Strategy for the Development of Sustainable Seed Supply Systems in Madagascar

SEED SYSTEMS GROUP

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Country Snapshot

Population- 28 million

23.7% Agricultural share to GDP

3 m ha Arable land

44.4% undernourished population

Age group < 15 -43%; 15-65 -54%; > 64 - 3%

68% Agricultural employment

Climate Risk index- 15

Global hunger index- 41.5

Figure 1: Country Snapshot - Madagascar

Nutrition Profile

- Child malnutrition is very high in Madagascar, averaging above 50% in rural areas.
- Madagascar is one of the world's most vulnerable countries, with natural disasters affecting communities' food and nutrition security.
- Cyclones and droughts affect Madagascar's southern regions, often devastating crops and leaving farmers without the means to generate income or critical food sources.
- Predominance of anemia, stunting, and wasting indicates lack of sufficient quantity of protein and micronutrients in the diet of Malagasy population.

Food insecurity	Nutrition	Dietary diversity	Average per capita Fruits & Vegetable intake
• Poverty rate-70.7 %	• < 5 stunting-54.8% • <5 wasting- 10.3% • Anaemia in women of 15-49 yearsage -36.8%	• 79% of energy source derived from cereals, roots and tuber representing low dietary diversity	• 125.3 and 46.4 g/day against recommended guidelines 200- 250g/day

Figure 2: Nutritional Profile - Madagascar

Crop Profile

The principal food crops are rice, cassava, maize, potatoes, beans, groundnut, sweet potatoes, and a wide variety of vegetables (Figure 3) Rice dominates Madagascar's agricultural production (cultivated by 82% of households) followed by cassava and maize.

The rice industry is the primary economic activity in rural areas in terms of volume. Current production does not fully meet the needs of the local population, and the country imports around 200,000 MT of rice per year. 'Mailaka' variety, released in 1994, and 'Makalioka', released in 1932, are the most popular varieties.

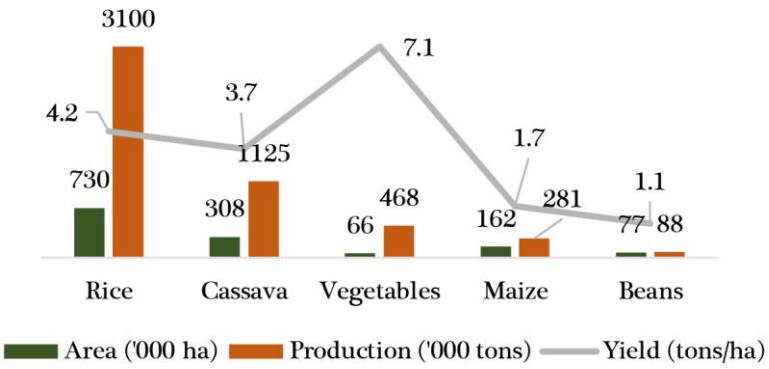

Figure 3: Crop Profile (2017) - Madagascar

Maize is also grown throughout the country, with 25% of the production utilized for poultry feed.

The yield of key crops is low due to extensive use of old varieties. Food crop production is highly dependent on rainfall, which is the main cause of the fluctuation of the quantities produced every year.

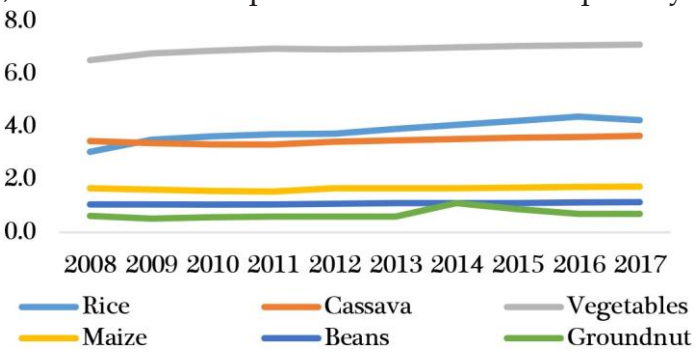

Figure 4: Yield Trends (tons/ha) - Madagascar

No discernible difference in crops yields have been observed (Figure 4) over the last decade as seed supply is dominated by recycled seed and hybrid adoption is negligible.

There are approximately 2.5 million farms in Madagascar. Ninety-nine percent are family farms which farm more than 95% of cultivated land. Seventy percent of family farms have a cultivated area of less than 1 hectare. Eighty-five percent of the active population is agricultural.

The General Agricultural Census of 2005 indicates that only 1.3% of rice farms in Madagascar use improved seeds (Table 1), explaining the relatively low yield obtained in spite of irrigated rice cultivation.

Table 1: Irrigated Rice Area (%)

	Hectares	%
Total (Madagascar)	979,803	100
Planted area with improved seeds	12,305	1.3
Area sown with traditional seeds	967,498	98.7

In this survey, 84.8% of rice farms studied used no fertilizer, 11.8% used only manure, 1.5% used inorganic fertilizers, and 1.9% combined both organic and inorganic.

Breeding, Variety Development and Release

The National Center for Applied Research on Rural Development (FOFIFA) promotes agricultural research in Madagascar and researches crops, livestock, forestry, postharvest, and socioeconomic issues. In the area of crop improvement, FOFIFA focuses on improving rice, maize, oil- seeds (groundnut), legumes (beans, Bambara groundnut), vegetable crops and export crops (coffee, vanilla, and pepper). FOFIFA collaborates with regional and international research institutes, including IRRI, CIMMYT, CIAT, CIP, IITA, and CIRAD to access improved germplasm. FOFIFA has eight regional centers across the country with a focus on various crops. It employs 24 breeders (19 rice; 1 maize; 2 beans; 2 groundnut) working on varietal trials and release. Rice research is supported by CIRAD, Japan, China, and AfricaRice, and beans by ECAPAPA / ECABREN.

The number of active plant breeders in Madagascar is clearly insufficient to allow the development of new, high-yielding varieties for the development of the seed sector. The result is there are very few new varieties available, and no hybrid varieties have been released for any crops.

Table 2: Number of Active Plant Breeders, 2016

	Public	Private	Total
Rice	19	1	20
Maïze	1	1	2
Beans	2	1	3
Groundnut	2	1	3
Total	24	4	28

Varietal selection is mainly carried out by FOFIFA and FIFAMANOR, both public research institutions. FOFIFA mainly deals with the improvement of rice, maize, oilseeds (peanuts), legumes (beans, voandzou, etc.), vegetable, and export crops (coffee, vanilla, pepper). Crop breeding work carried out within FOFIFA is supported by AfricaRice, CIRAD, JICA, and ECAPAPA-ECABREN. Breeding is based on local germplasm and advanced lines mainly coming

from international re- search institutes (IRRI, CYMMIT, CIAT, IITA, and CIRAD).

FIFAMANOR is an agricultural development project created in 1972 with a primary focus on breeding for the promotion of tuber crops (potato, sweet potato), wheat, and cereals (triticale, maize, and rainfed rice). The research team at FIFAMANOR is comprised of 17 researchers distributed for various crops, lab, and screen house activities. The institute works with FOFIFA for multiplication of upland rice and beans and with farmer groups for seed multiplication. The institute maintains collaborations with CIMMYT for wheat and CIP for potato. It imports clones or lines and selects for various traits. The selection process is done at research stations and trait confirmation is done on farmer fields followed by demonstration and multiplication plots. The institute is equipped with a basic seed quality lab for germination and moisture tests. Potato plants are produced through in vitro propagation with a capacity of 50,000 plantlets per year. It is currently equipped with six poly houses for potato seedlings.

Most varieties of rice grown are local land race varieties. The most widely used rice variety at the national level is 'X-265' or 'MAILAKA', a short cycle variety adapted to different soil and climatic conditions and of good organoleptic quality. In the case of maize, the majority of varieties grown are local varieties improved by FOFIFA or CIRAD. All are open pollinated varieties. The most widely cultivated variety of maize is 'IRAT-200', developed by CIRAD in the 1960s. A few tons of hybrid maize seed are imported each year from South Africa (PANNAR) by AGRIVET. Several improved varieties of beans have also been released through the collaboration between FOFIFA and ECABREN. The most widely cultivated are bush bean varieties with white or red seed coat. The majority of groundnut varieties cultivated are likewise very old varieties introduced by FOFIFA. The most widely cultivated groundnut variety today is the FLEUR 11 variety, an early-maturing variety resistant to rosette.

Table 3: The Most Widely-grown Varieties of Madagascar's Principal Food Crops

Crop	Varieties
Rice	Pluvial : FOFIFA 133, 152, 154, 3728, 2733, 3747, 3737, 3728, 3729, B22, 2366, 3406, 3391 Irrigué : MK 34, MKX, 4012, 27878, 1285, SEBOTA 65, SEBOTA 41, Tawoti, Chierang, Aromatica, IR 64FOFIFA 160, X265, 1632, Sarindra
Maïze	Tombontsoa, Meva (374), IRAT 200, Volasoa (Los Banos 8227), Bakoly (Suwan 8131), NTS 101
Beans	Rouge marbré (Marlat), Lingot blanc, Rouge de Majunga, Blanc Boribory
Potato	Spunta, Pôta, Meva, Lava, Miova

No private companies are involved in research activities for new varietal development. Agrivet imports small quantities of maize hybrids from South Africa (Pannar).

Proposed Interventions

- Rice, maize, cowpea, beans and Bambara groundnut varieties/hybrids will be introduced and varieties with competitive yield levels will be released for commercial production.
    - Rice: New varieties/hybrids of rice will be introduced from AfricaRice, IRRI, and public institutions and private companies from India
    - Maize: Yellow early-maturing maize hybrids with the yield potential of 7-8 times over cur- rent varieties will be sourced from IITA, CIMMYT and private companies
    - Cowpea: Varieties will be sourced from IITA for validation and commercialization by private companies
    - Vegetables: The capacity of SEEDFAS will be strengthened for vegetable seed production and commercialization for carrots, pepper, onion (colored), eggplant, and tomato
    - Enhancement of R&D capacity of five seed companies, including AgriPro, Andriko,
- SEEDFAS, Valy Prodsem, and FIFAMANOR to access varieties and hybrids from IITA and Cameroon, and evaluate and select varieties and hybrids for late stage validation and commercialization
- Human resource development (breeding and seed technology) for the above-mentioned crops via training of 15 MS and three Ph.D. (rice, maize, and vegetables) breeders in Ghana, Kenya, Uganda, and India. MS breeders will be trained for rice and maize crops

Seed Systems

FOFIFA is the main producer of pre-basic and basic seeds for rice, beans, and groundnut, but does not have enough land for production of early generation seed (EGS).

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

Four regional FOFIFA research centers specialize in the production of breeder and foundation seeds, and some seed companies also produce its own foundation seeds. However, this production does not meet the needs.

FOFIFA produces these seed categories on orders placed at least one year in advance. Most users of FOFIFA seeds complain of the inadequacy of the quality and quantity of foundation seed made available by FOFIFA. The problem of the availability in quality and quantity of basic seeds constitutes a major technical constraint to the development and supply of certified seeds in Madagascar. FOFIFA contracts with private seed company (Andriko) for basic seed production.

There is huge pressure on the land. Local farmers are occupying FOFIFA's land and the ministry must find 100,000 hectares of new agricultural land every year. Certified seed production (Figure 84) is mainly done by private entities and cooperatives.

Agrivet, Agrima (Maize- IRAT 200), Agripro (400-500 tons), and Andriko, with 300 tons of production capacity, is focused on rice, maize, and millets. Valy Prodsem with 50 tons capacity (maize, rice, cowpea and vegetables), SEEDFAS (vegetables), and SEEDLAN with 50 tons of capacity for rice, are other active companies and cooperatives producing certified seed. SEEDFAS, a nine-member cooperative, works on 44 varieties of vegetables such as leafy vegetables, African eggplant, Amaranthus, local beets, celery, cabbage, cauliflower, Chinese cabbage, Chinese onion, cucumber (local and Chinese). SEEDFAS has collaboration with World Vegetable Centre and have also procured the basic seed of apple, peach, and citrus along with vegetables. It has seven wholesalers throughout the country for distribution.

Based on the number of groups having obtained their seed certification from the Seed Control Service (SOC), 82 local seed establishments were identified in Madagascar from 2016 to 2019. In 2018, certified seed production of these 82 enterprises totaled 1,632 MT. Rice accounted for 75% of all seed produced, followed by maize at 15%.

Table 4: List of Seed Enterprises Recognized by the SOC and Their Production, 2018

Seed Enterprise	Region	Seed Production (MT)					
		Rice	Maize	Beans	Groundnut	Other	Horticulture
AGRIPRO SARL/AGROBOXX	Analamanga	28.14	128.6			1	
AGRIPROGRES	Analamanga						0.8
ANDRIAFENOSOA Willy Arthur	Bongolava	4					
ANDRIAMANDIMBY Fenohery	Bongolava	12					
ANDRIAMANGA Voahanginiaina	Bongolava	8	3				
ANDRIKO	Alaotra Mangoro	24	32	3.25	4	7	
APDIP	Bongolava			2.7			
ASSOCIATION FMDB	Anosy			4.6			
ASSOCIATION HAFA TY TALOHA	Anosy					16.7	
ASSOCIATION HERIMBATO	Anosy		1.3			0.6	
ASSOCIATION TMM	Itasy	27.85					
ASSOCIATION VORIRIKE	Anosy					2.9	
ASSOCIATIONS FMMDA	Anosy					10	
BIONERR	Itasy	4.5					
CASTELL'S	Alaotra Mangoro	42.5					
CMS BEHARA	Anosy			10.85			
CMS CFFAMMA	Alaotra Mangoro	104.7					
COOPERATIVE AVOTRA	Analamanga						1.2
COOPERATIVE FAMA	Itasy	13					
COOPERATIVE FIMA	Itasy	4.75					
COOPERATIVE KBMM	Bongolava	35.5	11				
COOPERATIVE TOLOJANAHARY	Atsimo Andrefana	3					
CPSA/CTAS	Anosy			1	0.3	3.3	
CRAM / GPS AINA	Haute Matsiatra	10.5					
CRAM / GPS RINDRASOA	Haute Matsiatra	13.5					
CRAM / GPS SOAFANIRY	Haute Matsiatra	33.8					
CRAM / GPS SOAMANDIMBY	Haute Matsiatra	5.5					
CRAM / GPS TVH	Haute Matsiatra			3.55			
CRAM Réseau SOA - Haute Matsiatra	Haute Matsiatra	20.3		3.25			
ETABLISSEMENT MIHARIVOLA	Bongolava	21.23	10.15				
FIFAMANOR	Vakinankaratra		2.9			4.9	
FMT Ankazomborona	Boeny	4.23					
FOFIFA		13.49	30		2.4		
GPS AINGA	Vatovavy Fitovinany	2.7					
GPS AMBININTSOA	Alaotra Mangoro		23.5				
GPS AMPARAFARAVOLA	Alaotra Mangoro	33.75					
GPS ANKATAFA	Boeny	2.52					
GPS AVOTRA	Itasy	1					

GPS EZAKA MIARAMITA	Amoron'i Mania	2.9					
GPS FANANTENANA	Vatovavy Fitovinany	11.7		1.8			
GPS FANEVA	Vatovavy Fitovinany	4.4					
GPS FITARATRA	Boeny	4.05					
GPS FIVOARANA	Boeny	3.99					
GPS FIZASI	Boeny	4.8					
GPS HORDEA	Alaotra Mangoro	104.5					
GPS KOTOMBOLO	Itasy	25.22					
GPS MIKALY	Boeny	1.59					
GPS MIRANA	Bongolava	32	17				
GPS MITADY NY SOA	Boeny	2.07					
GPS PAPRIZ	Alaotra Mangoro	34.55					
GPS RANDRIAMIARINJATO Jean Olivier	Itasy	52.85	2				
GPS SANTATRA	Itasy	14.7			0.5		
GPS SOAFIERENANA	Amoron'i Mania	0.8					
GPS SOAMIRAY	Boeny	10.16					
GPS TALAKIMANDEHA	Amoron'i Mania	0.2					
GPS TANAMBE	Alaotra Mangoro	10.35					
GPS VOLATIANA	Itasy	19.62					
GROUPE CONSEIL ET DEVELOPPEMENT	Itasy	2.95					
LEZOMA TsirybAndriamahatola	Bongolava	10					
MasombolybVoafantina DOM	Analamanga						19.63
MATAGRI - YUHAN'S	Alaotra Mangoro	5					
NARISOLO Hyacinthe	Bongolava		15				
RAKOTOARIMALALA Jean de Dieu	Bongolava		8				
RAKOTONANDRASANA Didie	Bongolava	15	2.5				
RAKOTONDRABE Mamy Jean Nicolas	Bongolava	10.4	7				
RAKOTONIRINA Jean Paul	Bongolava	12					
RAKOTONIRINA Tezandry Christophe	Bongolava	6	1				
RAKOTOSAMIMANANA Stéphan	Bongolava	5					
RASOJA	Menabe			11.8			
RAZAFINDRAIBE Jean Paul	Bongolava		12				
RELHARF AGROBUSINESS	Vakinankaratra	20.17					
SCA Nanisana	Haute Matsiatra	294.5					0.6
SEEDFAS	Analamanga						7.51
SEEDLAN	Analamanga	73.28					
SEMENCE AVOTRA	Analamanga						1.71
SILAC (Société Industrielle du Lac Alaotra)	Alaotra Mangoro	95.76					
TSAFARA	Atsimo Andrefana	4					
VALY PROD SEM	Analamanga		20.45	23.2	3.2		
VFTM	Haute Matsiatra	92.5		3.35			
VONOMAHATRATRA Joseph	Bongolava	2.5	4				
ZAFISOA	Haute Matsiatra						1.26
ZANANAHY Rosalie	Menabe			1.25			

Six seed multiplication centers were established in the 1980s and 1990s as part of a national multi-donor seed project. These are:

- Ambavahivahibe Antsiranana (Switzerland)
- Anosiboribory Alaotra (WB, UNDP, AFD, JICA), FOFIFA/CALA (WB, AFD),
- CCS Seed Packaging and Storage Center in Antananarivo (Japan)
- Anosy Fianarantsoa (PNUD)
- Marofarihy Fianarantsoa (EU) and
- Imehy (EU)

The centers based in Imehy, Anosiboribory, and Anosy Fianarantsoa remain active today, but have been privatized. The center at Imehy was privatized in 2018 under an agreement with the private input supplier AGRIVET/AGRIMA. Likewise, the seed center at FOFIFA/CALA remains operation- al but requires complete rehabilitation of its infrastructure and equipment. The centers of Marofarihy, Ambavahivahibe, and Antananarivo are no longer functional. It should be noted that some seed enterprises have their own infrastructure for the treatment and conditioning and storage of seeds, including VALY ProdSem, ANDRIKO, GPS Mirana, and the GPS of Miandrivazo (AD2M/IFA project).

Table 5: Quantities of Seed Certified, 2016-2019

Crop	Quantity (MT)			
	2016	2017	2018	2019*
Irrigated rice	1,232.52	Not available	1,216.24	217.28
Rain-fed rice			82.13	91.73
Hybrid rice			0.00	5.00
Beans	193.23		69.48	8.93
Vouandzou	47.67		6.34	1.14
Groundnut	21.35		10.46	0.00
Maïze	163.35		212.78	169.74
Horticultural Crops	28.72		34.20	12.48

Table 6: Total Certified Seed Produced by Seed Enterprises,

Crop	Number of Enterprises	Quantity (MT)
Irrigated rice	46	26.4
Rain-fed rice	13	6.3
Hybrid rice	1	0.0
Beans	12	5.8
Vouandzou	6	1.1
Groundnut	6	1.7
Maize	11	19.3
Horticulture	13	2.6

60-70% of the certified seed produced by companies and cooperatives is disseminated through a public distribution system. The remaining 30-40% is distributed through direct selling by wholesalers, retailers, and agro-dealers. There are about 140 agro-dealers in Madagascar of which 21 are wholesalers and 119 are retailers. Of the 140 agro-dealers, only 37 are registered with the Office of Seed Control (SOC). The number of agro-dealers translates to a ratio of one agro-dealer for every 17,300 agricultural households.

Most agro-dealer outlets are located near tarmac roads or trading centers, with few agro-dealers in rural areas. Some farmers must walk long distances to access their preferred seed varieties. Private seed companies need to establish sales agronomy capacity to conduct demonstration plots and educate farmers on best hybrids and agronomic practices.

Proposed Interventions

- Strengthen the basic/foundation seed production capacity at FOFIFA
- Build public-private partnership (PPP) between FOFIFA and private entities to establish a strong foundation for sustainable production of basic/foundation seed of key crops
- Seed grant funding to eight private seed companies such as (AgriPro, Andriko, SEEDFAS, Valy Prodsem & FIFAMANOR) to
    - Increase the capacity of quality seed production – aim to increase the quality seed production of existing varieties/hybrids and newly introduced ones by 37%
    - Strengthen business management and administrative skills
    - Expand the seed distribution network – expand their reach to farmers
    - Strengthen business entrepreneurship skills of 88 personnel through professional training courses over a period of 5 years
- Strengthening of seed processing infrastructure: install additional capacity of 2 tons/ day in the country at private sector premises
- Agro-dealer development
    - Provide grant to 750 agro-dealers in Madagascar 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 750 agro-dealers will be trained on these modules over a period of five 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 175 extension professionals over a period 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 will be provided to more than 80 seed inspectors on proper seed quality assessment and seed certification aspects

Facilitate an increase in quality seed production for the key crops to 4,929 tons covering an area of 12% under quality seeds

(Figure 6) at the end of five-year period, and 17,129 tons covering 37% area at the end of 10 years.

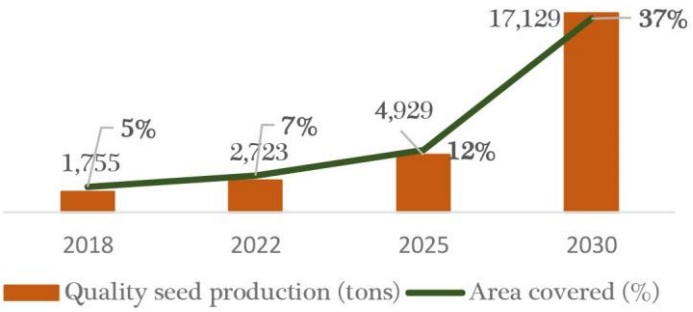

Figure 6: Projected Seed Quantity (MT) - Madagascar

Budget

Table 7: Madagascar Budget

Components	Amount (USD million)					
	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Component 1: Crop Variety Improvement						
NARS varietal Trials	0.31	0.25	0.13	0.00	0.00	**0.69**
Early generation seed production	0.06	0.09	0.00	0.00	0.00	**0.15**
MSc fellowships	0.18	0.18	0.18	0.00	0.00	**0.53**
PhD fellowships	0.15	0.30	0.00	0.00	0.00	**0.45**
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	0.30	0.25	0.15	0.00	0.00	**0.75**
Professional trainings	0.05	0.08	0.05	0.00	0.00	**0.17**
Component 3: Agro-dealer Development						
Grants to agro-dealer development agencies	0.23	0.45	0.45	0.00	0.00	**1.13**
Capacity Development (Book keeping, information dissemination, inventory management etc.)	0.01	0.02	0.02	0.00	0.00	**0.05**
Component 4: Seed extension						
Grants to NGOs for demos, small packs, etc.	0.46	0.42	0.00	0.00	0.00	**0.88**
ICT, infrastructure and training support	0.38	0.00	0.00	0.00	0.00	**0.38**
Professional trainings	0.06	0.06	0.05	0.00	0.00	**0.17**
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	0.02	0.03	0.02	0.00	0.00	**0.06**
Total	**2.44**	**2.39**	**1.21**	**0.15**	**0.00**	**6.19**