



**ICARDA**  
Science for Better Livelihoods in Dry Areas



## The Wheat Seed Sector in the Sudan



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## List of Abbreviations

|          |                                                                   |
|----------|-------------------------------------------------------------------|
| AAID     | Arab Authority for agricultural Investment and Development        |
| ABS      | Agricultural Bank of Sudan                                        |
| ARC      | Agricultural Research Corporation                                 |
| ASSCO    | Arab Sudanese Seed Company                                        |
| CIMMYT   | International Center for Maize and Wheat Improvement              |
| ICARDA   | International Center for Agricultural Research in the Dry Areas   |
| CGIAR    | Consultative Group on International Agricultural Research         |
| FAO      | Food and Agriculture Organization of the United Nations           |
| IARC     | International Agricultural Research Center                        |
| IFAD     | International Fund for Agricultural Development                   |
| ISTA     | International Seed Testing Association                            |
| MoAF(/I) | Ministry of Agriculture and Forestry (/Irrigation)                |
| PVP      | Plant Variety Protection                                          |
| SARD-SC  | Support for Agricultural Research and Development-Strategic Crops |
| SA       | Seed Administration                                               |
| SSTA     | Sudan Seed Trade Association                                      |
| TAAT     | Technologies for African Agricultural Transformation              |
| UPOV     | International Union for the Protection of New Varieties of Plants |
| USAID    | United States Agency for International Development                |

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## EXECUTIVE SUMMARY

1. This original study for this report was carried out in June 2015 by ICARDA as an activity of the SARD-SC Wheat Sub-project, which is engaged in various seed production initiatives within its 'Innovation Platforms'. The mission also addressed more general concerns of the government about the status of the seed sector and the need to improve seed supply to farmers.
2. Meetings were held with all the official agencies concerned with seeds and with key stakeholders in the private sector. A five-day field trip was made to the Gezira Scheme during which detailed discussions were held with the various partners in the sub-project both on the research and extension sides. It was not possible to see any wheat crops at this time of year but visits were made to physical facilities used for seed production and quality control.
3. It is clear that the seed supply system for wheat has been seriously weakened over recent years because there is no longer any direct involvement of government and the crop is not sufficiently attractive to the private sector. Staff of the wheat sub-project cite lack of good quality seed as a major constraint in their efforts to increase wheat production. For this reason, they have placed seed production and delivery as a high priority in their technology transfer program.
4. Despite a successful program of research by the Agricultural Research Corporation (ARC) and its international collaborators, domestic wheat production has been declining and now represents only 20-30% of the national requirement. This presents a heavy burden in terms of foreign exchange and there is now a campaign to increase the contribution of domestic wheat. The seed-related activities of the sub-project in Sudan are therefore in close harmony with, and provide support to, this policy of the Government.
5. The government also now recognizes seed supply as a high priority and has taken steps to focus more attention and resources on the seed sector. The regulatory framework has been revised, there is an effective National Seed Council and a National Seed Policy was being prepared at the time of the mission. The final approval of the policy is still pending with the Ministry of Agriculture and Forestry. In the specific case of wheat, the challenge is how to strengthen the seed system so that the achievement of national policy goals is not constrained by the quantity or quality of seed available.
6. It will be very difficult to meet the wheat seed requirement entirely through formal channels that lead to 'certified seed'. Some intrinsic characteristics of wheat seed as a product would make this an expensive and risky approach that could only be supported by subsidies. Moreover, the past experience of bulk seed purchasing schemes by government has caused financial stress for companies and they may lack the confidence to do this again.
7. For this reason, it is preferable to organise a supply chain that begins with certified seed and continues through one or two generations of multiplication on a semi-formal basis that is closer to the end users. This approach has advantages in terms of cost and accountability although it will require some support from extension staff. Seed production conditions are generally favourable in Sudan and it is quite

feasible to implement a more devolved system of this kind if farmers have been trained in good management practices.

8. The wheat sub-project is currently implementing various schemes of this kind within its Innovation Platforms (IP) and a range of experience is being accumulated by the project. It is absolutely essential that this experience is consolidated, reviewed and distilled into some pragmatic working models that can be replicated in different locations. As far as possible, the allocation of responsibility for each generation of multiplication should be standardized and there should be a limit on the number of generations, each with its defined name. Private sector companies could still participate in these arrangements by supplying the initial certified seed to selected growers and overseeing the subsequent multiplications.
9. While this devolved multiplication program will require careful management, the production of sufficient early-generation seed is an absolute requirement to maintain the system. ARC is now responsible for producing basic seed of its varieties and the new Seed Center at Wad Medani deserves all possible support in order to fulfil these obligations. Some additional facilities will be required, particularly small-scale processing equipment.
10. The overall management and funding of the Seed Center will also require careful attention. Ideally it should produce a sufficient quantity of basic seed of the main varieties so that requests can, within reason, be met from stock. However, basic seed is relatively expensive to produce and if left unsold it will represent a serious financial loss. Pricing will also be critical because it is impossible to recover the full costs of basic seed production in a price that buyers are prepared to pay. This Center should therefore be regarded as an essential service to the breeders and to farmers and as such it will have to be subsidized. The provision of high quality storage for the early generation seed to enable secure carryover of stocks would be a great help in planning the production program.
11. The system of seed supply for wheat that is proposed here will be implemented in a devolved way using formal and semi-formal actors and that will require good coordination. However, the government must provide confidence by maintaining a stable policy for wheat production and recognising the essential role that seed supply plays in this. There is complete agreement that 'wheat is a strategic crop' but that strategy must be reflected back into the upstream seed supply system, which has a planning horizon of two or three seasons and is therefore vulnerable to sudden changes. To achieve the necessary commitment, it is proposed that an indicative seed production plan be prepared each year involving all participants in the chain from breeders to millers. The National Seed Council should review this plan and monitor its implementation. The Council must have sufficient resources available to perform this important role.
12. The new Seed Policy, once approved, should provide overall guidance for the development of the seed sector with a medium-term planning horizon of, say, five to ten years. To implement the kind of program described here for wheat, it will be important for the policy to recognise alternative/local approaches to seed supply including the role of producer groups and individual farmers. The same will apply



for the rainfed crops such as millet, groundnut and sesame; these also need alternative low-cost solutions.

13. Agriculture in Sudan comprises several distinct sectors reflecting the different crops grown, the production systems used and the marketing chain for final products. Each of these crops and sectors require their own approach to seed supply; some are easily addressed by the formal or private seed industry while others, including wheat, require more complex, devolved approaches in order to meet farmers' seed requirements. The Seed Policy must take account of these diverse needs and facilitate appropriate seed supply systems.
14. Ultimately, the task for government is to identify the total sum it intends to spend on all aspects of the seed system and then to allocate that in the most effective way. The National Seed Council, as a high-level advisory body, should provide expert advice on this matter. Importation of seed is clearly not good value for money and heavily subsidised seed distributions are also very costly and may prove unsustainable. However, some subsidy will be required to ensure the effective running of the Seed Center and to provide coordination of the multiplication program.
15. This report was finalised in August 2015 and was reviewed at a High-level Consultation meeting on 10 April 2016. The report of that meeting has been included as Annex 1. The meeting broadly accepted the conclusions of the study but requested more detail on the actual quantities of seed to be produced and an estimate of the production costs. This would assist the government to make the strategic decisions required on support to seed production, in the overall context of national food security. In response, an indicative production plan or 'Road Map' was prepared that would provide the quantities of seed required for an area of 500,000 hectares (about 1.2 million feddans) of wheat. This is attached as Annex 2 of the report.
16. Another concern raised in the review process was how to coordinate and monitor the final stages of seed multiplication, which are to be done on a semi-formal basis by local stakeholders. This is a valid concern because it will be a devolved activity, embedded in the local communities and therefore more difficult to control. The additional experience gained over two cropping seasons by the Innovation Platforms should offer guidance on how this part of the production chain can be made sustainable, while retaining the benefits of local reputation and affordable price for farmers.
17. Although this study was conducted for the specific needs of Sudan, the same problem of organising seed supply in wheat and similar crops exists in many countries. There is still a need to gain experience in how to link formal and semi-formal production systems together in a secure way. To this extent, the model proposed in this report deserves support both to address the domestic priorities and to contribute to the body of experience that may be applied elsewhere. SARD-SC and any successor project may provide a mechanism for testing this approach as a form of 'action research'.



## 1. INTRODUCTION

The African Development Bank is currently funding the project “Support to Agricultural Research for Development – Strategic Crops” (SARD-SC) within which twelve countries participate in the wheat sub-project coordinated by ICARDA<sup>1</sup>. These countries are grouped on a geographical basis and Sudan provides the ‘hub’ for work in the East-African Lowlands. The Agricultural Research Corporation of Sudan (ARC) has long experience in wheat research and particularly for breeding heat-tolerant varieties, it is therefore well-placed to host this program. Despite this positive research background, national production of wheat in Sudan has decreased in recent years and this is a serious drain on the economy because of the rising demand for bread and the high cost of imported grain. The government is committed to restoring wheat production and has announced ambitious annual targets. This can be achieved both by productivity gains and an increase in the planted area.

The lack of good quality seed is widely regarded as a major factor contributing to the poor performance of this crop in recent years and this reflects a wider concern about the overall status of the seed sector. To address this issue, the government invited ICARDA to carry out a review of the seed sector and to make recommendations for its renovation. In response, Dr Zewdie Bishaw, Head of the Seed Section, visited Sudan in December 2013 for further discussions. In fact, the inception workshop of the SARD-SC Wheat Sub-project held in March 2013 had already prioritized seeds as a key component of technology transfer. It was therefore agreed among the parties that ICARDA, as the coordinator of the sub-project, would provide this mission with the main focus on wheat but also taking account of the wider seed issues in Sudan<sup>2</sup>. This dual purpose was emphasised in briefings with senior Ministry officials at the start of the mission. Terms of Reference for the mission are shown in Annex 3.

Although the institutional and regulatory aspects of this study are specific to Sudan, the analysis presented in this report may be relevant to other countries within the sub-project because the supply of wheat seed does present some generic challenges that arise from its biological and agronomic characteristics.

Section 2 of this report presents a brief overview of the evolution and current status of the seed sector, particularly regarding policy and institutional issues. This is intended mostly to provide sufficient context for later sections of the report, since the details are well-known to local stakeholders. Section 3 discusses the many issues that have impacted on the seed supply system, thus shaping its present condition and future

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<sup>1</sup>SARD-SC operates through four independent sub-projects for its strategic crops, namely wheat, rice, maize and cassava each managed by the relevant mandated CGIAR Center. It is being implemented from January 2013 to December 2017; the mid-term review was conducted in March 2015.

<sup>2</sup>The mission comprised of Dr Michael Turner (Seed Specialist) and accompanied by Dr Abdulla B. Elahmedi (retired Wheat Breeder of ARC), both hired as resource persons by ICARDA. Overall country coordination was provided by Dr Hassan El-Awad (Country Manager, ICARDA-Sudan) and Dr Izzat Tahir, National Coordinator for the SARD-SC Wheat sub-project in Sudan and also the regional hub for the East-African lowlands. Dr Zewdie Bishaw, (Head of Seed Section and International Nurseries) had responsibility as an overall coordinator of and main contributor to the study.

prospects. Section 4 summarises the main findings and recommendations based on this analysis. Finally, some 'next steps' are noted in Section 5 including a national workshop to review both the specific problems of wheat seed supply and the more general challenges of organising the seed sector in the most effective way, within the resources available. The findings and recommendations presented in this report will provide a basis for further discussion and should lead to a national strategy for seed supply, which must be tailored to the needs of different crops and farming systems.

## **2. OVERVIEW OF THE SEED SECTOR**

The organisational structure of the seed sector in Sudan is quite simple, with the main institutions having clearly defined functions within the system. The overview presented here adopts an institutional approach and this also illustrates the evolution that has taken place over the past four decades.

### **2.1 Agricultural Research Corporation**

ARC has its origins over a century ago when research was needed to support the rapid expansion of cotton production in the Gezira Irrigation Scheme. The headquarters at Wad Medani is one of the oldest agricultural research stations in Africa and despite financial constraints, that long and proud tradition is still felt today. Other stations have been added over the years to support the main agricultural areas in the north, east and west of the country, each of which have their distinctive agro-ecologies and production systems.

Unlike the Nile Valley to the north, wheat was not a traditional crop south of Khartoum. It was introduced in the 1960s when there was intensive breeding of material for the more tropical environments in countries such as Brazil and Bangladesh. These genetic advances provided one of the foundations of the Green Revolution. The Gezira may be considered as a frontier area for the commercial production of wheat because of the short, unpredictable cool season and the rapid rise in temperature during grain filling. These are critical factors in determining both yield and grain quality. For this reason, the station at Wad Medani has been an ideal location to select for heat tolerance and these lines are now being tested in other countries of the wheat sub-project, with encouraging results.

After a line has been selected and tested by the breeder, a Variety Release Committee constituted under the Seed Act reviews all the available trials data and makes recommendations for registration and release. Although this process is largely internal, it does not appear to be controversial because ARC is the only breeder of wheat; it has a detailed knowledge of the production systems through its network of stations and good extension linkages. The old Egyptian varieties from Giza have been gradually replaced and in practice ARC is the 'sole provider' of wheat varieties for most of Sudan, though most of the original genetic material came from CIMMYT and ICARDA.

In total, ARC has released about 20 wheat varieties since 1960 and as would be expected, only a few of these achieved widespread commercial use. It is said that there are seven to eight main varieties in use by farmers in Sudan today. Imam (released in 2000) is the dominant variety and the main one available as certified seed. It occupies approximately 80% of the area in the Gezira. Some later releases have not yet displaced

Imam, confirming the common experience that farmers remain loyal to a reliable variety they know and trust, even if there are others with potentially greater benefits.

After new varieties are registered and released, it is the breeder's responsibility to carry out regular cycles of maintenance and to produce small quantities of breeder seed, normally generated directly from the maintenance plots or with one further multiplication. The procedures for this work are well-established though with small variations between breeders. In the past, breeder seed was passed to the National Seed Administration (NSA), which undertook all subsequent multiplications for eventual sale as certified seed. This chain has worked less well since NSA was privatised in 1996, as explained in the next section. It is said that some varieties still in demand are no longer available as early generation seed.

With the renewed focus on seed supply and recognition of the current problems, ARC has been given the responsibility to produce basic seed of its varieties. This reflects the fact that the previous close link between ARC and NSA had become disrupted and it was necessary to restore a secure link between the breeder and seed producers. To address these new obligations, ARC is upgrading the Seed Center (formerly seed unit) at Wad Medani with specific responsibility for variety maintenance and basic seed production<sup>3</sup>. This is a very positive step but the Center will require dedicated facilities and staff as well as finance so that it does not compete with breeders needs. This is discussed in section 3.6 of the report.

Sudan is in the process of becoming a full member of the CGIAR; this will present some obligations in terms of financial contribution but it will also bring opportunities to attract funding from new external sources. The strength of ARC in wheat breeding and its position as a one of the hubs in the wheat sub-project, will enable ARC and Sudan to have a higher profile on the international scene. However, if this is to be reflected in increased domestic production, there must also be a stable policy environment that provides confidence to farmers and other stakeholders right through the value chain. This is a key theme in the present study.

## 2.2 National Seed Administration<sup>4</sup>

The Plant Propagation Administration (PPA) was established in 1968 to carry out seed multiplication for the Gezira Scheme, its headquarters and main facilities were at Sennar. In 1982 it was renamed as the National Seed Administration and for several years benefited from a large project funded by the African Development Bank. This project established production facilities in each of the main regions of the country, closely associated with the relevant ARC stations. As noted above, breeder seed was passed directly from ARC to NSA for further multiplication, processing, storage and final distribution as certified seed. It was a closely integrated system.

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<sup>3</sup> The naming of seed generations is confused because the 2010 Seed Law adopted the international 'OECD' system whereas the AOSCA system was used in the past. The correct term is now basic seed but this has the same meaning as foundation seed, and that term is still in use; later generations are referred to as certified seed.

<sup>4</sup> This is also sometimes referred to as the Federal Seed Administration or the General Seed Administration but 'NSA' is still the most familiar term and it is therefore used in this report.

NSA also had an internal quality control department that carried out field inspection of crops and laboratory testing of seed lots to ensure that these complied with the minimum standards that were eventually incorporated in the Seed Act (1990). Each of the regional centres had its own staff for this purpose. This was certainly not an independent quality control system, but since seed production was being done by the same organization, the system was well-coordinated. At its peak in the 1980s, some 80,000 feddans of seed crops (mostly wheat) were being inspected and certified each year.

In 1996, the Government decided to 'privatise' the production functions of NSA by establishing the Arab Sudanese Seed Company (ASSCO) with a substantial investment from the Arab Authority for Agricultural Investment and Development (AAAID). All the physical assets of NSA, including land, equipment, processing plants and storage facilities were transferred to the new company, together with the concerned staff. At the time there was a strong political trend towards the privatisation of public/parastatal enterprises in many different economic sectors, including seeds. The long-term implications of this separation are discussed in later sections.

NSA continued with its quality control functions and with the staff/facilities required for that task. Therefore, NSA effectively became an independent quality control agency – also in line with the recognised 'good practice'. Its headquarters was later moved from Sennar to Khartoum but it suffered progressive deterioration with no staff recruitment for many years and no replacement of its physical facilities. The main seed laboratory has remained in Sennar and this currently tests about 2000 samples each year (for most of the country) but the dedicated staff now work in very poor conditions.

A new seed laboratory has been established in Khartoum with funding from the IFAD Seed Development Project as the 'National Seed Testing Laboratory' and it will greatly improve the capacity of the organisation. The laboratory should become a member of the International Seed Testing Association (ISTA) and in the long term it should be accredited by ISTA. Despite this improvement in seed testing facilities, the number of staff available for field inspection is still quite small considering the size of the country. Due to the limited availability of vehicles, field inspectors often depend on the companies for transport, which may compromise their independence. There is a proposal to raise the Seed Administration to the status of a Directorate within the Ministry but it is not known if that would change its resources.

### **2.3 The Private Sector**

Since its establishment nearly 20 years ago, ASSCO has remained the largest single player in the seed industry because it inherited all the production assets of NSA. It operates largely as a private company although with the government as a majority shareholder, it may still be subject to some political intervention, if not direct control. It may therefore retain some characteristics of a parastatal. ASSCO is the only significant producer of wheat seed, continuing the role of NSA but production has declined rapidly and there have been bad experiences with seed sales, leading to large carryover stocks in some years. Unsold seed can be diverted to the grain market but of course this incurs a financial loss. Overall, it can be said that wheat seed production is unattractive for ASSCO and it has focussed increasingly on more profitable crops such as sorghum.

The true private seed sector comprises about 25 companies who are members of the Sudan Seed Trade Association. Among these, about six or seven may be counted as vertically-integrated service companies, and some of these have modest breeding programs in the profitable hybrid crops, notably sunflower and sorghum. However, they have very little involvement in wheat and make no significant contribution to the overall supply of seed. This is a consequence of the large seed volume required, uncertain demand and limited profit margin on this crop. They would also be in competition with ASSCO, which has its own farms and facilities. The majority of the seed companies are essentially importers or traders with no specialised seed facilities and limited technical capacity. In the past, some of the private companies participated in government schemes to produce seed for distribution to small farmers in the dryland areas and although this provided additional business, the financial arrangements were unsatisfactory and payment was often delayed.

The Sudan Seed Trade Association (SSTA) was established in 2007 but it remains a relatively small organisation due to limited financial recourses. It lacks a permanent office or secretary and depends on the goodwill of member companies and their staff. However, it does provide a forum for the commercial sector to discuss matters of mutual interest and to participate in regional organisations, notably the African Seed Trade Association. It is to be hoped that as the private sector expands, there will be sufficient interest and resources from the membership to support a more secure secretariat that can respond to members' needs both in the domestic market and internationally.

## **2.4 Agricultural Bank of Sudan**

This institution is an arm of government and a major player in the agriculture sector with a special role in the wheat system as the implementer of official pricing policies. Specifically, ABS provides credit in kind to farmers for the major inputs, namely fertilisers, seeds and equipment and also credit in cash for services like land preparation. At the end of the season, they buy in the wheat crop and the value of the credit for inputs is deducted from the payment due. The buying price for wheat grain is announced in October each year, before the planting season, and this naturally influences farmers' decisions to plant the crop. Grain purchased by ABS is sold on to the millers at a subsidized price, again fixed by government so there is effectively no open market for wheat, except for some very localised trading and for niche varieties that have special uses.

Although this credit model operates on its largest scale in the Gezira Scheme, where 60% of the wheat crop is grown, it is replicated on broadly similar lines in the other organised production areas and along the Nile Valley in the north. The universal provision of credit for seasonal inputs is a very distinctive feature of the production system in Sudan; it means that farmers do not have to put aside the cash required for each cropping season. While this may seem to be a good service for farmers, it means that they are permanently dependent on this credit model and at times it has given rise to complications both for farmers and for the bank.

## **2.5 Legal Framework**

As already noted, a new Seed Act was passed in 2010; its full title is the National Seeds and Varieties Protection Act. This is a very brief document with only six pages of substantive text and it covers both conventional aspects of seed production/marketing



and plant variety protection. Clearly all the details on both aspects of the law would need to be placed in secondary legislation and this was done in January 2012 when the 'Regulations' were published in a document of 38 pages. This includes many technical details that would often be placed in Annexes. It is not known to what extent these Regulations have been implemented so far.

One key provision of the new Seed Act was to establish the National Seed Council as an apex body to oversee the operation and development of the seed industry/sector. This has thirteen members, all experienced in different aspects of the seeds sector. The Council has been a proactive body, first preparing/reviewing the Seed Regulations and then in 2014 moving on to prepare a draft Seed Policy that is now pending approval at the Ministry. The content of the final version of this policy will be very important in guiding the development of the seed sector in general, and will have implications for the wheat system in particular, as discussed later.

## **2.6 Current status of wheat production**

Given this deep involvement of ABS in both seed supply and grain purchase, it is clear that the wheat supply chain depends ultimately on government because there is a policy decision to support domestic production so that the country does not rely entirely on imports. The sharp increases in world grain prices in 2007/08 prompted concerns in many countries and a wish to strengthen domestic production to improve national food security.

The annual wheat requirement of Sudan is about 2.5 million tons and in the 2014/15 season production was about 0.5 million tons. After erratic and declining production for many years, the government has decided to substantially increase domestic production. The long-term goal is to produce two million tons from one million feddans, with about half of this production being in the Gezira. There is a target to plant 400,000 feddans in 2015 and to increase this to 500,000 as quickly as possible. In the next two seasons, the government expects to increase the domestic contribution to 30 or 40% of the total requirement by setting a favourable buying price but of course the unknown factor is the world price, which can change quickly according to global harvests, which are highly seasonal. The government naturally keeps the overall strategy for support to agriculture under review and consequently there is always a risk that changes will be made in response to fiscal pressures or constraints.

Further analysis of this issue is beyond the scope of the current study but it is obvious that efforts to stimulate wheat grain production will only succeed if there is sufficient good quality seed for farmers to plant. Therefore, the status of seed supply is a key factor in achieving production targets, hence the interest of the government in reviewing the sector. Moreover, past experiences of large-scale seed importation were very negative with high foreign exchange cost and late delivery. It is absolutely clear that wheat seed production must be done in the country and there should be sufficient good seed available through a reliable channel to satisfy annual needs.

## **2.7 Role of the SARD-SC wheat sub-project in seed supply**

Technology transfer is a major theme in SARD-SC and improving seed supply has been identified as a key constraint for wheat. There are two aspects to this; first to multiply and test promising new varieties under farm conditions, second to develop a more

robust seed production and delivery system for all varieties required by farmers. There is no intention for the project to become a major seed supplier because that would lead to problems after closure – the key objective is to develop and test sustainable systems of seed production and dissemination. For this purpose, the project has established six Innovation Platforms (IP) that provide a coordination forum between all stakeholders within a defined target area.

Technology transfer is at the heart of the SARD-SC strategy and for the wheat sub-project, seeds were identified from the outset as a major component in the TT package.<sup>5</sup> This provides the justification for efforts to strengthen seed supply – and also for this study. As mentioned earlier, two aspects of seeds are being addressed by the project; first the evaluation, multiplication, and diffusion of new cultivars, and second, strengthening the regular seed supply chain to farmers. This study is concerned mostly with the latter, although variety issues are discussed in section 3.14.

Given the emphasis of the project on technology transfer, one important aspect of supplying seed is psychological, in that it makes farmers more aware of good management practices from the start of the season. This is especially relevant if farmers have seen a nearby demonstration or seed production field in good condition and recognised the benefits of the full management package. Although seeds may be only a part of the package, they focus farmers' attention at the start of the season. If high quality seed is used, including treatment, then the benefits become clear early on, providing an incentive to follow all subsequent recommendations and obtain substantial increases in productivity.

### **3. DISCUSSION OF ISSUES RELATING TO SEED SUPPLY**

Against the background presented above, this section analyses a number of issues that relate to the wheat sub-project, and in some cases, to the seed sector as a whole.

#### **3.1 Historical perspective**

Although the purpose of this study is to find solutions for the future, there are lessons to be learned from past experience. Sudan presents an interesting case because its large irrigation schemes such as the Gezira, Rahad and New Halfa were based on a rigid control of the entire production system, including a specification of what farmers could grow in their rotations and with various rules to maintain their standards of management. There are good reasons for doing this when water management is a key issue affecting thousands of farmers.

This colonial 'top-down' approach ebbed away after independence but the general principles of organising the system (including seed supply) surely influenced NSA in its early days when it was producing large quantities of seed with good facilities and at reasonable quality standards. NSA was in effect a core supplier of seed as an essential service to farmers, rather than as a commercial product. Cotton seed was handled in the same way by the Gezira Board. The financial circumstances at the time are not known but it may well be that the government considered the cost of this service too great and

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<sup>5</sup>It is reported that the AFSED project that is currently being implemented did not include seed as an input due the limited availability of quality seed.



was looking for a way out when it set up ASSCO in 1996. However, this had a negative impact because of the expectation that ASSCO would operate on a commercial basis and the relative unprofitability of wheat seed. It is difficult to reconcile commercial targets with a social responsibility role.

The Gezira Law of 2005 eliminated the last traces of central control and left farmers in the Gezira with complete freedom but with little support. This new environment may benefit a few who are more innovative but disadvantage the majority who will have to organise many more things individually. Efforts are now being made by ABS, the Microfinance Institution and the Innovation Platforms to reinstate some aspects of the previous service delivery system but in a more devolved way and with extension support rather than direct control. We may conclude that a highly institutionalized crop like wheat cannot be left to market forces and some level of intervention is required to ensure an adequate seed supply.

### 3.2 Private sector engagement in the wheat seed supply

Apart from ASSCO, which inherited the seed production facilities from NSA, the other companies have shown little interest in this crop. The reasons for this reluctance are clear. First, wheat seed is a large-scale operation in terms of field production, processing, storage and distribution. Therefore, it may require additional facilities to enter this market as a significant player. Second, the profit margin is limited because farmers are not prepared to pay a high price for this seed that has a high sowing rate and can be saved on the farm. Third, the demand is uncertain and there may be unsold stock to carry over or to sell as grain. Uncertainty about demand or about government policies are major disincentives to the private sector, particularly when they have more profitable and less risky products to sell. However, one possible motivation for companies to produce wheat seed is that it would add to the portfolio of crops they could offer to farmers, even if it does not make a big contribution to overall profits.

One company, Nile Sun Enterprises produced a reasonable amount of wheat seed on contract in the Gezira, in 2014/15 but this is an exception and there is no sign that others will follow. In principle, the government (or ABS) could provide incentives by offering to purchase seed from companies at a guaranteed price. However, they may be cautious of such arrangements because there is previous experience of a similar scheme to produce seed for distribution to farmers in the rainfed areas and payment to the companies was very slow. A further problem with subsidies of this kind is that they create dependency and the total costs tend to grow over time.

### 3.3 Characteristics of wheat seed as a product

Being a genetically stable, self-pollinating crop, wheat varieties can be maintained through many generations without deterioration if the correct management practices are used. There is no intrinsic or automatic deterioration in successive multiplications<sup>6</sup>. The main threats to the purity of a seed stock come from volunteer plants or off-types in the field and from mechanical contamination during post-harvest operations. In some

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<sup>6</sup>Some wheat varieties are prone to a low-level of mutation and this can multiply with each generation if the off-type plants are not removed. Apart from this, wheat varieties are stable and are not prone to genetic contamination.

countries, seed borne diseases are a serious threat but that is not the case in Sudan because of the very dry production environment. Therefore, in principle, a farmer who follows a few standard procedures could maintain a good seed stock for many years. This is a justification for doing extension work to support the informal system although it is contrary to the conventional approach of encouraging farmers to purchase seed from the formal sector, with an expectation of regular replacement.

### **3.4 Seed demand and market prospects**

The question of seed demand was raised many times during the mission and conflicting opinions were expressed. On the one hand, seed companies say that if they produce wheat seed they are not sure if they can sell it so they may incur a loss if seed has to be diverted to the grain market. ASSCO has certainly had this experience in the past. Unsold stock may be carried over for one year but the generally high ambient temperature and the period of high humidity during the rainy season will cause some deterioration.

On the other hand, project staff and their extension collaborators say that there is an increasing awareness of the value of seed and farmers are asking for good quality seed of specific varieties. There are farmer producers who are selling seed within their locality and gaining a reputation as reliable suppliers. This is a positive experience and it is surely based to some extent on the value of personal contacts and seeing demonstration plots growing in the field. Local seed production initiatives of this kind have the clear advantage that seed producers and client farmers can be closely linked together; this enables better planning of production and reduces marketing costs. However, it is still important to know the cost build-up as a basis for realistic pricing which will make the system financially sustainable.

Price is a key determinant of demand. In 2015, the price of grain was SDG400 per 100kg sack and the sale price by ASSCO is SDG700, therefore a 75% premium over grain. This is quite reasonable if they have to cover all operating costs. ASSCO has the 'advantage' of using its own land and old depreciated equipment but it probably incurs relatively high overhead costs. It is possible that private sector producers could offer a somewhat lower price than ASSCO due to their lower overheads. Ideally, there should be a clear pricing structure for all categories of seed based on actual costs but it is difficult to determine this because of the administrative pricing system linked to credit provision.

Overall, it seems very unlikely that there will ever be a truly competitive market for wheat seed based on a strong 'demand-pull' from farmers and with companies competing for that business. It will remain a managed system in which the key development objective is to maximise the use by farmers of good quality seed at moderate cost.

### **3.5 Strengthening the seed production chain**

Historically, ARC breeders were keenly aware of seed issues because of their close working relationship with NSA but this linkage was disrupted when ASSCO was formed. SARD-SC is trying to put in place a new delivery channel for wheat seed that is secure and sustainable. There are two distinct phases to this task, first to ensure a supply of high quality basic seed and then to multiply this through to certified seed that is made available to farmers. Basic seed is the crossover point where the breeder's responsibility ends and other parties continue with the large-scale production. This is where good

coordination is essential to ensure that sufficient basic seed is available to meet demands and likewise, that producers are ready to take this seed and make good use of it. Failure on either side leads to a weakness in the seed chain and wastage of resources.

Although ARC could, in principle, continue with further multiplication to certified seed, this would not be a good course of action because it may distract from their primary and most important responsibility of generating sufficient basic seed to meet all requirements. It is reported that ARC stations sometimes sell seed directly to farmers in order to generate revenue. Although this practice is understandable, and may be helpful to the immediate beneficiaries, it is not really the function of a research station, unless there is a clear objective in terms of variety testing or extension.

### **3.6 The ARC Seed Center**

The establishment of this Center as a distinct entity within ARC is a key step in securing the supply of basic seed and it deserves all possible support both from ARC management and from the project to put its operations on a sustainable basis. From an organisational standpoint, the Center should have its own dedicated resources, both human and physical, so it does not compete with the main breeding program. The technical procedures required for variety maintenance and early generation seed production are well-known to staff but some additional small-scale equipment is required, such as plot seeders and plot combine harvesters. Most important, the Center should have its own air-screen cleaner to handle bulks that are much too small to put through the main seed processing plant. This would enable full control of early-generation seed production. These machines are readily available, though relatively expensive, and the ICARDA Seed Section would be able to advise on the specification for the main crops to be handled, in addition to wheat.

Variety maintenance has been a problem in recent years and it is said that some varieties/parent lines of some crops are no longer available as a pure stock. Since this is such a critical stage in the multiplication program, it is recommended that NSA should inspect the fields used for basic seed production and should ensure that all this seed clearly meets the certification standards with regard to varietal purity. It is a common weakness in public seed programs that basic seed is not of sufficiently high quality and this leads to bigger problems in the subsequent multiplications.

Besides the technical work to be done by this Center, its operational and financial management will also be important because it will be difficult (or impossible) to set a price for basic seed that covers the full cost of production. Moreover, it will be counter-productive if the price is so high that it discourages downstream users to purchase it. Ideally the Center should produce an excess of basic seed of the main varieties so that clients can obtain it 'on demand' within reasonable limits. However, this would incur a financial risk if the seed was unsold and lost its viability. To reduce these risks, clients (private seed companies) could be expected to place contracts with the Center to produce the quantity of basic seed they require. Investment in improved storage facilities would help to reduce this risk and this could be justified for early generation seed.

### 3.7 Downstream seed multiplication and diffusion

It is in this part of the chain that the wheat sub-project is most actively involved through its six Innovation Platforms that bring together all stakeholders in an area and with a strong extension focus. Various models are being tried using demonstration plots, field days and farmer field schools to raise awareness of quality seed at the community/local level. As already noted, this approach enables direct contact between seed producers and farmers and with the possibility of purchase after the crop has been harvested.

The challenge for the project is to document the different experiences from within the IPs and identify a pragmatic model that can be replicated in other locations. The model should have clearly defined stages of multiplication that effectively bridge the gap from the formal to semi-formal systems, while maintaining some degree of control, for example:

- Basic seed from ARC used by Gezira Scheme (or equivalent body elsewhere) to produce certified 1<sup>st</sup> generation (C1) with contract growers, these fields would be inspected by NSA. The project has demonstrated this model by providing seeds for further multiplication by its stakeholders;
- C1 seed passed to recognised groups of trained farmers to produce certified (C2), this would be inspected by NSA and/or licensed inspectors;
- C2 seed passed to lead farmers to produce 'extension seed' that is made available to others within the immediate area, this would be mostly inspected by extension staff. This could possibly correspond with the category of 'good seed', which is recognised by the project but not yet properly defined. The precise title of this final generation has yet to be decided but the key point is that it should not be used for further multiplication. There must be a finite number of named generations with responsibility clearly allocated.

The first two of these multiplications should be covered by a contract whereas the final one could be simply an agreement with the farmer arranged by extension staff. It is important that the key players in the chain, namely the farmer groups and lead farmers are given some official recognition as a result of their training and good performance as seed growers. This will help to improve their status within the community and to ensure commitment to the scheme. However, there must also be a valid financial justification for all these actors to participate. If the scheme relies only on 'goodwill' and project support it may wither when that support finishes. The key elements of this scheme are summarised in Annex Table 1 and Figure 1.

Private companies could still be encouraged to participate in this model by producing their own certified seed and supplying this to their own farmers for further multiplication. If the quality assurance is good, they could then identify the later generation seed with their own label and gain some 'reputational benefit' from this.

### 3.8 Prospects for local (community-based) seed production

In many countries, local seed production schemes and small seed enterprises are being promoted to address the problems faced by more formal seed systems. This approach is especially relevant in areas where farming communities are isolated and infrastructure is weak, or where there is a need for location-specific varieties. In the parts of Sudan where wheat is grown, access is generally not a major problem and the environment is

relatively uniform over large areas of irrigated land. However, the formal sector (ASSCO and private companies) has still under-performed because the supply of wheat seed is relatively unprofitable. In this case, the clear justification for a more localised production system is to reduce costs and to make good quality seed more accessible at a village/community level.

There is general agreement that the production of wheat seed is not a technically difficult task provided that a few basic principles are followed. The challenge is to organise a system that is sustainable with only a moderate level of supervision and that brings sufficient benefits for the participants that they maintain their commitment and quality standards. This emphasises the need for training and recognition of the key actors on whom the system will depend. Although cooperatives do not have a successful history in Sudan, the formation of seed grower's associations may be helpful as a way to maintain loyalty and to make training activities more efficient.

In the absence of major disease threats, the main quality aspects that must be taken care of are physical contamination with other varieties and pest attack during storage. Roguing of seed fields is a routine activity to maintain varietal purity but farmers are often reluctant to do this work themselves because they consider (correctly!) that the removal of plants will have a direct impact on yield. However, failure to do this leads to increasing levels of variety mixture and ultimately to a high level of rejection of crops inspected by NSA, as already mentioned.

Seed treatment with appropriate insecticides and fungicides is very beneficial and this is done routinely but of course it does require some basic equipment to apply the treatment uniformly. The provision of small-scale/mobile seed processing units will be a strong support to local seed production initiatives and there is a window of several months during which this work could be carried out. Here again, the provision of a service of this kind is mostly an organisational issue; the project (or their successors) will have to decide who will operate the machines and how much to charge to ensure that all costs are covered and the service is sustainable.

### **3.9 Financing the seed production cycle**

ASSCO have the option of using their own farms for their seed production but almost all other producers, such as companies and projects, use farmers who grow on a contract basis. This is the preferred system globally because it allows flexibility in the location and area of seed production fields. It has the added benefit for a project like SARD-SC that contract growers can demonstrate good management practices within the community and they might even sell part of their crop, if that is allowed in the contract. In Sudan the premium for growing seed is well-established at 15% above the prevailing grain price and this should provide sufficient incentive for good farmers to undertake this task and thus share in the rewards of seed production.

Despite these advantages, and others, there is an inherent risk in contract production because the person or organisation that places the contract must have the resources to buy in the crop soon after harvest. If this is not done, the grower may lose confidence and simply sell the seed as grain; this is a disaster, because the seed is not available for further use and all the prior investment in basic seed production is wasted. Moreover, a farmer who has this bad experience will be unlikely to grow seed again in the following



year. At the next step in the production chain, the organisation that purchases seed from contract growers must hold this stock until the next sowing season and that is a financial burden.

To summarize, the annual cycle of cash flow is a critical element in seed production, however it is organised. This problem is more acute when there is strong seasonality in the production cycle, which is the case in wheat and other crops grown under irrigation. The project must make sure that the mechanisms it supports to facilitate seed production take full account of these financing aspects so that there is no loss of reputation or confidence among its IP partners. Local level production has the advantage that the demand may be more predictable, production costs are lower and the loss from diverting some seed to grain is also reduced. It is therefore less risky but continuing extension support will be required to maintain coordination among the participants – this is achieved at present by the Innovation Platforms.

### **3.10 The seed certification system**

Certification provides a comprehensive system of seed quality assurance with several different components and NSA is the certification agency, although it has never been given that title. The 2010 Seed Act adopted the OECD system for naming generations but there is no routine tagging or sealing of sacks and it is not clear if a systematic lot numbering system is used to enable full traceability within the seed multiplication system. In practice, certified seed is often recycled through several multiplications. This may be acceptable if good management practices are followed (as noted in section 3.3) but it does increase the risk of varietal contamination and NSA say that they reject a significant proportion of the crops that they inspect in the field on this basis.

Full certification is a relatively costly process and it will not be possible to extend this level of control to all the seed produced by the project, particularly if individual farmers with small plots participate as community seed producers. This problem could be mitigated if the fields of seed producers are clustered within a defined area, although this will still require coordination and monitoring. Alternatively, the project could undertake its own internal crop inspection as a component of the extension support provided to its farmers who are linked to the Innovation Platforms. This would mirror the objectives of the 'Quality Declared Seed' scheme formulated by FAO and adopted by some other local seed production schemes. The objective is to transfer responsibility for quality assurance largely to the producers while retaining limited independent monitoring. This approach works best when there is a direct link between producers and client farmers and where personal reputation and trust counts for more than a certification label. The project is already pursuing this approach within its Innovation Platforms and they have identified lead farmers who are producing seed in this way. It is essential to maintain the momentum of these positive experiences and document them for replication elsewhere.

There is an unofficial category known as 'good seed' but this has no defined standards. Since this term is widely used, it may be helpful for the project to define this category and to give it a clearer status/identity as the final stage in the seed production chain.



### 3.11 The Seed Policy

The need for a policy to guide the development of the sector has been felt by many countries where the seed industry is in transition to a more diverse model. The purpose of the policy is to provide guidance and consistency in decision-making so that the contributions of all stakeholders are aiming at the same goal. The process of preparing a policy was initiated at a workshop held in January 2014 with support from the IFAD Seed Development Project. Subsequently, a draft policy was prepared and a sub-committee of the National Seed Council carried out further rounds of consultation with stakeholders to refine the document. A 'final draft' was presented and discussed at a meeting in the Ministry on 15 June 2015 but this is still awaiting further comments and amendments or approval by the Ministry. When finally approved, the policy should be widely publicised and made available in both printed and electronic media so that all stakeholders are aware of it.

The content of this policy will be very important in guiding the development of the seed sector. One key issue for the wheat sub-project is that the policy gives due recognition to semi-formal local producers who will be essential players in a more devolved seed supply system as outlined above. Unlike the law, the policy should be regarded as a working document that can be reviewed and revised on a regular basis to reflect the development of the seed sector.

### 3.12 Role and status of the National Seed Council

This is closely linked to the policy issue because it will be the task of the Council to monitor the implementation of the policy on a regular basis and to provide advice to the Ministry. The Council also provides a focus for coordination among all stakeholders at the national level and that is similar in purpose to the ongoing efforts of the wheat sub-project within its IPs at a local level. It is important that the experience gained by the IPs in achieving stakeholder coordination is shared with the NSC.

The status of the Seed Council within the overall structure of the Ministry must be clarified. It could be a high level advisory committee or an executive office with some defined responsibilities. As part of its routine activities, the Council should consider holding an annual stakeholder forum to discuss the status and progress of the seed industry and this should be reflected in periodic revisions of the policy.

Given the focus on seed activities, and the various issues that need to be monitored, particularly with regard to wheat, it would seem logical to establish a permanent office for the National Seed Council. A small secretariat would then be required to prepare information and documents for the Council and this will imply a budget allocation. However, the Council should remain as a central office reporting to the Federal Ministry in Khartoum and should not attempt to establish satellite offices. Whatever, the final decision on these matters, the working relationship between the Council, the NSA and the Ministry should be defined. These matters could be included as recommendations in the Seed Policy.

### 3.13 Wheat as a strategic crop

All stakeholders agree that wheat is a strategic crop for Sudan, but what does that really mean in practice and how does it impact on seed supply? Apart from the traditional areas of wheat cultivation along the Nile Valley, wheat is a marginal crop in areas south

of Khartoum. Farmers in the Nile Valley have many options for winter cropping and the total area of land is limited, so any major increase in wheat production must come from the Gezira and similar irrigation schemes in addition to extensions into new areas in Northern and River Nile States. Advances in plant breeding have provided varieties that are more tolerant of high temperatures and the short growing season but yields are still vulnerable to these environmental factors. Continued efforts to increase heat tolerance fit clearly under the objective of climate-resilience which is being strongly supported by the donor community and ARC can play an important role in this work, as already noted. Other wheat growing areas in (sub)-tropical areas may come under threat if climate change leads to further changes in seasonal temperature patterns.

The government is promoting wheat production in order to increase the proportion of the total grain requirement that can be purchased domestically. As already noted, that was about 20% in 2015 and the government has decided, as a matter of policy, to increase that proportion in the coming years. This implies corresponding increases in the planted area and in the availability of good seed at planting time. Since a seed production program requires forward planning for two or even three seasons, there is an absolute need for stability in the wheat area so that the seed requirement can be planned more systematically, regardless of who actually does the work. Given the bulky nature of wheat seed, the planning of this production should be done for defined production geographical areas in which the seed growers and final users can be organised in such a way to minimise transport costs and strengthen links along the chain. The initiatives taken by the wheat sub-project are consistent with this approach.

### 3.14 Quality management in the wheat supply chain

Wheat is an industrial crop; all grain goes eventually to millers who mostly operate large industrial complexes. The proportion of the wheat crop used by artisanal millers is very small and can be ignored because they would have their own local sources of supply. Commercial millers are very concerned about the quality and consistency of the grain they purchase because this affects the amount of flour they recover and its quality. Wheat traded in the international market has defined quality standards and these are reflected in the price. Wheat purchased from farmers in Sudan is said to be more expensive than the international price at present but it is also a lower quality product due to the lack of good cleaning equipment between farm and mill, and the variability resulting from the many small lots produced by individual farmers. Grain quality may also be affected by environmental stress during the growing season.

Some aspects of quality could be improved through the provision of silos with pre-cleaning units at the reception points but that would require additional investment, presumably from government through ABS, as the buying agency. That would be a policy decision for the government and would require in depth cost/benefit analysis but it would ultimately put domestic wheat production in a better position.

The question of variety dynamics is very relevant here because it will always be difficult to organise small farmers to produce the same variety and to ensure that varieties are kept separate when purchased and bulked by ABS. At present, *Imam* is the dominant variety in the Gezira and in some other regions so this will be the main constituent of domestic grain but if new varieties become more widely adopted, for example *Goumria* and *Zakia*, currently under multiplication, it will be important that their milling

characteristics are broadly similar to Imam. The underlying question is - how many varieties should be grown when the consumers (millers) require a reasonably standard product? Breeders naturally wish to see their new improved varieties multiplied and adopted by farmers since this provides evidence of impact. On the other hand, a proliferation of varieties may be counter-productive for the reasons stated above, unless they fall within a fairly consistent quality specification.

### **3.15 Variety release procedures**

This did not appear to be a major issue in the discussion about wheat seed supply due to the relatively slow replacement rate of varieties and the lack of disease pressure in most of the wheat production areas. Moreover, and as mentioned, ARC is the only breeder of wheat, whereas in many other countries, variety release is a controversial issue, particularly where there are active private breeders working in competition with the public system.

As a matter of principle, varieties should be able to progress quickly through the testing system so that farmers can benefit from the gains made by plant breeders as quickly as possible. The same applies if there are disease threats that could require the rapid replacement of a susceptible variety. Concerns about this were raised when the UG99 rust strain appeared some years ago and ICARDA has been actively involved in this matter in several countries, including Egypt.

ARC and the National Variety Release Committee should be alert to these issues in case it should be necessary to undertake a rapid multiplication program for any reason, or if one of the new varieties being tested has outstanding merit and requires a special campaign to ensure its diffusion as a replacement for Imam. ICARDA is very well-placed to advise on these matters as a result of its experience in other countries.

### **3.16 Other crops of 'wheat-based farming system' and rainfed areas**

Although wheat is the main focus of this study, ICARDA has an interest in the other crops that can be grown in the cool season; faba bean is by far the most important but there are other grain legumes such as chickpea and lentil. These crops were not included in the study but from a seed production perspective they present the same general problems as wheat. They are not attractive to the private sector and so seed will be sourced almost entirely through informal channels, either saved on-farm or purchased locally. In this case, the major challenge is to devise a mechanism by which new varieties can be multiplied and injected into the local farming system after which horizontal diffusion within the community will depend mostly on the informal sector.

The crops of rainfed areas, namely groundnut, sesame, millet and sorghum, also suffer from a weak seed system due to the scattered communities of relatively poor farmers. Unlike the irrigated areas, this is a traditional farming system often based on shifting cultivation and with no history of organised seed supply. Farmers have always relied on informal sources either by saving their own seed or purchasing from local market traders. The government and many relief organisations have intervened by distributing free or highly subsidized seed but except in cases of real emergencies, this practice is highly questionable. It leads to dependency and makes any efforts to sell quality seed even more difficult. In practice, these areas need a devolved approach to seed supply similar to that proposed for wheat. The IFAD Seed Development Project based in

Kordofan is actively pursuing this approach, having discovered that there is little interest from the private sector – unless incentives are provided.

For all seed production initiatives, ARC must be in a position to supply high quality basic seed from its own farms and this should be passed on through a planned sequence of two or three multiplications. This again emphasises the critical role of ARC and its stations in the seed system and the need for all development projects to work closely with ARC to ensure that their needs can be met. ARC must likewise demonstrate that it can supply high quality basic seed and it is recommended that NSA should inspect the fields used to produce this seed to ensure that they comply with the standards.

### **3.17 Stimulating domestic plant breeding**

As already noted, ARC is the only breeder of wheat varieties in Sudan and the same applies to other self-pollinated crops such as sesame and all the grain legumes. These crops are of no interest to private sector breeders because there is no possibility of obtaining revenue from the sales of new varieties that can support the cost of a breeding program. There could in principle be an opportunity for a local company to act as an agent for a foreign breeder but in practice all breeding of these crops is done in the public sector. The introduction of a Plant Variety Protection (PVP) law could address these constraints by enabling breeders, both public or private, to collect royalties on the sale/use of their varieties but this would not be an easy system to implement in practice. The question of plant breeders' rights, and possible membership of UPOV, is currently under discussion within the Ministry and for convenience, a separate note was prepared on this topic (see Annex 4).

In the absence of a PVP law, private breeders will only be interested in producing hybrid varieties that can be sold for a much higher price but this is only applicable to cross-pollinating crops such as sorghum, sunflower and millet. There are some small breeding programs in these crops by local companies and public breeders in ARC and the Faculty of Agriculture have also produced some hybrids. In these cases, the key issue will be the licensing arrangements agreed between the public institution and potential users that can assure a good return to the breeders.

Several domestic seed companies act as agents for foreign breeders in India and Southern Africa and they sell hybrid seed of the crops mentioned above. Ideally, these seeds should be produced locally under contract at lower cost and the breeder would be paid a royalty on the production. However, this demands a high level of trust between the parties because there is a risk of the inbred lines being stolen. For the time being, foreign companies prefer to retain control of their parent lines but efforts should be made to encourage more local production, given the favourable environmental conditions that prevail in the cool season.

### **3.18 Sustainability of SARD-SC Wheat sub-project activities**

The implementation of the SARD-SC Wheat sub-project has provided a timely opportunity to strengthen the wheat seed system after many years of decline. It also coincides with a revival of interest in the seed sector by government. However, the project rightly emphasises that it must not become a significant seed producer because that could create difficulties when funding ceases. Instead, it must devise systems of seed production and delivery that can be continued and replicated on a sustainable basis

by its partners after project closure. For this reason, it is an absolute priority that the experience being gained by the IPs is documented and critically assessed in order to devise viable models. It will be difficult to make these models work on the basis of a conventional (formal) seed industry and it will be necessary to involve local (semi-formal) actors in the supply chain. This will require a special effort to define a standard pattern for these arrangements so that they can be managed.

The role of State Governments was not studied during the mission but they are possible players in the seed supply system if they can provide means of oversight and coordination. It is reported that in White Nile State an effective 'semi-formal' system of seed supply has been developed.

### **3.19 The critical need for coordination in the seed production program**

The over-riding conclusion of this study is the need for coordination between the various parties and at different levels. This reflects the general observation that seed production programs in a crop like wheat are constrained by organisational and economic issues rather than by any major technical obstacles. At the operational level within the wheat sub-project, the Innovation Platforms provide a coordination mechanism for seed production and distribution and this must be strengthened and formalized to the point where it can be transferred to the participants when the project ends. At the national (strategic) level also, coordination is required between the major players, including the millers, to prepare and implement a medium-term plan for the production of wheat grain and with the seed supply requirements factored into this plan. The National Seed Council is well-equipped to monitor this plan on behalf of the government although it will have many tasks and will certainly need a more formal status and good administrative support.

### **3.20 Allocation of the Government/MoAF budget for seeds**

The government allocates a certain amount of funding each year to support activities related to seeds and seed supply. The precise amount is not known but could be determined if necessary. Since the establishment of ASSCO, there is little direct involvement in seed production, the direct expenditure is mostly on NSA. However, in some seasons, large sums have been spent on importing wheat seed and on purchasing seed for distribution to farmers in the rainfed areas. Emergency measures of this kind are often poorly organised and do not achieve the desired objective. The challenge for wheat and other crops is to identify the most effective way for the government to allocate its resources to maximise impact on the seed system. It is recommended that the National Seed Council review this issue and make recommendations, once they have finished work on the seed policy. In fact, the priorities for resource allocation should be a key element in the policy document.

## **4. SUMMARY OF FINDINGS AND RECOMMENDATIONS**

1. The seed industry in Sudan had its origins in the highly organised irrigation schemes that were developed during the colonial era, particularly for cotton. Inputs were provided to farmers on credit and crops were purchased after harvest. Although that system was unsustainable, it has left a legacy in the seed system that we see today.



2. The privatisation of the previous governmental role in seed production has not worked, at least not in the case of wheat, which is relatively unprofitable as a seed crop. Since wheat has a strategic place in the economy, efforts are being made to re-establish a secure channel for delivering good quality seed to farmers and the SARD-SC wheat sub-project provides a timely opportunity to assist these efforts. The sub-project has identified the lack of good quality seed as a major constraint in its technology transfer activities and has demonstrated clear benefits from the use of good quality seed.
3. Whatever seed supply system is devised, it must be recognised and supported at the strategic level by national policies and the regulatory framework. It must also be capable of implementation and management at a practical level by the various stakeholders who are involved.
4. Wheat grain production depends largely on government policy, which aims to reduce dependence on imports and the high foreign exchange costs of this. Given that wheat is not the crop of first choice for most farmers, it is essential to maintain consistent support for grain production that will encourage regular planting by farmers. Uncertainty about government policy and pricing is a major disincentive for all those involved in the production chain, including seed producers at the start of the chain.
5. Wheat is an industrial crop and the milling companies are the ultimate buyers of the entire grain crop, with the Agriculture Bank acting as an intermediary. There are some weaknesses in this system that cause domestic grain to be of lower quality than that available from the international market. These matters are beyond the scope of this study but it is clear that the millers should be involved in discussions about seed supply since that is one determinant of the grain they eventually receive.
6. Seed production must be planned two or three seasons ahead and the targets for wheat grain production must therefore be reflected back into the seed supply system to ensure that there is good quality seed available to meet the planting area. Consideration should be given to preparing a five-year strategic plan for both wheat production, and the seed required to plant that area.
7. The formal seed industry is unlikely to provide sufficient certified wheat seed because of high volumes required along the production chain and the lack of confidence in the market demand. It is unlikely that there will ever be a truly competitive market for wheat seed driven by strong demand from farmers.
8. It will therefore be necessary to develop a new seed supply system involving both formal and semi-formal actors but with sufficient supervision to ensure reasonable quality control. The development objective of this system will be to provide good quality seed to as many farmers as possible at moderate cost. There could still be a role for the private sector to manage part of the production chain. A proposed structure for a system of this kind is shown in Figure 1.
9. Organising this production system at a local level will minimise production costs, facilitate seed distribution and reduce the loss when unsold seed is diverted to the



grain market. It will however require continuing support and coordination by extension staff, similar to that which is currently being implemented by the project Innovation Platforms. Access to small-scale or mobile equipment for cleaning and treating seed would be a valuable support to this system provided that suitable management arrangements can be devised.

10. The availability of sufficient high quality basic seed is an essential driver for the downstream production chain. It is therefore an absolute priority to support the ARC 'Seed Center' in discharging this task. The Center will require a budget allocation to operate its own facilities on behalf of, but not competing, with the breeding programs.
11. In addition to a regular operational budget, this Center needs some specialised items of equipment such as small plot seeders and small scale processing machines. The ICARDA Seed Section can provide advice on the most appropriate items to purchase. Improved seed storage facilities enabling safe carryover of seed stocks will greatly assist production planning.
12. The maintenance of varieties and production of early generation seed is a relatively expensive activity and it will be difficult for the Center to cover its costs from the sales of basic seed alone. To provide a reliable service to its clients, the Center will need to be subsidized but within clearly defined financial guidelines. Close coordination between the Center and its clients will be essential to ensure the effective use of basic seed. The Center should not extend its activities into certified seed production.
13. The ongoing seed activities of the Innovation Platforms established by the wheat sub-project should be analysed and formalised as far as possible into a model that can be replicated in other locations. It is proposed that there would be three multiplications from the basic seed provided by ARC. The naming of these successive generations and the responsibility for each of them must be standardized and clearly defined as far as possible. All key participants in this chain should be given formal recognition once they have been trained and demonstrated their capabilities.
14. Organised seed production, even at a semi-formal level, has financial implications because of the time that seed must be stored between harvest and the next sowing season. Any failure to purchase seed or pay contract growers may have very negative consequences. It is important therefore that the production and marketing models devised by the project take account of these financial aspects to avoid any loss of confidence.
15. It would be helpful to devise a transparent pricing structure for the different generations/categories of seed but this may be difficult because of the level of government involvement and the provision of subsidies. Information gained from the current value-chain study by the sub-project may provide useful information on wheat crop costs and these could be interpreted in the context of seed production.

16. The Seed Administration has a key role in providing quality assurance for the production of certified seed that is an essential input to the production system. It may also need to provide training and supervision for downstream multiplications that are not fully certified. In this connection, it would be helpful if the sub-project could define the category known as 'good seed' so that it can have a recognised place in the system.
17. Although not studied in detail, the crops of the traditional rainfed areas, such as groundnut, sesame and millet, lack an organised seed supply system. It will be even more difficult for the formal sector to meet the needs of widely-scattered farming communities in those areas and alternative local systems will be needed, particularly to ensure the initial diffusion of new varieties from ARC stations.
18. The national seed policy must take account of the need to adopt alternative systems of seed supply for certain crops including wheat for the irrigated areas and a range of crops grown in the rainfed areas where the formal seed system is weak or non-existent. This may ultimately require some adjustment in the regulatory framework. Once finalized, the policy should be made widely available in printed and electronic formats.
19. The National Seed Council will play a critical role in monitoring seed sector development including oversight of the alternative approaches to seed supply that are indicated by this study. Once the new seed policy is approved, it will be the responsibility of the Council to monitor the implementation of the policy and report on a regular basis to the Minister. To discharge its various responsibilities, the Council should have a budget allocation and its position/function within the structure of the Ministry should be clearly defined.
20. To implement the recommendations proposed in this study, actions are required both by government at a policy level and by stakeholders who are engaged in the seed production system at an operational level. However, these are not fundamental changes of direction, but rather a recognition of the current constraints on the seed system and then adopting measures to ensure a more stable and secure delivery channel.

## **5. FOLLOW-UP ACTION**

A high-level consultation meeting was held on 10 April 2016 to review this report and a parallel study of the wheat value chain that had also been supported by the sub-project. The report of that meeting is attached as Annex 1 and it contains recommendations for improvement of the wheat seed supply system. In light of the national plan for wheat self-sufficiency and incoming TAAT project, a wheat seed sector investment plan was developed where the strategies and seed road map were prepared to meet the targets as stated below and in Annex 4. A separate document is being prepared for the purpose.

## **6. THE WAY FORWARD**

Under SARD-SC project, adoption of innovation platform approaches clearly demonstrated the possibility of raising wheat productivity in the medium-term up to 4 tonnes ha<sup>-1</sup> in the areas currently available for wheat production in Sudan. This is a remarkable achievement, but the target of increasing domestic wheat production to 3.4

million tonnes per year can't be realized unless wheat production expands into new areas. Sudan aspired to meet wheat self-sufficiency by 2025 supported with the incoming TAAT project. Therefore, plans have been made for horizontal expansion of wheat production into the high terrace soils in Northern and River Nile States while continuing to increase productivity per unit land in the existing areas.

The expansion into new areas and environments requires developing or optimizing suitable technologies and innovations including wheat varieties with heat and salinity tolerance and good end-use quality, improved crop management technologies and innovations, a robust wheat seed delivery system involving both the formal (public/private) and innovative informal systems, and dissemination of knowledge and information on these new technologies and innovations among farmers through efficient and innovative technology transfer approaches supported by a flexible enabling policy environment for the development of a dynamic and functional wheat value chain in the country.

Cognizant of the fact that seed is a critical factor for the success of the ambitious government policy for self-sufficiency, it is envisaged to develop country strategies and road maps for wheat seed delivery to meet the goals and objectives of wheat sector transformation in Sudan. Four key issues need to converge to meet the anticipated goals of wheat self-sufficiency in 2025: projected changes in domestic demand for wheat during the period, technical changes in raising the productivity levels to reach the target production, availability of land for expansion to meet the target area and the investments made to ensure availability of wheat innovations to farmers.

The country strategies and seed road maps define the targets and critical investments that are needed for each key component of the seed value chain that enable to produce sufficient quantity seed of desired quality and provide to farmers at the right place, time and price making use of the diversity of the national seed sector.

Wheat seed delivery is not a one off shot or short-term effort since a range of new varieties will be released from the breeding programs and enter seed production. A continuous flow of quality seed of well adapted and farmer, industry and consumer preferred wheat varieties is desirable. For any given year, a systematic four-year seed production cycle (breeder, pre-basic, basic and certified seed) is required to achieve the amount of certified seed at the desired seed replacement rate annually. Moreover, the seed road map will provide targets for seed production taking into account area expansion and desired level of seed replacement rate (Table 2 in Annex 4)<sup>7</sup>. Moreover, commensurate with area expansion an investment plan for seed production, infrastructure and human resources were developed based on national review of current wheat seed supply, available facilities and capacity with core national wheat team in the country.

Achieving the seed production and investment targets would require establishing a functional wheat value chain by building partnership of broader coalition of

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<sup>7</sup>An average seed rate of 150 kg ha<sup>-1</sup>, average productivity of 3 tonnes ha<sup>-1</sup> (multiplication factor of 20) and annual seed replacement rate of 35% is assumed for developing the road map

stakeholders including NARS, seed producers and suppliers, financial and credit institutions, the industry, policy makers and above all the farmers.

## Annex 1: Key elements of the proposed seed supply system for wheat

| Activity/generation                               | Responsibility                                                                                                 | Comments                                                                                                                                                                 |
|---------------------------------------------------|----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Variety maintenance and breeder seed production   | ARC Seed Center, in close collaboration with breeder                                                           | Small scale activity; breeder closely involved; cold storage facility will assist;                                                                                       |
| <i>Pre-basic seed production</i>                  | <i>ARC Seed Center, with oversight by breeder</i>                                                              | <i>Pre-basic may not be required – depends on the quantity of basic seed needed</i>                                                                                      |
| Basic seed production                             | ARC Seed Center                                                                                                | May be done on a contract basis for seed companies, according to their needs                                                                                             |
| Certified seed production                         | Seed company or other registered entity with seed production capability <sup>1</sup>                           | Crop inspection and certification by SA or by licensed inspectors if SA accepts this approach                                                                            |
| <i>(Certified seed 2<sup>nd</sup> generation)</i> | <i>As above but this generation may not be needed; it will depend on the final seed requirement by farmers</i> |                                                                                                                                                                          |
| 'Quality declared seed' <sup>1</sup>              | Seed company or other entities with a seed production capability <sup>2</sup>                                  | Producer responsible for quality assurance – field inspection and simple laboratory test <sup>2</sup><br>This seed may be sold to farmers or may be multiplied once more |
| 'Extension seed' <sup>1</sup>                     | Designated farmers or farmer groups <sup>2</sup>                                                               | Field inspection by extension staff or accredited inspectors <sup>2</sup><br>This seed is only sold to farmers                                                           |

### Notes

<sup>1</sup> An acceptable local name/title should be found for these generations

<sup>2</sup> All farmers and producers' groups who participate must be registered and have a named person who has been trained in seed production and basic record keeping

The normal system will be two generations of multiplication after certified seed and this will require only small amounts of basic seed production. However, if demand for good quality seed increases, then certified seed or QDS can be sold without further multiplication. This will of course increase the amount of Basic Seed that has to be produced by the Seed Center.

From certified seed production onwards, production should be organized within defined geographical areas/zones to facilitate planning, demonstration and marketing/distribution.

Seed companies are welcome to continue their involvement in the downstream multiplication beyond certified seed if they see a benefit in doing this. (How could their participation be encouraged?) Any other concerned organizations are welcome to participate, for example to provide microfinance if it is consistent with their objectives.

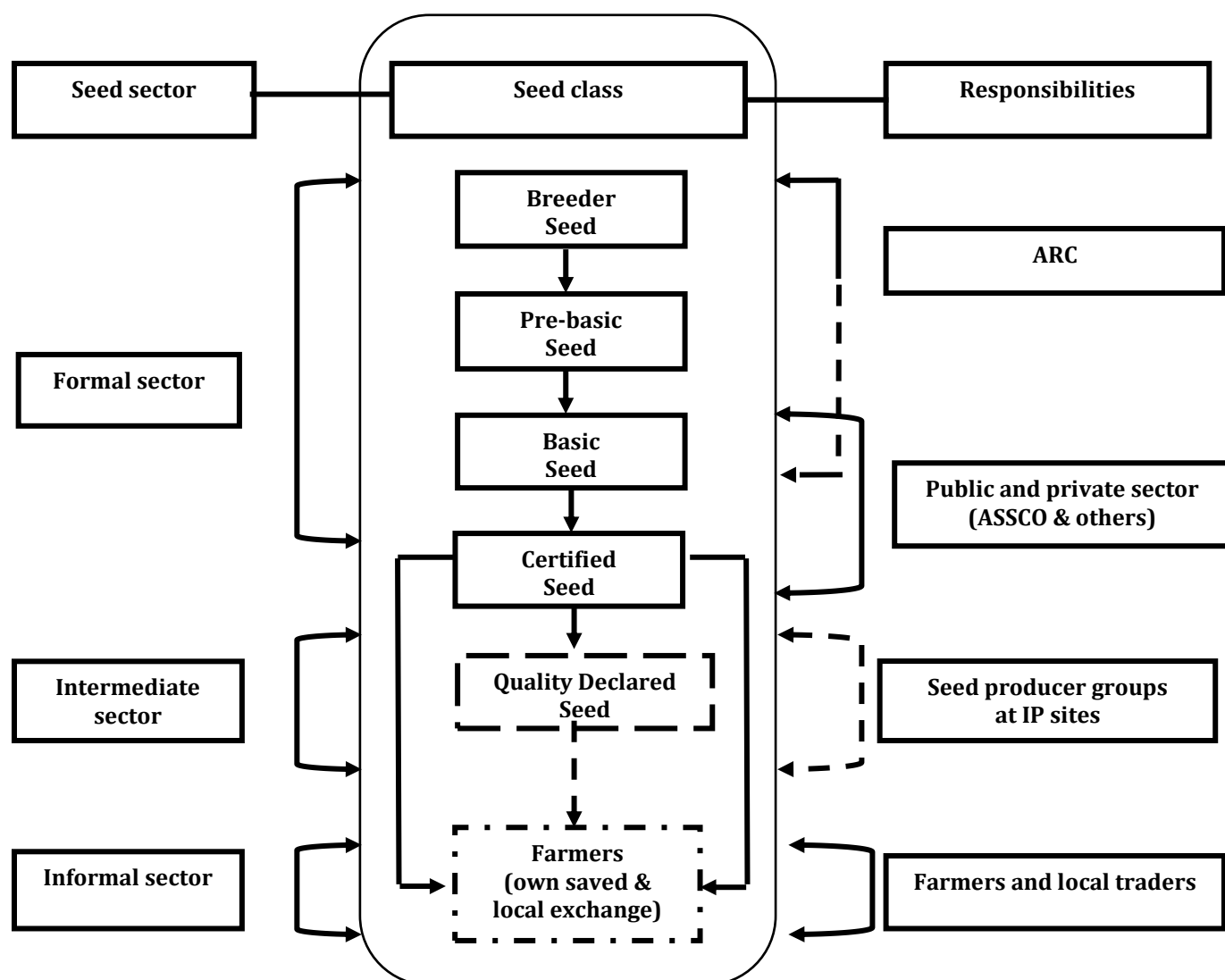
As far as possible, the production fields for QDS and Extension Seed should also be used for demonstration/training purposes during the growing season, not only for the seed/variety but also for the wider 'management package'.

The production costs at each generation should be carefully analyzed in order to provide the basis for a reasonable selling price. Certified seed already has an agreed (fixed) price from ABS and/or ASSCO. Knowledge of the cost/price structure is essential for

sustainability. The main 'subsidy' in the system is for the work of the ARC Seed Center, where recovering production costs in the basic seed price is difficult or impossible.



## Annex 2: Proposed organisational arrangements and responsibilities for wheat seed supply



**Source:** Adapted from Bishaw and Atilaw, 2016

### Notes

The wheat seed classes would be aligned to the revised seed law currently being reviewed by the Ministry of Justice.

Responsibility for basic seed production can be with ARC or public and private seed enterprises.

Quality Declared Seed may not be required if four generation of wheat seed production is introduced and sufficient quantity of certified seed is produced.

### Annex 3: Report of High Level Consultation Meeting on Wheat Seed System and Value Chain Analysis

With the support of the SARD-SC sub-project, and in collaboration with ARC, ICARDA conducted a Wheat Seed Sector Study and Wheat Value Chain Analysis to identify critical bottlenecks in the wheat sector in Sudan. To review these documents, a *High Level Consultation Meeting on Wheat Seed System and Value Chain Analysis* was organized on 10 April 2016 in Khartoum under the auspices of the Ministry of Agriculture and Forestry (MoAF).

The consultation meeting was opened by statement of H.E. Sabry Aldaw Bakheet, State Minister of Federal MoAF and attended by key wheat value chain actors from the public and the private sector including high level policy makers from MoAF and its affiliated Departments (ARC, Departments of Agricultural Production, Agricultural Extension Services, Seed Administration), Central Bank of Sudan, Agricultural Bank of Sudan, Farmers Bank, Sudan Seed Trade Association, National Seed Council, private seed companies (Arab Sudanese Seed Company, Nile Sun Seed Enterprises, irrigated schemes) and flour mills as well as country representatives of international development partners (FAO, IFAD, AAAID). About 100 participants attended the meeting.

The wheat seed sector review has identified critical constraints which hindered the development and growth of the sector. The annual wheat requirement of Sudan is about 2.5 million tonnes and in the 2014/15 season production was about 0.5 million tonnes. After erratic and declining production for many years, the government has decided to substantially increase domestic wheat grain production. The long-term goal is to produce two million tonnes of grain from 500,000 ha (1.2 million *feddans*), with about half of this production being in the Gezira. In the next two seasons, the government expects to increase the contribution domestic wheat production to 30 or 40% of the total requirement by setting a favourable domestic buying price.

The wheat seed supply system has been seriously weakened over recent years because there is no longer any direct involvement of government and the crop is not attractive to the private sector. The government also now recognizes seed supply as a high priority and has taken steps to focus more attention and resources on the seed sector in order to meet the area expansion. Given the revised regulatory framework with an effective National Seed Council and a National Seed Policy now being finalized, the challenge for the wheat sector is how to strengthen the seed system so that the achievement of national policy goals is not constrained by the quantity or quality of seed available. The seed-related activities of the wheat-project in Sudan are therefore in close harmony with, and provide support to, this policy of the Government.

It will be very difficult to meet the wheat seed requirement through formal channels that lead to 'certified seed'. Some intrinsic characteristics of wheat seed as a product would make this an expensive and risky approach that could only be supported by subsidies. Moreover, the previous experience of bulk seed purchasing schemes by government has caused financial stress for companies and they may lack the confidence to do this again. For this reason, it is preferable to organize a supply chain that begins

with certified seed and continues through one or two generations of multiplication on a semi-formal basis that is closer to the end users. This approach has advantages in terms of cost and accountability, although it will require some support from extension staff. Seed production conditions are generally favourable in Sudan and it is quite feasible to implement a more devolved system of this kind if farmers have been trained in good management practices.

The wheat sub-project is currently implementing various schemes of this kind within its Innovation Platforms and a range of experience is being accumulated by the project. As far as possible, the allocation of responsibility for each generation of multiplication should be standardized and there should be a limit on the number of generations, each with its defined name. Private sector companies could still participate in these arrangements by supplying the initial certified seed to selected growers and overseeing the subsequent multiplications.

The system of seed supply for wheat that is proposed here will be implemented in a devolved way using formal and semi-formal actors and that will require good coordination. However, the government must provide confidence by maintaining a stable policy for wheat production and recognizing the essential role that seed supply plays in this. There is complete agreement that 'wheat is a strategic crop' but that strategy must be reflected back into the upstream seed supply system, which has a planning horizon of two or three seasons and is therefore vulnerable to sudden changes. To achieve the necessary commitment, it is proposed that an indicative seed production plan be prepared each year involving all participants in the chain from breeders to millers. The National Seed Council should review this plan and monitor its implementation.

Based on the presentations and ensuing discussions in the workshop, the following recommendations were made for the development of a sustainable and viable wheat sector:

- Formation of a Wheat Commodity Council (or re-activate the Wheat Commodity Board formed during the Agricultural Revival Program which is now lie dormant) that includes all stakeholders along the value chain in order to strengthen backward and forward linkage among the key actors. It is suggested that the Board is directly backed by the Minister of Ministry of Agriculture and Forestry with partnership of SARD-SC and TAAT projects;
- Create stable and sustained policies for wheat commodity and develop a clear plan of action by the State for wheat grain and seed production and marketing, and to strictly adhere to these policies and action plans;
- Establish a clear short to long-term plan for total target area to be covered by wheat along with a plan for seed production to gradually cover with 25% certified seed annually, taking into account the contribution of the informal sector. This plan should be aligned and well coordinated with the production of higher seed categories of breeder and foundation seed and maintenance of commercial varieties;
- Adopt an integrated plan with enabling policies (tax exemptions, subsidies, etc) to encourage the private sector to engage in the seed production of the strategic crops and thus stimulate rapid evolution of the seed industry in Sudan;

- Declare innovative and supportive financial and insurance policies for agricultural production that would support producers and encourage them to continue and sustain wheat seed and grain production;
- Undertake further analysis and study of wheat seed sector and value chain by a specialized taskforce with the participation of all partners in the seed industry for with clear terms of reference and timeframe under the auspices of the Minister of MoAF and in partnership with SARD-SC/TAAT Projects;
- Develop a clear vision for wheat production from research to end use with a focus on strengthening the value chain supporting all stakeholders, their interrelations and capacity
- Ensure that the vision takes into account maintaining high standards of quality during seed and grain production and adopts marketing policies commensurate with area expansion;
- Explore areas for horizontal expansion and provide the required infrastructure and production technologies since the current area under wheat production may not achieve self-sufficiency.

## Annex 4: Development of an indicative production plan for wheat seed – The Road Map

In 2016, the wheat area is estimated to be 253,000 ha and this will expand to 535,000 ha by 2025, increasing at 10% per year from 2017-2021 and at 5% per annum from 2022-2025. This expansion plan would almost double the wheat area and the productivity is expected to reach the anticipated target of 4.4 tonnes ha<sup>-1</sup>.

In 2016, an estimated 5000 tonnes of certified seed was supplied through the formal sector and this satisfied 52.7% of the certified seed requirement based on a 25% seed replacement rate or 13.2% of the total seed requirement of 37,950 tonnes that would be needed to sow the entire wheat area. The production of certified seed should be commensurate with the area expansion at the planned seed replacement rate. In all cases, a four-year seed production cycle is expected to reach the planned seed replacement rate each year.

A road map has been prepared for the seed production required to meet these targets based on a 35% annual seed replacement rate, a sowing rate of 150 kg ha<sup>-1</sup> and an average yield of 3 tonnes ha<sup>-1</sup>. These indicative figures for area expansion, seed production and financial requirements are shown in Table 2.

During the initial phase of expansion, there may not be sufficient certified seed available to plant all the planned area. This gap should be filled with additional 'quality seed' obtained by recycling the certified seed distributed through formal sector in previous year, or seed produced at innovation platforms through SARD-SC and Arab Food Security Projects. This 'recycled' seed can be monitored for varietal purity and seed quality in the production fields and the harvested seed can be tested for physical purity and germination. A 'grain for seed' scheme of this kind should be used for planting new areas under expansion rather than importing seed of wheat varieties whose adaptation to Sudan conditions is not certain. Importation is a costly and risky option.

**Table 2. Wheat seed road map for planting 500,000 ha (with 35% replacement rate)**

| Items                          | 2016           | 2017           | 2018            | 2019            | 2020            | 2021            | 2022            | 2023            | 2024            | 2025            |
|--------------------------------|----------------|----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Area in ha (thousands)         | 253            | 287            | 316             | 347             | 382             | 420             | 462             | 485             | 510             | 535             |
| Potential seed required (t)    | 37950          | 43050          | 47355           | 52091           | 57300           | 63030           | 69332           | 72799           | 76439           | 80261           |
| <b>Seed production (t)</b>     |                |                |                 |                 |                 |                 |                 |                 |                 |                 |
| Certified seed                 | 9488           | 8610           | 16574           | 18232           | 20055           | 22060           | 24266           | 25480           | 26754           | 28091           |
| Basic seed                     | 474.4          | 430.5          | 828.7           | 911.6           | 1002.7          | 1103.0          | 1213.3          | 1274.0          | 1337.7          | 1404.6          |
| Pre-basic seed                 | 23.7           | 21.5           | 41.4            | 45.6            | 50.1            | 55.2            | 60.7            | 63.7            | 66.9            | 70.2            |
| Breeder seed                   | 1.19           | 1.08           | 2.07            | 2.28            | 2.51            | 2.76            | 3.03            | 3.18            | 3.34            | 3.51            |
| <b>Total</b>                   | <b>9986.78</b> | <b>9063.10</b> | <b>17446.47</b> | <b>19191.12</b> | <b>21110.23</b> | <b>23221.25</b> | <b>25543.38</b> | <b>26820.55</b> | <b>28161.57</b> | <b>29569.65</b> |
| <b>Financial estimate (\$)</b> |                |                |                 |                 |                 |                 |                 |                 |                 |                 |
| Certified seed                 | 7981359        | 7243163        | 13943088        | 15337397        | 16871136        | 18558250        | 20414075        | 21434779        | 22506518        | 23631843        |
| Basic seed                     | 478882         | 434590         | 836585          | 920244          | 1012268         | 1113495         | 1224844         | 1286087         | 1350391         | 1417911         |
| Pre-basic seed                 | 27935          | 25351          | 48801           | 53681           | 59049           | 64954           | 71449           | 75022           | 78773           | 82711           |
| Breeder seed                   | 1596           | 1449           | 2789            | 3067            | 3374            | 3712            | 4083            | 4287            | 4501            | 4726            |
| <b>Total</b>                   | <b>8489772</b> | <b>7704552</b> | <b>14831263</b> | <b>16314389</b> | <b>17945828</b> | <b>19740410</b> | <b>21714451</b> | <b>22800174</b> | <b>23940183</b> | <b>25137192</b> |

### Notes

- Seed replacement rate means that only 35% of the area is sown with certified seed each year.
- Multiplication factor is based on the ratio of harvested seed to seed sown.
- Financial requirement is calculated based on a grain price of SDG 4500 (USD 673) tonnes<sup>-1</sup> with a premium of 25, 50, 75 and 100% for certified, basic, pre-basic and breeder seed, respectively.

## **Annex 5: Plant Variety Protection and the Wheat Seed Supply System**

### **Introduction**

Although not specifically mentioned in the mission TOR, the availability of PVP is an issue in national seed programs generally and it is particularly relevant to wheat as a self-pollinating, non-hybrid crop. The Government is actively reviewing the question of PVP and also whether Sudan should aim to become a member of the Union for the Protection of New Varieties of Plants (UPOV), which provides an international framework to promote and support the rights of plant breeders. As part of this process, a high-level committee has been established to review this matter and make recommendations to the Government. We understand that they have not yet produced a final report, so the matter is still under discussion. In the briefing meetings, it was requested that the mission should look at this matter and this short paper presents some personal observations that may be useful for the Committee.

### **Origins and purpose of PVP**

PVP became prominent in Europe during the 1960s and the first UPOV Convention, prepared in 1964 reflected that development. At that time, most of the plant breeding effort took place in government research stations and there was little investment by the private sector, except in hybrid crops, chiefly maize. A PVP law gives breeders a property right in their varieties and enables them to collect a royalty on the use of their varieties by others. This revenue supports their continued investment in breeding programs, which is a long-term activity.

### **Current legal status in Sudan**

The Seed Law of 2010 is very brief (six pages) and covers both conventional seed production/ marketing aspects and variety protection, both at a very superficial level. It was clearly intended that all the detail on both topics would be placed in secondary legislation as Regulations. These were published in 2012 although the English translation is not good and in places it is difficult to understand the true meaning.

Membership of UPOV requires that a country has passed a PVP law that is consistent in all substantive matters with the 1991 UPOV Convention. There is clearly no possibility that the 2010 Seed Law could meet this requirement and UPOV does not recognise secondary legislation, it only considers the primary law. Therefore, if Sudan wishes to become a member of UPOV, it must pass a new PVP law. This would imply repealing that part of the Seed Law that refers to variety protection, otherwise, there would be two laws on the same topic! UPOV also recommends that the PVP law is separate from the Seed Law since it covers different subject matter relating to intellectual property.

### **Technical requirements and obligations of PVP**

The requirements for obtaining a grant of plant breeders' rights for a variety are well-known and need not be discussed in detail here. They are Distinctness, Uniformity and Stability (DUS), Novelty and an acceptable denomination. The meanings of all these terms are defined in the UPOV Convention. To operate a DUS system it is necessary to prepare a detailed morphological description of the new variety, normally using the Technical Guidelines prepared by UPOV for this purpose. At present, there is no DUS requirement for variety registration in Sudan so the capability for this would have to be established. It is not difficult work, but must be done precisely because the variety



description is the basis for claiming legal ownership. UPOV, or existing member countries, can provide training in this topic.

### **Implementation of a national PVP system**

The law must establish an office for handling PVP applications and granting certificates of breeders' rights; this is a legal/administrative activity. The technical work of examining varieties for DUS is normally done by a competent agency within the Ministry of Agriculture. In Sudan, this would presumably be the National Seed Administration.

A certificate of Breeders Right is a property right and it is the breeder's responsibility to use that right in whatever way they wish to obtain revenue from the use of the variety by others. Since the breeder is not normally involved in large-scale seed production, this is done by licensing other parties to undertake seed production and marketing and to collect a royalty on the seed they sell, typically 5 -10% of the sale price. The licensee must therefore keep a record of sales and return the royalty element of their sales to the breeder. The arrangements for doing this vary between countries but there must ultimately be a transparent and pragmatic system for handling the royalties.

PVP is normally a 'civil law', which means that it is the responsibility of the breeder to use the law in whatever way they wish and to ensure that their rights are being respected. If a breeder believes that a third party is multiplying or selling a protected variety without paying the royalty, then they must launch an action in the civil courts and present evidence. In practice, this is a costly process and is only done as a 'last resort'; disputes are normally solved by negotiation or arbitration between the concerned parties. The key point here is that the government does not act as a policeman for the breeders, they have to manage the system themselves. In Sudan, this would probably be done by the Seed Trade Association, possibly in collaboration with any organisation concerned with IP issues in a wider context.

### **Benefits of PVP**

Besides providing an incentive for private plant breeders, foreign breeders may be more willing to market their varieties in a country that has PVP. However, that decision will still depend on whether they can expect to collect a royalty. Biotech companies, or those who wish to establish micro-propagation/ tissue culture facilities, may also be reassured if there is PVP Law – for example Singapore is a member of UPOV even though it has no conventional agriculture.

### **Which crops are protected by PVP?**

PVP is most relevant to self-pollinated crops where no opportunities exist to make F1 hybrids. Wheat, rice, barley and grain legumes are all examples among the main field crops. However, it should be noted that private companies always strive to create hybrid varieties if they possibly can because the biological protection of a hybrid is more secure and less complicated than the legal protection provided by PVP. Hybrid rice has attracted the attention of private companies for the past 15 years or so, although its agronomic value remains questionable considering the high cost of seed. Breeders have been trying to make hybrid wheat for the past 60 years; there have been many false starts but little commercial success so far.

The great majority of vegetable crops (except for legumes) are now bred and sold as hybrids. They are far superior to the old open pollinated varieties and even relatively

poor farmers generally choose to sow hybrid varieties if they are growing for a market. Clonally propagated crops like potatoes, fruit trees and many ornamental species are also normally protected in countries that have a PVP law.

### **Membership of UPOV**

The procedures for joining UPOV are precisely defined and are explained in their literature. Membership provides advantages, for example by facilitating the exchange of DUS variety descriptions and thus reducing the work for individual testing agencies. There is an annual fee for membership and this depends on the size of the plant breeding industry in each country. Sudan would certainly fall in the lowest payment category and would have to pay about \$2000 per year. The exact amount would be confirmed during the negotiations with UPOV.

### **WTO aspects**

It is a condition of the WTO 'TRIPS Agreement' that member countries have an effective law to protect intellectual property rights and this includes the rights of plant breeders. There is no requirement to use the UPOV model for PVP or to be a member of UPOV but in practice this has been the most convenient route to follow because of the support available from the UPOV secretariat. Many countries that have joined UPOV in recent years have been motivated by this requirement of WTO even though they have little private sector breeding activity. It is more a question of compliance rather than implementation.

### **Royalty collection**

It should be emphasised again that breeders (public or private) only benefit when there is an effective royalty collection system that returns significant revenue from the users of the variety, i.e. the farmers. This means that the price of a protected variety must be somewhat higher than that of a non-protected variety but of course the benefits of using a superior variety should easily exceed the small extra seed cost. There is no automatic return of revenue to a breeder and in the case of breeders who work for public organisations like ARC or the Universities it would be a policy decision to allow the legal protection of these materials. A contrary view is that the products of public breeding are a public good that should be freely available to all farmers in the country, as they have been up to now. In countries where small-scale farming predominates, the enforcement of breeders rights is very difficult. Royalty collection can only be done on the initial sale of certified seed and this may represent a very small part of the total seed supply when the informal sector predominates.

### **Farmers rights and breeders' rights**

Within civil society there are some who oppose plant breeders' rights on the grounds that all the genetic material used by breeders was originally selected by many generations of farmers and companies have no right to appropriate this material for their own financial gain. Of course this ignores the fact that plant breeding is a long-term activity that requires much detailed scientific and technical work to exploit the original genetic resources. To address these concerns, there is a strong lobby from some civil society organisations for 'farmer's rights' to have due recognition but it has proved very difficult to frame these rights in legislation that achieves the desired objectives. It is especially difficult to accommodate the rights of both breeders' and farmers' rights within a single law that is also acceptable to UPOV. Moreover, based on experience in other countries

the process of reviewing these laws in the parliament can become very protracted, although the discussions there are often based on mis-information. Farmers' rights might be better accommodated within a law on biodiversity.

## **Annex 6: Terms of Reference**

- 1. Review current government policies for the wheat sector in particular and agriculture in general**
  - Review key agricultural policies and strategies relevant to the wheat sector;
  - Document how current agricultural policies and strategies evolved;
  - Document how agricultural policies and strategies are linked to the national seed policy;
  - Document the importance of wheat sector in Sudanese agriculture (area coverage, production share, role in agro-industry sector, etc);
- 2. Review the policy and regulatory framework for varieties and seeds, with emphasis on wheat**
  - Review current status of the policy and regulatory framework
  - Review seed quality control and certification procedures and their implementation
  - at field level, taking account of facilities and human resources;
  - Analyze the relevance of these policy and regulatory documents to the wheat seed system and comment on their effectiveness;
- 3. Review institutional arrangements and linkages in the wheat seed sector**
  - Review the evolution of institutional arrangements that regulate and support the national seed system;
  - Review of the institutional arrangements for seed quality control and certification;
  - Review trends and current linkages of actors in the national seed system in general, and for wheat seed in particular;
  - Describe characteristics of the wheat seed market actors including research, seed companies, market agents and final users;
  - Describe and analyse the role of public and private actors in wheat seed system
- 4. Assess current performance of the wheat seed sector (variety development, production, marketing, etc)**
  - Review the research capacity and the characteristics of wheat varieties developed
  - and released in recent years
  - Review trends in the volume of wheat seed produced over the last 10 years by variety, type (including durum if any), and producer
  - Importance of wheat in the seed sector, for example the proportion of wheat seed
  - compared with total seed production, and number of actors engaged in wheat seed among all seed industry actors
  - Trends in the price of wheat by type over the last 10 years
  - Review the adoption and impact of new wheat varieties, including any adoption
  - studies conducted in recent years.
  - Describe and analyze the contribution of informal seed supply in the wheat

- seed system;
  - Review the efficiency of the seed market in general and for wheat seed in particular, including the cost structure for certified seed, price relations of seed to grain, trends in carryover seeds, etc)
5. **Based on the above information, undertake a SWOT analysis of the current wheat seed system and its value chain, focusing on:**
    - Variety release and supply early generation seed
    - Certified seed production
    - Certified seed marketing
    - Quality control of production and marketing system
  6. **Based on this analysis, identify key constraints and opportunities for wheat seed sector development**
  7. **Make recommendations for policy action**
  8. **Reporting and Feedback**
    - Prepare a summary of findings and recommendations for presentation at a debriefing meeting with key stakeholders at the end of the mission;
    - Prepare a final draft report incorporating all the comments from the debriefing meeting and submit within one week from the end of the mission;
    - If necessary, respond to any further comments received on the final draft report.