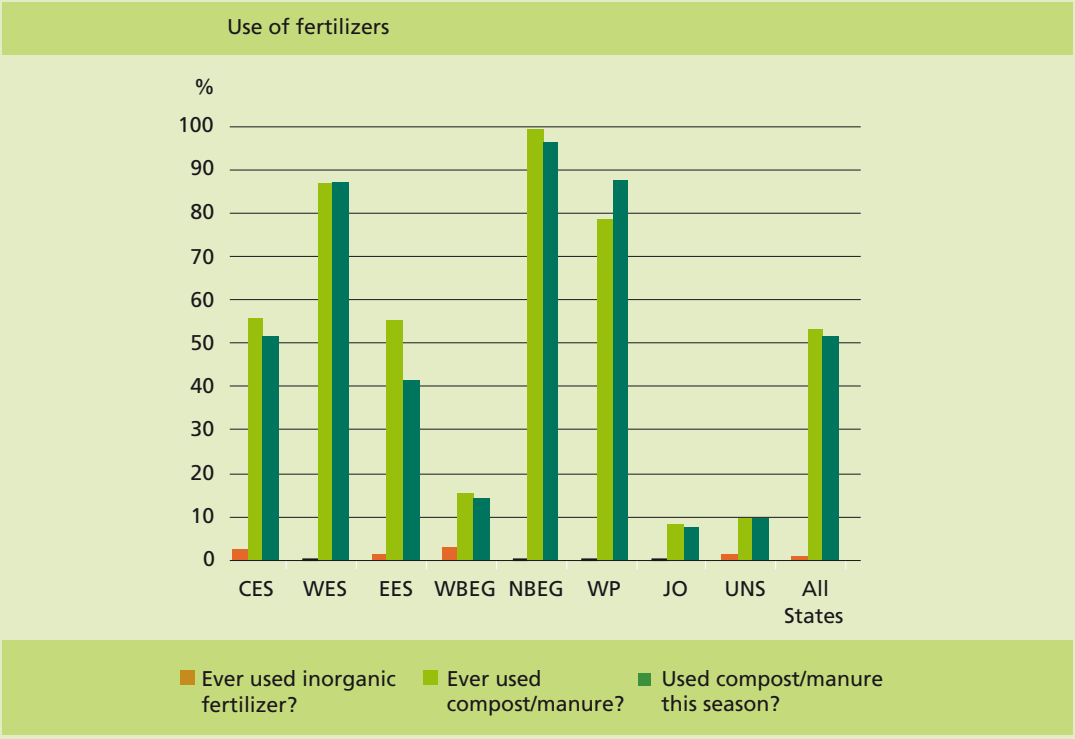
Fertilizer and Manure Compost Use

The use of soil amendments – both inorganic (mineral fertilizer) and organic (manure/compost) – was also examined during the SSSA, as a complement to the analysis of the seed situation.

Frequency of use

As expected, inorganic fertilizers are rarely used in Southern Sudan. Less than 1 percent of farmers indicated they had ever applied them. In contrast, slightly more than half of the farmers surveyed have used compost/manure (Figure 6.9). However, its use varies considerably by state. In Western Equatoria, Northern Bahr el Ghazal and Warrap, a large majority use compost/manure. In Central Equatoria and Eastern Equatoria, about half use it. Very few farmers in Western Bahr el Ghazal, Jonglei and Upper Nile reported using compost/manure.

Figure 6.9: **Farmers' use of inorganic fertilizers and compost/manure (N = 885)**



Types of manure/compost

The main types of organic input used included large animal and small animal manure, crop residues and kitchen refuse.

Table 6.23: **Types of organic fertilizers applied in the study areas, by state (N = 541)**

State	Number of instances of application						
	Large animals (cow, horse or donkey) manure	Small animals (e.g. goat, sheep) manure	Poultry manure	Crop residues	Kitchen refuse	Other	Total
CE	6	31	15	42	14	2	110
WE	2	18	9	77	9	0	115
EE	34	4	0	2	1	0	41
WBEG	1	3	0	8	0	0	12
NBEG	28	30	17	0	22	0	97
WP	81	53	1	6	4	0	145
JO	7	4	0	0	0	0	11
UNS	3	6	0	4	0	0	13
All states	**162**	**149**	**42**	**139**	**50**	**2**	**544**

Crop emphasis for manure/compost application

In terms of the crop focus of manure application, sorghum and maize were by far the priorities. However, there was also an impressive use of such organic amendments on vegetables. (Note that the data are difficult to interpret in absolute terms: one has to compare use against the number of times a crop has been planted.) Table 6.24 reports actual use during the 2010 main season.

Table 6.24: **Crops to which organic fertilizers (compost/manure) were applied, 2010 main season**

Crop	# of cases applied	% of cases
Sorghum	217	28.8
Maize	156	20.7
Vegetables	47	6.2
Okra	37	4.9
Tomato	34	4.5
Cassava	31	4.1
Groundnut	31	4.1
Banana	26	3.5
Sweet potatoes	23	3.1
Onions	23	3.1
Eggplant	22	2.9
Millet	17	2.3
Pineapples	17	2.3
Sesame	16	2.1
Common bean	15	2.0
Orange	7	0.9
Cabbage	6	0.8
Pumpkin	5	0.7
Fruit trees	5	0.7
Cowpea	4	0.5
Tobacco	4	0.5
Coffee	3	0.4
Rice	2	0.3
Sugar cane	2	0.3
Butter leaves	1	0.1
Apples	1	0.1
Pawpaw	1	0.1
Total	**753**	**100.0**

In all of the above, one can say little about efficiency of use, a topic that merits a great deal more analysis. Interestingly, those farmers not using organic fertilizers state with equal frequency that a) they are not 'necessary for me'; or b) they do not know about them. The latter refers either to

lack of knowledge about their existence, or lack of technical information on how to process and use them. Farmer enhancement of knowledge might be considered via farmer field schools (FFS) or other skill building mechanisms. As for mineral fertilizers, farmers cite the main reasons for not using them (in order or priority) as: not knowing about them; their not being available; and their not being necessary for his/her agricultural production.

Summary: Chronic Seed Security Findings and Emerging Opportunities

The review of longer-term trends (since CPA) in seed security in Southern Sudan reveals both surprisingly positive moves forward and staggering bottlenecks. Features of each are suggested below.

Positive moves forward

1. In a short five years (and for many farmers, only five seasons), there have been overall significant changes in seed sources for a range of crops. These range from heavy reliance on outside sources – seed aid (from FAO/NGOs), selling labour for seed, and high use of markets – to high use of own stocks and hence greater self-sufficiency.

2. New variety access has been impressive, with over 50 percent of households (51.1 percent) indicating they accessed a new variety in the period 2005–2010, mostly sorghum, maize, groundnut, sesame, okra or common bean. While it is not possible to confirm whether these new materials are 'modern varieties' or new local varieties, the rate of introductions is remarkable. About 89 percent of these varieties have been retained for continued use.

3. Organic fertilizers (manure/compost) have been employed by slightly more than half the population (53 percent), although use varies greatly by state. A large majority of households use compost/manure in Western Equatoria, Northern Bahr el Ghazal and Warrap States. About half use compost/manure in Central Equatorial and Eastern Equatoria. Very few households use compost/manure in Western Bahr el Ghazal, Jonglei and Upper Nile. Of special note is that many households which do not use compost/manure state that they 'do not know' about them – that is, what these organic materials can be used for or the techniques for using them.

4. Farmers are eager for market development and in some states they are intentionally *not* expanding areas to key crops (although they could!) until such markets are strengthened (e.g. for maize). Some traders also suggest that the market for horticultural crops to be produced within Southern Sudan is already expanding quickly, e.g. for crops such as eggplant, onions and okra.

Mixed factors: positive and negative

5. Outside seed aid (free distribution) has been a key positive force for introducing new varieties. When this has been effected in a developmental context, there have been possibilities for much needed follow-up and access to technical advice. The introduction of new varieties in an emergency context has also taken place – which is less prudent. New variety use has to be monitored and ultimately verified; and such novel introductions during an emergency can expose farmers to unwarranted risk.

Negative and ongoing stresses

6. There is very little agricultural transformation in rural communities: flours, pastes and beer, but not much more. This means that farmers cannot reap the benefits of value addition from their raw agricultural products.

7. Transport problems (linked especially to lack of roads) are well known. Figures from one region (Mugwo) suggest that a farmer loses 56 percent of her potential sale gains during the transport and storage process, before she even has a chance to put her produce up for sale.

8. Inorganic (mineral) fertilizers are used by less than 1 percent of the population. They are currently perceived as costly, unavailable and often not necessary.

9. Seed aid, that is free distribution of seed under emergency and development initiatives, has been conducted on a large scale, with half the Southern Sudanese population having received such aid a mean of 1.8 times since the CPA. Such aid can promote dependency: some households have received seed assistance 12 times since 2005.

All in all, there has been a great deal of positive dynamism in seed/farming systems in a short five-year period. However, it is time (indeed past time) for some of the key agricultural and marketing bottlenecks to be alleviated, particularly those centring on market development and the creation of transport infrastructure. It is notable that interest in market and value chain development is high. The SSSA collected over 10 value chain analyses during the fieldwork period – on tomato, groundnut, sesame, vegetables, sorghum and other crops (see References).

ANTICIPATING THE FUTURE

It remains for us to comment on possible seed security stresses in the very near future associated with the Referendum period. Such analyses have to be based on an actual understanding of seed system trends supported by multiple stakeholder assessments and on practices already unfolding on the ground. Several items are of note:

- Farmers themselves, across Southern Sudan, increased their seed use by some 17 percent in 2010. They also project they will increase use by 80 percent in 2011. While this rate of expansion cannot yet be confirmed, it is obvious that farmers are making a significant push to intensify production and open new lands. Overall, they very positive about the future, as documented in their actions.

- Traders (N = 70) are speaking with their money. Among those who note changes that have already taken place (tied to Southern Sudan's future), the vast majority (94 percent) assess their business changes as positive. They had expanded the range of goods they sell and the volume of trade; roads had now been improved (for instance between Twic and Wau, an between Wau and Raja); and several had started to transform crops into commercial products such as flours, pastes and alcohol. They are investing in a positive future.

Further, in terms of possible disruptions:

- Seed flow analyses in one of the more potentially vulnerable regions, Northern Bahr el Ghazal, show that local and regional seed systems will likely continue to guarantee flows of seeds and other planting materials, even if cross-border movements become difficult.

- To date (February 2011), returnee figures hover around 215 000 (IOM/OFDA, personal communication). This is currently below the projected influx of 400 000 to 500 000.

All in all, current signs 'for the future' are quite promising. While some of those returning to the South and those displaced will require major assistance, this might best be targeted on a well defined population, with the type of aid given tailored to real needs.

The next and final chapter of this assessment recommends a set of concrete, doable measures to strengthen seed security in Southern Sudan.

- Overall, there are few emergency seed security problems, aside from those anticipated from returning, displaced and refugee populations. There are some potential exceptions. Some farmers planted less in 2010 in certain states (NBEG and UNS), apparently tied to a 'lack of seed'. Ways to enhance their immediate access to seed might be addressed. Other farmers, including a large group of female-headed households, are planting less due to labour, health and income concerns – which fall more appropriately under the rubric of chronic stress. Finally, some farmers are planting less because of poorly developed markets for their production. Here the problem is one of missed development potential. Generally**, in Southern Sudan, there should be a move away from the emergency focus in agriculture.**

- Short- and medium-term developmental actions now need priority attention. The findings of the SSSA suggest **there needs to be immediate and significant investment in small farmer-driven variety development, seed production and distribution, and agricultural marketing systems**. **Comprehensive efforts to alleviate labour shortages and other related constraints, as well as the problem of general depressed buying power, should also be given priority.**

Some of the specific priorities are discussed in Chapter VII.

VII. Recommendations: Across Sites

The seed system security assessment (SSSA) fieldwork encompassed diverse and representative regions across Southern Sudan. While evaluating the immediate seed security situation, pre-Referendum, it also assessed agricultural and seed system trends over the longer term, including those since the Comprehensive Peace Agreement of 2005. In some sense, this assessment represents a comprehensive baseline against which to match advancements in Southern Sudan's promising future.

Below, we put forward a set of recommendations that apply across the regions assessed. These include recommendations related to possible emergency response; but others go well beyond that, to address chronic stress concerns as well as developmental opportunities. Recommendations are made in the following thematic areas: 1) emergency aid; 2) variety introduction; 3) sustainable seed production and agro-enterprise models; 4) formal/informal outlets and local markets for agricultural outputs; and 5) rural women and seed security.

I. EMERGENCY SEED AID

Emergency seed assistance should be planned and delivered only if a) it is assessed to be needed, and b) it maximizes benefits and minimizes risks to farmers.

This season

1. Because the seed security situation is, on the whole, very promising, any aid given should be limited, focused on enhancing farmer access to seed, and clearly targeted on:
   - specific regions (parts of Upper Nile State and Northern Bahr el Ghazal), and
   - 'special groups' such as a subset of IDPs and returnees.
2. New varieties should not be introduced in an emergency situation. Before their introduction, there should be clear evidence that they can perform in a given agro-ecological site and that they meet farmers' wants and needs.

In the next few seasons

3. In zones where emergency seed aid is being repeatedly implemented (three seasons in a row), donors, MAF-GoSS and implementers should programme a formal review as to the necessity of the aid.
4. Emergency seed assistance guidelines should be developed for Southern Sudan. These should include good-practice guidance for the range of possible seed-security-related responses: direct seed aid, vouchers, cash, seed loans and other mechanisms. Guidelines should be concise and easy to understand.
5. Assessments that are used to influence seed-related responses should contain an explicit seed security assessment component. In this vein, a specific component on seed security assessment should be added to the Crop and Food Supply Assistance Assessment (CFSAM) and the Annual Needs and Livelihoods Analysis (ANLA) if these exercises are to make any recommendations on seed security.
6. Preferably, separate and focused seed security assessments should be conducted whenever seed-security-related actions are being contemplated.

General advice for more effective emergency seed assistance in Southern Sudan

7. In areas where seed may be available (e.g. often the Green Belt) but where access is difficult for some groups such as IDPs and returnees, input trade fairs (ITFs) and vouchers should be used to increase access. This will help provide markets for those who have the seed to sell, at the same time increasing access to the seed needed by the target beneficiaries. Priority could be given to seed-producing groups and local agro-dealers to participate in the fair.

8. In areas where both access to, and availability of, seed of a given crop are problems, priority should be given to local seed collection from areas with a similar ago-ecology or areas of Southern Sudan where the same crop varieties are grown.
9. Where the use of imported seed is inevitable, MAF-GoSS has to take the lead in providing clear guidance on acceptable crop varieties and locations to which they are adapted. The seed quality of any imported varieties must be rigorously checked and all necessary documents (import permit issued by GoSS, phytosanitary certificates, etc.) provided. An independent body must be used to certify the quality before shipment; additional quality checking by the responsible government body at border posts should be made mandatory; at state level, the agency importing the seed, in collaboration with the state ministry of agriculture, should conduct the final quality check before seeds are distributed to the target beneficiaries.
10. Extra efforts should be made by the agencies or organizations involved in the importation of emergency seed to ensure that farmers are provided with the necessary agronomic information on the imported seeds. Regular field monitoring should be done in areas where imported seeds have been distributed.

II. VARIETY INTRODUCTION

There is a generalized need, across regions of Southern Sudan, to develop and identify varieties that are adapted, meet farmer preferences, and respond to dynamic market needs.

11. The GoSS/SSARTO should make public a list of already recommended varieties. This should include those already performing well in Southern Sudan. Methods for fast-tracking such releases should be employed to address the backlog.
12. The Directorate of Research of MAF-GoSS should develop guidelines for variety release and seed production inspection to enhance the release of varieties and production of seeds. The guidelines should be operationalized through ministerial order (Seed Act, Seed Policy and Regulations).
13. Multi-locational sites might be quickly established for screening 'best bets' from elsewhere. Neighbouring national research systems as well as CGIAR centres might be well placed to advise on 'best bet' entries and help to provide initial seed stocks.
14. To facilitate decentralized screening within agro-ecological zones, the present research centres at Yei, Palotaka and Halima, along with universities (Juba, Upper Nile, John Garang Memorial College), NGOs (AAH-I, WVI, NPA, CRS, etc.) that deal with agriculture, and selected progressive farmers groups, might establish a temporary network of testing sites. All screening would be coordinated by the Directorate of Research, MAF-GoSS.
15. All variety screening should allow for end-user evaluation. Participatory variety selection (PVS), mother-baby trials, and garden variety trials are among the well established variety screening formats that allow for intensive farmer and trader/market evaluations.
16. Specific efforts should be made to enhance national capacity for variety maintenance and early-generation seed multiplication. These should include activities for quickly scaling up both breeder and basic seed production – responsibilities that rest squarely with GoSS/SSARTO.
17. Seed testing facilities should be established at the regional level (as a first priority). This would include Greater Bahr el Ghazal, Greater Upper Nile and Greater Equatoria. (In Greater Equatoria the existing laboratory needs to be staffed appropriately.) GoSS/SSARTO would be best positioned to take the lead here.
18. Collections of local germplasm should be planned for the near future (next one to three years). This will facilitate much needed plant breeding efforts as well as help conserve important landrace material.

Key to all variety screening are that a) local adaptation be confirmed; b) farming communities be engaged to ensure performance and cooking/taste acceptability; and c) traders/private sector companies be involved to anticipate market acceptance. Top-down models that fail to stimulate local innovation should be avoided.

III. SUSTAINABLE SEED PRODUCTION AND AGRO-ENTERPRISE MODELS

Current decentralized seed production is limited, geared to institutional buyers (development and relief) and not reaching smallholder farmers as effectively as possible. Sustainable decentralized production models need to be confirmed. In general, seed programmes should only be promoted if they are:

- geared to meeting small-farmer client needs;
- tied to continuing new sources of germplasm;
- contain an explicit delivery (and, where appropriate, marketing) component; and
- are economically viable for the producers involved in such enterprises.

19. Seed production efforts should focus on new varieties with high market-demand potential, as well as those crops for which seed/planting material might be difficult for farmers to manage – for example, groundnut seed and cassava planting material.
20. Efforts should be made by those supporting or engaged in seed multiplication to ensure that seed used in their multiplication programme is obtained from reliable and trusted sources. Basic seeds of modern varieties should be sourced from research organizations. Where the intention is to produce Quality Declared Seeds (QDS), seed may be sourced from seed companies.
21. Artificial markets, including those geared to seed for emergency distribution (e.g. contract growers tied to relief agencies), should be discouraged. If emergency seed is needed, it should be procured locally from seed producer groups and local agro-dealers (for vegetable seed).
22. Links have to be catalyzed for feeding farmer-acceptable, market-preferred crops into seed production initiatives. Efforts such as farmer field schools (FFS) and the end-user evaluation mechanisms mentioned above (#15) might all help to raise awareness of and access to new, needed varietal materials.
23. Improved storage methods should be investigated and promoted, particularly to deal with storage constraints of crops such as groundnut and cowpea. Use of metal silos and triple bagging options might be tested. Rigorous post-harvest loss assessments should be conducted to determine the degree and geographic scope of loss.

Value-added seed production, processing and marketing should be supported and encouraged among seed-producing groups or associations. Processing activities such as mechanized cleaning, grading, packaging and labelling will help consumers (farmers) clearly distinguish between grain and seed on the market. This will also help producers sell their products at a premium.

More generally, seed production has to be routinely tied to agro-enterprise possibilities. As first steps, we suggest the following:

24. The wealth of existing value chain studies should be brought together and synthesized.
25. Market information systems that farmers can trust need to be reviewed and further developed. This includes ensuring that market information – currently being collected by GoSS/SIFSIA/WFP – is accessible and user-friendly, even to ordinary farmers.
26. Diverse business and organizational models need to be tested so as to help farmers organize into effective production, processing and marketing groups (e.g. farmer field schools or specialized producer groups or collectives).

In brief, we recommend the development of a market-driven decentralized seed production system, which scales up foundation seed and then decentralizes seed production in multiple zones country-wide. Supply has to respond to demand, meaning that hard-to-produce crops (e.g. groundnut and cassava) and new desired varieties have to drive the production process.

IV. FORMAL/INFORMAL OUTLETS AND LOCAL MARKETS FOR AGRICULTURAL INPUTS

Farmers need regular access to outlets that can provide them with the varieties and quality seed they desire. Currently there are few such outlets and these are located only in major town centres.

Specialized formal outlets

27. The only formal input shops identified during the SSSA were in Yei, Wau and Aweil. Selling mostly horticultural crop seed, shop owners asked for a) better technical advice on crop varieties, b) training in business/marketing skills, and c) more ongoing links to the research that provides new varieties. Shop owners assess that business will grow substantially as Southern Sudan starts to produce its own array of fruits and vegetables, especially onions, eggplant and tomatoes which are already in demand in town centres. These fledging formal sector outlets need to be more systematically supported.

Expansion of informal outlets

Most farmers continue to obtain a significant proportion of their seed, and also new varieties, from various types of local markets. We recommend that creative initiatives be taken to tie the supply of new varieties and quality seed to the multiple venues where farmers routinely make purchases. Three initial methods for making new varieties more accessible might be tested:

28. Trials might be initiated whereby the seed of new varieties is sold in open markets throughout rural areas via a network of licensed vendors. Vendors would have to be trained to provide farmers with the technical advice needed to guide informed seed choices and management.

29. Seed fairs, whether in the context of emergency aid or development programmes, might be systematically linked to sources of new varieties and quality seed.

30. Seed loan schemes that allow farmers to obtain seed of new varieties on credit should be tested and include monitoring mechanisms to determine the quality of the seed returned by farmers and their real repayment rates.

Seed sales through the above-mentioned informal outlets can be facilitated if high-quality seed is sold in small quantities in sealed plastic packs. Experience elsewhere suggests this should be done in quantities acceptable to farmers (perhaps 100–200 g), with labels reporting varietal characteristics.

31. Farmer-focused, small-pack sales models might be tested in the range of venues where farmers routinely buy seed and other goods. (See recommendations 28–30.)

If implemented smartly, these suggestions for broadening seed sale venues and sale formats should stimulate the creation of a broad customer base, focusing directly on producers (small-scale farmers) and reducing reliance on large institutional buyers. Building on the varied local market channels that these farmers already regularly use should also minimize transaction costs.

V. RURAL WOMEN AND SEED SECURITY

Half the households surveyed in the Southern Sudan SSSA are female-headed, with women playing a key role by promoting food security, seed security and general well-being. Even in male-headed households, women are often responsible for seed and grain storage at the household level, as well as limited marketing so as to obtain essential household supplies such as tea, sugar and oil.

32. Women's groups that were contacted during the SSSA carry out a range of activities such as providing seed storage during critical post-harvest periods, processing products (groundnut and sesame pastes, maize, cassava and sorghum flours), and setting up nurseries and selling vegetables. Such groups, rather than individuals, should be considered important entry points for development and investment support. Precedents for collaborative work already exist, e.g. the Tiwu ku Yupet (Kajokeji County) and Abulometa (Mugwo) women's groups.

33. More generally, little research has been carried out on gender dynamics in Southern Sudan's agricultural systems and rural economy. The government and development organizations should invest in focused study of women's participation in agricultural activities to determine appropriate entry points for women in key value chains, seed security and food security initiatives.

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Annexes

Three documents used in the SSSA are here presented as annexes. The first two are data collection forms used for individual-farmer and community interviews. The third is an inventory form for documenting the activities of seed multiplication organizations.

SSSA, SOUTH SUDAN: INDIVIDUAL FARMER INTERVIEW

Interviewer name _____ Organization _____ Date _____ Interview # _____

Household head _____ Age _____ Sex M F (circle); Marital status: single, married, widowed, divorced (circle); HH size__

Area cultivated current season: < 1 feddan; 1-3; over 3 feddans (circle); Type of settler: resident, IDP, returnee, refugee (circle)

State _____ County _____ _____ Payam _____ Boma _____

PART I. SEED SOURCES FOR CROPS GROWN CURRENT SEASON: (June 2010 to January 2011)

1. For this current season, what are your three most important crops for which you use seed or planting material (including suckers)?

Crop A	Crop B:	Crop C:

2. For each crop, in Question 1, from where did you obtain your seed, how was it acquired, which variety was used,-- etc (see table below).

Crop A: _____ MAIZE _____ (fill in crop name)

Sources of Seed planted list ALL sources See codes 1-9	How acquired see codes A-J	Variety		Quantity local units		Quantity (kg)	Was the Seed Quality: G=good A=average P= Poor	Will you sow again this seed? Y = Yes N = No
		Name	Local (L) or Modern (M)	#	unit			
Total planted for Crop A								

Sources of seed: CODES

1= home saved /own stocks
2= local market
3= agro-input dealer
4= community-based seed group
5= friends/neighbours, relatives
6= Government
7= NGO
8= UN-FAO
9= Other (specify)

How acquired: CODES

A= purchase/buy
B= exchange/barter
C= gift (friend, relatives, neighbours)
D= vouchers/coupons (sometimes with fairs)
E= direct seed distribution
F= seed loan
G= food aid
H= money credit
I= save - own stocks
J= other (specify)

Follow-up questions Crop A

Normally, how much seed do you plant this season?	Total quantity actually planted this season (see above)	This season, did you plant M=more; S=same; or L=less than usual?	If different (M or L) explain

Crop B __ ___ SORGHUM _____ (fill in crop name)

Sources of Seed planted list ALL sources See codes 1-9	How acquired see codes A-J	Variety		Quantity local units		Quantity (kg)	Was the Seed Quality: G=good A=average P= Poor	Will you sow again this seed? Y = Yes N = No
		Name	Local (L) or Modern (M)	#	unit			
Total planted for Crop B								

Follow-up questions Crop B

Normally, how much seed do you plant this season?	Total quantity actually planted this season (see above)	This season, did you plant M=more; S=same; or L=less than usual?	If different (M or L) explain

Sources of seed: CODES		How acquired:CODES	
1= home saved /own stocks	6= Government	A= purchase/buy	F= seed loan
2= local market	7= NGO	B= exchange/barter	G= food aid
3= agro-input dealer	8= UN-FAO	C= gift (friend, relatives, neighbours)	H= money credit
4= community-based seed group (specify)	9= Other	D= vouchers/coupons (sometimes with fairs)	I= save - own stocks
5= friends/neighbours, relatives		E= direct seed distribution	J= other (specify)

Crop C __ _____ GNUTS __ (fill in crop name)

Sources of Seed planted list ALL sources See codes 1-9	How acquired see codes A-J	Variety		Quantity local units		Quantity (kg)	Was the Seed Quality: G=good A=average P= Poor	Will you sow again this seed? Y = Yes N = No
		Name	Local (L) or Modern (M)	#	unit			
Total planted for Crop C								

Follow-up questions Crop C

Normally, how much seed do you plant this season?	Total quantity actually planted this season (see above)	This season, did you plant M=more; S=same; or L=less than usual?	If different (M or L) explain

PART II: SEED SOURCES NEXT SEASON

3. For next season, where will you get your seed for your TWO most important crop: (specify month season starts: _____)

Crop A:	Crop B:

Crop	Planned Seed Sources (codes 1-9)	How acquired (codes A-J)	Amount in local units		Amount in kg
			#	Unit	
A:					
	Total to be planted- Crop A				

Follow-up questions Crop A- next season

Normally, how much seed do you plant this season?	Total quantity you expect to plant (see above)	This next season, will you plant M=more; S=same; or L=less than usual?	If different (M or L) explain

Sources of seed: CODES		How acquired:CODES	
1= home saved /own stocks	6= Government	A= purchase/buy	F= seed loan
2= local market	7= NGO	B= exchange/barter	G= food aid
3= agro-input dealer	8= UN-FAO	C= gift (friend, relatives, neighbours)	H= money credit
4= community-based seed group (specify)	9= Other	D= vouchers/coupons (sometimes with fairs)	I= save - own stocks
5= friends/neighbours, relatives		E= direct seed distribution	J= other (specify)

Crop	Planned Seed Sources (codes 1-9)	How acquired (codes A-J)	Amount in local units		Amount in kg
			#	Unit	
	Total to be planted Crop B				

Follow up questions Crop B- next season

Normally, how much seed do you plant this season?	Total quantity you expect to plant (see above)	This next season, will you plant M=more; S=same; or L=less than usual?	If different (M or L) explain

PART III. ACCESS TO NEW VARIETIES

4. In the last 5 years, have you ever received /obtained a new variety? No Yes (circle one)

If yes, How many varieties _____ 4 _____

If yes, specify source, crop, variety name, source, and if you are still sowing the variety.

Source (codes 2-9 above)	Crop	Variety name	When (year)	Are you still sowing it ? (Yes/No), if no, specify WHY

PART IV: FERTILIZER AND COMPOST USE

5. (Questions on Fertilizer and Manure/Compost use- see table below: GENERAL use)

General use	Fertilizer	Manure/Compost
Have you ever used: (fertilizer or manure/compost) Yes/No		
If no, why not (see codes 1=7)		
If yes, on which priority crops		

Use this season		
Did you use (fertilizer or manure/compost) this season?		
If no, why not (see codes 1-7)		
If yes, on which specific crops		
Specific type used (see codes E-J for manure/compost) (specify type for inorganic fertilizer)		

CODES for not using fertilizer of manure/compost

1= not available 2= not necessary for me (soils fertile) 3= too expensive	4= I do not know them or how to use them 5= they are not profitable for me 6= not allowed to use them	7= other (specify)

CODES for types of compost/manure (for fertilizer specify type by name)

Manure/compost:		
E = large animal (cow, horse, donkey, etc) F = small animal (sheep, goats)	G = poultry manure H = crop/field residue	I = kitchen refuse J = other (specify)

PART V. SEED AID

6. In the last 5 years, have you received seed aid? No Yes (circle one) If yes, how many times: _____

If yes, specify the organization, means of delivery, crop, variety name and year received (table directly below)

Organization (codes P-S)	Means of delivery (codes 1-3)	Crop	Variety name	Local/modern	When (year)

Organizations involved in seed aid: CODES	Means of delivery
P= Government S= Other (specify) Q= NGO R = UN-FAO	1. free – direct seed distribution 2. vouchers (and fairs) 3. seed loan (and pay back expected)

(THAT IS ALL. THANK YOUR HELP. ANY QUESTIONS FOR US?)

SEED SYSTEM ASSESSMENT, South Sudan. November 2010. COMMUNITY-BASED INTERVIEW 1

Boma _____ Date_____ Note recorder _____ Int# _____

State _____ Country _____ Payam_ _____ Group Interview: # Total _____ #Men _____ #Women _____

Note: The questions below are broad guide questions. Most important is to stimulate discussion and insights on strategy.

PART I. BRIEF COMMUNITY PROFILE

History- PAYAM (when community came together); Relationship among families, e.g. one ethnic group, one clan, all resettled?
Families in 'community'; other salient features to assess 'community unity'

PART II. OVERALL CROP PROFILES AND TRENDS

1. We would like to learn about the main uses of your crops, for food and/or for income. Please rate their importance in each of the two categories -- as High (H) Medium (M) or Low (L). Also indicate if any of the crops are further transformed.

Crop	Use for Food (H, M, or L)	Use for Income (H, M, or L)	Any transformation? Specify

Indicate which crops are most important for FOOD SECURITY_____

Indicate which crops are most important for INCOME_____

2. For the last: 3 seasons how would you rate each season overall: good, average, poor - starting from current season

Rating (G, A, P) Good, Avg. Poor	Current season: date	Previous: date	2nd previous: date
Comments			

3. In the last five years, have there been changes in proportions of crops planted in your community?

Crops gaining in area and why	Crops decreasing in area and why

4. In the last five years, have there been changes in types of varieties planted in your community?

New varieties that have come into use in the last 5 years?				Varieties that are decreasing in use (being abandoned) + why		
Crop	**Variety**	**When introduced**	**From where/ whom**	**Crop**	**Variety**	**Why?**

5. Generally, what have been the major constraints you have faced in agriculture production over the last five years—and what do you see as the opportunities

Constraints to agricultural production - last five years	Opportunities

(Probe: do women have the same constraints and opportunities as men?

PART III. STRATEGIES FOR OBTAINING SEED: MAPPING OF SEED SOURCES

6. For each of the major three crops, please MAP major seed sources used by the community**. (See separate guide)**

A. Map the seed sources for this current season (2010)

B. Map the seed sources as they were 5 years ago (about 2005)

subjects to discuss:

- main sources for seed (and **rank in importance**, 1= most important; 2= second in importance, 3= third in importance
- advantages and disadvantages of different sources
- quality of seed from different sources
- types of varieties from different sources
- different in seed source use by wealth
- availability of seed from different sources
- price/costs seed from different sources

PART IV. INNOVATIONS

7. **What types of positive innovations are taking place in your community—related to farming or to seed security**

Innovation	Yes/No	Explain
Are there community-based seed related enterprises or other seed-producers?		
Are there any agro-enterprises in the area? (or plans for agro-enterprises)?		
Are there any new farmers' associations? women's groups developing activities?		
Are there any new agricultural management techniques being introduced (such as storage techniques)?		
Generally, are there new skill-building efforts in this zone?		

PART V: COMMUNITY ASSESSMENT OF SEED SECURITY AND INSECURITY

Seed Security means that a household has the seed it needs (in house stocks / harvest) or that it can get the seed it needs, for example, through purchase or barter.

8. In this payam: what proportion of households would be considered potentially SEED SECURE (that is**, they have enough seed already OR they can get it.** Go crop by crop, for the four important crops grown.

CROP	Out of 100 households, how many who grow the crop?	Out of those who grow the crop, how many were seed secure this last season?	Comments

9. For those who are seed insecure… what might families do (or the community do) to relieve seed insecurity (go crop by crop)

Crop	Actions to relieve seed insecurity for those in need

THANK YOU, THAT IS ALL. MIGHT YOU HAVE QUESTIONS FOR US?

INVENTORY FORM: SEED MULTIPLICATION ORGANIZATIONS

Name of Organization:

Part I: Organization Overview

Physical address

Contact Address

Post:

Telephone:

Email:

Type of organization

S/No	Organization	
1	Government parastatal	
2	Private Company	
3	UN Agency	
4	NGO/CBO/FBO	
5	Farmer Association/Cooperative	
6	Individual entrepreneur	
7	Other (specify)	

Date organization commenced activities in southern Sudan (month/year)

Start:

Zone of action and the current number of households (beneficiaries) targeted

State	County	Partner	# Group	# Household	# individuals

Range of activities in which organization involved

Are you involved in any seed multiplication/production activity? Yes or No and comments:

What other non-seed activities are you involved in?, list:

Part II: Seed-related Activities

Year commenced seed-related activities and the funding/supporting organization

Partners/groups/farmers involvement and organization

State	County	Payam	Partner	# group	# individual	
					F	M

How is the multiplication organized?

Type, source and quantity of seeds used for multiplication

Crop	Variety	Year: 20….			Year: 20……..		
		Type	Source	Qty (Kg)	Type	Source	Qty (Kg)

Seed type: 1 = Breeder seed, 2 = basic seed, 3 = certified seed, 4 = Quality Declared, 5 = Local

Seed source: 1 = Southern Sudan; 2 = Northern Sudan; 3 = Uganda; 4 = Kenya; 5 = Other (specify)

Overview of seed related activities. Describe: e.g. multiplication; marketing; training; other: list

a) Training and capacity building activities related to seed production and marketing

Have you trained your extension agents and famers on seed production? Yes No

	Female	Male	Total
Extension agents			
Farmers			

What are some of the key seed production areas that you normally train extension/farmer on?

What methods and approaches do you use for disseminating seed production technologies?

Do you have any community storage facilities? Yes No. If yes, please give the location(s)

State	County	Payam	Boma	Village	Size: Small (S), Medium (M), Large (L)

Describe the ownership and management of the storage facilities

Have you established any modern seed processing equipment? Yes No. If yes, please describe them and give the location(s):

b) Multiplication, processing and marketing
Actual

Year	Crop	Variety	Local (L)/ Modern (M)	Area planted (feddan)	Production (MT)	Quality	Quantity (MT) marketed
20…							
Sub-total							
20…							
Sub-total							
Plan 2011							
Sub-total							

Projection for the coming year (2011)

Year	Crop	Variety	Area planted (Ha)	Production (MT)	Quality	Quantity (MT) marketed
2011						
Sub-total						

Organization of multiplication (describe process e.g. individual or group managed plots etc)

Organization of distribution/ marketing (describe: process e.g. collective storage and marketing, direct sale to clients; sale to wholesaler; sale through agro-dealers, seed loan and recovery processes, free distribution (give numbers when possible, for example, number of agro-dealer outlets)

USE ADDITIONAL SHEET OF PAPER IF THE SPACE PROVIDED IS NOT ENOUGH