Strategy for the Development of Sustainable Seed Supply Systems in Chad

SEED SYSTEMS GROUP

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Country Snapshot

Population- 16 million

59% Agricultural share to GDP

5.2 m ha Arable land

37.5% Undernourished population

Age group < 15 - 46%; 15-65 -51% >

81% Agricultural employment

Climate Risk index- 116

Global hunger index- 44.2

Figure 1: Country Snapshot - Chad

Nutrition Profile

- The 2019 Global Hunger Index reports "alarming" levels of hunger in Chad
- Limited access to nutritious food is exacerbated by lack of reliable information on agricultural markets. Deficiencies in micronutrients including iron, vitamin A, and iodine are a result of inadequate food consumption
- Chad's National Development Plan (2017-2021) aims at transforming the agriculture sector, with the objectives of boosting exports, diversifying the economy, reducing the dependence on oil exports, and increasing the tax-based revenue

Food insecurity	Nutrition	Dietary diversity	Average per capita Fruits & Vegetable intake
• Poverty rate- 46.7 %	• < 5 stunting-39.8% • <5 wasting- 13.3 % • Anaemia in women of 15-49 years age -47.7 %	• 68% of energy source derived from cereals, roots and tubers representing low dietary diversity	• 23.3 and 21.1 g/day- against recommended guidelines 200-250g/day

Figure 2: Nutritional Profile - Chad

Crop Profile

Millet and sorghum are the key staple crops that dominate the cropping systems in Chad. Other important crops are groundnut, berbere, maize, rice and cassava (Figure 3). Millet occupies the largest land areas (1.5 to 2.3 ha) per household, for an average production of approximately 500 kg and yields from 0.2 to 0.3 MT/ha.

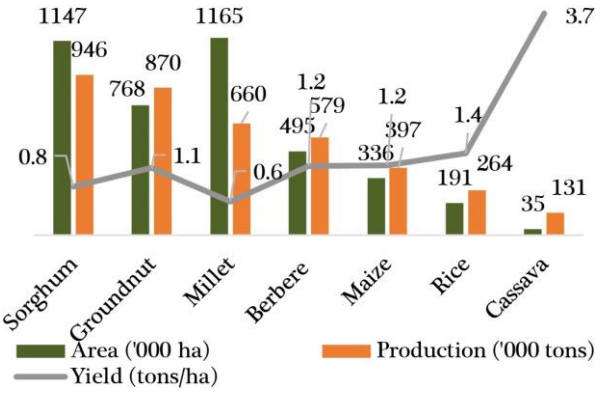

Figure 3: Crop Profile (2017) - Chad

Seeding rate for sorghum and millet is 10 kg/ha. Land area for sorghum production are less than those of the millet. For surfaces from 0.5 to 1.6 ha, production seldom exceeds 500 kg and yields are in the order of 0.4 T/ha. For maize, fields are approximately of 0.5 ha, and the seeding rate is 15 kg/ha. Three key types of vegetables are widely cultivated in Chadian cropping systems: (a) Vegetables: okra, eggplant, pepper, zucchini, and cucumber; (b) Leafy vegetables: lettuce, celery, cabbage, sorrel, mussel, amaranth, spinach. and parsley; and (c) Roots and tubers: onion, garlic, carrot, and radish.

Figure 4 depicts the yield trends of the key crops in Chad. While yields for cassava have shown improvement (a high yield of 6.3 tons/ha in 2016 and low of 1.8 tons/ha in 2009), the yield of all other key crops have remained stagnant for more than a decade. Low yields of millets and sorghum are primarily due to insufficient access to seeds of improved varieties.

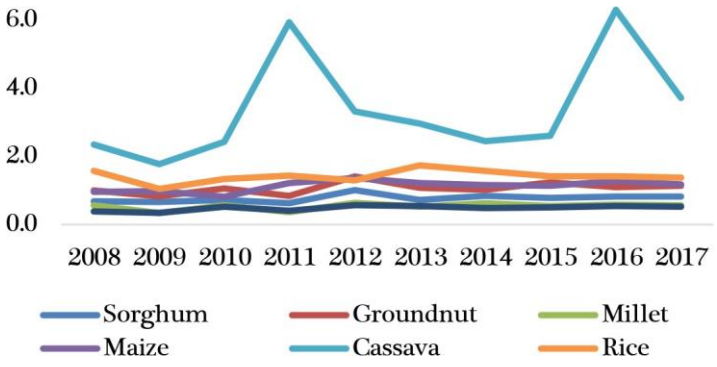

Figure 4: Yield Trends (tons/ha) - Chad

The vast majority of Chad's food production comes from family smallholdings whose mean size is from 2 to 5 ha cultivated by farmers practicing subsistence farming. The systems of production agricultural are extensive, low-yielding, and rain-fed.

Breeding, Variety Development and Release

The Chadian Institute for Agriculture Research and Development (ITRAD) is Chad's principal agricultural research agency, operating under the Ministry of Agriculture and Environment. It

researches crops, forestry, fisheries, and natural resources. ITRAD's mission encompasses varietal selection, development, and adoption of new introductions. Owing to ITRAD's minimal breeding capacity, varietal release is through selection of improved varieties accessed from international institutes such as ICRISAT, IITA, CIRAD, CORAF, AfricaRice, and regional NARS.

The key focuses of ITRAD's breeding programs are sorghum, millets, maize, rice, sesame, cowpea, cassava, and industrial crops like cotton. Varietal research is public sector-driven and only conducted by ITRAD. There are limited research efforts within the university system. Currently, the varieties of key crops being cultivated across the country range in age from 15 to 28 years: varieties of millet and sorghum are 28 years old; groundnut is 18 years old; maize is 25 years old; sesame is 27 years old; and rice is 15 years old.

DUS tests have not been performed, and since these varieties are not released regionally, are not incorporated in the catalogue of released varieties. The current popular varieties released for the key crops include: (a) Maize: CMS 8501, CMS 8504 (Cameroon), Matafo I, TZEE-W (97TZEE W2C1), 95TZEE-Y1 (IITA), Mexican Early 17 (CIMMYT), 2009 TZEE W STR (IITA); (b) Sorghum: S35 (ICRISAT), Red Kolmon, K3R, Yellow Kolmon (ITRAD); (c) Millet: GB8735 (ICRISAT), DBS3, DBS5 (ITRAD), SOSSAT C88 (ICRISAT); (d) Groundnut: Rose de Deli (ITRAD), JL24 (India); (e) Sesame: S42 (Burkina Faso), Pachequeno-Sel, DLS-1.

Current variety testing programs for key crops include: (a) Millet: 1 hybrid and 6 varieties (including bio-fortified traits zinc, iron and folic acid) from ICRISAT; (b) Sorghum: 22 varieties (ICRISAT) and 2-3 hybrids from private companies; (c) Maize: 10 varieties and 3 hybrids including traits for high yield, bio-fortified (zinc, iron and folic acid), tolerance to drought and various biotic stresses; (d) Groundnut: 14 varieties (ICRISAT and Mali's research program); (e) Cowpea: 8 varieties of cowpea (IITA) from IITA; (f) Rice: Several new varieties including bio fortified traits (AfricaRice).

ITRAD has three regional agronomic research stations located in the Saharan (Faya Lazoguo), Sahelian (Gassi, Ndjamena), and Sudanian zones (Bébédjia). The most important stations are those of Bébédjia and Gassi. Currently, the ITRAD team has 54 researchers, including two breeders (sorghum and date palm), crop specialists for cotton, rice, groundnut, cassava, and other root and tuber crops.

ITRAD employs 54 researchers of which nine are PhD-holders. The 54 researchers are unequally divided in the regional centers in the three agro-ecological zones of the country as follows:

- 48 in Sahelian the zone, including the head office and the scientific department;
- 4 in Soudanese zone soudanienne of it; and
- 2 in Saharan zone

Proposed Interventions

- Hybrids/varieties of sorghum, groundnut, millets and hybrids of maize, millets, sorghum and vegetables will be sourced from regional research programs for testing. SSG proposes to support the testing and release of 20-25 varieties and/or hybrids of the selected crops over the next five years. Hybrids with competitive yield levels will be released for commercial production. Some of the key sources and yield gain potential for these crops that will be utilized include:
  - *Sorghum* hybrids from ICRISAT, Mali and Niger
  - *Maize* hybrids from Cameroon and IITA that have Striga resistance
  - *Millet* hybrids from ICRISAT
  - *Groundnut* varieties from ICRISAT, Bhabha Atomic Research Center (BARC), India and Niger, and ECOWAS list with early maturity and drought tolerance
  - *Sesame* varieties with low shattering loss and tolerance to foliar diseases sourced from Indian Institute of Oilseeds Research
  - *Vegetable* hybrids for okra, pepper, tomato, cabbage and leafy vegetables
- Train new breeders for key crops by awarding ten MS students and two Ph.D. students' fellowships to WACCI or Indian universities for vegetable breeders. MS breeders would be trained for millets and vegetable.

Seed Systems

The supply of early-generation seed (pre-basic and basic seeds) is done primarily by ITRAD. Currently, Chad produces a total of 3,390 tons annually of certified seeds for the key crops, meeting only 3% of the need for certified seeds (Figure 5).

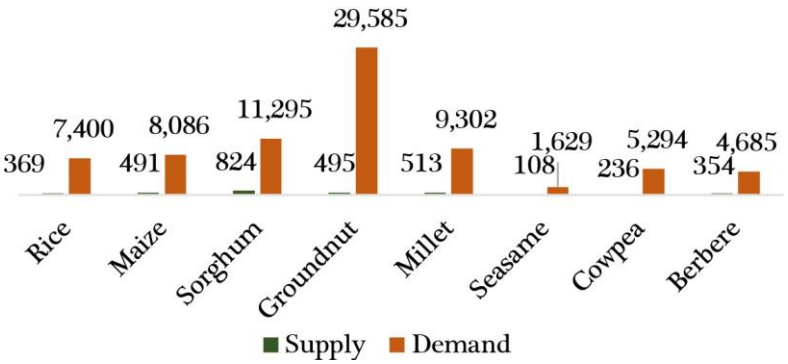

Figure 5: Seed Supply Demand Gap (MT) - Chad

Certified seed production is primarily through ITRAD, donor funded projects, and cooperatives.

One of the key challenges that the seed cooperatives face is the unavailability of the required quantum of basic seeds from ITRAD. As an alternative, the cooperatives procure basic seeds of the same varieties from regional research stations in Burkina Faso and Cameroon.

In Chad three seed-supply systems exist side-by-side: the formal seed system directed by the public services of the state, community-based seed systems, and traditional seed exchange and sales systems managed by farmers.

Quantities of breeder, foundation, and certified seed produced over the past year are shown below.

Table 1: Quantity (MT) of Seed Certified, 2017-2018

Cultures	Maize	Sorghum	Rice	Groundnut	Millet	Sesame
Breeder						
Foundation	8.8	5.1	7.9	5.2		1.6
Certified R1 et R2	88.8	58.6		4.9	29.2	2
Total	100.1	66	8.8	13.6	30.7	3.6

Table 2: Quantities (kg) of Certified Seed of Horticultural Crops Produced from, 2012-2014

Crop	2012	2013	2014	Total
Onion	0	615	1,259	1,874
Tomato	424.5	202	620	1,246
Okra	1,143	343	1,250	2,736
Cucumber	126.8	195	112	433.8
Watermelon	2,162	195	145	2,502
Cabbage	627.4	50	348	1,025
Potato	13,800	0	0	13,800
Garlic	12,232	0	1,850	14,082
TOTAL (kg)	**30,516**	**1,600**	**5,584**	**37,700,27**

Improved seed supply has been identified as one of the inputs making it possible to intensify agricultural production. However, the seed sector in Chad is poorly structured and organized, and fails to supply farmer demand. The rate of adoption of improved seeds is very low: approximately 5% of all seed planted.

The majority of improved seed is distributed to beneficiaries of development projects. For all other farmers, the situation is worse. Farmers resort to replanting seeds from their harvests or seed stocks sold by tradesmen. These stocks often have lost their varietal purity and sometimes even their genetic potential but these inferior seeds constitute in many cases the only recourse. ITRAD has land area of about 10,000 hectares, which is more than enough to meet pre-basic and basic seed production requirements.

ITRAD is equipped with a small cold room to ensure good conservation of seed collections and breeder seed, a soils laboratory, and a seed laboratory for the internal control of seed quality. Private actors in the multiplication and marketing of seeds hardly exist outside the rare groups multiplying seed under support from projects primarily located in the south of the country. Private seed companies do not exist, but Agro ESCOR, due to the partnership which it recently signed with NAFASO of Burkina Faso, could be on track to become a seed company.

The individual seed producers, groups, or associations are grouped together in a National Federation of Seed Producers (FENOPS), Chad. The organization comprises seven regional and inter- regional federations covering 15 of the country's 23 region. FENOPS-Chad aims to facilitate the activities of the seed producers' organizations in order to produce quality seeds meeting the needs of the country. Its members buy (or receive) basic seeds from ITRAD and multiply them for two generations to produce the certified seeds. Among the eight largest seed producers there are three individual producers, two private limited companies (including Sahel Agritech and Droit Vert), two seed producer groups, and a seed cooperative. The large operators produce mostly cereal crop seeds (maize and sorghum) and legume crop seeds (groundnut and cowpea).

Seed processing is predominantly manual. However, a seed processing unit with storage facility installed at the Gassi center has been operated irregularly due to limited availability of technicians. The lack of processing facilities has a negative impact on seed. Seed operators use artisanal practices of beating, winnowing, and sorting to clean the seeds. The processes do not ensure adequate purity. These seed are likewise preserved under precarious conditions because the country does not have adequate infrastructure for storage and conservation of seed. Untreated seeds are put in plastic, unventilated packing bags of 80 kg for groundnut, 25 kg for maize and cowpea, 10 kg for millet, 5 kg for sesame, 40 kg for rice, and 10 kg for sorghum.

Only one seed laboratory is available, but is not ISTA accredited. The Seeds and Plants Directorate (DSP) is responsible for the control and certification of seed in Chad and is working with a few projects (like ProPAD, PROFISEM) for increasing the volume of certified seeds across the country.

The Operationalization of Seed Chain in Chad (PROFISEM) project, funded by the Swiss Cooperation and implemented by GIZ, has been working with seed producer groups and cooperatives for a decade towards enhancing production of certified seeds. The Chadian government, through a World Bank funded project on climate resilient agriculture and productivity enhancement project (ProPAD), is aiming at increasing the supply of improved seeds of key crops to farmers in the provinces of Salamat, Moyen Chari, and Mandoul. Currently, there are eight major seed producers' cooperatives, including Sahel Agritech (sesame and vegetables) and Green Finger, among others, producing most cereal seeds (maize and sorghum) and legume seeds (ground nut and cowpea).

These groups collaborate with projects and NGOs for commercial seed delivery. Local NGOs such as ATADER, CECADEC, and BELACD have systems for sale of seeds to its own group members. However, the volumes operated through these systems are much lower than demand. Still, the groups are left with unsold goods due to improper diffusion strategies. Many private players (Doigtsverts, Technisem,Tropicasem) import vegetable seeds. While there are no global seed companies operating in Chad or supplying seed for main crops from elsewhere, one regional seed company (NAFASO) from Burkina Faso has recently made progress in establishing a production base in the country as a private entity called Escor Agro Challan Chad.

Since the quantity of seed supplied locally is insufficient, the government is open to imports and is generally not restrictive. Directorate of Plant Protection and Packaging (DPVC) controls the import of seeds. Seeds imported for conducting trials must have requisite plant quarantine certificates. The number of agro-dealers available is very limited. In the villages, no businesses sell agri-inputs, although there is some availability in the cities.

Policy Advocacy

In 2014, the ministry reaffirmed its will to restructure the seed sector, stating that hence forth the production of certified seeds would be withdrawn from public institutions and entrusted to the private sector (individual producers or associations). Now the focus of ITRAD will solely on early-generation seed production.

A new seed policy elaborated in 2016 clearly defines the roles and the responsibilities for the various actors (state, farmers, individuals, rural organizations, and private sector) as well as the coordination mechanisms. The modernization of the seed sector is aimed at making it possible for Chad to achieve its goal of increasing the adoption of improved seed from 5% to 40%.

The low-level of use of improved seeds (5%) explains the low level of productivity of Chadian agriculture. Thus, the concern of the government is to create an adequate institutional framework for the development of a durable seed sector in order to ensure the availability of seeds improved in quantities and qualities to satisfy the needs of farmers.

Proposed Interventions

- Provide seed grant funding to five private seed companies/cooperatives (such as Escor Agro Challan Chad, Sahel Agritech, Doigtsverts) for:
    - Building capacity in quality seed production: aim to increase the quality seed production of existing varieties/hybrids and newly introduced varieties/hybrids by 26% of the current quality seed production
    - Production of hybrids seeds and capacity development
    - Expanding the seed distribution network to reach farmers through extension activities.
    - Strengthen business entrepreneurship skills of 104 personnel through professional training courses over a period of five years
    - Technical skill improvement such as varietal selection, inbred line maintenance, seed standards and quality, and controlled storage
- Incubating new entities from groups of seed producers/cooperatives to take up quality seed production and marketing
- Support ITRAD breeder to conduct trait validation trials for recommending suitable hybrids for seed enterprises
- Operationalize the seed processing infrastructure at Gassi center, and installing additional capacity of 2 tons/day in the country. Capacity building of technicians on operation of farm machinery and seed processing units
- Agro-dealer development
    - Provide matching grants to 500 agro-dealers in Chad to open new outlets, renovate or relocate shops, procure inventory supplies and build cost- effective storage units
    - Capacity building of the agro-dealers on aspects related to storage, quality control and safe handling of products, and how to better manage micro enterprises through courses on bookkeeping, cash management, inventory management, quality standards, customer relations and compliance. All the 500 agro dealers will be

trained on these modules over a period of 5 years

- Strengthening of agro-dealer network and association building

- Extension and knowledge dissemination
  - Enabling wider adoption of improved varieties through grants to NGOs for demos, small packs, etc.
  - Promotion and introduction of ICT enabled infrastructure through various stakeholders to accelerate adoption of quality seeds.
  - Professional trainings will be provided to over 125 extension professionals over a period of 5 years. Trainings will be provided on aspects related to farm demonstrations, farmer training through deployment of ICT tools.

- Seed policy and advocacy
  - Continued dialogue with public sector stakeholders for sensitization on national seed laws implementation and outreach methods to stakeholders, seed standards and regulations refinement and oversight of the seed delivery by national and international players and harmonization of regional policy
  - Professional trainings will be provided to more than 100 seed inspectors on proper seed quality assessment and seed certification aspects.

Facilitate an increase quality seed production for the key crops to increase production to a total of at least 8,731 tons covering an area of 13% under quality seeds (Figure 6) by the end of five-year period, and 20,281 tons covering 28% area at the end of 10 years.

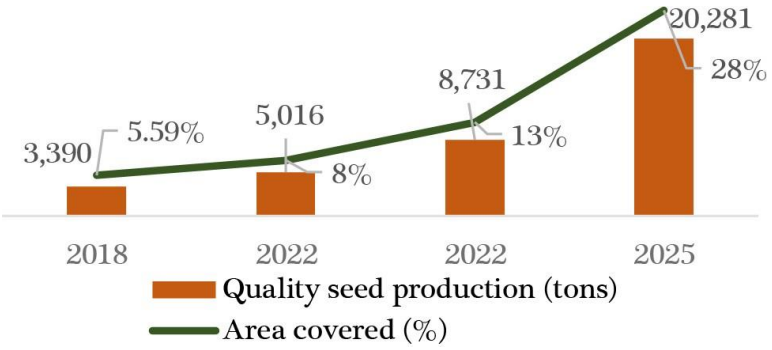

Figure 6: Projected Seed Quantity (MT) - Chad

Budget

Table 3: Chad Budget

Components	Amount (USD million)					
	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Component 1: Crop Variety Improvement						
NARS varietal Trials	0.38	0.33	0.20	0.00	0.00	**0.90**
Early generation seed production	0.08	0.08	0.05	0.00	0.00	**0.20**
MSc fellowships	0.11	0.18	0.07	0.00	0.00	**0.35**
PhD fellowships	0.15	0.15	0.00	0.00	0.00	**0.30**
Component 2: Seed Enterprise Development						
Grants for start-up seed companies	0.23	0.23	0.15	0.15	0.00	**0.75**
Multiplication support for vegetative crops	0.00	0.00	0.00	0.00	0.00	**0.00**
Hybrid seed production training	0.13	0.38	0.13	0.00	0.00	**0.70**
Professional trainings	0.05	0.11	0.05	0.00	0.00	**0.20**
Component 3: Agro-dealer Development						
Grants to agro-dealer development agencies	0.23	0.23	0.30	0.00	0.00	**0.75**
Capacity Development (Book keeping, information dissemination, inventory management etc.)	0.01	0.02	0.01	0.00	0.00	**0.04**
Component 4: Seed extension						
Grants to NGOs for demos, small packs, etc.	0.49	0.49	0.00	0.00	0.00	**0.98**
ICT, infrastructure and training support	0.25	0.00	0.00	0.00	0.00	**0.25**
Professional trainings	0.05	0.05	0.05	0.00	0.00	**0.14**
Component 5: Seed Policy and Advocacy						
Seed Policy and Advocacy (grantee and stakeholder meetings)	0.10	0.05	0.00	0.00	0.00	**0.15**
Professional trainings	0.02	0.05	0.02	0.00	0.00	**0.08**
Total	**2.24**	**2.30**	**1.08**	**0.15**	**0.00**	5.76