Strategy for the Development of Sustainable Seed Supply Systems in Benin

SEED SYSTEMS GROUP

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Country Snapshot

Population- 12 million

25.6% Agricultural share to GDP

2.8 m ha Arable land

10.1% Undernourished population

Age group < 15 - 45%; 15-65 -53%; > 64 - 3%

41% Agricultural employment

Climate Risk index- 107.5

Global hunger index- 2

Figure 1: Country Snapshot - Benin

Nutrition Profile

- Benin performs relatively well against other developing countries but still experiences malnutrition burden among its under-five population. Much of the population is challenged with food insecurity, wasting, stunting, and micronutrient deficiencies
- Stunting and wasting are caused by poor maternal nutrition, inadequate feeding practices, food insecurity, lack of diversified diet, and poor hygiene
- National Priorities are focused on strengthening the capacities of smallholder farmers to promote local production and food security and implementing the strategy to diversify agricultural products
- Figure 2 indicates the key statistics related to nutritional aspects in Benin

Food insecurity	Nutrition	Dietary diversity	Average per capita Fruits & Vegetable intake
• Poverty rate-40.1 %	• < 5 stunting-32.2% • <5 wasting- 5 % • Anaemia in women of 15-49 yearsage -46.9 %	• 72% of energy source derived from cereals, roots and tubers representing low dietary diversity	• 135 and 156.9 g/ day against recommended guidelines 200-250g/day

Figure 2: Nutritional Profile - Benin

Crop Profile

The key crops of Benin are cassava, maize, yams, vegetables, rice, soybean, ground- nut, cowpea, sorghum, and millet. Maize is by far the most important staple crop occupying 77.3% area of cereals (Figure 3), followed by rice. NERICA varieties of rice are the most popular for both upland and lowland regions with average yields of 3.26 tons/ha.

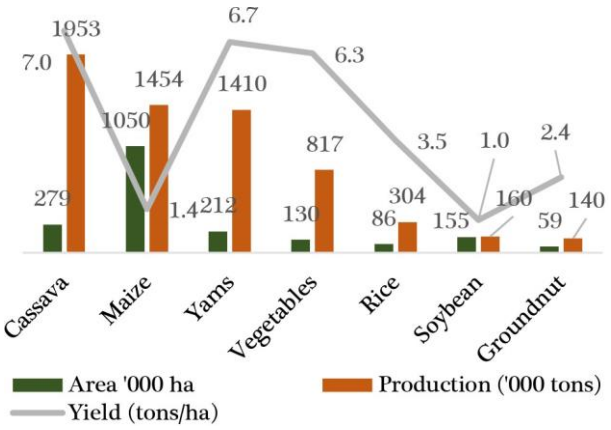

Figure 3: Crop Profile (2017) - Benin

Maize varieties TZPB-SR; TZL Composite 4 F2 released in 1997 and 2008, respectively, are currently in production. There is demand for early-maturing varieties of soybean, groundnut, and cowpea but the availability of new varieties and foundation seeds is a major challenge. Vegetable crops are highly developed in the valleys with good yields for the main species: tomato (8 tons/ha), pepper (2.9 tons/ha), onion (17.51 tons/ha) and leafy vegetables (7.76 tons/ha).

There is a huge opportunity to develop the capacity for vegetable seed production locally. The yield trends (Figure 4) indicate that the productivity of most of the major crops has remained stagnant, except vegetables increased from 36 tons/ha in 2008 to 63 tons/ha in 2017. This is primarily due to the presence of a number of regional private seed companies and global seed companies focused on marketing hybrids.

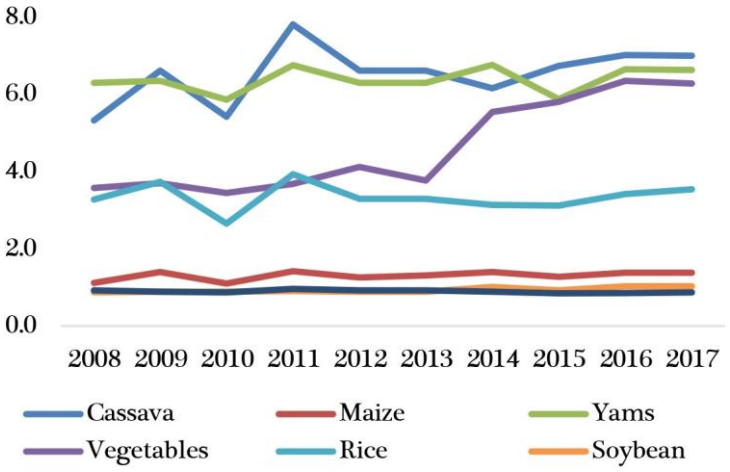

Figure 4: Yield Trends (tons/ha) - Benin

Breeding, Variety Development and Release

The main public research institute of Benin, National Institute of Agricultural Research of Benin (INRAB), has a network of research stations throughout the country. The institute is mainly focused on varietal trials, release, production, and supply of basic and foundation seeds to private entities and gene bank maintenance. INRAB collaborates with IITA, AfricaRice and the World Vegetable Center for conducting research trials for key staple crops (maize, rice) and vegetables. The researchers also develop new varieties of rice and maize to meet the requirements of the country with a focus on climate resilience, mechanized planting and harvest (rice), and food and nutrition security.

Apart from INRAB, the University of Abomey (UAC) is also involved in research activities through micropropagation techniques for various crops, conservation of genetic resources, and irradiation/ mutation breeding in maize. UAC works closely with INRAB for varietal testing pro- grams, but currently only INRAB is doing the varietal testing. INRAB also maintains an active vegetable seed supply unit at its headquarters and promotes the production of a wide range of traditional leafy vegetables. The seeds of vegetable crops (tomato, pepper, carrot, lettuce) are imported from neighboring countries and cover 75-80% of national needs.

The maize development center at INRAB is currently screening maize hybrids and conducting local assessment programs for four hybrid varieties (M1226-4; M1026-8; M0926- 2; M1526-4) at five different ecologies. Societe Jinukumja SARL Seed Company is testing one yellow maize hybrid from India, five hybrids from IITA, 32 from AATF, Nairobi and two from Pannar. INRAB has also developed a maize hybrid which is being tested against the hybrids accessed from various sources. ECOWAS approved maize hybrids are available and some are already being tested in the country. Currently only two breeders, one each for maize and rice, are available at INRAB to conduct re- search activities, while the University of Abomey (UAC) has 12 researchers working on various crops.

The most commonly grown maize varieties in Benin (all non-hybrids) belong to four maturity groups, which are:

- Late-maturing varieties (120 days to maturity): 'TZPB-SR' and 'Composite TZL 4 F2'
- Intermediate varieties (105 days): 'QPM/Faaba
- Early varieties (90 days): 'EVDT 97/STR', 'DMR ESRW', 'AK94 DMR ESRY', 'DMR/QPM', '2008 EV DT STR Y', 'TZE POP STR QPM'
- Extra-early varieties (75 days): '2000SYN-EE-W', '2008 SYN-EE DT/STR-W', and 'TZEE POP STR QPM'

The most commonly grown rice varieties are the NERICA and IR series (in irrigated conditions). All millet and sorghum varieties grown are local land races.

Proposed Interventions

- Hybrids and advanced lines of maize, vegetables, and rice with competitive yield levels will be introduced and released for commercial production
    - *Maize*: Yellow maize hybrids will be sourced from private companies, IITA, AATF and ECOWAS-registered and approved hybrids from neighboring countries (Nigeria, Ghana and Mali) with yield grain potential of 7-8 times over current productivity.
      Twenty-five ECOWAS-registered maize hybrids from IITA (Table 1) will be tested, and the best hybrids will be selected for release.
    - *Rice*: hybrids and recently developed lines from AfricaRice and interested private companies in India will be introduced and tested
    - *Soybean:* Recently developed early maturing varieties available from IITA will be selected and released
    - *Vegetables*: Brassica, tomato, and pepper hybrids will be introduced in collaboration with mid-sized global vegetable companies such as East West, Advanta, Technisem, Sakata and the World Vegetable Center. These hybrids will be validated with the help of INRAB and local seed companies for commercialization. Capacity building of IIA to produce basic/foundation seeds and build a public-private partnership to strengthen basic and foundation seed production
    - *Cassava:* New, virus-resistant cassava varieties available from Ghana and IITA will be tested and released and rapidly put into farmer multiplication schemes

- Several young, committed plant breeders for existing and new crops, especially vegetables, will be trained. Fellowships will be awarded to 12 MS and two Ph. D students. MS breeders will be trained for rice, cowpea, groundnut, soybean, and vegetables

Table 1: List of ECOWAS Registered Varieties

S. No	Variety name	Base genetics	Outstanding characteristics and potential yield	Year of release
1	Ife Maizehyb-5	TZEEI 29 × TZEEI 21	Extra-early maturing, high grain yield (5-6 t/ha), *Striga* resistance, drought and low soil nitrogen tolerance	2013
2	Ife Maizehyb-6	TZEE-W Pop STR C5 × TZEEI 6	Extra-early maturing, high grain yield (4.5-5.5 t/ha), *Striga* resistance, tolerance to drought and low soil nitrogen	2013
3	SAMMAZ 41	TZEI 124 × TZEI 25	Early maturing, high grain yield (5-7 t/ha), *Striga* resistance, drought and low soil nitrogen tolerance	2014
4	SAMMAZ 42	TZE-Y Pop DT STR × TZEI 13	Early maturing, high grain yield (5-7 t/ha), *Striga* resistance, drought and low soil nitrogen tolerance	2014
5	SAMMAZ 46	TZEI 60 × TZEI 86	Early maturity, high grain yield (7.5-9.5 t/ha), *Striga* resistance, tolerance to drought and low soil nitrogen.	2016
6	SAMMAZ 47	ENT 3 × TZEI 65	Early maturity, high grain yield (8-10 t/ha), *Striga* resistance, tolerance to drought and low soil nitrogen	2016
Mali				
1	Sanu	TZEI 60 x TZEI 86	Early maturity, high grain yield (5-6 t/ha), *Striga* resistance, tolerance to drought and low soil nitrogen	2012
2	Sahel kaba	TZEE-W Pop DT STR C5 X TZEEI 6	Extra-early maturity, high grain yield (5-6 t/ha), *Striga* resistance, tolerance to drought	2014
3	Sosani	TZEE-Y Pop DT STR C5 X TZEEI 58	Early maturity, high grain yield (5-6 t/ha), *Striga* resistance, tolerance to drought	2014
4	Dilika	TZEI 24 X TZEI 17	Early maturity, high grain yield (5-7 t/ha), *Striga* resistance, tolerance to drought and low soil nitrogen	2014
5	Apraku	TZEI 11 X TZEI 23	Early maturity, high grain yield (7-8 t/ha), *Striga* resistance, tolerance to drought and low soil nitrogen	2014
6	Tamalaka	TZEI 124 X TZEI 25	Early maturity, high grain yield (6-7 t/ha), *Striga* resistance, tolerance to drought	2014
Ghana				
1	Kunjor-wari	TZE-Y Pop DT STR C4 × TZEI 17	Early maturity, high grain yield (5.5-5.7 t/ha), *Striga* resistance, tolerance to drought and low soil nitrogen	2015
2	Suhudoo	TZE-W Pop DT STR C4 × TZEI 7	Early maturity, high grain yield (5.5-5.8 t/ha), *Striga* resistance, tolerance to drought and low soil nitrogen	2015
3	Afriyie	TZEEI 6 × TZEEI 4	Extra-early maturity, high grain yield (5.5-5.7 t/ha), *Striga* resistance, tolerance to drought and low soil nitrogen	2015
4	Obotantim	TZEEI 15 × TZEEI 24	Extra-early maturity, high grain yield (5.5-5.8 t/ha), *Striga* resistance, tolerance to drought and low soil nitrogen	2015
5	Nkabom	TZEE-Y Pop STR C5 × TZEEI 82	Extra-early maturity, high grain yield (5.5-5.2 t/ha), *Striga* resistance, tolerance to drought and low soil nitrogen	2015
6	CSIR-Similenu	TZEI 60 × TZEI 86	Early maturity, high grain yield (6-6.5 t/ha), *Striga* resistance, tolerance to drought and low soil nitrogen	2017
7	CSIR-Denbea	TZEI 124 × TZEI 25	Early maturity, high grain yield (6.5-7 t/ha), *Striga* resistance, tolerance to drought and low soil nitrogen	2017
8	CSIR-Komnaaya	TZEE-W Pop STR C5 × TZEEI 29	Extra-early maturity, high grain yield (5.5-6 t/ha), *Striga* resistance, tolerance to drought	2017
9	CSIR-Wang-Basig	TZEE-W Pop STR C5 × TZEEI 21	Extra-early maturity, high grain yield (5.5-6 t/ha), *Striga* resistance, tolerance to drought	2017

- Enhancement of R&D capacity of four seed companies (including Societe Jinukumja, SARL, AKJ seeds, The Lama Sarl and SAHGUI et Fils) for hybrid seed production and validation trials. This will help bring new hybrids more rapidly to market. Additionally, the release of high yielding varieties/hybrids with key desirable traits like drought tolerance and other biotic stresses in the country will be undertaken.

Seed Systems

Free seed supply of 16,000 MT of maize and 5,000 MT of rice was available until 2016. In 2018, the actual tonnage was only 1,790.5 MT for maize and 457 MT for rice (Figure 5). The downward trend shown in Figure 6 is due to the disengagement of the government in seed supply beginning in 2015. Until then, the government had been the principal purchaser of seed. However, since the government's retreat from the seed market, the private sector has struggled to fill the gap. Figure 6, showing total rice seed production in Benin from 2014-2018, likewise illustrates the retraction of government from the rice seed markets. Foundation seed production for maize and rice has followed a similar trend, based on reducing demand from government, and the lag-time involved in private sector building its certified seed production capacity, as shown in Figures 7.

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

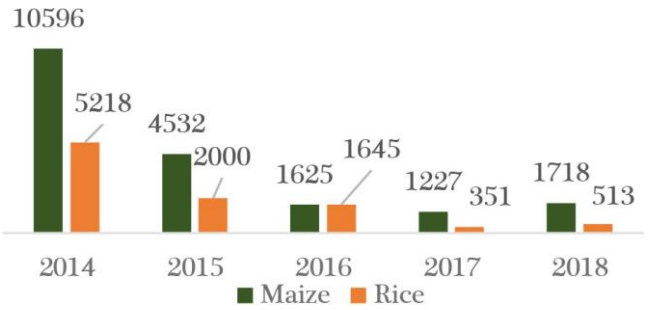

Figure 6: Total Maize and Rice Seed Production (MT), 2014-2018 - Benin

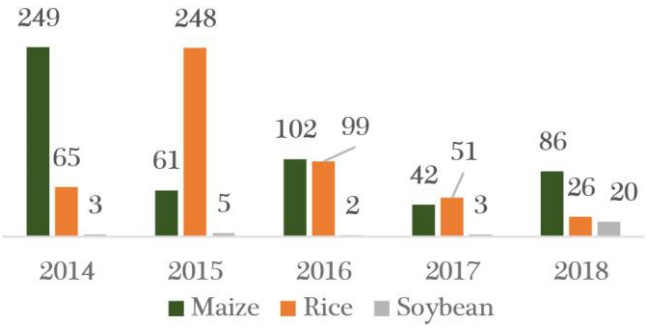

Figure 7: Foundation Seed Production of Maize, Rice and Soybean (MT), 2014-2018 - Benin

In the case of soybean, however, the trend is reversed, as several national projects aimed at capitalizing on soybean demand for export have been initiated, as shown in Figure 7. Cotton farmers are moving towards soybean cultivation, as there is good demand for soybean oil in the country.

Currently, INRAB is the primary source of basic seeds. Basic seed production is entrusted to the seed farms Alafiarou for the north, and Ketu in the southern region. Infrastructure at INRAB for the production and packaging of seeds is in need of new investment. This increases the difficulty of processing operations and generates a negative impact on costs, production, and sale of pre-basic seeds. Non-governmental organizations (NGOs) and other private organizations are actively engaged in the production and supply of seeds of various species.

There is a scarcity of private seed companies that import and test hybrids and varieties and pro- duce and distribute seeds. One effective seed company is the Société Jinukumja SARL; it is involved in production and sale of maize, soybeans, rice, and cowpea.

Over the last several years, with seed policy reforms beginning to take effect, a public-private partnership has gradually emerged in the seed sector of Benin, with the creation and the emergence of a number of small and medium-size seed companies. These emerging companies have already demonstrated appreciable performance and deserve technical and financial support in order to build a competitive and durable national seed sector. Since 2014, 30 businesses were created for multiplying, processing, and marketing seeds (12 SMEs) such as Société Jinukumja SARL (45 tons), AKJseeds (22 tons), Sahgui ET Fils (23 tons), Monkassado Sarl (25 tons), and many others who are mainly focused on maize, rice, and soybean seed production. Several of these with progress management can be identified for scaling up production, increased technical capability, and production of hybrid maize seed. Twelve private companies have likewise been authorized to produce foundation seed. Thirteen SME seed companies approved for the production and marketing of certified maize seed are distributed throughout most of the country. Total production from 2014-2018 is 1,280

MT, which equates to approximately 25% of production target set by the government for the same period.

Table 2: List of SME Seed Companies Producing Maize Seed in Benin, 2014-2018

N°	Company	Location	Owner	Contacts (+229)	Seed Supplied (tons)				
					2014	2015	2016	2017	2018
1	AKJ Semence	Banikoara-Alibori	AGBAN-KESSE Josué	64 20 45 15 / 96 15 96 03	50	13	16	6	35
2	Société SAHGUI et Fils	Tanguiéta-Atacora	SAHGUI Paul	97 24 04 02	24	20	10	11	20
3	LA LAMA Sarl	Toffo- Atlantique	AYLARA Louise	97 17 67 35	0	0	4	3	3
4	BORGALI Sarl	N'Dali-Borgou	GORADO BIO Amadou	94 71 02 05 / 97 32 07 00	106	65	39	63	75
5	GIE-ALAFIAROU	Parakou- Borgou	HOUESSOUDEGBO Antoine	97 72 07 85	43	61	34	38	41
6	SIMAGRO	Savalou- Collines	MILOHIN Simon	97 85 20 71	28	3	9	6	8
7	JINUKUNJA Sarl	Dassa-Zoumè-Collines	DOSSOUHOUI C. Gaston	65 49 57 57	4	0	1	1	3
8	AGBLEGNON Sarl	Klouékanmè-Couffo	SATCHI GBONDJE A. Pierre	97 33 38 82/ 65 36 19 99	27	11	10	7	21
9	DALLAS CITY Sarl	Djougou- Donga	EDJADESSIBA Pauline	97 87 39 71	43	2	14	33	38
10	OGOUTOYOSSI et Fils	Ifangni- Plateau	OGOUTOYOSSI Firmin	97 08 74 07/ 64 25 45 89	10	8	3	0	0
11	GAT	Kétou-Plateau	AHOLOU Gbèwa	96 34 88 57	2	3	6	1	1
12	Ferme AMOUSSA et Fils	Kétou-Plateau	AMOUSSA Sadicou Séidou	97 71 16 03	12	8	18	31	25
13	TOUGAN et Fils	Djidja-Zou	TOUGAN Félix	95 77 22 19	25	32	16	20	10

There are likewise 10 SME seed companies licensed to produce certified rice seed throughout the country. The total production of rice seed during the period 2014-2018 is 1,240 MT, which rep- resents 50% of the target set by the government over the period.

Table 3: List of Registered SME Rice Seed Companies in Benin

N°	Company Name	Location	Owner	Contacts (+229)	Seed Production				
					2014	2015	2016	2017	2018
1	MONKASSADO Sarl	Malanville-Alibori	BOSSOU Arouna	97 29 58 64 / 64 63 86 52	117	114	31	42	20
2	OROUSANGUI & Fils	Banikora- Alibori	OROU SANGUI Méré		2	1	0	1	0
3	YENI BANSEM Sarl	Matéri- Atacora	GNARIGO Catherine	96 88 43 03 / 95 35 74 95	0	0	11	5	11
4	DJROWANOU	Zè- Atlantique	MEDJAGBONON Pauline	66582840	2	5	1	1	0
5	Entreprise Semencière du Centre Sarl	Savalou- Collines	DAMASSOH Firmin	97 55 28 90 / 94 03 91 96	13	0	3	0	8
6	AWEDE et Fils	Houéyogbé-Mono	AWEDE Euloge	95 82 62 90	0	2	0	2	0
7	BOGNON et Fils	Aguégués- Ouémé	BOGNON Barthélémy	97 22 22 38 / 94 99 22 68	17	0	4	3	3
8	SERIB Sarl	Adja-Ouèrè-Plateau	GODONOU Barthélémy	96 55 89 05	370	0	141	7	15
9	AGUENNENGOUE et Fils	Covè-Zou	AGUENNENGOUE Victor	95 84 15 81	140	83	30	6	10
10	AGBLEGNON Sarl	Klouékanmè-Collines	SATCHI GBONDJE Pierre	97333882	6	6	2	2	3

Table 4: Agro-dealers Operating in Benin

N°	Region	Number of Shops	Company Name
1	Alibori	3	AKJ Semence
			MONKASSADO
			Bénin Semence
2	Atacora	2	Société SAHGUI et Fils
			Yeni Bansem Sarl
3	Atlantique	3	LA LAMA Sarl
			DJROWANOU
			Bénin Semence
			JINUKUNJA Sarl
4	Borgou	4	BORGALI Sarl
			GIE-ALAFIAROU
			Bénin Semence
			DEDRAS ONG
5	Collines	4	Société Semencière du Centre
			JINUKUNJA Sarl
			UNIRIZ
			APrSeV
6	Couffo	1	AGBLEGNON Sarl
7	Donga	2	DALLAS CITY Sarl
			S & K
8	Mono	3	2 Pains 5 Poissons
			Espace Vert
			HESSOU & Fils
9	Ouémé	2	BOGNON & Fils
			SONGHAÏ
10	Littoral	3	Accueil Paysan
			Bénin Semence
			EREVAN
11	Plateau	3	OGOUTOYOSSI & Fils
			GAT
			Ferme AMOUSSA & Fils
			SERIB Sarl
12	Zou	2	TOUGAN & Fils
			AGUENNEGOUE & Fils

There exists only one modern seed processing plant in Benin, operated by JINUKUNJA Seed Company, based in the Commune of Dassa-Zoumè. The company is now producing seed of maize, rice, soybean, cowpea and groundnut and selling the seed in 5, 10, and 20 kg bags.

Currently, only 32 agro-dealers are active across different regions of the country, mostly for vegetable seed, which is insufficient for seed dissemination services. The National Association of Seed producers of Benin (ANASEM) has 50 members and sells seeds through agro-dealers. Lack of infrastructure for seed storage facility at ANASEM is a major issue which hinders proper distribution of seed to farmers.

The companies approved for the production of the certified seeds are supplied either directly in the seed-bearer farms of state or near the productive enterprises of basic seeds of their region. Currently, the supply is done by direct purchase in cash and there does not exist yet a strategy of supply based on the contracts of service.

Proposed Interventions

- Provide seed grant funding to five private seed companies (Société Jinukumja SARL, AKJ seeds, Monkassado Sarl and SAHGUI et Fils) to:
    - º Increase the capacity of quality seed production: aim to increase the quality seed pro- duction of existing varieties/hybrids and newly introduced ones by 35% of the current quality seed production
    - º Production of hybrid seeds and capacity development
    - º Expansion of the seed distribution network: expand their reach to farmers
    - º Enhance business management and administrative skills of 88 personnel through professional training courses over a period of 5 years
- Strengthen the capacity of INRAB and private companies in early generation seed production/processing through infrastructure development
- Build public-private partnerships (PPP) between INRAB and private entities to establish a strong foundation for sustainable production of basic/foundation

seeds of key crops

- Establish sales agronomy staff in private companies to train farmers on best varieties and agronomic practices
- Strengthen seed processing infrastructure: installation of additional capacity of 2 tons/day in the country at private sector premises
- Agro-dealer development
    - Provide matching grants to 650 agro-dealers in Benin 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 microenterprises through courses on bookkeeping, cash management, inventory management, quality standards, customer relations, and compliance. All the 650 agro-dealers will be trained on these modules over a period of five years
    - Strengthening of agro dealer networks 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 100 village-based advisors over a peri- od of five 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 willbe provided to more than 80 seed inspectors on proper seed quality assessment and seed certification aspects

Facilitate increase in quality seed production for the key crops to 6,887 tons covering an area of 13% under quality seeds (Figure 8) at the end of five-year period and 19,035 tons covering 37% area at the end of 10 years

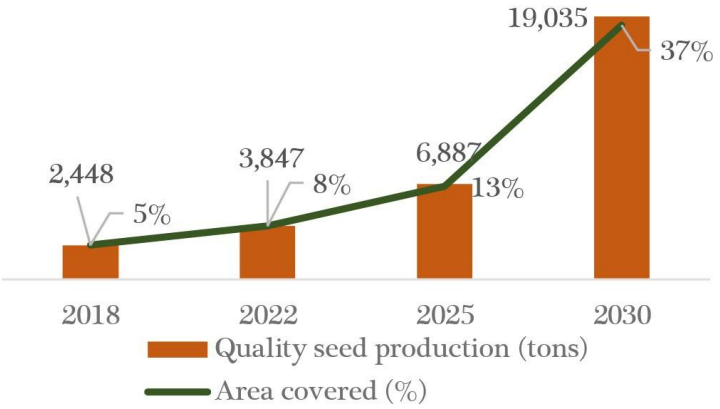

Figure 8: Projected Seed Quantity (MT) - Benin

Budget

Table 5: Benin Budget

Components	Amount (USD million)					
	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Component 1: Crop Variety Improvement						
NARS varietal Trials	0.20	0.20	0.13	0.00	0.00	**0.53**
Early generation seed production	0.06	0.05	0.03	0.00	0.00	**0.14**
MSc fellowships	0.11	0.18	0.14	0.00	0.00	**0.42**
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	0.10	0.10	0.00	0.00	0.00	**0.20**
Hybrid seed production training	0.13	0.25	0.13	0.00	0.00	**0.58**
Professional trainings	0.08	0.05	0.05	0.00	0.00	**0.17**
Component 3: Agro-dealer Development						
Grants to agro-dealer development agencies	0.23	0.45	0.30	0.00	0.00	**0.98**
Capacity Development (Book keeping, information dissemination, inventory management etc.)	0.01	0.03	0.01	0.00	0.00	**0.05**
Component 4: Seed extension						
Grants to NGOs for demos, small packs, etc.	0.42	0.35	0.00	0.00	0.00	**0.77**
ICT, infrastructure and training support	0.15	0.00	0.00	0.00	0.00	**0.15**
Professional trainings	0.05	0.05	0.03	0.00	0.00	**0.12**
Component 5: Seed Policy and Advocacy						
Seed Policy and Advocacy (grantee and stakeholder meetings)	0.05	0.08	0.00	0.00	0.00	**0.13**
Professional trainings	0.03	0.02	0.02	0.00	0.00	**0.06**
Total	**1.97**	**2.15**	**1.05**	**0.15**	**0.00**	**5.32**