N2Africa Annual Report 2015

Authors: Theresa Ampadu-Boakye, Minke Stadler, Greta van den Brand, Fred Kanampiu

With contributions from Ken Giller, Edward Baars, Emmanuel Sangodele, Samuel Adjei-Nsiah, Endalkachew Woldemeskel, Peter Ebanyat, Freddy Baijukya, Jeanmarie Sanginga, Speciose Kantengwa, Paul Woomer, Regis Chikowo, Lloyd Phiphira, Wilson Leonardo, Nkeki Kamai, Mahamadi Dianda and Charlotte Schilt

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N2Africa

Putting nitrogen fixation to work for smallholder farmers in Africa

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Email: n2africa.office@wur.nl
Internet: www.N2Africa.org

Authors of this report and contact details

Name:	Theresa Ampadu-Boakye	Partner acronym: IITA
E-mail:	t.ampadu-boakye@cgiar.org	
Name:	Minke Stadler	Partner acronym: WU
E-mail:	minke.stadler@wur.nl	
Name:	Greta van den Brand	Partner acronym: WU
E-mail:	gretaj.vandenbrand@wur.nl	
Name:	Fred Kanampiu	Partner acronym: IITA
E-mail:	F.Kanampiu@cgiar.org	

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Abstract

N2Africa aims to contribute to increasing biological nitrogen fixation (BNF) and the productivity of grain legumes among African smallholder farmers; in turn this helps to enhance soil fertility, improve household nutrition, and increase the income of smallholder farmers. The project is implemented in five Core countries (Ghana, Nigeria, Tanzania, Uganda, and Ethiopia) and six Tier 1 countries (DR Congo, Malawi, Rwanda, Mozambique, Kenya, and Zimbabwe).

N2Africa's Vision of Success is to build sustainable, long-term partnerships to enable African smallholder farmers to benefit from symbiotic N2-fixation by grain legumes through effective production technologies including inoculants and fertilizers adapted to local settings. A strong national expertise in grain legume production and N2-fixation research and development will be the legacy of the project.

N2Africa Annual Report for 2015 presents the results and progress made against the five project objectives in the eleven countries. Table 2.1 presents the achievements against each milestone. The narrative report provides more detailed information behind the numbers presented in the table.

Results to date

Public-Private Partnerships are the main implementation strategy of N2Africa. A total of 97 partnerships have been formed up to now (81 signed agreements and 16 under discussions but already operational). The partnerships mainly cover dissemination, input and output markets, capacity building, and research; dissemination comprises over 30% of the partnerships.

Capacity building is achieved through both non-degree and degree training. Non-degree training of partner staff, especially field staff, is an integral part of all partnerships. A total of 7,961 persons (36% female) have been trained between 2014 and 2015 across topics such as legume agronomy, handling and application of rhizobia inoculants, organization and execution of demonstration and adaptation trials, post-harvest practices, data collection using tablets, and legume processing and utilization, business plan development and marketing, and credit and savings. The degree training currently supports 34 MSc and 13 PhD students across various topics and disciplines.

Through the partnerships' implementation and capacity building activities, 157,500 households have been reached with N2Africa technologies in 2015. A total of 257,404 households have been reached to date. This represents a number 38% above the 2015 target. A total of 293 diagnostic trials, 2,018 demonstration trials, and 21,212 adaptation trials were established in both Core and Tier 1 countries. Diagnostic and adaptation trials are conducted mainly in the Core countries.

The focus of nutritional interventions included the following; food processing and utilization at household levels, marketing of processed products, and provision of new opportunities for income generation for women farmers. Main legumes processed were soyabean and groundnut. Products included soyabean milk, *khibab*, *soy-akara* yoghurt, soy snacks, protein fortified flour, groundnut oil, and groundnut paste. In northern Ghana, soyabean milk was integrated in the school feeding

programme and about 92 caterers of the school feeding programme were trained in soy milk processing.

Experiments conducted in 2015 on diagnostics and demonstration trials indicated that the average yield of bush bean, climbing bean, cowpea and faba bean increased after adding P-fertilizer (39%, 36%, 32%, 37% respectively). The addition of phosphorus fertilizer (P) seems to be promising technology to close legume yield gaps. The average yield of all target legumes cultivated on diagnostic and demonstration trials in Nigeria, Ghana and Uganda showed an increase after adding P-fertilizer (47%, 32%, 32%, respectively). The reasons for these positive results differ per adoption domain.

Rhizobiology interventions are ongoing in the various countries through PhD and MSc students and specific research partners in selected countries. Over 1,000 new rhizobial isolates for cowpea, groundnut, common beans, chickpea, and faba bean have been identified in all core countries in 2015. In Ethiopia and Ghana, 32 candidate elite strains that improve biological nitrogen fixation ability have been identified from indigenous rhizobial isolates through screening. The selected candidate strains will be centralised at NoduMax, where a collection of promising strains and several worldwide reference strains for the target crops is being established for sharing among the participating countries.

Learning 2015 and focus 2016

Through the implementation of partnerships, the number of households has increased more than expected as compared to 2014. Operating in partnerships resulted in cost sharing and helped to reach out more beneficiaries. In 2016, the focus should be on strengthening and scaling out the existing partnerships and, where limited, map new partnership to mobilise new farmers.

In 2015, the majority of partner staff required capacity building in major thematic areas such as agronomy, nutrition, M&E, amongst others. This resulted in a large number of persons trained per partner organisation. In 2016, this number of partner staff trained seems to be sufficient for reaching out to the remaining 250,000 farmers. The various dissemination approaches used by the partners contributed to the achieved number of households reached. However in 2016, dissemination approaches, such as field days and media events, should be planned and organised to mobilise new farmers, particularly women.

Results of 2015 with regard to access and use of inputs indicates a progress in the use of improved seeds, inoculants, fertilizers and herbicides. However, the target has not been met in relation to the number of households reached and the average land size. The focus for 2016 will be to strengthen the input supply strategies of specific partnerships to enhance access to these inputs by already reached and new farmers.

In 2015, various output markets and market requirements such as legume volumes, varieties and produce qualities have been identified. However, farmer groups with market access indicated they required support to access the output markets. The focus for 2016 will be to integrate market requirements in the partnership implementation plans and activities.

The validation of labour saving tools in 2015 has started focussing on planters, threshers and herbicides. However the use and integration of these labour tools into

the dissemination activities remained a challenge. In 2016 the focus will be to develop and implement strategies resulting in actual use of the preferred tools. Similarly, legume processing methods and tools have been introduced to various households. Various nutritional activities were undertaken in 2015 in terms of legume processing and value addition. In 2016 the actual value addition activities that directly contribute to household nutrition will be pursued.

Furthermore, the analysis of agronomic data across target sites showed that there is a great variability in responses due to treatments across locations on the targeted legumes. The focus in 2016 will be to analyse the best-fit technologies per agro-ecological zone, provide recommendations and include these in dissemination activities of major partners.

On monitoring, evaluation and learning, the timely delivery of agronomy and other M&E data improved in most countries by using tablets. This has resulted in aggregation of project data on the centralised database, hence generating feedback loops and learning. However, the focus for 2016 will be on ensuring the quality of such data, clarifying the M&E indicators using the project data and reviewing the M&E system based on feedback generated in 2015. To ensure the quality of the data, practical hands-on training based on gaps identified will be offered to existing partner staff.

Keywords

Annual report, Key milestones, objectives, progress, biological nitrogen fixation, grain legumes, Nigeria, Borno State, Ghana, Tanzania, Ethiopia, Uganda, DR Congo, Rwanda, Kenya, Malawi, Zimbabwe, Mozambique.

1 Progress narrative

This Annual Report evaluates the progress made during 2015 in reaching the N2Africa Vision of Success. Results and progress are evaluated against the five main objectives of the project, which are:

1. Project strategy, coordination and implementation, and capacity strengthening
2. Delivery and dissemination, sustainable input supply, and market access
3. Empower women to increase benefits from legume production
4. Tailor and adapt legume technologies to close yield gaps and expand the area of legume production within the farm
5. Enable learning and assess impacts at scale through strategic Management & Evaluation

1.1 Project strategy, coordination and implementation, and capacity strengthening

The first objective aims at engaging research, development, the private sector, and other relevant partners in each of the target countries. It involves identifying, engaging, negotiating for buy-in and roles, and selecting partners along the legume input and output value chains who will actively cooperate towards achieving the N2Africa goals.

A partnership is considered developed and active if there is a partnership agreement with roles and responsibilities to disseminate technologies including N2Africa technologies and with activities focusing on at least one of the following: capacity building (partner capacity building), marketing, dissemination, and input supply.

1.1.1 Project strategy

The N2Africa Master Plans are strategic project documents intended to foster a common approach across the five Core and six Tier-1 countries. In 2015, the set of Master Plans has been completed with the Dissemination Master Plan and the Communication Master Plan. The Master Plans have been used to develop the country-specific plans. In 2015, all countries updated their country plans based on the results from the previous year.

1.1.2 Coordination and implementation

Sharing of research-based knowledge and dissemination approaches is the key to the success of the N2Africa project. Private-Public Partnerships (PPP) play key roles in the dissemination of legume technologies in all countries. The partnerships are a form of cooperation in which parties belonging to the public and private sectors are jointly accountable for activities carried out under their common objective, using their pooled resources and personnel and sharing risks.

In 2015, the country teams have formed partnerships along the segments of the various value chains. Major partnerships are those with agricultural research institutes, universities, local governments, private input suppliers, legume buyers, processors, and development partners. The number of partnership agreements that have been formalized has increased from 22 in 2014 to 81 in 2015. An additional 16

partnerships are awaiting signature by various partners, although they have already started implementing some activities together with N2Africa. All countries are well on track with the number of signed partnership agreements. Appendix I provides a full overview of all partnerships per country.

The 81 signed partnerships have the dissemination of technologies as the leading pillar. Capacity building, markets, and (to some extent) input supply strategies are an integral part of most of the partnerships (Figure 1). This allows for the integration of value chain activities, resolving issues and challenges along the entire legumes value chain. It also allows for the coordination of efforts from all value chain actors and supporters.

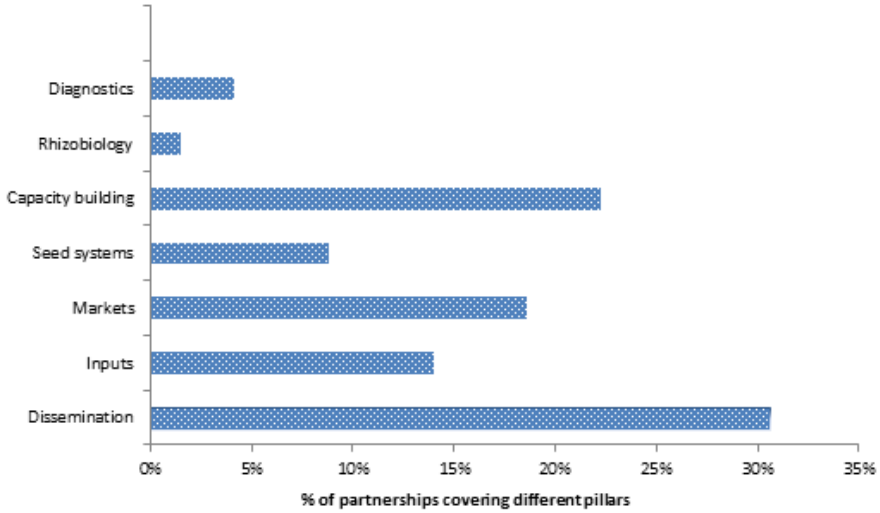


Figure 1. Coverage of partnerships over the different pillars in 2015 (% of partnership agreements).

The number of active partnerships in all countries has increased markedly in 2015 as compared with 2014 (

Figure 2). The majority of 2014 partnerships focused on research (diagnostics and rhizobiology). As most partnerships in 2015 covered dissemination activities, a large number of households could be reached (Figure 2). The use of inputs at the farmers' level and access to output markets also improved due to the various input supply strategies pursued by the various partnerships.

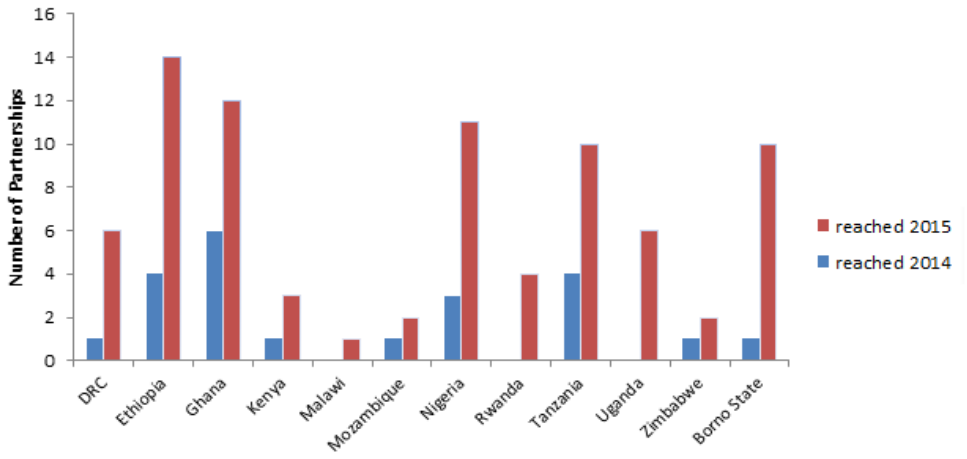


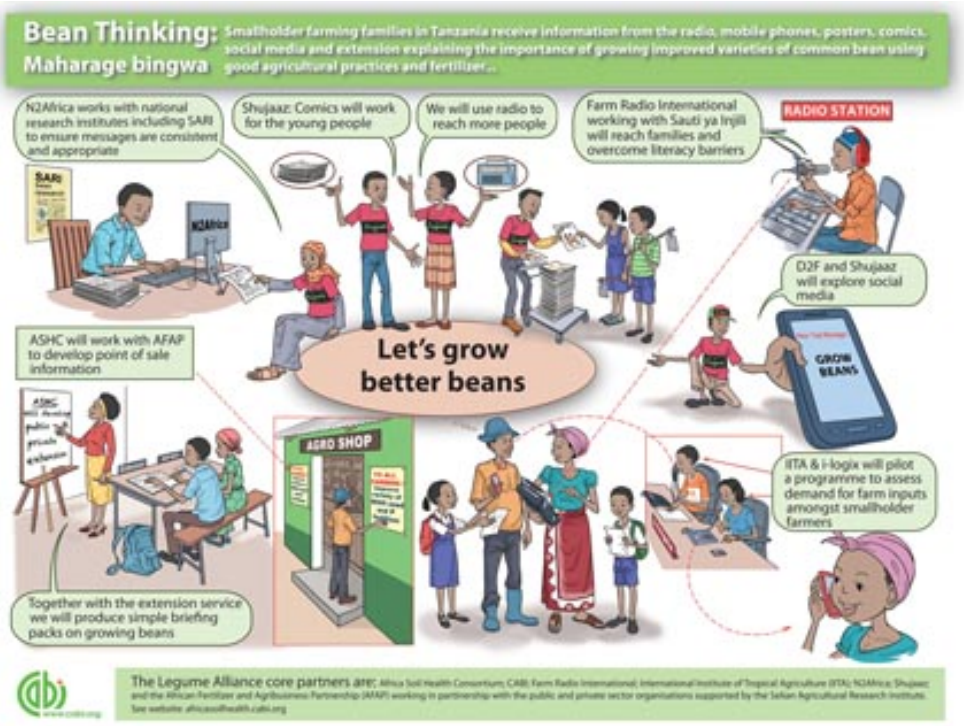
Figure 2. Total number of active partnerships per country in 2014 and 2015.

1.1.3 Capacity strengthening

Results obtained from N2Africa's activities and the continuous needs assessment of implementing partners informed capacity strengthening activities and supported development-to-research learning. Strategies for capacity strengthening include: non-degree trainings, degree trainings and use of media to share information. Dissemination within N2Africa is also characterized by an emphasis on developing PPP, sharing reliable information and research outcomes on agronomic and socio-economic variables through various campaigns, and creating awareness through the use of the media. The *Maharage bingwa* campaign in Tanzania is an outstanding example of a campaign (Box I).

Box I: Maharage bingwa (Champion Beans) in Tanzania

In Tanzania, N2Africa helped to establish the Legume Alliance, the first cluster of partners under the Africa Soil Health Consortium. Recently, the Legume Alliance initiated the *Maharage bingwa* (Champion Beans) campaign on common beans in Tanzania. The Legume Alliance seeks to raise awareness of the benefits of the improved varieties combined with appropriate fertilizer techniques and good agricultural practices to support livelihoods, food security, and soil health benefits in smallholder farming families in northern Tanzania. The Legume Alliance does this by combining media approaches that can support changes in attitude and behaviour. N2Africa provides knowledge and technical support on the technologies for dissemination.



http://africasoilhealth.cabi.org/materials

In 2015, the intensity of all activities related to capacity strengthening increased. All countries trained more personnel from partner organisations. This was mainly due to the large numbers of partners that have become involved in N2Africa activities.

1.1.3.1 Non-degree training

Non-degree training involves enhancing the capacity of partner staff and the subsequent capacity of all value chain actors. Trainings involved both training of trainers (ToT) and general trainings (step-down trainings to value chain actors) focusing on topics such as dissemination approaches, legume agronomy, handling and use of rhizobia inoculants, organization and execution of demonstration and adaptation trials, post-harvest handling and crop storage, management and data collection using tablets, legume nutrition and utilization, business plan development and marketing, credit and savings. A database of all trainings conducted is maintained that shows the content of trainings and targets.

The data presented in Table 1 is related to 97 partnerships through which the trainings were implemented. Persons trained included staff of private partner organisations, Government extension workers, development partners and other dissemination lead actors (lead farmers, village volunteers, and community based facilitators). Summary data of persons trained as trainers in 2014 and 2015 are indicated in Table 1 and Figure 3.

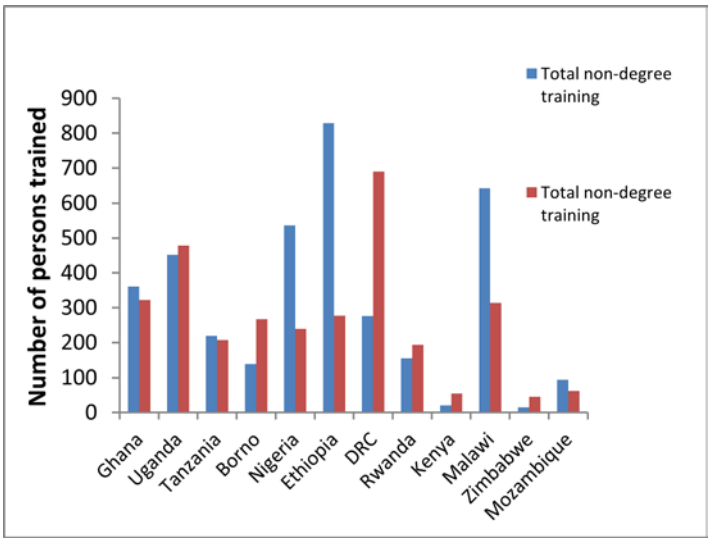


Figure 3. Total numbers of persons per gender trained through non-degree training per country in 2015.

Table 1. Numbers of persons trained through non-degree training.

Achieved 2014	Target 2015	Achieved 2015
1,059	210	7,961

Although each country surpassed the number of persons to be trained in 2015, the total per country depended on the coverage of partners and country/partner implementation strategies. For example, partners in Ethiopia, Nigeria, and DR Congo are sparsely located across long distances. In these three countries several trainings of different partner staff had to be conducted in different locations to aid the implementation of agreed activities. The opposite is true for Kenya, where country dissemination activities were implemented in one specific area (Western Kenya) and through one main platform (WeRATE); a limited number of trainings were conducted. There is, however, the need to evaluate the country capacity plans 2015 to enable learning and to adjust the training content and people targeted, amongst others.

In addition to the trainings, extension materials on legume agronomy and techniques have been developed with Africa Soil Health Consortium in Nigeria, Ethiopia, Rwanda, Zimbabwe, Kenya, and Mozambique with multiple unique materials for each country (all available on http://www.n2africa.org/ and http://africasoilhealth.cabi.org/materials/). Materials for Tanzania, Ghana, and Malawi are under development. In Uganda, the national research institutes and World Vision Uganda have developed extension materials for dissemination activities.

1.1.3.2 Degree training

In total, 47 MSc and PhD students contribute to N2Africa research activities (Table 2); 34 MSc students (45% female) and 13 PhD students (38% female) are being trained to get a degree. In particular, the number of MSc students increased in 2015; there were 11 MSc students in 2014 as compared with 34 MSc students in 2015.

Table 2. Numbers of MSc and PhD students trained through a degree training in 2015.

Country	MSc students			PhD students		
	Male	Female	Total	Male	Female	Total
Ghana	4	2	**6***	2	0	**2**
Nigeria	6	4	**10***	1	2	**3**
Borno State	2	2	**4**	1	1	**2**
Tanzania	1	2	**3**	1	0	**1**
Uganda	1	1	**2**	1	0	**1**
Ethiopia	3	1	**4**	1	0	**1**
The Netherlands	2	2	**4**	1	2	**3**
Zimbabwe	0	1	**1**	0	0	**0**
Total	**19**	**15**	**34**	**8**	**5**	**13**

* Nine MSc students from Ghana (4) and Nigeria (5) were supported in their research work, but did not receive the N2Africa scholarship.

The related students' topics focused mainly on market research, adoption processes, use of legume residues, and gender dynamics in selected value chains. Understanding these socio-economic factors will support the targeting of grain legume technologies to biophysical and socio-economic domains. Six additional interns were involved and supported in the Netherlands and Uganda.

The PhD topics cover the interactions between the host legume and rhizobia strains in common beans, cowpea, groundnut, and chickpea, the intensification of legumes on small farms, use of grain legume residues as livestock feed, and agricultural economics. One PhD student focuses on human nutrition in grain legume based cropping systems.

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

The second project objective focuses on the process of communicating proven and locally adoptable legume technologies to beneficiaries at all levels. Particularly important are the number of households (farmers) who have been introduced to proven technologies by N2Africa and its partners and the use of such technologies. This second objective aims at:

- Reaching the anticipated number of households targeted and continuing to engage in legume intensification post-project *(Indicators: Number of target households (men/women) reached by dissemination partners)*;
- Local agro-dealers marketing fertilizers, seeds, and inoculants are aligned with grassroots producer groups and input wholesalers and manufacturers *(Indicators: Volume of seeds, fertilizers, and inoculants used per targeted producer groups per land area; Volume of seeds, fertilizers, and inoculants sold by agro-dealers*);
- 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 *(Indicators: Number 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)*.

1.2.1 Delivery and dissemination

Through 97 partnerships and different dissemination approaches (e.g., demonstrations, adaptation plots, media events, field days, and post-harvest training sessions), the total number of farmers reached increased by 56% between 2014 and 2015. Follow-up trainings conducted for farmers, agro- dealers, and seed producers with the use of the above trained persons have reached about 22,459 persons in other specific trainings. Table 3 indicates the actual number of farmers reached against target. This was achieved as a result of implementation through partnerships using various modes of dissemination.

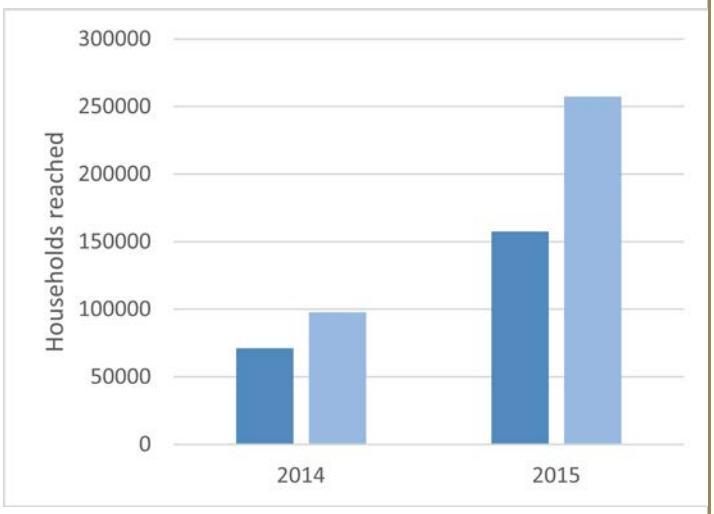


Figure 4. Total number of farmers reached in 2014 and 2015.

Table 3. Number of households (farmers) reached.

Achieved 2014	Target 2015	Achieved 2015
97,775	157,500	257,404

Figure 5 reports the cumulative number of households (farmers) with N2Africa technologies per country in 2014 and 2015 and shows the variability among the eleven countries. For example, in Ethiopia, where implementation was done through limited partnerships in 2014, only 4,008 farmers were reached in 2014. However, in 2015, the implementation through partnerships resulted in an increase of 78% in number of farmers (18,992) reached. The situation was the same for Tanzania and Ghana.

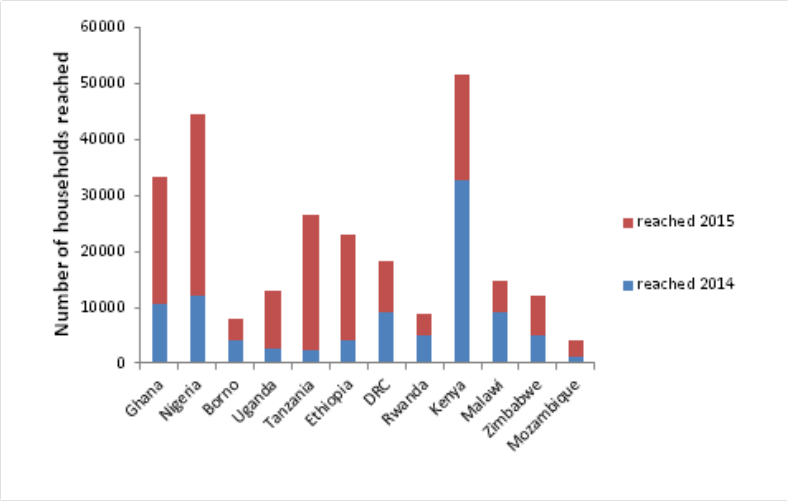


Figure 5. Cumulative numbers of households (farmers) with N2Africa technologies per country in 2014 and 2015

1.2.1.1 Demonstration and adaptation trials

In total, 2,018 demonstration and 21,212 adaptation trials have been established in 2015 across all countries. Though the various dissemination approaches contributed to reaching many households and enhancing farmers' knowledge, field days proved instrumental to reach out to about 50% more farmers compared with other approaches. However, some countries focused field day activities mainly on farmers, who were already participating in demonstrations, hence limiting the objective of the field days. Over one hundred other media events were organised in all countries. The effectiveness of the media events (e.g., radio talk shows, agricultural shows, TV shows, among others) (including reaching out to new actors) will be assessed in Ghana, Nigeria and Uganda in 2016.

Table 4. Breakdown of households (farmers) reached through various dissemination approaches in 2015.

Country	Total households reached in 2015	Dissemination approaches		
		Demonstration	Adaptation	Field days & media events
Ghana	22,650	7,670	2,454	12,646
Nigeria	32,401	13,890	9,425	9,086
Borno State	4,030	3,000	400	630
Tanzania	24,259	16,531	829	6,899
Uganda*	10,344	133	4,474	1,454
Ethiopia	18,992	4,342	3,630	11,020
DR Congo	8,953	8,953	Not applicable	-
Rwanda	3,752	698	Not applicable	1,178
Kenya	18,875	13,338	Not applicable	5,537
Malawi	5,362	5,362	Not applicable	-
Zimbabwe	7,000	7,000	Not applicable	-
Mozambique	2,970	2,100	Not applicable	870

**Malawi, DR Congo, Zimbabwe, and Mozambique have field day data included in demonstration field data.*

Farmers' feedback on certain aspects of the approaches was obtained to assist future learning. One aspect has been the use of master farmers who do not have the leadership skills to mobilize and train other farmers around certain demonstration plots, which results in poor participation by the entire group. Also the inability of farmers to select their own adaptation packages (due to limited availability and timely

delivery of packages requested by farmers) results in some not planting and contributes to the non-adoption of such technologies.

1.2.2 Sustainable input supply

Through the various input supply strategies pursued by the various partnerships, farmer beneficiaries of N2Africa and its partners had access to various inputs needed for increased production and productivity. Inputs obtained included inoculants, seeds of various legumes supported by the project, and fertilizers, among others.

Table 5. Volume of inputs used on farmers main fields in 2015.

Input type	Volume used in tons*		
	Achieved 2014	Target 2015	Achieved 2015
Inoculant	1.23	16	7.96
Seeds	304.3	1890	625.2
Fertilizer	67.9	3150	628.2

**2015 Achieved figures are for 105,939 farmers whose input usage data was obtained as at reporting period.*

The increases in input use in 2015 (Table 5) are due to the following input supply strategies in the various countries:

- Strong links established between inoculant producers and cooperatives under partnerships in Ethiopia, cooperatives serve as buyers and distributors of inoculant;
- Establishment of one-stop shops with cooperatives in Kenya and Rwanda who operate agro-input shops with links to inoculant producers;
- Dissemination through partnerships with established input supply systems such as the use of nucleus farmers;
- Establishment of community seed production systems focusing on the production of varieties selected by farmers;
- Support for the registration of preferred varieties by private sector partners.

1.2.2.1 Inoculant production

All eleven countries have inoculants available and registered for sale through either local production and/or importation. Inoculants are produced locally in seven of the countries ((Ethiopia (Menagesha Biotech Industry Plc), Nigeria (Nodumax, International Institute of Tropical Agriculture), Uganda (Makerere University), Kenya (MEA Ltd), Zimbabwe (Soil Productivity Research Laboratory), Rwanda (Rwanda Agricultural Board) and Malawi (Agri-Input Suppliers Limited)). Strategies, as indicated under market access, are being pursued to facilitate access by farmers.

Three countries obtain inoculants through importation (Tanzania, Ghana, and Mozambique). In Tanzania, inoculants are registered for import and sale by Export Trading Group (ETG) and MEA Fertilizer Ltd (Box II). Ghana is supporting a private sector organisation (Green-Ef) to register inoculants for importation. Mozambique imports inoculants mainly from Brazil and is facilitated by projects in which N2Africa has partnerships. Box III shows examples of legume seeds and fertilizers made available in Nigeria.

Box II: BIOFIX and LEGUMEFiX inoculants registered in Tanzania

Inoculant products BIOFIX (from MEA Ltd - Kenya) and LEGUMEFiX (from Legume Technology Ltd - UK) have been registered in Tanzania as fertilizer supplements which can be directly imported into Tanzania. The COMPRO-II project has collaborated with Tanzania Fertilizer Regulatory Authority (TFRA), N2Africa, and other stakeholders to develop registration guidelines for bio-fertilizers including rhizobium inoculants. The BIOFIX inoculant will be marketed and distributed by MEA Ltd; LEGUMEFiX will be marketed and distributed by Export Trading Group (ETG). As the distribution of the product is important, MEA and ETG are now working on mechanisms to ensure that smallholder farmers can gain access to these inoculant products. So far, no inoculant outlet has been established, but ETG has engaged CRS and CDI to sell inoculants to their farmers and the experience will be shared to allow future strategies to be developed.

Box III: Examples of legume seeds and fertilizers made available

In **Nigeria**, community based seed producers produced 1,110 tons of legume seeds out of which 175.78 tons were was sold to farmers in communities. In **Borno State**, 100 community seed farms were established and certified in 2015, though the volume produced is not yet known. In **Uganda**, 10 groups have been trained and one women's group has been linked to Simlaw with contractual arrangements to produce specific varieties of climbing beans. In **Ghana**, legume farmers sourced 206 tons of certified seeds; half were soyabean seeds from both community seed producers and major input suppliers. In addition, farmers sourced 40-45 tons of phosphorus fertilizer. In **Kenya**, 94 tons of legume seeds were produced through stakeholders' groups. Also a soyabean variety cv Saga, has been registered by SeedCo.

A network of farmers and agro-dealers in Nigeria

A total of 279 agro-dealers and 194 community based seed producers were trained to network for a sustainable input supply to target farmers within the project's intervention areas in 2015.

In most countries, agro-dealers receive training on the handling, storage, and use of inoculants and participate in selected field days. These agro-dealers are to be linked to input manufacturers/suppliers. In Tanzania, they will be linked to ETG to supply the inoculants after clear demands have been established.

Although the use seed, fertilizer and inputs increased in 2015 (Table 5), the use of inputs is still far below targets. By comparing the number of farmers reached and the average inputs required per average land size of 0.2 ha, we had expected a larger amount of inputs to be used in 2015. Feedback from farmer groups also indicated that further support with regard to input supply is needed. Farmer groups commented as follows:

- ‘To make the seeds and inoculant available to farmers.’
- ‘To make sure the new varieties are available to farmers.’
- N2Africa to make the new variety and technology available in the market for farmers to buy.’
- ‘Should make the inputs available and accessible to farmers.’
- ‘Training on the safe handling, use, storage and precautionary measures of pesticides.’
- ‘Need more demonstration on legumes and to help get some of the improved groundnut varieties such as Samnut 22, 23 and 24.’
- ‘Fake inputs and no quality seed available.’

1.2.3 Output market access and collective marketing

Collective marketing is where farmers come together to sell their produce as a group, allowing better prices and lower transaction costs. A total of 80,603 farmers accessed various legume markets through various partnerships and models (Table 6). This is triple the number in 2014 and 7.5% above the 2015 target.

Table 6. Numbers of farmers accessing output markets in 2014 and 2015.

Farmers accessing output markets		
Achieved 2014	**Target 2015**	**Achieved 2015**
25,982	75,000	80,603

**In Ethiopia, the season was still ongoing so data is an estimate of the farmers who have contracts with buyers in the partnerships and are obliged to sell produce to them.*

Various business models are being pursued in the countries, and these have contributed to the increase in the numbers of farmers reaching output markets. These included input supplier-driven models, micro-entrepreneur-driven models, lender-driven models (i.e., cooperatives), producer collective-driven models (cooperatives, associations), buyer-driven models (out-grower schemes/nucleus farmers) and combinations thereof. About 36% of partnerships established in 2015 have had either buyers as signatories or a marketing component. Improved marketing can be attributed to approaches as pursued by FAIDA Mali in Tanzania; in Ethiopia, buyers are signatory to the partnerships (Guts Agro, ACOS, and AKF), and nucleus farmers have helped with marketing in Ghana.

Though there has been a significant improvement in access to output market, feedback obtained on the nature of market agreements indicates that the majority of cooperatives still have only informal relationship with buyers and this hampers negotiations for good prices. Also the prices are always affected by the quality of goods, as indicated by some farmer groups.

Box IV: Integration of marketing strategies in partnerships

In collaboration with AGRA in Nigeria, eight community information resource centres were established in Kano and Kaduna States to provide innovative market linkages; through these centres 1,250 producers were linked to markets. Under the MARKETS II implementation agreement, two identified soyabean processors are linked with networks of farmers in Benue and Niger States for collective marketing where MARKETS II value chain project facilitated grain soya buy-back from networks of farmers; over 9,500 farmers market their produce through the networks.

In Rwanda, 13 cooperatives and 50 groups of farmers with total membership of 4281 (2911 women) worked with COCOF to bulk soyabean grain to feed the processing plant of COCOF.

1.3 Empower women to increase benefits from legume production

Businesses led and owned by women (in N2Africa) are considered as commercial activities focusing on any aspect of the selected legume value chains, from input supply through to processing and marketing. Business opportunities are a proven business concept or idea within any of the N2Africa legume crops that can generate livelihoods for a household or an individual. These activities play a vital role in empowering women.

In 2015, all countries have developed strategies to empower women in different ways. These include sensitization meetings with partners and farmers/producers groups to mainstream gender when promoting and disseminating N2Africa technologies, identifying and organising women-specific dissemination activities such as value addition trainings targeting women's groups, validation of labour-saving tools focusing on women's needs. The empowerment also includes identifying business opportunities for women along the various value chains supported and the eventual establishment of such businesses by the women. Some countries (Nigeria, Tanzania, and Ethiopia) formed specific partnerships to address gender issues.

On sensitization, most partnerships have gender-specific mainstreaming activities integrated as part of work plans to be implemented. Examples include the roles of gender in value chain development and the need for a leadership role for women.

1.3.1 Businesses led by women

A number of business opportunities were identified for women along the selected value chains in the various countries in 2014. The trainings conducted for selected women on these opportunities have resulted in three main types of businesses (legume seed production, processing of legume products, and processing of crop residue for livestock feed). The numbers of businesses with the associated numbers of women are presented in Table 7.

Table 7. Number of businesses with associated number of women in 2014 and 2015.

Business type	Number of businesses		Number of women involved in 2015
	Achieved 2014	Achieved 2015	
Legume seeds production		4	110
Legume processing	2	9	Over 4,000 (individuals and groups)
Processing of crop residue for livestock feed		1	23
Total		**14**	**4,133**

In addition, 15 Youth Agripreneur businesses have been registered in Borno State focusing on legume production and marketing, groundnut oil and cake processing, farm input supply, and the fabrication of agro-labour-saving tools. The by-products of processed legumes are being used by businesses related to poultry rearing, cattle fattening, and fish farming. To date, 40 of the youth (23 males, 17 females) have been trained in grain legume production technologies and entrepreneurship.

Box V: Borno Youth Agripreneurs; marketing legumes and producing poultry

The empowerment of women requires however a deeper understanding of the dynamics of power relations at the household level. Therefore a Ugandan MSc student is researching how such dynamics can be best integrated in women's empowerment in grain legume marketing.

In N2Africa's results framework, better knowledge of and access to household-level legume processing tools are to improve the nutritional status of women and children. Therefore N2Africa continues to organize training events and workshops on legume processing.

1.3.2 Legume processing tools improving nutritional status

The focus of nutritional interventions included the following; food processing and utilization at household levels, marketing of processed products, and provision of new opportunities for income generation for women farmers. Main legumes processed were soyabean and groundnut. Products included soyabean milk, *khibab*, *soy-akara* yoghurt, soy snacks, protein fortified flour, groundnut oil, and groundnut paste. Nutrition activities had the following results.

In northern Ghana, soyabean milk was integrated in the school feeding programme and about 92 caterers of the school feeding programme were trained in soy milk processing;

- Community business groups (women) established in Nigeria producing *soy-akara*, soy-milk, tom brown, and soup condiments for the local market (Box V);
- Processing and sale of soy products in most countries by farmers' cooperatives; e.g., Kenya (by 69% of groups supported), Rwanda, and Zimbabwe;

Box VI: Borno's women increasingly benefit from legume production

In Borno State, Nigeria, training women on processing and utilization of soyabean was considered an important way to address gender equity. The training events attracted 660 women. Among the attendees were women soyabean farmers, women members of community-based organisations (CBO's), wives of CBO members, as well as non-members within the communities. Although the training was designed for women, men were also interested so 120 men watched and observed keenly how the processing went on, and at the end took part in tasting the processed products.

Recipes for soya milk, soya cheese, soya stick meat, soya scramble, *soya-akara*, tom brown, and vegetable soup were developed through practical demonstrations during the training.

Women prepare soyabean products (left) and soy stick meat (right), Borno State, Nigeria.

- As a business opportunity, about 4,660 women were introduced to new processed products in Borno State.

In Ghana, women farmers who own livestock made a special request for training in the processing and storage of grain legume crop residues as livestock feed during the dry season. Twenty-three women farmers received training and have stored large quantities of groundnut residues for feeding livestock in the dry season.

1.3.3 Labour-saving tools

The use of the tools is the extent to which the tools are used by the target women for labour-saving purposes in terms of effectiveness, efficiency, and satisfaction in a specified context (before or after harvesting).

In 2014, a number of labour constraints were identified. These included the labour intensity of planting, weeding, and harvesting. In 2015, various labour-saving tools (hand-drawn planters, threshers, dibblers and herbicides) were identified in various countries and validated with farmers, especially women. About 2,000 farmers validated these tools (56% women) in Ghana, Nigeria and Uganda. Farmers indicated their preference for the various tools using criteria that included the time spent, ease of operation, quality of planting, and space, amongst others. The technical quality of the tools turned out to be an important determinant of farmers' appreciation.

Though the tools are available in each country, access to finance by individual farmers remains a challenge. Therefore, the strategy will be to organise and integrate such tools in commercial agro-services in the various communities. The partnership with CropLife, which includes crop spraying and other services, linking fabricators to cooperatives, is a good example of this strategy (Box VII). The Youth Agripreneur programme in Borno State has integrated the local fabrication of such tools as a business and some young people are already engaged.

Box VII: CropLife Nigeria assesses contract sprayers in Borno State

Contract sprayers applying pesticides for a fee for farmers in Borno state in Nigeria do not follow responsible use practices.
- 10% do not wear any protective equipment;
- 40% do not read the label;
- 30% do not triple rinse the empty container;
- more than 60% leave the empty containers on the farm.

These are some of the conclusions of an assessment carried out by CropLife Nigeria on behalf of the N2Africa project. Resulting from the negative results of the assessment carried out at the end of 2015, N2Africa has asked CropLife Nigeria to train 45 of the contract sprayers to become proper Spray Service Providers and link them to member companies.

The second recommendation is related to the need of creating awareness among farmers that make use of contract sprayers, on the correct manner for the disposal of empty containers,that children are never allowed to be involved in any activity related to pesticide handling or application, and the importance of buying and using good quality pesticides. Based on these recommendations, N2Africa agreed to have CropLife set up a network of Spray Service Providers in Borno state. The first activities are likely to start in March 2016.

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

The objective four of the project involves tailoring and adaptation of legume technologies to close yield gaps and expand the area of legume production within the farms. The major focal areas of results include:

- Recommendations for the intensification of legume production result in at least 50% increase in legume productivity *(Indicators: Percentage change in legume productivity among target households participating in adaptation trials, Number of target households (men/women-headed) with 50% increased productivity through adaptation trials);*
- Inoculant producers avail improved inoculant formulations for the target legumes resulting in at least 10% increase in legume productivity and BNF *(Indicators: Number of inoculant formulations applied/used by inoculant producers for target legumes in core countries; Productivity measured through adaptation trials).*

1.4.1 Diagnostic, demonstration and adaptations trials

All Core countries established diagnostic trials to determine the main biophysical factors that constrain legume yields. In 2015, a total of 2,018 demonstration trials have been implemented. The demonstration trials showcase the best-best technologies to large numbers of farmers and are used to collect data on the performance of these technologies. Adaptation trials are the small trials that farmers establish on their own farm. In 2015, in total 21,212 adaptation trials were established by farmers on their farms. A selection of these adaptation trials are closely monitored to assess the performance of the technologies under the heterogeneous farmers' conditions and management. Table 8 gives an overview of the numbers of trials established in the Core and Tier 1 countries.

Table 8. Diagnostic, demonstration, and adaptation trials in 2014 and 2015.

Country	Diagnostic trials		Demonstration trials		Adaptation trials	
	2014	2015	2014	2015	2014	2015
Borno State	-	40	160	120	480	400
DRCongo	**	**		130	**	**
Ethiopia	393		423	176	3,192	3,630
Ghana	80	27	210	213	1,862	2,454
Kenya	**	**		26	**	**
Malawi	**	**		312	**	**
Mozambique	**	**		113	**	**
Nigeria	*	90	245	463	5,880	9,425
Rwanda	**	**		118	**	**
Tanzania	16	25	102	164	3,205	829
Uganda	283	111	85	133	696	4,474
Zimbabwe	**	**		50	**	**
Total				**2,018**	**15,315**	**21,212**

* A set of trials was established in collaboration with partners.
** Not applicable

1.4.2 Preliminary results from diagnostic and demonstration trials

shows the mean effects of P-fertilizer per target legume over all available diagnostic and demonstration trials in 2015. The average yield of bush bean, climbing bean, cowpea and faba bean increases after adding P-fertilizer (39%, 36%, 32%, 37% respectively). Particularly groundnut and soyabean show little yield response after adding P-fertilizer (6%, 16%, respectively). The reasons for these yield responses differ per adoption domain.

Table 9: Mean effects of P-fertilizer per country over all available diagnostic and demonstration trials in 2015.

Country	P^- fertilizer (kg/ha^{-1})	P^+ fertilizer (kg/ha^{-1})	Yield increase (kg/ha^{-1})	Yield increase (%)
Ethiopia	1670	1890	220	13%
Ghana	789	1042	253	32%
Nigeria	610	898	287	47%
Tanzania	272	308	37	14%
Uganda	819	1084	265	32%

Table 9 shows the mean effects of P-fertilizer per country over all available diagnostic and demonstration trials in 2015. Particularly the yield of target legumes cultivated on diagnostic and demonstration trials in Nigeria, Ghana and Uganda shows an increase after adding P-fertilizer (47%, 32%, 32%, respectively). In Ethiopia and Tanzania, the average yield of target legumes cultivated on diagnostic and demonstration trials increased marginally after adding phosphorus (13%, 14%, respectively). However, diagnostic and demonstration work in central Tanzania showed positive response of groundnut to a combined application of P and cattle manure. Also in Ethiopia, the application of phosphorus in combination with inoculation (+P+I) showed better responses compared to only P application. In general, the reasons for these yield responses differ per adoption domain.

Table 10: Mean effects of P-fertilizer per target legume over all available diagnostic and demonstration trials in 2015.

Target legume	P^- fertilizer (kg/ha^{-1})	P^+ fertilizer (kg/ha^{-1})	Yield increase (kg/ha^{-1})	Yield increase (%)
Bush bean	878	1219	341	39%
Climbing bean	1474	1999	525	36%
Cowpea	596	788	192	32%
Faba bean	211	290	79	37%
Groundnut	908	959	51	6%
Soyabean	867	1008	141	16%

In Ethiopia, preliminary analysis of 2014 data from faba bean diagnostic trials across target sites showed that there is great variability in responses due to treatments across locations. The application of Phosphorus (in the form of DAP) and/or inoculant generally shows comparably better yield benefit (Figure 6). The percent yield increased due to the applied inputs ranged from 10 % to 29%.

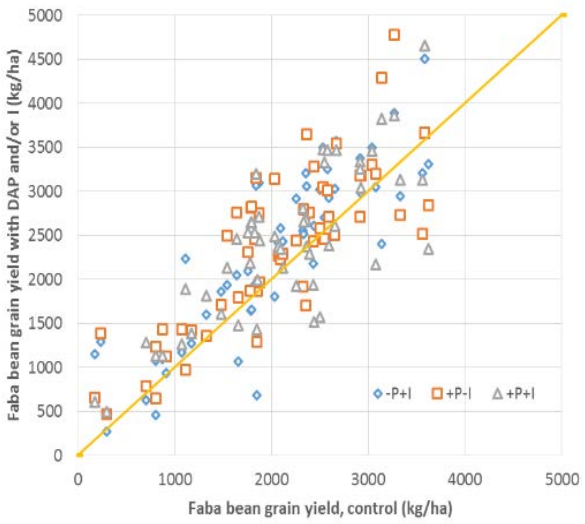


Figure 6. Faba bean grain yields in 2014 in Ethiopia.

Based on the results, the OARI-SARC researchers in collaboration with the N2Africa Ethiopian team reached to agreement on the lack of response in some faba bean fields owing to the low rate of DAP fertilizers application (25 kg/ha). The comprehensive conclusions lead to adjusting the rate of DAP fertilizer application for the 2015 cropping season diagnostic trials to 50 kg/ha instead.

Furthermore, last year's Demonstrations and Feedback Meeting with farmers from Ghana resulted in moving from best-bet to best-fit technologies. In obtaining feedback from farmers to arrive at best fit technologies, selected farmers in Northern Ghana evaluated five different groundnut varieties (Samnut 22, Samnut 23, Samnut 24, Chinese, farmers material) using criteria such as disease resistance, maturity time, yield, seed size and colour, oil content, pedicel.

Farmers' feedback indicated their preference for Samnut 22 and Samnut 23. They preferred Samnut 23, because it is early maturing, high yielding, high oil content for existing market (processing company), has strong peg, and disease resistant as compared to other varieties. Samnut 22 was appreciated based on its disease resistance, bigger seed size and higher number of pods per plant and is late maturing. It also has prolific biomass, which was interesting for livestock farmers. Livestock farmers indicated their preference for Samnut 22, because it has more fresh green leaves, which will be palatable to animals. Farmers indicated that although the variety "Chinese" is early maturing, it is more susceptible to groundnut rosette virus than the other varieties.

With this feedback on farmers' preference to grow Samnut 23 and 22, N2Africa and partners included both varieties in the various dissemination activities. Consequently, Samnut 23 and 22 were the main varieties demonstrated to farmers in 2015. Also for access to seeds, selected farmers were trained in seed production and were supplied with foundation seeds. Farmer groups were then linked to the seed producers. A total of 46 tons of groundnut seed were produced and sold to farmers in these communities.

1.4.2.1 Non-responsive soils and long-term trials

Ghana is the only country so far that has identified non-responsive soils based on trial results from earlier seasons and designed trials to assess the mechanisms that contribute to the non-responsiveness of these soils to legume technologies (Box VIII). Tanzania and Ethiopia established long-term trials. The performance of the six long-term trials in Ethiopia (faba bean, chickpea, common bean and soyabean) was affected due to erratic and late onset of rainfall in 2015. In Tanzania the long-term trials were established to assess the rotational benefits of legumes.

Box VIII: Non-responsive soils in Ghana

On farm trials were conducted on earlier identified non-responsive soils on seven sites in the three Northern Regions of Ghana. Non-responsive soils were defined as soils where the application of P and rhizobia inoculants had no effect on grain yield during the 2011 and 2012 cropping seasons. The prototypes for rehabilitation were (i) Mineral fertilizer (P+K+Ca+Zn+B), (ii) Fertisol (organic fertilizer) and (iii) Mineral fertilizer plus fertisol. Soil samples indicated that the soils were low in organic matter (<1.5%), available Phosphorus (<20mg kg $^{-1}$), exchangeable Potassium (<0.4 cmol+ kg^{-1}) and Mg (<5 cmol+ kg^{-1}). With the exception of Pishiau and Serekpere, all the other sites also had low concentrations of exchangeable Calcium (<5 cmol+ kg^{-1}). The soils were slightly acidic with a pH range of 5.7 to 6.0.

The application of Fertisol resulted in larger yields than the application of Mineral fertilizer. Figure 7 shows the shoot biomass at 50% podding as affected by the various interventions for rehabilitating the non-responsive soils. The combined application of Mineral fertilizer and Fertisol was the most promising intervention for rehabilitating the non-responsive soils at all locations except at Serekpere, resulting in about 213 and 223% increase in biomass production at 50% podding relative to the control at Naaga and Pishegu respectively.

However, the 2014 demonstration trials do not show a combined effect of Fertisol and phosphorus fertilizer in grain yield of cowpea. The effects of Fertisol on grain yields of different legumes thus has to be further investigated.

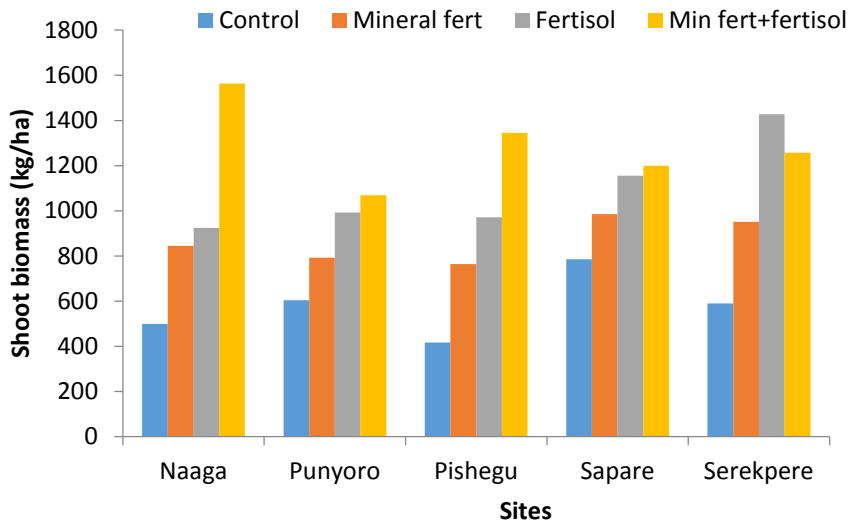


Figure 7. Shoot biomass at 50% podding as affected by the various interventions for rehabilitating the non-responsive soils in Ghana.

1.4.3 Rhizobiology

The N2Africa Core countries isolated more than 1,000 new rhizobial isolates for cowpea, groundnut, common beans, chickpea, and faba bean in 2015 (Table 11). Ethiopia and Ghana have already advanced indigenous rhizobial isolates to the screening for effectiveness stage in the screen house, resulting in 32 candidate elite strains that improve the BNF ability of the legume crops compared with standard strains. These selected candidate strains will be gradually centralised at IITA (NoduMax) where a collection of promising strains and several worldwide reference strains for the target crops is being established for sharing among the participating countries. To date, the strain sharing program reached Malawi, Tanzania, Uganda, and Ghana.

Table 11. Summary of new strains collection in the 5 Core countries of the N2Africa project in 2015.

Legume species	Country	Bio-prospecting	# Isolates	# Rhizobia authenticated	Authen-tication (%)	# Candidate elite strains
Cowpea	Ghana	Farmers' fields Trapping	330	47	14%	9
	PhD (NoduMax)	Trapping	540	-	0%	-
Groundnut	Ghana	Farmers' fields	70	23	33%	2
	Uganda	Trapping	98	7	7%	
Common bean	Ethiopia*	Farmers' fields	-	60		6
	Uganda	Trapping	44	5	11%	
Chickpea	Ethiopia*	Farmers' fields	-	61		7
Faba bean	Ethiopia*	Farmers' fields	-	70		8
Total			**1082**	**273**	**25%**	**32**

* Number of rhizobia already authenticated

Box IX: Responses of varieties of common beans (left) and chickpea (right) to rhizobial inoculation in screen house trials in Ethiopia

1.4.4 Inoculant production

Soyabean inoculants using a peat carrier (ETP) and rhizobial strain USDA 110 are produced in the Nodumax inoculant plant. In 2015 activities focused on controlling the major rate-limiting factors for production identified during product development in 2014. These include the control of contaminants over the production line, the improvement of broth production, and the registration of the product for distribution in the local market.

Gamma irradiation to sterilize the peat carrier greatly improved the quality of the inoculants compared with autoclaving (Figure 7). Whereas large bags of peat still showed contamination, small peat bags did not contain any contaminants after gamma irradiation in Ghana and Nigeria. Peat bags sterilized in the UK functioned as control.

Routine quality control (QC) tests were conducted to assess the shelf life of NoduMax inoculants. The results demonstrate that the population of rhizobia in NoduMax inoculant remained high (10^9 per g) and stable during the nine months in which the shelf life was assessed. However, counts for contaminants exceeded the standard thresholds (>10^6) after the first six months. Although the small bags of gamma irradiated peat did not show any contaminants, the final inoculant product could have become contaminated in two ways: 1) There are indications that the quality of gamma irradiation in Abuja is not consistent over time and may need improvement, 2) Sub-sampling freshly produced inoculant from larger bags is certainly a major source of contamination which should not be continued on the production line at the BIP/NoduMax facility.

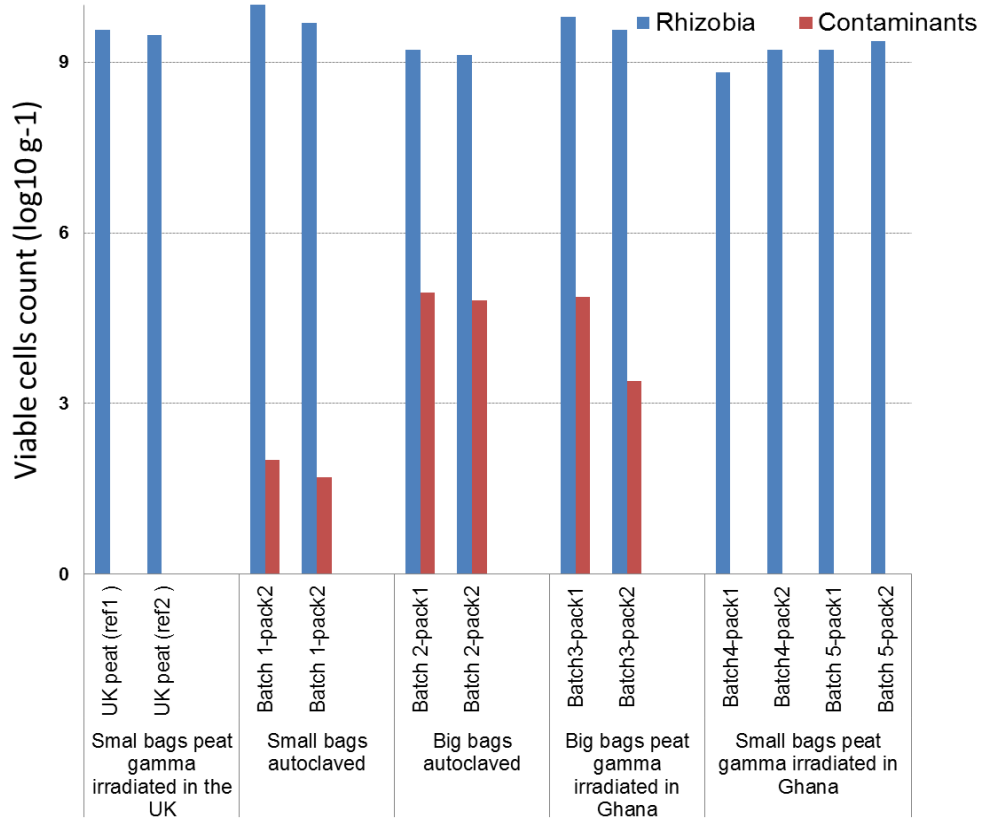


Figure 8. Effects of peat sterilization methods on contamination in NoduMax batches.

In Kenya, samples of BIOFIX are routinely recovered from the factory shelves and tested using the drop plate method on Congo Red YMA from dilutions of 10^{-6} to 10^{-9}. In 2015, 43 such samples were subjected to quality control testing and the results presented in Figure 9.

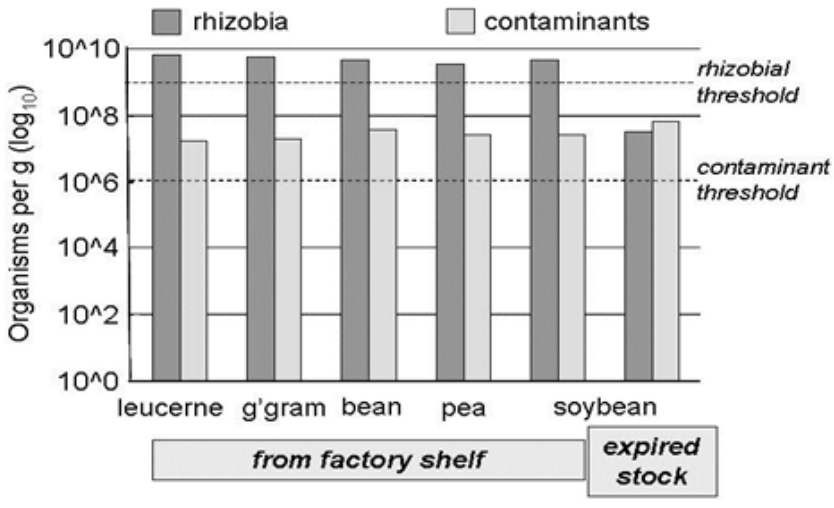


Figure 9 Quality control results for BIOFIX inoculant produced in 2015 of 43 samples from five host products

The quality control findings are mixed in that the number of rhizobia consistently exceeds the minimum threshold but contaminants greatly exceed the maximum. The tests of expired soyabean inoculant stock suggest that it is best to rely upon recently produced product. The two main raised in relation to excessive contamination include the possibility of the contaminants being hostile to rhizobia, reducing product efficacy. These findings lead to three main recommendations; BIOFIX must improve the sterilization of its "filter mud" carrier, MEA should consider an alternative carrier such as pre-sterilized peat used by NoduMax in Nigeria (a much purer product), and finally MIRCEN should conduct a more thorough examination of BIOFIX contaminants to assure their safety to product users.

In addition to above quality control measures, Standard Operating Procedure (SOPs) for quality control and application have been developed in conjunction with the COMPRO II project, and shared with partners in various countries.

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

The fifth objective aims at providing guidance, outline principles, and allow for country teams and partners to learn lessons from monitoring experiences, and make adjustment and/or adaptations to the implementation of the project. It also provides partners with information on effectiveness and efficiency of dissemination approaches in their programmes across target countries.

1.5.1 ICT tools to collect data and provide feedback to stakeholder groups

To enable timely learning and integration of feedback in planning, an Information and Communication Technologies (ICT) platform has been enabled so that rapid feedback can be made on data collected in the field and allowed legume technologies to be adapted in the following seasons. In 2015, N2Africa has especially improved the flow of data from field to analysis. Most data collection was done using tablets. This has allowed data from the different field trials and partner results against indicators to be collected, processed, and compiled much more quickly than was possible using paper forms.

The first advantage of using tablets is that data do not need to be transferred from paper to an electronic form, thereby speeding up the delivery process. In addition, the tablet-based forms come preloaded with information on locations, crops, and treatments. This means that the data are much more uniform, and the need for time-consuming editing of information is removed. The built-in GPS device and camera also provide great benefits in the field, allowing more rapid monitoring and recording of crop condition.

An automated system for compiling, formatting, and sharing data has been set up during the past year. Data is automatically compiled and uploaded from the tablets into the database and information and is made available to all project members on the N2Africa Intranet. In this way, uploaded data are available within a couple of days after receipt and feedback loops can effectively feed the last year’s results into the planning for the next.

2 Achievements in relation to project milestones

Table 12. Progress Key milestones table 2015 N2Africa Project

Milestone	Indicator	2015	Target 2015	Cumulative target project end	% achieved 2015 target
Objective 1					
1.3. Partners along the legume input and output value chains cooperate actively towards achieving the overall N2Africa goals	# of partnerships developed and active	97 partnerships are active in 2015 as compared to 22 in 2014, with 81 formalized partnership agreements	21	32	461%
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	6 Master Plans have been completed, based on which each (11) country has partner-specific research and dissemination plans	5	5	120%
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	The plan has been developed in year 1. 13 PhD Students (5 female) and 34 MSc students (15 female) are being trained in both Core and Tier 1 Countries.	1	1	100%

Milestone	Indicator	2015	Target 2015	Cumulative target project end	% achieved 2015 target
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)*	In total, 7,962 persons from partner organizations have received non-degree training in 2015 as compared to 1,059 in 2014.	210	320	100% - overachieved
Objective 2					
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)*	257,404 households (farmers) have been reached in all countries. In 2015, total number of farmers reached increased by 56% as compared with 2014	157,500	555,000	163%
2.3. Local agro-dealers marketing fertilizer, seed, and inoculants are aligned with grassroot 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 agrodealers	Inoculants (7.96 tons), Seeds (625.2 tons), Fertilizer (628.2 tons)	Inoculants (16 tons), Seeds (1890 tons), Fertilizer (3150 tons)	6660; 11,100; 56	Inoculants (49%), Seeds (33%), Fertilizer (20%)

Milestone	Indicator	2015	Target 2015	Cumulative target project end	% achieved 2015 target
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	64 media events have been implemented in all Countries. These events exclude field days in 2015	20	50	over 300%
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	80,603 households are engaged in collective marketing as compared with 25,982 individual households in 2014 in all countries. Sales data (volumes sold) are still being compiled in various countries due to harvest time	75,000	275,000	107%
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	7 out of 11 N2Africa Countries locally produce inoculants. 3 countries obtain inoculants through importation. Inoculants are produced in Ethiopia, Nigeria, Uganda, Kenya, Zimbabwe, Rwanda and Malawi. In Tanzania, inoculants are registered for imports and sale.	3	5	100%, overachieved

Milestone	Indicator	2015	Target 2015	Cumulative target project end	% achieved 2015 target
		Other countries partner with other projects to facilitate permits and registration of inoculants.			
Objective 3					
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	Although not a target yet, 14 businesses with 4,133 women involved in seed production, legume processing and processing residues for livestock feed.	4	10	350%
3.3. Better knowledge of and access to household-level legume processing tools improves the nutritional status of women and children in at least 2 target countries	# of women using household level-legume processing technologies	660 women have been trained in using household-level legume processing technologies. The use of the technologies will be pursued in 2016.	2000	5000	0%
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	About 2000 farmers (56% women) validated various labour saving tools. The strategy to enhance the use of these tools will be pursued in 2016.	15,750	55,500	0%

Milestone	Indicator	2015	Target 2015	Cumulative target project end	% achieved 2015 target
3.5.1. By Q4 of year 3, relationships between grain nutritional quality and management / environmental conditions quantified	# of relationship equations quantified	Research plan has been developed for selected countries to analyse the relations between grain nutritional quality and G_LxG_RxExM.	2	5	0%
Objective 4					
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). # of target households (men/women headed) with 50% increased productivity through adaptation trials.	293 diagnostic, 2,018 demonstration and 21,212 adaptation trials have been conducted in all the countries.		275,000	
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.	Recommendations will be generated based on 2014 and 2015 complete agronomic research data.	10	15	0%
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)	More than 1000 new rhizobial isolates were identified for cowpea, groundnut, common bean, chickpea and faba bean of which 32 are candidate elite strains.		3	In progress, according to plan

Milestone	Indicator	2015	Target 2015	Cumulative target project end	% achieved 2015 target
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	SOPs for quality control and application have been developed in conjunction with the COMPRO II project, and shared with partners for use		5	In progress, according to plan
Objective 5					
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.	There is a project wide M&E system collecting data on partnerships, dissemination and research. The data are collected electronically through ODK and immediately available for analyses.	1	1	95%
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)	All countries are working with several dissemination partners with approaches tailored to country specific conditions. The effectiveness of the various approaches will be assessed in 2016.	0	16	In progress, according to plan

Milestone	Indicator	2015	Target 2015	Cumulative target project end	% achieved 2015 target
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	Not applicable yet	0	16	In progress, according to plan

3 Lessons learned and decisions made

Below we provide some examples of lessons learned and how these have been used to redirect N2Africa's activities.

- From previous years, modifications were explored of the nutrient management components of some legume technology packages. It appears that yield gaps of climbing beans can be nearly closed (80-90%) by adding potassium and liming to the P-package especially in the eastern highlands of Uganda. The major concern is the cost effectiveness and the appropriate dose needs to be established.
- Access to finance has been a critical factor in the adoption of technologies. Due to the intervention by N2Africa and its partners to integrate access to finance in DR Congo, it is now possible for farmers' organizations to have access to credit.
- During technology evaluation events in Ethiopia the majority of farmers selected plots treated with inoculants and phosphorus applications. Therefore, farmers who tested the technology (or participated in the FTDG learning groups) invariably agree on the use of the technology to enhance yields of target legumes in the coming season.
- Integration of results from 2014 demonstrations and feedback meetings with farmers resulted in a move from best-bet to best-fit technologies in Ghana. For example, results from the 2014 demos resulted in focusing only on groundnut varieties that performed well in the 2015 demos. Plant population has been integrated as one of the technologies as a result of diagnostic survey analysis.
- Data from diagnostic studies in Tanzania do not sufficiently provide the best indications of what nutrients are limiting. One big reason is the short distance variations within experimental fields, usually caused by past management (e.g., application of manure, fertilizers, etc.,) creating a steep fertility gradient. Diagnostic work therefore needs to be replicated per site (to minimize field variations) and supported by leaf sampling from farms around the trials/demos.
- Diseases and pests (including weeds) become important especially where the best treatments are applied. Therefore, input studies need to be complemented with IPM technologies, where available, to offer integrated solutions to farmers.

4 Challenges encountered in implementation

- In the north of Uganda, Agrinet established bulking centres, trained farmers in PHH, and was able to buy approximately 40 tons of soyabean grain. This was owing to competition with other buyers and the amounts purchased were dismal compared with the demand made to farmers for 300 tons per season. We recognize that farmers are yet to become more organized to meet such a demand. More group institutional strengthening is required.
- Despite the efforts made by N2Africa and its partners to scale out integrated legume packages in Mozambique, none of the packages were sold to farmers. There are many inherent constraints faced by agro-dealers due to capacity, credit, understanding, and risk-mitigation, among other factors that affect their input distribution channels. A market survey has been initiated to determine the underlying reasons.
- The vast operational areas of partners in Mozambique and DR Congo limit to some extent the close monitoring of on-going partner activities as well as the opportunities to explore new partnerships.
- Emerging diseases in Ethiopia (soyabean rust in the west and faba bean gall in the north) have become the most economically damaging diseases for the dissemination of legume technologies. The intensity of the faba bean disease exacerbates its devastating effects.
- Extreme delays in data submissions by partners in Ethiopia. The availability of collected data from partners for immediate analysis and learning has become more difficult to obtain in time. Frequent complaints have emanated from partners on the detail of the data tools and their requirements in compiling information. Researchers and dissemination partners are overstretched in undertaking duties in their institutions.
- Lack of a legume targeted fertilizer blend in Ethiopia: it was expected that new formulations of blended legume fertilizer would be supplied by the Ethiopian Agricultural Transformation Agency for the current cropping season. However ATA could not fulfil the target. DAP, which has a significant amount of N (18%), is the only available source of P fertilizer for wider use in Ethiopia. The expected benefits from rhizobia might be directly affected.
- In Kenya, collective marketing through WeRATE continues to pose challenges. Farmers remain reluctant to release their produce without payment, resulting in shortfalls at collection points. Buyers too often are slow to pick up and to pay. Operations are not based upon contractual arrangements. Fortunately, two new buyers have recently agreed to assigned recurrent quotas and spot payment during the next season.
- Scarcity of quality seeds of soyabean is a big challenge to farmers who want to expand soyabean cultivation. The new varieties released in Rwanda are owned by a private company, which has made it a complicated business, with high prices that are not affordable to farmers.
- Varieties of climbing beans require a lot of stakes, and this is a big challenge to poor households, leading to low yields owing to the use of inappropriate staking materials such as maize stalks.

- Lack of new strains of rhizobia for production of inoculants, disfunctional laboratory equipment, standard of technical expertise in the inoculant laboratory.
- Lack of labour-saving tools along the legume value chain: planting equipment, threshers, etc., especially for soyabean.
- Poor understanding of proposed partners' agreement by some development partners in DR Congo; delay in the signing of the agreement resulted in delay in the implementation of project activities.
- Relatively low demand for legume inoculants coupled with limited demand for information is not motivating registered agents, i.e., ETG and MEA Ltd in Tanzania to embark on importation and establish distribution channels. Related to this is the large size of packs of Legumefix, which may limit adoption of the technology by smallholder farmers (storability of the product after use is very difficult, especially in rural areas).
- The concept of partnership is still a new way of thinking in Uganda and most partners have not really adjusted to mainstreaming N2Africa within their strategies, but want it implemented as an independent project. Delays in the execution of partnership agreements led to some agronomy trials (climbing beans and groundnut) not being executed in the 2015A season by the research partners; trials were established only in the 2015B season. There is still inadequate capacity within partners' organizations to fully execute M&E data collection.

5 Opportunities identified

- The operational areas of N2Africa have been extended in most countries (e.g., extending soyabean to the Zambezi Valley in Mozambique) through partnerships and by attracting new partners (e.g., SNV in DR Congo, Conservation International, IFAD project ILRI and IITA in livestock integration system), and other partners in most countries. In Ghana, new projects on grain legumes with funding from USAID (Cowpea scaling up project, RING Project on soyabean, SIL Project) offer great opportunities for new partnerships to advance the goals of N2Africa. In Tanzania, a number of organisations are seeking to partner with N2Africa to address constraints around soyabean, beans, and groundnut markets. These include East Africa Grain Council (EAGC) and Food Trade. Others are private companies such as Yara and Syngenta who are promoting the use of legume fertilizer blends, and fertilizer and herbicides in legume production. Other funding opportunities: i) Grant to Farm Radio International (US$ 1.5m) from the IFAD - New Alliance ICT Extension Challenge Fund. The grant has a strong SMS and radio strand for work in Tanzania and, among other crops to be promoted, has three legumes. N2Africa is a main partner in this. ii) ASHC grant from BMGF on technology scaling up where N2Africa is also a partner.
- The gradual removal of the Government's subsidy on maize fertilizers and an increasing demand for grain legumes, particularly soyabean, are causing farmers from Ghana to gradually shift from maize production to soyabean production, leading to legume intensification.
- Demand for soyabean by processors and the large demand gap of about 40,600 tons per annum in Ghana has created an opportunity for legume intensification for the cereal-based farming system. A private factory processing common beans (precooked bean packaging), in Rwanda has been built and will provide a market opportunity for beans producers and consumers at the national/ regional level.
- Willingness of farmers to increase their production due to available markets for legume commodities through farmers' cooperatives, and the existence of processing factories.
- Opportunities for new partnerships in Uganda with J Fortunes, a private company that trades in climbing beans and is interested in engaging farmers in the eastern Highlands to produce a specific variety of climbing beans called large white. Simlaw Seed would like to engage with farmers' associations to produce seeds of bush beans and groundnut. Savannah Commodities Ltd is establishing a fertilizer blending plant in Mukono and is interested in a research partnership to formulate appropriate blends for cropping systems with maize, soyabean, and coffee but is also willing to buy the output. We exploring forging a partnership model to deliver fertilizer but also to buy the farmers' produce.
- The new strategy of World Vision Uganda (WVU) 2016-2020 has emphasis on partnerships and business /economic development focus in the Lake Victoria Crescent (LVC) and would like to expand to all the districts where they have livelihood activities. A continued partnership provides an opportunity to reach more farmers in the country and an avenue for tapping into more partnerships in different regions.

Appendix I – Overview of active partnerships

Table 13. Overview of active partnerships.

Country	Partner main - lead	Signed date:	AGTYPE	Number of additional partners	Pillars
ALL	Legume Technology UK		Cooperative/Collaboration Agreement		Inp
	Women for Women International (WfWI)	28-Nov-14	Grant Agreement		D
DRC	World Vision Malawi (WVI)	25-May-15	Cooperative/Collaboration Agreement		
DRC	ZOA Uganda (ZOA Uganda)	08-Sep-15			
DRC					
DRC	Plantations Ndagano	08-May-15	Cooperative/Collaboration Agreement		S
DRC	Adventist Development and Relief Agency (ADRA)	13-Nov-15	Cooperative/Collaboration Agreement		D, Inp, M, CB,
Ethiopia	Ethiopian Institute of Agricultural Research (EIAR) - Pawe Agricultural Research Centre	22-Jul-15	Cooperative/Collaboration Agreement	*5*	D, Inp, M, CB,
Ethiopia	Tsehay Multi Purpose Cooperative Union (Tsehay Union)	30-Jun-15	Cooperative/Collaboration Agreement	3	D, Inp, M, CB,
Ethiopia	Hawassa University (HwU)	30-Jun-15	Cooperative/Collaboration Agreement	*5*	D, Inp, M, CB,
Ethiopia	ILRI/N2Africa	21-Mar-15	Cooperative/Collaboration Agreement	4	D, Inp, M, CB,
Ethiopia	Menagesha Biotech Industry P.L.C. (MBI)	31-Dec-14	Grant Agreement	1	D, Inp, M, CB,
Ethiopia	SNV/Agritera-Cooperatives for Change (C4C)	16-Jul-15	Cooperative/Collaboration Agreement	*5*	D, Inp, M, CB,
Ethiopia	Facilitator for Change (FC)	22-Jul-15	Cooperative/Collaboration Agreement	3	D, Inp, M, CB,
Ethiopia	Bale Green Spices and Grain Development Plc.	16-Nov-15	Sub-Contract	3	D
Ethiopia	International Fertilizer Development Centre (IFDC)	06-Jul-15	Cooperative/Collaboration Agreement	*5*	D, Inp, M, CB,
Ethiopia	Bale Green Spice and Development Plc. (BSGD)	06-Jul-15	Cooperative/Collaboration Agreement	4	D, Inp, M, CB,
Ethiopia	Amhara Region Agricultural Research Institute (ARARI)	16-Jul-14	Sub-Contract		D
Ethiopia	Ethiopian Institute of Agricultural Research (EIAR)	16-Jul-14	Sub-Contract		D
Ethiopia	Hawassa University (HwU)	16-Jul-14	Sub-Contract		D
Ethiopia	Oromia Agricultural Research Institute (OARI)	16-Jul-14	Sub-Contract		D
Ghana	The Agricultural Cooperative Development International/Volunteers	07-Nov-14	Cooperative/Collaboration	3	D, Inp, M, CB,

Country	Partner main - lead	Signed date:	AGTYPE	Number of additional partners	Pillars
	in Overseas Cooperative Assistance (ACDI/VOCA)		ation Agreement		
Ghana	Evangelical Presbyterian Development and Relief Agency YENDI (EPDRA-Yendi)	29-May-14	Sub-Contract		D
Ghana	Urban Agriculture Network (UrbANET)	29-May-14	Sub-Contract		D
Ghana	Sungbawiera Foundation (SBF)	29-May-14	Sub-Contract		D
Ghana	Evangelical Presbyterian Development and Relief Agency - CHEREPONI (EPDRA- CHEREPONI)	29-May-14	Sub-Contract		D
Ghana	Savanna Agricutural Research Institute, Ghana (SARI, Ghana)	08-Jul-14	Sub-Contract		Variety evaluation Rh, Evaluation of non-responsive
Ghana	Kwame Nkrumah University of Science and Technology (KNUST)	08-Jul-14	Sub-Contract		soils, , ,
Ghana	BUSAKA Agribusiness Company Limited	22-Dec-14	Cooperative/Collaboration Agreement		D, Inp, M, CB,
Ghana	AgDevCo Ghana Limited	07-Jan-15	Cooperative/Collaboration Agreement		D, Inp, M, CB,
Ghana	SEND-GHANA (SEND-GHANA)	21-Apr-15	Cooperative/Collaboration Agreement		
Ghana	Youth Advocacy on Rights and Opportunities (YARO)	02-Jun-15	Cooperative/Collaboration Agreement		
Ghana	Youth Advocacy on Rights and Opportunities (YARO)	06-Aug-15	Sub-Contract		
Ghana	BUSAKA Agribusiness Company Limited (BUSAKA)	06-Aug-15	Sub-Contract		
Ghana	Green-Ef Eco-Business Village Limited (Green-Ef)	09-Nov-15	Cooperative/Collaboration Agreement		Inp
Kenya	Western Region Agricultural Technology Evaluation (WERATE)	07-Mar-14	Sub-Contract		D
Kenya	Western Region Agricultural Technology Evaluation (WERATE)	14-Jan-15	Sub-Contract		
Kenya	Annapolis Wonder Enterprises (AWE)	19-Jan-15	Sub-Contract		
Malawi	Inter-church Organization for Development Cooperation (ICCO) - Churches Action in Relief and Development (CARD)	15-Jun-15	Cooperative/Collaboration Agreement		
Mozambique	The USAID AgriFUTURO (AgriFUTURO)	10-Sep-14	Cooperative/Collaboration Agreement		D, Inp, M, CB,
Mozambique	The National Cooperative Business Association. CLUSA International (NCBA CLUSA)	28-Aug-15	Cooperative/Collaboration Agreement		
Nigeria	United States Agency for International Development - Maximizing Agricultural Revenue and Key Enterprises In Targeted Sites II Project (USAID- MARKETS II)	29-Sep-15	Cooperative/Collaboration Agreement	*3*	D, S, M, CB,
Nigeria	Abednego Youth Development Foundation (AYDF)	26-Jun-15	Sub-Contract	1	D, S, M, CB,
Nigeria	The Inventive Minds (TIM)	30-Jun-15	Sub-Contract	1	D, S, M, CB,
Nigeria	Palm Valley Nigeria Ltd (PVNL)	30-Jun-15	Sub-Contract	1	D, S, M, CB,
Nigeria	Hybrid Agro-business Consultant Ltd (HABC)	29-Jul-15	Sub-Contract	1	D, S, M, CB,
Nigeria	Notore Chemical Industries Limited (NOTORE)	27-Jun-15	Sub-Contract	2	Inp, CB, , ,

Country	Partner main - lead	Signed date:	AGTYPE	Number of additional partners	Pillars
Nigeria	SG 2000 'promoting the adoption and scaling up of improved agricultural technologies that increase the productivity and incomes of smallholder farmers in Africa (SG2000/AGRA-IEP)	09-Jul-15	Sub-Contract	1	D, Inp, M, CB,
Nigeria	CRS Support to Vulnerable Households for Accelerated Revenue Earnings (CRS-SHARE)	07-Jan-15	Cooperative/Collaboration Agreement	1	D, S, M, CB
Nigeria	EGALF Ventures Ltd (EGALF)	07-Oct-15	Sub-Contract	1	D, S, M, CB,
Nigeria	Niger State Agricultural and Mechanization Development Authority (NAMDA)	17-Aug-15	Sub-Contract	1	D, Soyabean
Nigeria	Niger State Agricultural and Mechanization Development Authority (NAMDA)	11-Sep-15	Sub-Contract	1	D, Cowpea
Nigeria	WACOT		Cooperative/Collaboration Agreement	1	D, S, M, CB,
Nigeria	Kaduna State Agricultural Development Project (KADP)	15-Jul-14	Sub-Contract		D
Nigeria	Sasakawa Global 2000 (SG2000)	23-Jul-14	Sub-Contract		D
Nigeria	Niger State Agricultural and Mechanization Development Authority (NAMDA)	24-Jul-14	Sub-Contract		D
Nigeria	The Borno State Agricultural Development Project (BOSADP)	12-Aug-14	Sub-Contract		D, S, M
Nigeria	Notore Chemical Industries Limited (NOTORE)	01-Mar-14	Cooperative/Collaboration Agreement		Inp, D
Nigeria	CRS Support to Vulnerable Households for Accelerated Revenue Earnings (CRS-SHARE)	15-Jan-15	Sub-Contract		D, S, M, CB
Nigeria	Institute for Agricultural Research (IAR) Ahmadu Bello University, Zaria	28-Apr-15	Sub-Contract		Diag
Nigeria	SG 2000 'promoting the adoption and scaling up of improved agricultural technologies that increase the productivity and incomes of smallholder farmers in Africa (SG2000/AGRA-IEP)	03-Jul-15	Cooperative/Collaboration Agreement		D, S, M, CB
Nigeria	Federal University of Technology Minna (FUT Minna)	11-Aug-15	Sub-Contract		Diag
Nigeria	Bayero University Kano (BUK)	17-Aug-15	Sub-Contract		Diag
Nigeria	SG 2000 'promoting the adoption and scaling up of improved agricultural technologies that increase the productivity and incomes of smallholder farmers in Africa (SG2000/AGRA-IEP)	05-Oct-15	Sub-Contract		D, S, M, CB
Rwanda	Development Rural Durable (DRD)	28-Apr-15	Sub-Contract		
Rwanda	Conseil Consultatif des Femmes (COCOF)	11-Jun-15	Sub-Contract		
Rwanda	Caritas Rwanda (Caritas Rwanda)	15-Jun-15	Sub-Contract		
Rwanda	Eglise Presbyterienne au Rwanda (EPR)	15-Jun-15	Sub-Contract		
Tanzania	CABI	01-Oct-15	Grant	*5*	D, Inp

Country	Partner main - lead	Signed date:	AGTYPE	Number of additional partners	Pillars
			Agreement		
			Project Support Consultancy		
Tanzania	iLogix	19-May-15	Agreement	1	S
Tanzania	Export Trading Group (ETG)		Cooperative/Collaboration Agreement	1	Inp
Tanzania	CABI		Cooperative/Collaboration Agreement	1	D, Inp, M, CB
Tanzania	Rural Urban Development Initiatives (RUDI) - Integrated Project to Increase Agricultural Productivity in the Breadbasket Area of Southern Highlands of Tanzania Project	08-May-15	Cooperative/Collaboration Agreement	2	D, Inp, M, CB
Tanzania	Nelson Mandela Africa Institute of Science and Technology (NM-AIST)	27-Aug-14	Sub-Contract		Rh
Tanzania	Catholic Relief Services (CRS)	09-Jan-15	Cooperative/Collaboration Agreement		D, Inp, M, CB
Tanzania	SNV Netherlands Development Organisation		Cooperative/Collaboration Agreement		D, Inp, M, CB
Tanzania	The Clinton Foundation		Cooperative/Collaboration Agreement		D, Inp, M, CB
Tanzania	Agricultural Research Institute, Makutupora (ARI Makutupora)	13-Jan-15	Sub-Contract		D, Diag
Tanzania	Agriculture Research Institute -Uyole (ARI-UYOLE)	14-Jan-15	Sub-Contract		D, Diag
Tanzania	FAIDA MARKET LINK (FAIDA)	04-Feb-15	Sub-Contract		M, CB
Tanzania	ARI - SELIAN (ARI - SELIAN)	15-Apr-15	Sub-Contract		D, Diag
Tanzania	BRAC Maendeleo Tanzania (BRAC, Tanzania)	09-Oct-15	Cooperative/Collaboration Agreement		D, Inp, M, CB
Uganda	World Vision, Uganda	16-Apr-15	Cooperative/Collaboration Agreement	*5*	D, S, M, CB, Diag, D, S
Uganda	Africa 2000 Network Uganda (A2N)	30-Apr-15	Sub-Contract	*5*	CB
Uganda	VECO Uganda		Sub-Contract		D
Uganda	National Agricultural Research Laboratories (NARL)	20-Mar-15	Sub-Contract		Diag
Uganda	Makerere University (MAKERERE)	14-Apr-15	Sub-Contract		Rh
Uganda	World Vision, Uganda	16-Apr-15	Sub-Contract		D, S, M, CB
Uganda	National Crops Resources Research Institute (NaCRRI)	22-Apr-15	Sub-Contract		D
Uganda	Organisation Néerlandais de Développement (Netherlands Development Organization) (SNV) - The Uganda Oilseed Subsector Platform (OSSUP)	01-May-15	Cooperative/Collaboration Agreement		Platform Groundnut
Uganda	National Agricultural Research Organization (NARO)	22-Jul-15	Sub-Contract		Research, Diag, D, CB
Zimbabwe	International Livestock Research Institute (ILRI) - University of Zimbabwe (UZ)	17-Aug-15	Material transfer		

Country	Partner main - lead	Signed date:	AGTYPE	Number of additional partners	Pillars
	Farm Radio International (FRI)			1	

* Pillars: Inp = inputs supply, D = dissemination, CB = capacity building, S = seed systems/seed multiplication, M = market linkages, Diag = diagnostics, Rh = Rhizobiology

Appendix II – PhD and MSc student overview

Table 14. Overview of PhD students involved in N2Africa Phase II.

Country	Name	Gender	Research
Ethiopia	A. Hailu	M	Understanding host legume x rhizobium strain interactions in common bean and chickpea
Ghana	B.D. Akapo	M	Grain legume residues as a livestock feed resource for smallholders in Northern Ghana
Nigeria	O. C. Tinuade	F	Exploring the potential benefits of rhizobium inoculation with cowpea in Nigeria
Nigeria	T. D. Kehinde	M	Phenotyping and yield stability studies in soyabean under rhizobia inoculation
Nigeria	A.A. Oluatan	F	Physiological responses of cowpea varieties to rhizobia inoculation, nutrient management and sowing dates in Nigeria Southern Guinea Savanna
Tanzania	E. Kisetu	M	Intensification of common bean cultivation on smallholder farms in the Northern Highlands of Tanzania
Uganda	A. Ochieng	M	Understanding the need for inoculation of common bean in smallholder farming in Uganda
Borno State	F.G. Umar	M	Rhizobiology
Borno State	B.A. Zongoma	F	Agricultural Economics
The Netherlands	E. Ronner	F	Co-design of 'baskets of options' of improved legume technologies for African smallholder farmers
The Netherlands	I. de Jager	F	Agricultural productivity and nutrition: linkages and drivers of smallholder farmers in Ghana and Kenya

M= male, F=female

Table 15. Overview of MSc students involved in N2Africa Phase II.

Country	Name	Gender	Topic
Ghana	G. Wilson	M	Bio-prospecting for effective rhizobia isolates for groundnut and cowpea
Ghana	F.J. Kumah	F	Influence of P source on growth, nodulation and nitrogen fixation by different soyabean genotypes in two acid soils in northern Ghana
Ghana	G. Mensah[1]	M	
Ghana	K. Ahlija	M	Response of soyabean to rhizobial inoculation and nitrogen management
Ghana	J.T. Dankwa	M	Effect of rhizobial inoculation and P application on growth, N-fixation, and yield of soyabean
Ethiopia	Dagmawit Getachew	F	Factors influencing the adoption of agricultural technology
Ethiopia	Yitbarek Tegegne	M	Relating Farmers' Technology Adoption with their Livelihood Performance:
Ethiopia	Getahun Negash	M	Symbiotic effectiveness and host range of indigenous rhizobia isolated from root nodules of different varieties of faba bean (*Vicia faba*)
Nigeria	I.M. Mustapha	M	Cowpea rhizobiology. Topic to be finalized
Nigeria	A.N. Okpobo	M	Effects of tillage, variety, and starter nitrogen on soil physical quality, root profile, biological nitrogen fixation and inoculated soyabean performance at Minna, Nigeria
Nigeria	M. Musa	M	Response of cowpea to mycorrhizae and rhizobium inoculum for the management of *Striga gesnerioides*
Nigeria	M. Haliru	M	Determinants of input demand and adaptation of grain legumes and associated technologies of N2Africa in Kano State, Nigeria.
Nigeria	Gambo Umar[1]	M	Response of soyabean to rhizobial inoculation and phosphorus application
Tanzania	Y. Namkeleja	M	Isolation, authentication, and evaluation of symbiotic effectiveness of elite rhizobia strains for *Phaseolus* bean in Hai District, Tanzania
Borno State	M.N. Isa[4]	M	Soil Microbiology (Rhizobiology). Topic to be finalized
Borno State	A.M. Sherrif[4]	M	Legume Agronomy. Topic to be finalized
Borno State	A.A. Ghide[4]	F	Agricultural Economics. Topic to be finalized
Borno State	M.M. Baba[4]	F	Agricultural Economics. Topic to be finalized
Zimbabwe	V. Chekanai[2]	F	Common bean agronomy using both improved and local varieties
Zimbabwe	T. Taguta[3]	F	
The Netherlands	L. van Reemst[1]	F	Evaluation of smallholder adaptation of climbing bean technologies in Kapchorwa district, Uganda
The Netherlands	W. Marinus[1]	M	Opportunities and constraints for climbing bean cultivation by smallholder farmers in the Ugandan highlands: A basket of options?
The Netherlands	J. Huskens[1]	M	Climbing bean (*Phaseolus vulgaris L.*) cultivation and its diffusion in Kapchorwa district, Uganda

M= male, F=female

[1] Student having collaborative research or internship with N2Africa
[2] New MPhil student
[3] MPhil student finalizing from Phase I
[4] Enrolment not yet formalized

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 soyabeans, common beans, cowpeas and groundnuts varieties with proven high BNF potential and sufficient seed availability in target impact zones of N2Africa Project
10. Project launch 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 seed 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 Seed 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. Identified 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. Launch 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 Launch 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

Partners involved in the N2Africa project

A2N

Bayero University Kano (BUK)

Caritas Rwanda

Diobass

Eglise Presbyterienne Rwanda

Ethiopian Institute of Agricultural Research

Kwame Nkrumah University of science and Technology

MIRCEN
University of Nairobi MIRCEN

Resource Projects-Kenya

Sasakawa Global; 2000

Université Catholique de Bukavu

University of Zimbabwe

Urbanet