Tanzania Annual Report 2018

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N2Africa

Putting nitrogen fixation to work for smallholder farmers in Africa

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Acronyms

ACTN	Agriculture Conservation Tillage Network
AEZ	Agro-ecological Zone
AGRA	Alliance for a Green Revolution in Africa
ARI	Agricultural Research Institute
ASA	Agricultural Seed Agency
ASDP	Agriculture Sector Development Program
BRiTEN	Building Rural Income through Enterprise
CRS	Catholic Relief Services
CV	Community Volunteers
DADPs	District Agricultural Development Plans
DAICO	District Agriculture Irrigation and Cooperative Officer
DCAM	Distribution Channel Analysis Matrix
DCDO	District Community Development Officer
EAGC	East Africa Grain Council
LGAs	Local Government Authorities
M&E	Monitoring and Evaluation
MoU	Memorandum of Understanding
NGO	Non-Government Organization
NM-AIST	Nelson Mandela African Institution of Science and Technology
QDS	Quality Declared Seeds
RUDI	Rural Urban Development Initiatives
SnP	Soya ni Pesa Project
SUA	Sokoine University of Agriculture
TFRA	Tanzania Fertilizer Regulatory Authority
TOSCI	Tanzania Official Seed Certification Institute
TIJA	Transforming Industrial through Joint Agriculture Transformation in Tanzania
ToT	Training of Trainers
VBAA	Village Based Agricultural Advisor

1 Introduction

This report provides highlights on activities, implementation success, challenges and opportunities in Tanzania for the period January through December, 2018. The target areas for activities implementation remain unchanged. The project maintained its presence in 22 districts as it was in 2017 (Figure 1). The presence of N2Africa in these district is largely through the strong partnerships established with local governments, the national agricultural research institutes, the local input companies and various development organizations working around these project target districts.

Following reduced funding, we decided to resize our activities in 15 districts and concentrated in 7 districts (Njombe, Songea, Ludewa, Mufindi, Mbozi, Moshi and Hai), where we could easily implement the project exit strategy that fostered on continuity of established activities by local governments, ensuring sustainable delivery of legume technologies (notably improved seeds, fertilizers, inoculants, GAP) by public research institution and private sector and ensuring to farmers access to market both public and private sector. Achievement in the year 2018 is explained in the following sections.

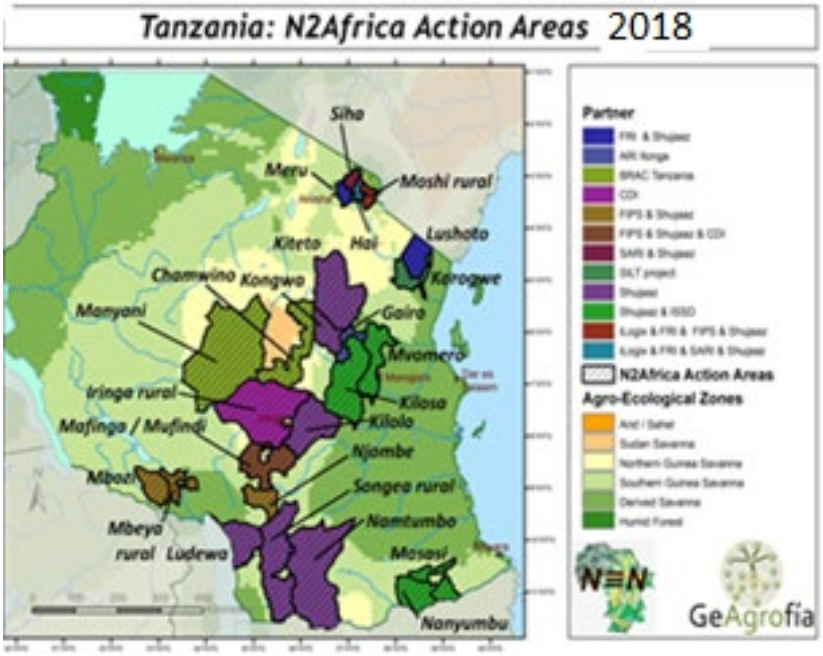

Figure 1. N2Africa coverage in Tanzania for 2018. Target areas remained unchanged from that of 2017

2 Results achieved per project objective

2.1 Project strategy, coordination and implementation and capacity strengthening

2.1.1 Strategy for implementation and coordination

a) Partnership

No new partners were formalized in 2018, except that the project worked informally with Rizobacter, an Argentine company, that investigates, improves and commercializes bio-fertilizers, in this case rhizobia inoculants (see 2.2.2 for details). However, the project continued to work with all 34 collaborative partnerships formalized between 2014 and2017. This was done through knowledge and information sharing, participation through different platforms notably the soyabean development platform (lead by East Africa Grain Council EAGC) and the Soil Health Platform lead by SAGCOT Centre. Some of partners continue using N2Africa experience to disseminate legume technologies by themselves or with support from different initiatives as summarized in Table 1. Most of these initiatives build on the N2Africa exit strategy formulated in 2017.

Table 1. Key active N2Africa partners in 2018, coverage and projects/initiative supporting their activities

Partner Name	On-going activity and coverage	Project of framework supporting activities
Sokoine University of Agriculture (SUA)	Quality Control of rhizobia inoculants (country wide)	Routine, with support from TFRA and inoculant importer(s).
Tanzania Fertilizer Regulatory Authorities (TFRA)	Registration of inoculants and provision of import permits (country wide)	Routine, Fertilizer (mineral and biological) regulatory authority
TARI;s Uyole and Selian	- Production of breeder and foundation seeds (common bean and soyabean - Promotion of Fe and Zn reach beans. - Purification of breeder seeds (Northern and Southern Highlands)	- Agra-supported TIJA – Projects (Transforming Industrial through Joint Agriculture Transformation in Tanzania); - TAAT bean compact; Africa RISING NAFAKA - N2Africa part of exit strategy
Local governments (all that partnered with N2Africa	Promoting and scaling of various legume technologies according to AEZ (all 22 project focus districts)	Promotion and scaling as part of District Agricultural Development Plans (DADPS), funded under Agriculture Sector Development Programmed (ASDP)
NAFAKA –Africa Rising	Production of legume seeds, promotion of legumes production as CSA practice, promotion labour saving tools (Sothern highlands)	USAID Mission in Tanzania under Feed the Future program.
BRiTEN	Market access (input and output market) (Southern Highlands, Eastern Zone)	AGRA support through TIJA – Projects (Assigned to ensure farmer have access to market including legume crop
G2L	Buy soyabean and common bean through established collective marketing centers. (Southern Highlands)	Company's investment.
FAIDA MALI	Working to ensure farmer have access to markets of crops they produce, grain legumes included. (Northern and Southern Highlands)	Supporting AGRA funded TIJA – Project (Transforming Industrial through Joint Agriculture Transformation in Tanzania).
Agriseed Co. Ltd.	Production and distribution of certified soyabean and common bean seeds (Southern Highlands, Eastern Zone)	Company's investment and small grant from N2Africa to purify basic seeds of soyabean
Beula Seed Co. Ltd.	Production and distribution of certified beans seed varieties (Southern Highlands, Northern Zone)	Company's investment.
GUAVAY	Establishment of inoculant distribution centers. (Southern Highlands, Eastern Zone)	Company's investment and small grant from N2Africa.
CRS	Dissemination of legume technologies, input/outputs marketing (Southern Highlands)	USDA funded projects

b) Effective partnership

Interesting is the emergence of what is seen as an effective partnership among actors in the legume value chain as summarized in Box 1.

Box 1: A new business platform to improve soyabean farmer's access to inputs and output market

Since, 2016 N2Africa and is partner CRS have been working with Mtewele General Traders (MGT) a Hub-Agrodealer, ensuring that farmers in the Southern Highlands of Tanzania easily access seeds of improved soyabean, inoculants and fertilizers. In 2017, N2Africa identified AgriSeed as potential seed company to supply soyabean seeds and Guavay to distribute rhizobia inoculants. In their operations, both AgriSeed and Guavay found MGT to be their potential agent with capacity to sell their products to last mile. This is because MGT has a good network of rural agro-dealers, and is well linked with Community Volunteers (CVs) and or Village Based Agricultural Advisors (VBAAs) who were trained by N2africa to aggregate input demand from legume producer groups.

During 2017/2018 agricultural season, the three companies together realized that many farmers are willing to buy and use inputs they trade if there is readily available markets of soyabean. As part of an exit strategy, in July 2018, N2Africa brought CEO's of these companies and 56 representatives of legume producer groups (from districts Njombe, Ludewa, Songea and Namtumbo) together to discuss possibilities of forming a business platform that will ensure increased production as well as markets of soyabean and all parties expand their business. The business platform and guidelines guiding its business created where clear roles and responsibilities of each member of the platform is indicated. For example, Guavay and Agriseed are responsible for identifying the existing and new potential markets of soyabean, whereas MGT and leaders of producer groups are charged with mobilizing farmers to produce soyabean using inputs (improved seed, inoculant and fertilizer).

Between October and November 2018, the platform managed to identify and visited four big animal feed manufacturers who indicated readiness to buy 130,000 Mt of soyabean (i.e. Mount Meru Millers require 100,000 Mt of soyabean grain; International TANFEED, 10,000 and Highland Millers, 20,000Mt). On the other hand, MGT and leaders farmer groups have managed to engage 638 producer groups, with a total of 19,140 members capable of cultivating 28,720 ha of soyabean with anticipated production of about 30,000 Mt. In future, MGT plans to invest in soyabean processing as the company sees opportunity in soyabean. It would be interesting to monitor the performance of this initiative at the end of the growing season.

c) Capacity building

Degree training

In 2018, two students namely Eliakira Kisetu (PhD) and Fides Temu (MSc) were fully under N2Africa.

In addition, in June, the project hosted Charlotte Mallet, an intern from Wageningen University, for 3 months. In August, the project hosted a new PhD student, Wilson Charles, who will study the contribution of soybean and maize value chain as part of food systems in the Southern Highlands of Tanzania. The study topic and status of each student is summarized in Table 2.

Table 2. Postgraduate students under N2Africa-Tanzania 2018, study topic and status

S/N	Name of student	Gender	Level of training	Research Topic	University	Status
1	Eliakira Kisetu	M	PhD	Intensification of maize – bean cropping system in Northern Tanzania	Nelson Mandela African Institution of Science and Technology	Continues

2	Fides Temu	F	MSc	Dynamics of common bean insect pests with altitudes, cropping season and cropping patterns in Hai district Tanzania	Sokoine university of Agriculture	Final thesis submitted
3	Charlotte Mallet	F	MSc	Prediction of bush bean (*Phaseolus vulgaris* L.) yields in Northern Tanzania based on spectral analyses of soils	Wageningen UR	Completed
4	Wilson Charles	M	PhD	Bridging the Missing Middle: the case of maize-soyabean-chicken value chain in the Southern Agricultural Growth Corridor of Tanzania".	Wageningen UR	Continues

Summary of student findings is finding available for Fides Temu as summarized in Box 2.

Box 2: Summary findings of a study on dynamics of common bean pest in Northern Tanzania

The study reports great diversity of insect pest species attacking common beans, some of which occurs at high incidences in each of the cropping seasons, cropping systems and altitudes. The severity of inflicted injuries to the crop varied greatly depending on the dominant insect pest species, their population and nature of damage caused. Major insect pest include bean stem maggot (*Ophiomyia phaseoli*) at lower altitudes in both mono-cropping and inter cropping systems, the black bean aphids (*Aphis fabae*) at high and medium altitudes in both cropping systems, the American ball worm larvae (*helicoverpa armigera*) at both lower and high altitudes mostly in monocropping system, the flower beetle (*Mylabris* spp) across all altitudes in both cropping systems but more abundant during long rain seasons and the same was observed on Leaf foliage beetles (*Ootheca bennigsseni*) and pod borer *Maruca (testulalis) vitrata*. Higher pest damages were found at emergency stage where significant difference (P<0.05) in insect pest species between the cropping seasons could be observed. At seedling stage, and pods formation and pod filling, the results suggested a highly significant difference (P<0.05) in insect pest species and their incidence between the cropping systems, cropping seasons and altitudes. Also there was significant difference (P<0.05) on yield in different cropping seasons, cropping patterns and altitudes. The study proposes scouting and early spray as the rational method to reduce the impact of bean insect pests among the farmers.

Non-degree training

Special trainings were conducted to build capacity of 146 beneficiaries categorized into legume seed growers, extension staffs and agro dealers (Table 3). This number is less compared to numbers trained in the last four years, the reason being resizing of project activities.

Table 3. Categories of beneficiaries and area of training received 2018

Category	Area of training	Type of training	M	F	Total
Farmer	Certified seed production, inoculant use, marketing and storage	General training	92	49	141
Extension staffs	Inoculant use, marketing and storage and establishment of input demonstration trials.	Training of trainers	2	0	2
HUB- agrodealers	Inoculant use, marketing and storage and establishment of input demonstration trials.	Training of trainers	2	1	3
Total			**96**	**50**	**146**

2.2 Delivery and dissemination, sustainable input supply, and market access

2.2.1 Farmers reached

Activities related to dissemination of legume technologies through demonstration, field days and media event were implemented in collaboration with four partners namely CRS, NAFAKA Africa-RISING, Beula Seed Co and Guavay. A total of 31,568 (13,341 male and 18,227 female) were reached (Table 4), making a cumulative number of 120,777 farmers reached within five years of the project (Figure 2). 102 (61 male and 41 female) farmers had opportunity to evaluate legume technologies. This year the project did not distribute field books thus, the information on farmers reached were captured in partner reports and N2Africa partnership template.

Table 4. Number of farmers reached (in 2018) by partner by dissemination approach

Partner name	Demonstration		Field day		Media		Total
	M	F	M	F	Male	Female	
CRS	4,140	9,660	-	-	-	-	13,800
NAFAKA-Africa Rising	8,890	8,206	-	-	-	-	17,096
Guavay	36	18	13	9	142	217	435
Beula seed	72	85	48	32	-	-	237
Total	**13,138**	**17,969**	**61**	**41**	**142**	**217**	**31,568**

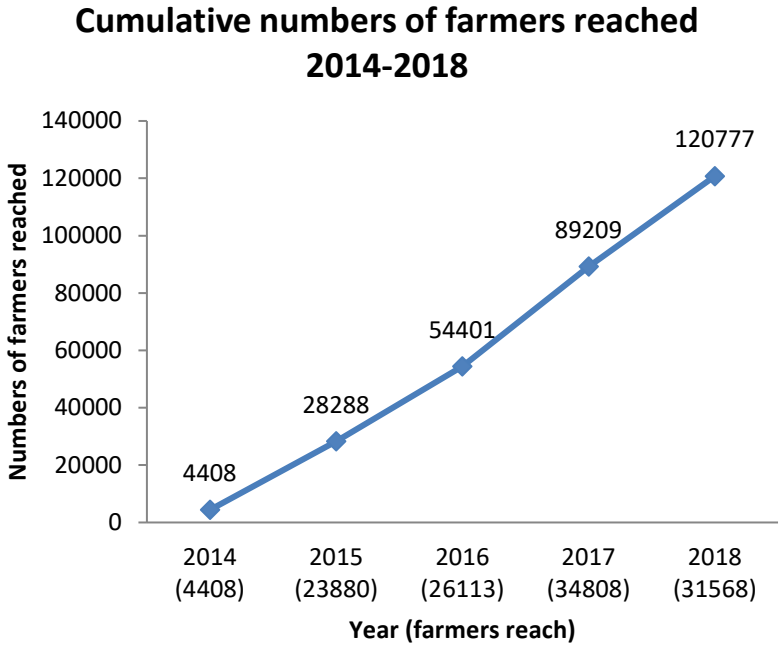

Figure 2. Cumulative number of farmers reached by the project (2014-2018)

Type of knowledge disseminated to farmers

Overall, farmers reached were exposed to use of legume technologies (improved seed varieties, inoculant and fertilizer) and good agronomic practices. In 2018, awareness creation on the use of rhizobia inoculant and use of improved legume seed were the most important knowledge disseminated by input suppliers Guavay, Mtewele General Trades and Beula Seeds co. A total of 14 demonstrations on GAP and improved seeds (Njano Uyole and Lyamungo 90) were established by Beula Seed Co and 4 demos on use of rhizobia (Legumefix) inoculants by GUAVAY. In additional, seed growers had an opportunities to visit Agriseed Company to learn more about seed processing including quality packaging of legume seeds.

Photo. Farmers receiving training on seed packaging at AgriSeed Co facility in Mbeya.

2.2.2 Sustainable Input supply

Rhizobia inoculant

Piloting of distribution channels and sale of rhizobia inoculant was done by partner Guavay. The exercise was done using a model proposed by N2Africa and partner CRS (Figure 1). The model is considered repeatable and scalable for timely distribution of inoculant focused on understanding key drivers for product promotion on short and medium terms. Three key participants in the model were identified as 3 hub agro-dealers (Mtewele General Traders in Njombe region, Alpha Agro Chemical Supply in Iringa, and a local agro-dealer Makyao Agrovet based in Morogoro region) and several community volunteers (CV).

The Distribution Channel Analysis Matrix (DCAM) was used to provide an understanding of different factors that would matter in selecting the channels. Results of DCAM analysis are summarized in Table 5. Notable is that, farmer's access inoculants cheaply, in time and with low risk when the CVs/VBAA distribution channel is used. However, the channel lacks storage facilities, which may lead to difficulties to control and monitor the quality of inoculants. Establishment or inoculant storage facility at local level is recommended.

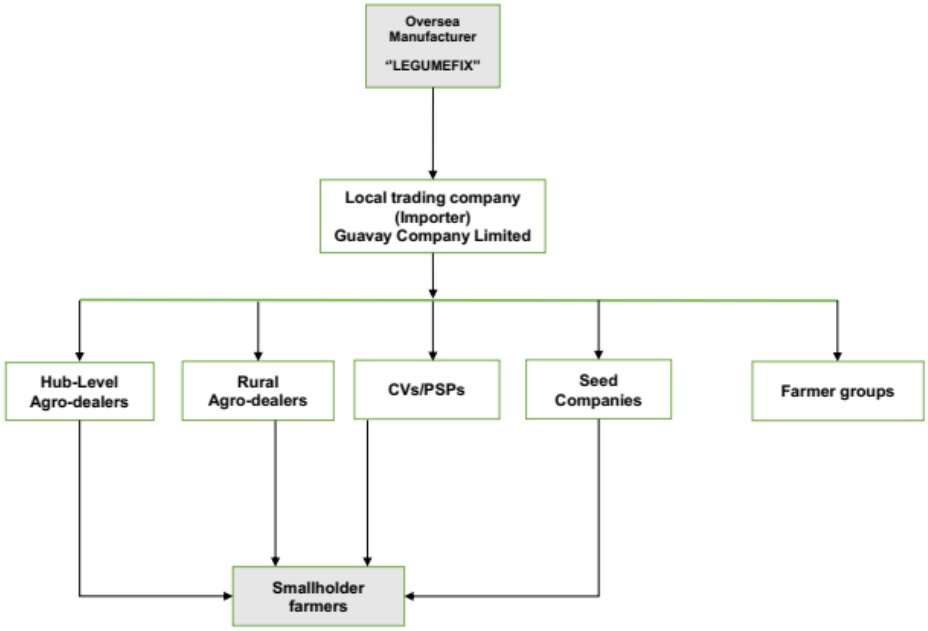

Figure 3. Rhizobium inoculants distribution model

Table 5. Distribution Channel Analysis Matrix (DCAM)

Distribution Channel	Profit Margin	Cost of distribution	Storage efficiency	Customer service to a farmer	Risk of doing business
1. Hub Agro-dealers	Low	Medium	High	Low	Low
2. Rural Agro-dealers	Medium	High	Medium	High	Medium
3. CVs/PSPs	High	Low	Low	High	High
4. Farmer groups	High	Very high	Low	High	Low
5. Seed companies	Low	Medium	High	Medium	Low

Using different distribution channels, a total of 3232 packets (250 g each) of Legumefix inoculant, equivalent to 808 kg were sold in the period of December 2017 to December, 2018 through established agro-dealer networks and community volunteers. The amount of inoculant sold is at 81% achieved in the past year (2017) with low sales attributed to the lack of soyabean market in 2017. Despite a difficult season to achieve sales targets, partner realized that, those areas where there is visibility of N2Africa and Soya Ni Pesa projects activities, the willingness and readiness by smallholder farmers to purchase inoculants was more than 85%. A customer feedback survey was conducted to 100 farmers and agro-dealers in Njombe, Songea, Morogoro and Iringa by the partner GUAVEY to see the acceptability, effectiveness and efficiency of the product. Out of 100 farmers visited, 85% revealed the willingness to purchase inoculant in the coming season. Nevertheless, during the customer feedback survey, rising demand for common bean inoculant was observed among more than 80% of the 100 surveyed households. By the time this report was produced inoculant demand stood at 680 kg, and it could double as the growing season approaches.

Seed

To ensure availability of legume seeds, the project engaged two private seed companies (Beula and Agriseed) to produce and market certified seed of common bean and soyabean. The companies contracted 19 seed growers, 12 in Southern Highlands and 7 in Northern Highlands. TARI Uyole also continued to produce pre-basic, basic and certified seed of soyabean and common bean to feed into registered QDS farmers. During the reporting period, a total of 94 MT seed of different classes was produced, with 47.8 MT (50.1 %) sold (Table 6).

Table 6. Amount (MT) of common bean and Soyabean seeds produced and sold in 2018

A: Common bean								
Seed producer	**Beans produced**				**Bean Sold**			
	Basic	Certified	QDS	**Total**	Basic	Certified	QDS	Total
ARI Uyole	14.0	-	-	**14.0**	9.0	-	-	**9.0**
Beula Seed Company	-	17.0	-	**17.0**	-	13.90	-	**13.9**
Agriseed Company	-	15.0	-	**15.0**	-	3.0	-	**3.0**
CRS seed growers	-	-	-	**-**	-	-	-	**-**
NAFAKA seed growers	-	-	15.6	**15.6**	-	-	10.6	**10.6**
Total	14.0	32.0	15.6	**61.6**	9.0	16.90	10.6	**36.5**

B: Soyabean								
Seed producer	**Soyabean produced**				**Soyabean sold**			
	Basic	Certified	QDS	Total	Basic	Certified	QDS	**Total**
ARI Uyole	-	0.9	-	**0.9**	-	0.20	-	**0.2**
Beula Seed Company	-	-	-	**-**	-	-	-	**-**
Agriseed Company	4.6	10.0	-	**14.6**	-	2.0	-	**2.0**
CRS seed growers	-	-	16.9	**16.9**	-	-	9.1	**9.1**
NAFAKA seed growers	-	-	-	**-**		-	-	**-**
Total	**4.6**	**10.90**	**16.9**	**32.4**	**-**	**2.2**	**9.1**	**11.3**

Fertilizers

No attempt was made to estimate the amount of fertilizers used by farmers in the project area. This is because during the 2017-2018 growing season, the majority of farmers got their fertilizers from different sources on ad hoc manner following institution by the government of “bulk procurement” of fertilizers. In this system, fertilizers are bulk procured using a tendering where a company winning the tender imports NPK and Urea fertilizer on a quarterly basis. The system also institutes an indicative price of fertilizer for different areas. The majority of local agro-dealers hesitated to sell fertilizers as they are considered not profitable, making it difficult for the project to record both fertilizer sales and use. Data from the N2Africa impact survey should give an impression of farmers’ use of fertilizers on legumes.

Strategies to inputs ensure sustainable input supply

To ensure continuous availability of legume seeds, the project supported registration of legume seed growers associations in 5 districts (Mufindi, Mbozi, Njombe, Ludewa and Songea rural) under the patronage of District Community Development officers. These associations were linked with seed companies AgriSeed and Beula seed who have contracted some of the associations to produce certified legume seed and sell to the companies. In this arrangement, the companies provided the basic seed and are responsible for all cost associated with certified seed production including cost of field inspection. The approach to this initiative is to ensure that seed production is done in an area where there is high demand, which will in turn reduce the price of seeds as transportation costs are limited.

Meanwhile GUAVAY has established links with key inoculant manufactures, MEA Kenya ltd (Biofix) and Legume technology UK (Legumefix) to supply inoculants. The company has also established substantive inoculant outlets in key soyabean growing districts where farmers can easily access inoculants. GUAVAY is also working with Agriseed and MGT to sell seed and fertilizer alongside inoculants.

Opportunities for sustainability of the input strategies

Key opportunities for a sustainable seed and inoculant supply strategy include

- Renewed demand of soyabean by feed manufacturers following increased tariffs on imported soyabean grain and cake. Feed millers are now sourcing soyabean locally.
- Registered seed growers have an opportunity to access loans from the District Community Development office for production, packaging and distribution of legume seed within their locality. The District development offices have responsibilities to help, supervise and guide all registered groups within the district and make activities grow, built capacities to the groups related to business skills, contract farming, and help them to develop business plans.
- Existence of TIJA – Consortium by AGRA and launch of TAAT common bean compact, and in future soyabean compacts guarantees continued demand of legume seeds and inoculants.
- Existence of ASDP II which recognized legume as key crop to diversify and intensify agricultural systems and as one of climate smart agricultural practices.
- Entry of new soyabean inoculant (rizoliq soy) by Rizobacter Argentina, the company is planning to promote use of this product.

Challenges related to sustainability of input supply

- Insufficient amounts of foundation seeds to move with quality demand of certified seeds.
- Contaminated foundation seeds from research institutions leads to ASA and seed companies making loss (logging % of many varieties is estimated at above 20%)
- Inoculants: inoculants are imported, no local production, low profit margin may not attract big investors.
- Low capacity (human resources) of ASA to lend inspection services of expanding fields under seed production

2.2.3 Access to output market

Data on output markets could be captured from partner CRS. The amount of soyabean produced in 2018 was 4,500 MT where 3,122 MT were sold to Soldecom commodities, KEA and Matembwe village companies. A total of 8,200 members of producer groups (2,460 males and 5,740 females) benefited from collective marketing in 2018.

Sustainability of access to output market

Markets for farmers produce are a pull factor to adoption of improved technologies and access to agricultural inputs. Having this in mind, some of partners are joining hands to ensure the continued availability of markets for grain legumes (see Box 1).

In another development, common bean farmers in the Southern Highlands are now linked with the East Africa Grain Council (EAGC), assisting them to develop and promote orderly structured marketing systems and providing them with market information across countries in the East Africa region. The EAGC got opportunities to meet with farmers and discuss on the market and market requirements. The discussion continues, which is worth monitoring.

The TIJA program by AGRA builds on past initiatives by AGRA and N2Africa and works to ensure availability and accessibility of agricultural inputs and markets for farmers' produce across the country. This three year project works as consortium, including some of N2Africa partners (BRiTEN, FAIDA MALI, and ARI Uyole) and in the N2Africa focus districts.

Challenges related to sustainability to output market strategies

- Product with low quality, most of the farmers have little knowledge on product quality
- Most of the preferred soyabean varieties by the feed and food industry are not yet registered.
- Low prices of soyabean and common beans coming from outside the country outcompeting locally produced grains.
- Restrictions of food export of crops to neighbouring countries instituted by the government limiting farmers to secure remunerative external markets
- Side selling by contracted farmers

2.3 Empower women to increase benefits from legume production

2.3.1 Women participations

Participation of women in project activities is quite significant. During the reporting period, nine female farmers (45%) got the opportunity to lead the campaign on the use of rhizobia inoculants, and one female farmer was involved in actual marketing and distribution of inoculants in the Southern Highlands. This makes a total of registered female farmers leading dissemination activities since the start of project to be 392. As indicated before, a total number of 18,227 female famers (58%) participated in project activities this reporting year.

2.3.2 Women specific businesses established and legume processing

Soyabean processing and legume seed production are the business that attracted more women. In the reporting period, 24 women seed growers participated to QDS production. Among these six women seed growers are contracted Agriseed and Beula seed companies to produce certified seeds. The number of businesses with women involved in soyabean processing remains unchanged (26), the majority processing soyabean into various products such as fortification of maize flour with soyabean flour, production of soya milk and different baked products from soyabean flour. The level of processing remains at both household cottage levels. Expansion of business is constrained by a lack of capital and limited markets. To ensure that these women continue with the business, the project made efforts to connect them with the community development office in their respective districts for further support (training and small loans to expand business).

2.3.3 Labour saving technology

a. Validated tools

Planting, weeding and threshing of legumes are considered labour intensive operations, this withholds farmers from increasing the area of legumes on their farms. The project evaluated, with farmers, three prototypes of planters and herbicides (post and pre-emergence) as labour saving technologies. All three prototypes of planters did not meet most farmers' set criteria (not breaking seed, ease of handling, efficiency in planting - fast and not breaking seeds, and possibilities of using them on different types of soils and terrain. The planters are now being modified by a local engineer (Agromech ltd) to further improve their efficiency as recommended by farmers. The Africa RISING-NAFAKA project is keen to further evaluate the new generation of planters once ready.

A total number of 346 farmers (62% women) tested the use of herbicide in common bean and soyabean in the Southern Highlands and Eastern Zone. Preliminary results show that the use of herbicide in legumes could reduce weeding labour by more than 40%. However, cost benefit ratios were negative; an indication that it is not economical to use herbicides. This is largely because of high cost of herbicide and small sizes of legume fields. Testing of herbicides will be repeated under the Africa RISING-NAFAKA project to ascertain results of this season.

2.4 Tailor and adapt legume technologies to close yield gaps and expand the area of legume production within the farm

2.4.1 Diagnostic, Demonstration and Adaptation trials

Research campaigns towards legume intensification and yield gap closure continued in Lushoto district in the Northern Highlands of Tanzania. Five (5) demonstration trials were established to evaluate common bean response to rhizobia inoculation and NP fertilizers. The treatments comprised of Control (no amendment); Nitrogen (N) alone at 40 kg/ha); phosphorus (P) at 20 kg/ha; N+P (40 kg N +20 kg P); inoculant 1 (Legumefix –form Legume Technology UK); inoculant 2 (Rhizoliqbean – from Rizobacter Argentina); inoculant 1+P; and inoculant 2+P.

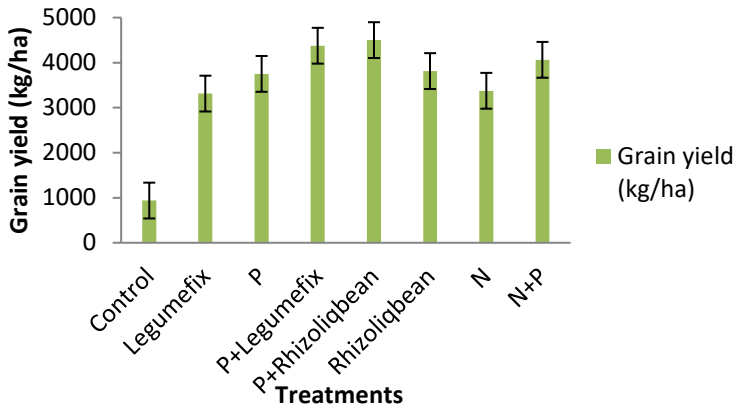

Figure 4. Response of common bean to N and P fertilizer, and inoculants as observed in farmers' fields in Lushoto (n = 4)

The results show the importance of inoculants, NP fertilizers and their combinations on increasing bean production (Figure 4). Different from previous years, beans plants in the current season grew tall and this could be attributed to good weather (rains and temperature) and the selection of demonstration sites with good initial soil fertility and less acidity.

2.4.2 Rhizobiology

a. Strain evaluation

Focus was on evaluation of elite rhizobia strains of soyabean and groundnuts in order to come up with strains that could be readily advanced to inoculant production. We could not access strains of common bean and cowpea from Nodumax factory at Ibadan Nigeria. The experiments were established at three sites: Suluti, Milundikwa and Mbimba in the Southern Highlands of Tanzania.

Soyabean strains evaluated included NAK 12, NAK 84, RACA 6, RANI 22, IRJ 2180A, against a commercial inoculant Legumefix, a commercial strain USDA 110, N at 20 kg/ha and a control (no amendment). Groundnut strains tested included IGB469, NJR 493, NC 92, SBG 234, SNN 336, SNN 343 against a control and N at 20 kg/ha.

Results soyabean strains

As for the previous season, the results in this season showed no significant differences between evaluated elite rhizobia strains, but there was clear indication of the need for inoculation (Figure 5). However, the commercial inoculant Legumefix, and the commercial strain USDA performed slightly better than the rest of strains. Interesting was that the strain RANI 22 showed consistency in terms of performance when compared to the previous season.

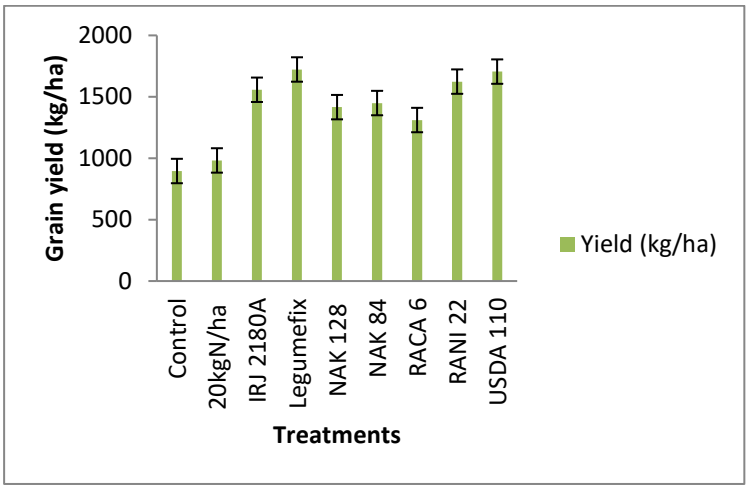

Figure 5. Performance of soyabean elite rhizobia strains in the Southern Highlands of Tanzania (n = 3)

Results groundnut strains

There were no significant differences in yield of groundnut treated with different strains. However, groundnut inoculated with NC 92 strain had consistent performance compared with last season, in contrast to other strains.

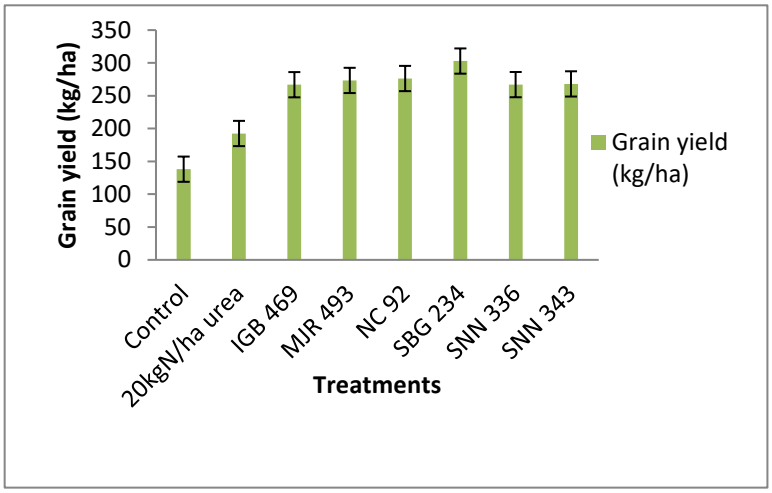

Figure 6. Performance of groundnut elite rhizobia strains in the Southern Highlands of Tanzania (n = 3)

It is worth noting that presented results on the performance of both soyabean and ground strains are based on final grain yield, not on other parameters like biomass accumulation and nodulation which are equally important in evaluation of rhizobia strains. This is because at the time this report was produced such data were being compiled by our partner TARI Uyole. A detailed analysis will follow, and a comprehensive report given by February 2019. However, cross country analysis of strain evaluation trials is required in order to identify a more stable strain that can be advanced as commercial strain.

Inoculant quality control

In the reporting period, quality control of inoculants was performed by Sokoine University of Agriculture to the newly registered inoculants by Rizobacter (rizoliq soy) and a stock of Legumefix inoculants stocked at IITA for partner Guavay.

Lab testing results were:

- RizoliqSoy: 8.6 x 10^9 (+/- 19%) colony forming units (CFU) per ml on YMA CR average of seven drop plates.
- Legumefix: 8.4 x 10^9 (+/- 21%) colony forming units (CFU) per ml on YMA CR average of seven drop plates

All inoculants are considered of excellent quality by both TFRA and international standards.

2.5 Enable learning and assess impacts at scale through strategic M&E

2.5.1 Strategic for M&E for project implementation at Country level

Tools to capture agronomy data were used in Lushoto district. However, selected local government (LGA) partners that visited indicated to continue using N2Africa data collection tools in their demonstration activities, such as in Moshi and Kilolo districts. Use of inoculant on common bean is a new recommendation to include in dissemination campaigns, although for now, the challenge is the availability of bean inoculants. This challenge is being worked on by partner GUAVEY and Rizobacter.

2.5.2 Effectiveness of dissemination approaches

An assessment of effectiveness of different dissemination approaches used by N2Africa partners was done in collaboration with the project "Suitable Intensification of Legume Technologies in Tanzania" (SILT) that was funded by Canada's International Development Research Centre (IDRC). A compressive report on the findings are available in SILT report (https://idl-bnc-idrc.dspacedirect.org/bitstream/handle/10625/57098/57149.pdf) and a summary is given in Figure 7.)

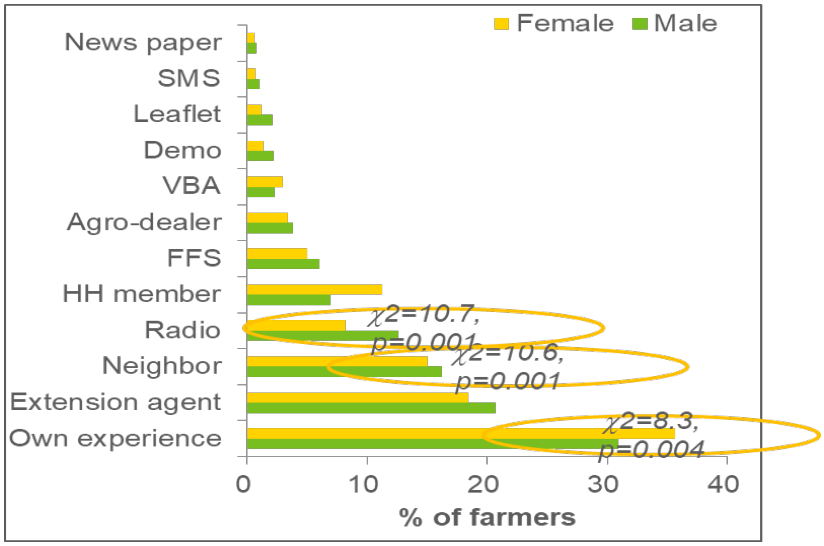

Figure 7. Access to agricultural information by gender in the household (intra-household survey)

Overall there were significant differences between dissemination methods in reaching different gender groups. Study results showed that more women accessed information on legumes compared to general agricultural advice, due to use of interactive approaches in the campaign that encouraged women participation at community level. Practices such as community-based demonstrations and field days allowed women to participate in experimental design and monitoring, enhancing uptake of innovations. Radio achieved wide coverage with improved legume technologies. Integration with interactive radio listening groups at community level ensured more targeted reach of women and youth. Monitoring visits observed a higher proportion of youth and women in listening groups. Information sharing was observed at family level particularly by older and male family members. Though currently less structured, it provides an opportunity to promote family focused learning. Uptake of technologies requiring cash input was low. However, there were no significant differences in uptake between men and women. This implies the need to focus on system wide strategies to make inputs available such as community-based seed production and input brokerage.

2.5.3 Impact assessment

The impact survey was conducted from the first week towards the last week of September 2019. The survey was conducted in three districts: Moshi, Ludewa and Songea rural, covering a total of 630 farming households (210 HH per district). Focus crops in the assessment were bush beans in Moshi and soyabean in Ludewa and Songea. The survey was done using a standard tool in ODK format. All field data have been shared in the N2Africa data platform and analysis continues.

3 Achievements in relation to Specific Project Milestones

Progress in achieving the Milestones are summarized in Table 7. Quantifiable information are uploaded in the ODK.

Table 7. Achievements with related Milestone Targets

Activity per Objective	Milestone	Indicator	Milestone Target 2018	Achieved 2018	Achieved so far-Cumulative (2017+ 2018)	Reasons for Variance with Planned Target (if any)
Objective 1						
1.3. Engage research, development, private sector, and other relevant partners in each of the target countries	1.3. Partners along the legume input and output value chains cooperate actively towards achieving the overall N2Africa goals.	# of partnerships developed and active	0	0	28	Focus was on setting and executing project exit strategy. No new partners were thought to be recruited
	1.3.1. By Q2 of year 1, potential partners operating within priority legume value chains mapped	# partners within N2Africa legume value chains mapped	0	0	20	
	1.3.2. By Q3 of year 2, MoUs with priority partners in each of the target countries signed.	# MoUs signed with priority legume partners	0	0	12	
1.5. Develop country-specific research and dissemination implementation plans, including a sustainable exit strategy	1.5.1. By Q4 of year 1, country-specific research and dissemination implementation plans formalized, including an exit strategy.	# of specific research and dissemination plans formalized	0	0	0	none
	1.5.2. By Q4 of each year, implementation plans are updated based on M&E feedback	# implementation plans updated with M&E feedback	1(strain testing)	1(strain testing)	9 (2 rhizobia strains, testing planter, and use of herbicides	none

Activity per Objective	Milestone	Indicator	Milestone Target 2018	Achieved 2018	Achieved so far- Cumulative (2017+ 2018)	Reasons for Variance with Planned Target (if any)
1.6. Organize seasonal/yearly project-wide and country-specific planning workshops	1.6 Scientists and other stakeholder groups are empowered to further the N2Africa research and development	# Scientist and stakeholder groups leading implementation of activities in N2AFrica yearly plans	4	6	10 (ARIs Makutopora agronomy research, ARI Ilonga and Uyole - Agronomy research and Rhizobiology, SUA rhizobiology) Stakeholder group maintained	New scientists joint project at ARI Makutupora
	1.6.2. By Q4 of each year, 1 or 2 seasonal, in-country implementation plans developed, evaluated, and revised through in-country- planning meetings	# Seasonal in-country plans developed	1	5	8	NCE plan focused on individual partner(s)
1.7. Develop and implement a degree (PhD and MSc)-related research plan	1.7.1. By Q4 of year 1, a research plan, engaging at least 5 PhD and 10 MSc candidates, developed	# of Project wide research plans to engage PhD and MSc students developed & # of PhD and MSc students (men/women) engaged	0	2	12 (2 PhD, 4 MSc students and 6 interns)	New student through Missing middle project
1.8. Develop and implement a non-degree-related capacity strengthening plan for relevant partners working within legume value chains	1.8.2. By Q4 of each year, at least 4 relevant and demand-driven training materials developed in cooperation with the African Soil Health Consortium (ASHC)	# training materials developed with ASHC	1	1	4	none
	1.4. By Q4 of year 5, at least 320 partners trained in N2Africa technologies and approaches	# of persons trained (gender disaggregated data) in N2Africa technologies and approaches & # of N2Africa technologies (by type) in which the persons were trained. *(Note: Count the total number of persons trained from the collaborating partners for dissemination. Disaggregate data by gender, topics and ToT level i.e. the type of or the capacity within the trainer is*	100	146 (96M and 50 F) Among them (2 extension staffs, 3 agrodealers and 141 farmers	5,130 trained on legume technologies. Among them (380 extension staffs, 159 agrodealers and 4,591 farmers)	Increase demand on inoculant use by CV, VBAA

Activity per Objective	Milestone	Indicator	Milestone Target 2018	Achieved 2018	Achieved so far- Cumulative (2017+ 2018)	Reasons for Variance with Planned Target (if any)
		operating like extension officer, partner-M&E officer, agronomist etc.)				
Objective 2						
2.1. Constitute and facilitate in-country/in-region N2Africa stakeholder platforms	2.1. Country-specific inoculant, seed, and fertilizer supply strategies guarantee the sustainable supply of high quality seeds and inoculants and legume-specific fertilizer	# and types of input supply strategies related to seed, fertilizers and inoculants. Performance of various strategies identified in relation to sustainable input supply	**2**(inoculant, and seed)	**2**(inoculant, and seed)	9	
	2.1.1. By Q2 of year 1, N2Africa stakeholder platforms operationalize	# N2Africa stakeholder platforms operational issue	1	1 - input supply platform led by Guavay to improve farmer access to inputs (seed, inoculant and fertilizer) and market	4 (input supply platform, Seed Policy Platform, Soyabean innovation platform led and Legume alliance	none
	2.1.2. By Q4 of years 1-4, stakeholders agree on specific roles and responsibilities across the various N2Africa objectives	# N2Africa stakeholders with agreed roles and responsibilities	1	1	4 (roles of each stakeholders within the platform have been identified and agreed up on.	none

Activity per Objective	Milestone	Indicator	Milestone Target 2018	Achieved 2018	Achieved so far-Cumulative (2017+ 2018)	Reasons for Variance with Planned Target (if any)
2.2. Facilitate N2Africa-led dissemination campaigns in the context of development-to-research learning cycles with specific attention to gender	2.2. Dissemination partners attain/surpass the anticipated number of households targeted and continue to engage in legume intensification post-project	# of target households (men/women) reached *(outcome level: these farmers continue to engage in legume intensification activities after participating in dissemination activities)*	**10,000**	31,568 (13,341Male and 18,227 Female)	120,777 registered households	Partners e.g., AR-NAFAKA increasing target and expanding into new villages
	2.2.1. By Q1 of years 1-4, specific dissemination guidelines for legume intensification assembled	Document indicating specific dissemination guidelines for legume intensification.	**1**	1	18 guidelines developed for different legume technologies and shared with partners	none
	2.2.2. By Q4 of years 1-4, specific dissemination guidelines evaluated by a preset (see Returns-on-Investment calculations) number of male and female farmers	# of farmers (men/women) who evaluate the guidelines (Note: # of farmers (men/women) who have evaluated technologies and dissemination activities and methods (Disaggregated by type of dissemination activity)	**-**	102 (61male and 41 females	8039 (4,454 male and 3,585 females)	Partners decided to establish demonstration trials that were eventually evaluated
2.3. Create widespread awareness on N2Africa technologies and interventions	2.3. Local agro-dealers marketing fertilizer, seed, and inoculants are aligned with grass-root producer groups and input wholesalers and manufacturers	*Volume of seeds, fertilizers and inoculants used per targeted producer groups per land area, *Volume of seeds, fertilizers and inoculants sold by agro-dealers	**2** 1 MT inoculant 40 MT common bean	3 (agrodealers were engaged to distribute and market legume inputs) 808 kg of rhizobia inoculant distributed via agrodealers and CV/VBAA	2.158MT of inoculant 52 MT bean seed 186.1MT soyabean seed	This is early purchase, Inoculant and seeds distribution continues, volumes increases in January. Target will be met

Activity per Objective	Milestone	Indicator	Milestone Target 2018	Achieved 2018	Achieved so far- Cumulative (2017+ 2018)	Reasons for Variance with Planned Target (if any)
			40 MT soyabean	15.9 MT Beans certified (Beula and Agriseed) and 10.6 MT Beans QDS (seed growers) 3.0 MT Soyabean certified (Agriseed) and 9.1 MT soyabean QDS (seed growers)		
	2.3.1. By Q4 of years 1-4, at least 2 media events (e.g., radio, newspaper articles, field days, etc) per country implemented	# of media events implemented	2	2 radio show programs(focus on promotion and marketing of inoculant	34 media events	none

Activity per Objective	Milestone	Indicator	Milestone Target 2018	Achieved 2018	Achieved so far- Cumulative (2017+ 2018)	Reasons for Variance with Planned Target (if any)
2.4. Facilitate partner-led dissemination campaigns with specific attention to gender	2.4. A preset (see Returns-on-Investment calculations) number of households engaged in the collective marketing and value addition of legume grains and value-added products	# of individual households (men/women) engaged in collective marketing, value addition of legumes and value-added products. Volume of produce sold through collective marketing, volume of value addition products and types of value added products	5000	8200 (2,460 male and5,740female) engaged and benefited in collecting marketing collective marketing 4,500MT of soyabean produced and 3,122MT sold through collective marketing	43,010 (20,528 male and 22,482 female) engaged and benefited in collective marketing 10,829MT of soyabean produced and 13,204MT sold through collective marketing 884.6MT of common beans produced and 873.8MT sold through collective marketing	Data was captured in partner progress report In 2017 data on volume produced not captured from farmers in but volume soils well capture from collective centers
	2.4.1. By Q4 of years 2-4, household targets (see Returns-on-Investment calculations), dissemination approaches, and content for partner-led dissemination activities agreed and implemented, with specific attention to gender.	# of partner-led agreements/ partnerships with agreed target households, dissemination approaches & activities focusing on gender	-	-	8	Unchanged no new dissemination partner engaged

Activity per Objective	Milestone	Indicator	Milestone Target 2018	Achieved 2018	Achieved so far- Cumulative (2017+ 2018)	Reasons for Variance with Planned Target (if any)
	2.4.2. By Q4 of years 3-5, feedback on the performance of the dissemination models and the demonstrated content fed back to N2Africa	*Performance reports of dissemination models *Type of performance feedback fed back into N2Africa	-	-	-	none
2.5. Facilitate private-public partnerships towards the sustainable supply of inoculants and fertilizer	2.5.1. By Q4 of years 1-4, inoculants available through public-private partnerships, through importation and/or local production, the latter facilitated by the inoculant production pilot plant	# of inoculant outlets in the target areas Volume of inoculants imported and /or produced with the identified outlets	**1** **-**	1 (Community Volunteers/ Village Based Agricultural Advisor CV/VBAA No importation Stock 1000kg 358 kg supplied to farmers through agrodealers network, Guavay and CV	3 outlets (Guavay company importer and distributor, Hub agrodealers traders and CV/VBAA 3123 kg imported 2,4821 kg supplied to farmers	One channels was added (use of CVs or VBAAs)
	2.5.2. By Q4 of years 1-4, legume-specific fertilizer made available to smallholder farmers by fertilizer companies/retailers	# of fertilizer outlets in the smallholder target areas	-	-	31 outlets retained	
		Volume of legume-specific fertilizer at the retail shops			208,409kg of fertilizers (114541kg of DAP, 90568kg of Yara Miller Winner (NPK) and	Data on fertilizer are not yet captured

Activity per Objective	Milestone	Indicator	Milestone Target 2018	Achieved 2018	Achieved so far- Cumulative (2017+ 2018)	Reasons for Variance with Planned Target (if any)
					3,300kg of Minjingu Mazao of fertilizer demanded and supplied	
2.6. Facilitate the establishment of private sector-led and/or community-based legume seed systems	2.6.1. By Q4 of years 1-4, sufficient legume foundation seed produced by private enterprises and/or government institutions	# of private enterprises & government institutions producing legume foundation seed in the target countries.	1	2 (ARI Uyole and Agriseed)	8	none
		Volume of legume foundation seed produced by private enterprises & government intuitions in the target countries	6 MT common bean 3.2 MT soyabean	ARI Uyole 9 MT beans Agriseed 4.6MT soyabean	8.45 tons of soyabean 11 tons of common bean (Njano Uyole) 320 kg cowpea	New seeds grower associations were added
	2.6.2. By Q4 of years 1-4, sufficient quality legume seed available to farming communities	Volume of quality legume seed available to target farming communities in the target countries	16 MT soyabean 30 MT common bean	27.8MT of Soyabean (10.9MT certified and 16.9 MT QDS) 47.6 MT of Common beans (32MT certified and 15.6 MT QDS)	790.4MT of legume seeds (391MT of certified and QDS soyabean seed 388.7MT of certified and QDS common bean seed 6.4MT of QDS cowpea seed 4.69MT of QDS groundnuts seed)	Increased number of seeds producers

Activity per Objective	Milestone	Indicator	Milestone Target 2018	Achieved 2018	Achieved so far- Cumulative (2017+ 2018)	Reasons for Variance with Planned Target (if any)
2.7. Engage agro-dealer and other last-mile delivery networks in supplying legume agro-inputs	2.7.1. By Q4 of years 1-2, a minimum number of agro-dealers and other delivery network partners trained in the storage, handling, and use of inoculants	# of agro dealers & other delivery network partners trained in storage, handling and use of inoculants	10	21(13 male and 8 female) trained on rhizobia technology	216 agro dealers and CV/VBAA trained on storage, handling and use	Newly recruited CVs and VBAAs
	2.7.2. By Q4 of years 2-5, agro-dealer and other last-mile delivery networks engaged in the commercial supply to farmers of agro-inputs, including inoculants	# of agro-dealers & other last mile delivery networks in full business of supplying agro-inputs to target farmers including inoculants	3	14 (3 input supply (Beula, Agri seed, Guavay) 3 hub agro dealers 3 rural agro dealers 5 CVs/VBAA)	209 agro dealers and other delivery network supply agro inputs to target farmers	
2.8. Establish agri-business clusters around legume marketing and value addition	2.8.1. By Q4 of years 1-4, opportunities for collective marketing and value addition for smallholder farmer associations identified	# of collective marketing and value addition opportunities identified for smallholder farmer associations	-	No new collection centers	45 collection centers (10 Northern Highland and 35 Southern farmers use them for selling collectively	
2.9 Assess the effectiveness and efficiency of various input delivery and marketing systems especially for women	2.9.1. By Q4 of year 2, inventory and analysis of input supply and marketing systems conducted across all countries	Report of inventory and Analysis of the input supply & marketing systems in target countries	-	-	-	Focus of NCE
Objective 3						

Activity per Objective	Milestone	Indicator	Milestone Target 2018	Achieved 2018	Achieved so far- Cumulative (2017+ 2018)	Reasons for Variance with Planned Target (if any)
3.1. Sensitize partners, farmer associations, and farming households and mainstream approaches to address gender inequity in farming and decision-making	3.1. Female farmers increasingly lead N2Africa promotion and dissemination activities	# Female farmers leading N2Africa promotion and dissemination activities	6	9 female farmers (Guavay, and Beula) engaged in promotion of use of improved legume inputs	392 female farmers	No significant over-achievement
	3.1.1. By Q4 of years 1-4, all partners and households engaged in N2Africa activities that address gender inequity	# of Partner agreements with gender specific activities	-	-	7 partner agreements with focus to gender	
3.2. Assess business opportunities for women in agro-input supply and legume marketing and value addition opportunities	3.2.1. By Q4 of years 2-4, business opportunities for women identified	# business opportunities identified with focus on women		1 (Certified seed production)	4 business identified	
	3.2.2. By Q4 of years 4-5, at least 2 businesses led by women established per country	# of businesses established and led by women & # of women involved in the businesses established	20	Legume seed production 24 women seed growers	4 business led by women (Fortified soyabean flours, soyabean flour and QDS and certified seeds of soyabean and common beans, 150 (124certified and QDS seeds and 26 Fortified soyabean and soyabean flours soyabean flour	
3.3. Conduct dissemination campaigns targeting women farmers	3.3. Better knowledge of and access to household-level legume processing tools improves the nutritional status of women and	# of women using household level-legume processing technologies	30	145	145 Most process soyabean and or cowpea	Prioritized activity by partner TARI Ilonga

Activity per Objective	Milestone	Indicator	Milestone Target 2018	Achieved 2018	Achieved so far- Cumulative (2017+ 2018)	Reasons for Variance with Planned Target (if any)
	children in at least 2 target countries					
	3.3.1. By Q4 of years 1-4, themes and models for women-specific dissemination campaigns identified	# and types of women specific dissemination campaign themes and models identified.	-	-	-	-
	3.3.2. By Q4 of years 2-5, at least 25% of the female farmers participating in the overall N2Africa dissemination activities are also actively engaged in the women-specific dissemination campaigns	% female farmers participating in women specific dissemination campaigns				
3.4. Develop labour-saving pre- and post-harvest legume tools for female farmers	3.4. Women use pre- and post-harvest labour-saving tools, resulting in higher net profits from legume production and processing	# of women using pre- and post-harvest labour-saving tools	-	-	3,580 women using Herbicides (CRS and RUD consortium)	Same group maintained in 2018
	3.4.1. By Q4 of year 2, prototype labour-saving pre- and post-harvest tools for female farmers validated	# and type of prototype labour-saving pre- and post-harvest tools for female farmers validated	-	-	-	Planter Prototype are still under improvement
	3.4.2. By Q4 of years 2-4, labour-saving tools included in the various dissemination campaigns	# pre and post-labour saving tools included in dissemination campaigns				

Activity per Objective	Milestone	Indicator	Milestone Target 2018	Achieved 2018	Achieved so far- Cumulative (2017+ 2018)	Reasons for Variance with Planned Target (if any)
3.5. Evaluate the impact of environment (E) and management (M) on nutritional quality of legume grain	3.5.1. By Q4 of year 3, relationships between grain nutritional quality and management / environmental conditions quantified	# of relationship equations quantified				Target of NCE
Objective 4						
4.1. Develop variety x inoculant x nutrient management recommendations for the target legumes and legume production areas based on yield gap analysis	4.1. Recommendations for the intensification of legume production result in at least 50% increase in legume productivity	% change in legume productivity among target households participating in adaptation trials (early adoption instead of adaptation trials. Can look at progressive farmers). # of target households (men/women headed) with 50% increased productivity through adaptation trials				Pending Results from impact survey
	4.1.1. By Q4 of years 1-4, seasonal research campaigns towards legume intensification and yield gap closure implemented	# and type of Diagnostic trials conducted by N2Africa	-	-	26 (15 on cowpea, 11 on groundnut)	
	4.1.2. By Q4 of years 2-4, improved legume production recommendations integrated in the dissemination campaigns	# of improved legume production recommendations (based on diagnostic trials) integrated in dissemination campaigns				
4.2. Develop recommendations for rehabilitation of non-responsive soils for legume production	4.2. Inoculant producers avail improved inoculant formulations for the target legumes resulting in at least 10% increase in legume productivity and BNF	# of inoculant formulations applied/used by inoculant producers for target legumes in core countries (Productivity will be measured by milestone 4.1)	-	2 (legumefix powder Rizoliqsoy- liquid	3 (legumefix and Rizoliqbean	Rizoliqsoy inoculant registered in Tanzania
	4.2.1. By Q4 of year 2, major mechanisms leading to non-responsiveness understood	Major mechanisms contributing to non-responsiveness identified, analyzed & documented				

Activity per Objective	Milestone	Indicator	Milestone Target 2018	Achieved 2018	Achieved so far- Cumulative (2017+ 2018)	Reasons for Variance with Planned Target (if any)
	4.2.2. By Q4 of years 3-4, prototype rehabilitation measures for non-responsive soils validated	Validated measures(Prototype) for non-responsive soils				
4.3. Intensify crop-livestock interactions through enhancing feed availability of legume crop residues	4.3.1. By Q4 of year 2, niches for use of legume crop residues within and between farms identified	# niches for use of legume crop residues documented				
	4.3.2. By Q4 of years 3-4, feed availability and quality enhanced through appropriate use of grain legume residues	% of livestock feed quality dependent on appropriate use of legume residues				
4.4. Evaluate the medium- to long-term impact of legumes on overall farming system productivity and natural resource conditions	4.4. Overall farming system productivity and soil fertility status is improved through increased legume productivity	% increase in overall productivity and soil fertility of various farming systems as a function of increased legume productivity				
	4.4.1. By Q4 of year 2, at least 1 long term legume monitoring site established per priority region/country approaches	# long term monitoring sites established		4 soyabean maize rotation trials	4 soyabean maize rotation trials	The sites were maintained
	4.4.2. By Q4 of year 5, the medium- to long-term impact of legumes on overall system productivity and natural resource conditions evaluated using time series analysis and modelling	% contribution of legumes production on overall productivity and natural resources evaluated				
4.5. Isolate, authenticate, and evaluate new strains of rhizobia for the target	4.5.1. By Q4 of years 2-4, at least 50 new strains of effective rhizobia genetically characterized using molecular techniques	# candidate strain evaluated**# New rhizobia strains collected**	-			

Activity per Objective	Milestone	Indicator	Milestone Target 2018	Achieved 2018	Achieved so far- Cumulative (2017+ 2018)	Reasons for Variance with Planned Target (if any)
legumes for high symbiotic effectiveness	4.5.2. By Q4 of year 5, newly identified effective rhizobium strains for common bean, cowpea, groundnut conserved in a rhizobium gene bank and at least 5% of these used for inoculant	# Newly identified rhizobium strains conserved in a gene bank. % of identified effective rhizobium strains used for inoculant production				
4.6. Identify elite rhizobium strains and inoculant formulations for beans, groundnut, and cowpea	4.6.1. By Q4 of year 3, at least 5 new effective and elite rhizobia for beans, groundnut, and/or cowpea identified	# new effective and elite rhizobia identified				
	4.6.2. By Q4 of year 5, elite strains used for inoculant production for beans, groundnut, and/or cowpea	# of elite strains used for inoculant production				
4.7. Evaluate competitiveness and survival of introduced rhizobium strains as affected by M x E	4.7.1. By Q4 of year 4, environmental and management conditions affecting the competitiveness and survival of introduced rhizobia elucidated	Documented explanation of MxE on introduced rhizobium strains				
4.8. Develop standard operating procedures for the production, quality control and application of rhizobium inoculants	4.8.1. By Q4 of year 2, standard operating procedures of quality control (storage), product registration and application of inoculants used by inoculant producers and retailers	# of inoculant producers and retailers (public private suppliers) using standard operating procedures	**1**	1	1 (SUA)	SOP developed for Tanzania and adapted by TFRA since 2016
Objective 5						

Activity per Objective	Milestone	Indicator	Milestone Target 2018	Achieved 2018	Achieved so far-Cumulative (2017+ 2018)	Reasons for Variance with Planned Target (if any)
5.1. Develop an innovative framework for strategic M&E, allowing for timely feedback loops	5.1. National system scientists use the GL x GR x E x M framework and the obtained information to advance legume research for development within their countries	# of national institutions partnering N2Africa in D2R activities (Also # of participating scientists in those institutions) # of national institutions in target countries using GL x GR x E x M for research	-	1 (from RARI Makutupora)	14 scientists in eleven 6 institutions using GL x GR x M for research	One new scientist at TARI Makutupora joined the project
	5.1.1. Throughout the project, a strategic M&E framework provides timely feedback to learning and future planning	Existence of M&E framework that outlines the types of feedback for planning and provides timely data.	-	-	7 dissemination partners (CRS, RUDI Consortium, BRAC, CDI, AFAP, CABI, Africa Rising-NAFAKA	Same partners were maintained
5.2. Set-up data collection, management, and analysis infrastructure	5.2. Dissemination partners integrate effective and efficient dissemination approaches for legume technologies in their future development initiatives	# of dissemination partners integrating effective and efficient dissemination approaches in their programmes across target countries. (Effectiveness and efficiency of dissemination approaches will be measured by activity 5.6)	2	4	4(AR-NAFAKA, CRS, Moshi and Kilolo LGAs')	
	5.2.1. By Q4 of year 1, data management infrastructure is in place and data population initiated	Data Management system established with all project data				Project wide
5.5. Unravel G_L x G_R x E x M interactions for legume production towards the development of best-fit recommendations	5.5.1. By Q4 of year 4, the relative important of G_L, G_R, E, and M understood for specific legumes and production environments and integrated in improved recommendations	# of quantified relationships integrated in improved recommendations. Best-fit recommendations available to all target legumes in each country				Focus of NCE

4 Lessons Learned

- Village based agricultural advisors (VBAAs) and or community volunteers (CV), if supported, can become and effective conduit to connect farmers and input dealers, thereby achieving an efficient input delivery systems. This is because of their closeness and knowledge of farmers in their communities and capability of aggregating input demand at a minimum cost. They are also trusted by farmers as farmers can easily trace back inputs they sell.
- Different from the general perception that smallholder farmers save their seeds from season to season, they use a mixed bowl of seeds, including seeds they have saved themselves and seeds that they buy from open air markets. Improving the availability and affordability of seed will lead to increased seeds demand as was observed with high uptake of QDS produced locally.
- Farmers are ready to use inputs on their legumes only if they have an assured market of the excess produce they will attain by using those particular inputs.
- Improved agricultural practices such as spacing, early planting and crop rotation have a big chance to be taken up by farmers, mainly because of the low costs associated with them.

List of project reports

1. N2Africa Steering Committee Terms of Reference
2. Policy on advanced training grants
3. Rhizobia Strain Isolation and Characterisation Protocol
4. Detailed country-by-country access plan for P and other agro-minerals
5. Workshop Report: Training of Master Trainers on Legume and Inoculant Technologies (Kisumu Hotel, Kisumu, Kenya, 24-28 May 2010)
6. Plans for interaction with the Tropical Legumes II project (TLII) and for seed increase on a country-by-country basis
7. Implementation Plan for collaboration between N2Africa and the Soil Health and Market Access Programs of the Alliance for a Green Revolution in Africa (AGRA) plan
8. General approaches and country specific dissemination plans
9. Selected soyabean, common bean, cowpea, and groundnut varieties with proven high BNF potential and sufficient seed availability in target impact zones of N2Africa Project
10. Project launching and workshop report
11. Advancing technical skills in rhizobiology: training report
12. Characterisation of the impact zones and mandate areas in the N2Africa project
13. Production and use of rhizobial inoculants in Africa
18. Adaptive research in N2Africa impact zones: Principles, guidelines and implemented research campaigns
19. Quality assurance (QA) protocols based on African capacities and international existing standards developed
20. Collection and maintenance of elite rhizobial strains
21. MSc and PhD status report
22. Production of seeds for local distribution by farming communities engaged in the project
23. A report documenting the involvement of women in at least 50% of all farmer-related activities
24. Participatory development of indicators for monitoring and evaluating progress with project activities and their impact
25. Suitable multi-purpose forage and tree legumes for intensive smallholder meat and dairy industries in East and Central Africa N2Africa mandate areas
26. A revised manual for rhizobium methods and standard protocols available on the project website
27. Update on Inoculant production by cooperating laboratories
28. Legume seeds acquired for dissemination in the project impact zones
29. Advanced technical skills in rhizobiology: East and Central African, West African and South African Hub
30. Memoranda of Understanding are formalized with key partners along the legume value chains in the impact zones
31. Existing rhizobiology laboratories upgraded
32. N2Africa Baseline report

33. N2Africa Annual Country reports 2011
34. Facilitating large-scale dissemination of Biological Nitrogen Fixation
35. Dissemination tools produced
36. Linking legume farmers to markets
37. The role of AGRA and other partners in the project defined and co-funding/financing options for scale-up of inoculum (Banks, AGRA, industry) identified
38. Progress towards achieving the vision of success of N2Africa
39. Quantifying the impact of the N2Africa project on Biological Nitrogen Fixation
40. Training agro-dealers in accessing, managing and distributing information on inoculant use
41. Opportunities for N2Africa in Ethiopia
42. N2Africa project progress report month 30
43. Review & Planning meeting Zimbabwe
44. Howard G. Buffett Foundation – N2Africa June 2012 Interim Report
45. Number of extension events organized per season per country
46. N2Africa narrative reports Month 30
47. Background information on agronomy, farming systems and ongoing projects on grain legumes in Uganda
48. Opportunities for N2Africa in Tanzania
49. Background information on agronomy, farming systems and ongoing projects on grain legumes in Ethiopia
50. Special events on the role of legumes in household nutrition and value-added processing
51. Value chain analyses of grain legumes in N2Africa: Kenya, Rwanda, eastern DRC, Ghana, Nigeria, Mozambique, Malawi, and Zimbabwe
52. Background information on agronomy, farming systems and ongoing projects on grain legumes in Tanzania
53. Nutritional benefits of legume consumption at household level in rural sub-Saharan Africa: Literature study
54. N2Africa project progress report month 42
55. Market analysis of inoculant production and use
56. Soyabean, common bean, cowpea, and groundnut varieties with high Biological Nitrogen Fixation potential identified in N2Africa impact zones
57. A N2Africa universal logo representing inoculant quality assurance
58. M&E workstream report
59. Improving legume inoculants and developing strategic alliances for their advancement
60. Rhizobium collection, testing and the identification of candidate elite strains
61. Evaluation of the progress made towards achieving the Vision of Success in N2Africa
62. Policy recommendation related to inoculant regulation and cross-border trade
63. Satellite sites and activities in the impact zones of the N2Africa project
64. Linking communities to legume processing initiatives
65. Special events on the role of legumes in household nutrition and value-added processing

66. Media events in the N2Africa project
67. Launching N2Africa Phase II – Report Uganda
68. Review of conditioning factors and constraints to legume adoption and their management in Phase II of N2Africa
69. Report on the milestones in the Supplementary N2Africa grant
70. N2Africa Phase II Launching in Tanzania
71. N2Africa Phase II 6 months report
72. Involvement of women in at least 50% of all farmer-related activities
73. N2Africa Final Report of the First Phase: 2009-2013
74. Managing factors that affect the adoption of grain legumes in Uganda in the N2Africa project
75. Managing factors that affect the adoption of grain legumes in Ethiopia in the N2Africa project
76. Managing factors that affect the adoption of grain legumes in Tanzania in the N2Africa project
77. N2Africa Action Areas in Ethiopia, Ghana, Nigeria, Tanzania, and Uganda in 2014
78. N2Africa Annual Report Phase II Year 1
79. N2Africa: taking stock and moving forward. Workshop report
80. N2Africa Kenya Country report 2015
81. N2Africa Annual Report 2015
82. Value Chain Analysis of Grain Legumes in Borno State, Nigeria
83. Baseline report Borno State
84. N2Africa Annual Report 2015 DR Congo
85. N2Africa Annual Report 2015 Rwanda
86. N2Africa Annual Report 2015 Malawi
87. Contract Sprayer in Borno State, Nigeria
88. N2Africa Baseline Report II Ethiopia, Tanzania, Uganda, version 2.1
89. N2Africa rhizobial isolates in Kenya
90. N2Africa Early Impact Survey, Rwanda
91. N2Africa Early Impact Survey, Ghana
92. Tracing seed diffusion from introduced legume seeds through N2Africa demonstration trials and seed-input packages
93. The role of legumes in sustainable intensification – priority areas for research in northern Ghana
94. The role of legumes in sustainable intensification – priority areas for research in western Kenya
95. N2Africa Early Impact Survey, Phase I
96. Legumes in sustainable intensification – case study report PROIntensAfrica
97. N2Africa Annual Report 2016
98. OSSOM Launch and Planning Meeting for the west Kenya Long Rains 2017
99. Tailoring and adaptation in N2Africa demonstration trials
100. N2Africa Project DR Congo Exit Strategy

101. N2Africa Project Kenya Exit Strategy
102. N2Africa Project Malawi Exit Strategy
103. N2Africa Project Mozambique Exit Strategy
104. N2Africa Project Rwanda Exit Strategy
105. N2Africa Project Zimbabwe Exit Strategy
106. N2Africa Annual Report 2017
107. N2Africa review of policies relating to legume intensification in the N2Africa countries
108. Stakeholder Consultations report
109. Dissemination survey Tanzania
110. Climbing bean x highland banana intercropping in the Ugandan highlands
111. N2Africa Annual Report 2018
112. N2Africa Annual Report 2018 Ethiopia
113. N2Africa Annual Report 2018 Ghana
114. N2Africa Annual Report 2018 Nigeria, Borno State
115. N2Africa Annual Report 2018 Tanzania
116. N2Africa Annual Report 2018 Uganda
117. N2Africa training and extension materials

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