Plans for interaction with the Tropical Legumes II project (TLII) and for seed increase on a country-by-country basis

Milestone reference number: 1.2.1, 1.2.5, 1.2.7

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N2Africa

Putting nitrogen fixation to work for smallholder farmers in Africa

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This report has been prepared to fulfill milestones 1.2.1, 1.2.5 and 1.2.7; namely

1.2.1 By month two of year 1 hold TLII meeting.

1.2.5 Detailed country-by-country seed increase plan developed (month 6 year 1)

1.2.7 Final TLII interaction plan developed (month 6 year 1)

1 Introduction

This seed increase and TLII interaction plan is critical to the success of N2Africa because one of the first steps to achieving the milestones related to Objective 4: "Deliver legume and inoculants technologies to farmers throughout sub-Saharan Africa" is to have seed of improved varieties of soybean, common bean, groundnut and cowpea available for farmers to plant.

N2Africa is determined to deliver a combination of technologies such as improved varieties of grain legumes, rhizobium inoculum, improved agronomic practices and P fertilizer to African farmers that will dramatically increase crop production. We are committed to do this with partners such as the private industry, and the various governmental and nongovernmental organizations so that these technologies that increase crop production will continue to be available to the producers after N2Africa has ended. We have decided to combine reports on several milestones that involve interactions with TLII and the seed increase plan as all of these involve interaction with TLII scientists. TLII is leading the development of improved varieties of grain legumes in Africa has used a large number of different models for seed multiplication and we can learn from their experience. Although the N2Africa project was only launched officially in January 2010, the TLII and N2Africa projects have already integrated their activities, planning, and communications.

This implementation plan has been developed because for N2Africa to meet the projected impacts of directly reaching 225,000 households and greatly improving crop productivity on 109,831 ha in eight countries by the fourth year of the project we must have been successful with several different activities. Two of the most important activities are: 1) identify highly productive varieties of grain legumes well adapted to the action sites with high rates of nitrogen fixation and 2) ensure that sufficient seed of these highly productive varieties is available in all eight countries.

2 Objectives

This milestone report is particularly relevant to the following project objective:

Objective 4: Deliver legume and inoculant technologies to farmers in eight targeted countries within three impact zones

Activities

4.3. Engage with other legume seed production and marketing activities, farm input, commodity marketing and processing initiatives, and household and children's nutrition programs operating throughout the impact zones.

and the following future milestones.

4.3.1 Sufficient (several tons) legume seed is acquired through cooperation with TLII and private seed companies (month 12 year 1)

4.3.2 At least half of the farming communities engaged in the project are actively producing legume seed (month 2 year 2)

4.4.2 Large scale demonstration and dissemination campaigns held in each impact zone (month 6 all years)

3 General Principles

- Work with agro dealers and seed companies.
- Work as partners with TLII and take advantage of their experience with using several different methods to multiply and distribute legume seeds.
- Help TLII increase productivity in their seed multiplication programs with improved agronomy and inoculum.
- Have regular M&E of seed multiplication activities.
- Identifying the best two or three varieties of each crop in year one is critical and seed multiplication of these varieties must start as soon as they are identified.
- The dissemination activities must be implemented each year with seed of available, released varieties even if seed of the best varieties is not sufficient to be distributed to all participating farmers.
- With the high grain yields we anticipate on farmers fields, community-based seed programs should be the best option in most or all countries.
- The training workshops on legume and inoculants technologies for agro-dealers and officers of farmer associations and community-based associations will include seed harvesting, cleaning, sorting storage, transportation and handling.
- There will never be one variety that has all the preferred traits needed by farmers and consumers so it is important to offer 3-4 different varieties with different characteristics so that farmers can choose one or more varieties.

N2Africa Policy on Seed

- All large-scale (commercial) farmers buy all seed.
- Always seek some form of (serious) farmer investment (e.g. seed loans, vouchers, returning 2-fold or 3-fold the amount of seed given at planting after harvest to the project to benefit other nearby farmers).
- If farmers are given seed then maximum of 1 kg of seed one time only for on-farm testing.
- The project should support sale models wherever possible (e.g. Agrovets, open markets, local shopkeepers, mobile trucks).
- When new improved varieties are identified and seed is available in years 3 and 4 the farmers that have participated in the project in earlier years should have the opportunity to purchase seed of the new variety even if it is only 100 g.

4 Specific Implementation Plan

Cooperation with the Tropical Legumes II (TLII) project

During our grant preparations with the Bill & Melinda Gates Foundation we had discussions with Dr Tsedeke Abate, leader of the Tropical Legumes II (TLII) project (see www.icrisat.org/tropicallegumesII/). We agreed on a set of principles for cooperation between the TLII project and N2Africa, namely:

"The N2Africa project will receive newly-released varieties and elite breeding materials of the major legumes and screen them for nodulation and N2-fixation ability. No breeding activities will take place within the N2Africa project itself but rather it will rely upon TLII and affiliated national programs."

Interactions with TLII include:

- Very early in the project, leaders from TLII and N2Africa will develop a joint implementation plan (Milestone 1.2.6) and representatives will attend each others' annual planning meetings to ensure streamlining of activities.
- N2Africa will provide to TLII a protocol of methods for breeding conditions to be used within TLII to ensure optimal selection for N_2-fixing ability (without N fertilizer, rhizobial inoculation, adequate P availability etc). This will be accomplished by holding a one day workshop during 2010.
- TLII will provide to N2Africa newly-released varieties and advanced elite breeding materials of the major legumes. These materials will be screened for BNF to select varieties for multiplication.
- N2Africa will test elite rhizobial strains with the selected varieties to identify appropriate rhizobial strains for scaling-up as inoculants.
- TLII will share with N2Africa advice on seed multiplication approaches.
- N2Africa will provide to TLII inoculants of elite rhizobial strains for use in breeding and seed multiplication.
- N2Africa will provide to TLII technical advice on methods for routine screening for N_2-fixation."

Ken Giller and Prem Warrior attended the TLII annual meeting in Bamako, Mali from 15-20th November 2009. During this meeting Ken Giller was allotted an hour in the meeting program during which he introduced the project with a slide presentation (see Appendix 1). There was ample time for discussion with participants within TLII to discuss varieties that should be used by N2Africa, and to discuss approaches on seed systems. During this meeting contact with Dr Louise Sperling of the CIAT Bean Program led her to being invited to join the steering committee for N2Afica to give oversight on seed systems approaches. The leaders of TLII (Dr Tsedeke Abate) and N2Africa (Dr Ken Dashiell) met in Nairobi in March 2010 and have confirmed the above priorities for joint work. The projects are currently working closely together to identify sources of foundation seed of appropriate varieties of the four legume crops that will be used by N2Africa.

There is also very good interaction already established at the in country and on the ground implementation level. The N2Africa Hub Leader for Southern Africa is based in the same building as the TLII Soybean Breeder in Malawi. The N2Africa Hub Leader for West Africa is based in the same building as the TLII Systems Agronomist in Nigeria and the N2Africa Hub Leader for East and Central Africa is based in the same building as two TLII Research Technicians.

Table 1: Approximate quantity of seeds needed by the eight countries during their first season

(Please note that the countries in Southern Africa will not plant during year one of the project and thus will have only three crops during the four year project.)

WEST AFRICA (for the May 2010 season)	
Nigeria	▪ Cowpea: 4 varieties (250 kg each) ▪ Soybean: 4 varieties (250 kg each) ▪ Groundnut: 4 varieties (250 kg each)
Ghana:	▪ Cowpea: 4 varieties (250 kg each) ▪ Soybean: 4 varieties (250 kg each) ▪ Groundnut: 4 varieties (250 kg each)
EAST/CENTRAL AFRICA (for the February 2010 season)	
Kenya:	▪ Soybean: 4 varieties (250 kg each) ▪ Bush beans: 3 varieties (333 kg each) ▪ Climbing beans: 3 varieties (333 kg each)
Rwanda:	▪ Soybean: 4 varieties (125 kg each) ▪ Bush beans: 3 varieties (167 kg each) ▪ Climbing beans: 3 varieties (167 kg each)
East DRC:	▪ Soybean: 4 varieties (125 kg each) ▪ Bush beans: 3 varieties (167 kg each) ▪ Climbing beans: 3 varieties (167 kg each)
SOUTHERN AFRICA (for the October 2010 season)	
Malawi:	▪ Soybean: 4 varieties (490 kg each) ▪ Groundnut: 4 varieties (270 kg each) ▪ Bush beans: 3 varieties (440 kg each) ▪ Cowpea: 3varieties (50 kg each)
Zimbabwe:	▪ Soybean: 4 varieties (380 kg each) ▪ Groundnut: 4 varieties (240 kg each) ▪ Bush beans: 3 varieties (505 kg each) ▪ Cowpea 3 varieties (120 kg each)
Mozambique:	▪ Soybean: 4 varieties (420 kg each) ▪ Groundnut: 4 varieties (120 kg each)

TLII has two years of practical experience with community based seed multiplication of the four grain legumes in four (Nigeria, Kenya, Malawi and Mozambique) of our eight target countries. Our project is committed to learn more about the best approaches that have worked well and pattern our implementation after theirs and also learn about the problems they have encountered and avoid them.

The leaders of their seed multiplication activities will be participating in our country planning meetings and/other planning meetings throughout the four years of our project. With this close interaction of TLII and N2Africa Staff experiences learned by TLII will be immediately shared with N2Africa and vice versa.

Table 2: Seed production (MT of various categories) under TL II for the period 2007-2009 Country.

	Crop				
Country	**Groundnut**	**Common bean**	**Cowpea**	**Soybean**	**Total**
Nigeria	101.5	-	161.86	123.2	**386.56**
Kenya	-	113	-	47.1	**160.1**
Malawi	367	-	-	70.74	**437.74**
Mozambique	-	-	43.7	189.8	**233.5**
Total	**468.50**	**113.00**	**205.56**	**430.84**	1,217.90

This table has been edited from TLII report to include only N2Africa countries and crops.

4.1 Progress Checks that start during year two

Progress Check 1: The N2Africa Farm Liaison Specialist in each country will have contact with seed multiplication organizations working in collaboration with N2Africa to determine their current stock or expected stock of seed relevant to N2Africa and their distribution points. If more support from an organization is needed then a meeting will be held as needed.

Progress Check 2: The N2Africa Farm Liaison Specialist in each country will have contact with Agro Dealers that have been involved with N2Africa and determine their current stock or expected stock of seed, fertilizers, inoculum and other supplies relevant to N2Africa and their distribution points. If more support from an Agro Dealer is need then a meeting will be held as needed.

Progress Check 3: The hub leader in consultation with members of the country teams will develop Tables for each crop in each country that describes the progression of area planted by farmers working with our project. This table and similar tables made for yield and total production will then be used within our M&E plan to monitor the progress we are making relative to our goals for area planted, yield and total production and adjustments will be made to our seed production plans, Dissemination plans and other plans if needed.

Table 3: Estimated area (ha) planted to soybean by N2Africa farmers in Ghana using improved technologies in years one through four.

This table assumes that farmers will plant 0.02 ha in the first year, 0.2 ha in their second year and 0.4 ha in their third and fourth year.

The goal for soybean in Ghana for the fourth year is 3,250 ha so the assumptions made when preparing this table meet the goal.

This is a hypothetical table given as an example but a table similar to this needs to be prepared by each country team for each crop using actual estimared values based on M&E data.

It could be more complicated than one table as there could be different values for farmers based on location, age, gender, market access, farm size etc.

	Number of farmers	**Year 1**	**Year 2**	**Year 3**	**Year 4**
		Ha			
1st Set	1,000	20	200	400	400
2nd set	2,000		40	400	800
3rd set	7,000			140	1400

4th set	27,000				540
Totals	37,000	**20**	**240**	**940**	**3,240**

5 Strategy for monitoring and evaluation and revising country-specific strategies.

The M&E scientist will use the three Progress Checks described in this report to keep all N2Africa Staff and partners informed about progress related to seed supply area planted to improved varieties and crop yields. When progress is less then expected all team members involved in that activity will need to meet and develop a revised plan to address the deficiency and help move the progress back to the expected level.

6 Country-specific implementation plans for seed production

Background

Dissemination actions are covered within the N2Africa Project under *Objective 4: Deliver legume and inoculant technologies to farmers throughout sub-Saharan Africa*

4.3. Engage with other legume seed production and marketing activities, farm input, commodity marketing and processing initiatives, and household and children's nutrition programs operating throughout the impact zones.

Table 4: Outreach targets for different hubs and countries over the project lifetime

Sub region	**Year**				**Total**
Country	**1**	**2**	**3**	**4**	
	------ number of empowered households -------				
East & Central Africa	***2000***	***4000***	***14000***	***55000***	***75000***
Kenya	1000	2000	7000	27500	37500
DR Congo	500	1000	3500	13750	18750
Rwanda	500	1000	3500	13750	18750
Southern Africa	***0***	***6000***	***14000***	***55000***	***75000***
Malawi	0	2400	5600	22000	30000*
Mozambique	0	1200	2800	11000	15000*
Zimbabwe	0	2400	5600	22000	30000*
West Africa	***0***	***6000***	***14000***	***55000***	***75000***
Ghana	1000	2000	7000	27500	37500
Nigeria	1000	2000	7000	27500	37500
Total	**4000**	**14000**	**42000**	**165000**	**225000**

The project will work with 225,000 farm households in eight countries and three African sub-regions over four years. These households are reached in gradually with 4000 in Year 1, 14,000 in Year 2, 42,000 in Year 3 and 165,000 in Year 4, with 75,000 in each of three sub-regional "hubs" (see Table 1). In the East and Central African sub-humid midlands and highlands, it will operate in west Kenya, Rwanda and east DR Congo. The onset of rains is early in this hub (February and March), so deployment of the first year's outreach materials occurred prior to the preparation of this report. In Southern African Plateau, the project operates in Malawi, Mozambique and Zimbabwe although because of its monomodal seasonal rains beginning late in the year (November) outreach activities of years 1 and 2 are combined. In the West African savannah, it operates in the northern Guinea savannas of Ghana and Nigeria. The targets for each of the countries presented in Table 1 are presented as a guide and in a more recent review of these numbers (Appendix D July 2009) the total number of households targeted was Malawi 30,000, Zimbabwe 30,000 and Mozambique 15,000. The funds available for materials to work with each household are $7, $6, $5 and $4 during years 1, 2, 3 and 4, respectively. This includes the cost of developing dissemination tools (Activity 4.2) and local community demonstrations (Activity 4.4). These activities target both women and men but to ensure the full participation of women there is a separate budget for the empowerment of women participants (Activity 4.5).

Objectives, outputs and milestones

Task 4.3.1: involves the acquisition of improved legume seed varieties and care must be taken to incorporate multiplication of these seeds into the dissemination campaigns.

Task 4.3.1: At least half of the farming communities engaged in the project are actively producing legume seed for local distribution

General approaches to extension activities/seed multiplication

Target technologies. This project coincides with the development and emerging availability of several improved grain legume varieties including promiscuously nodulating soyabean, disease resistant groundnuts, prolific climbing bean and higher yielding cowpeas (see the N2Africa report "Selected soybeans, common beans, cowpeas and groundnuts varieties with proven high BNF potential and sufficient seed availability in target impact zones of N2Africa Project).

Activities that are expected in all eight countries to ensure enough seeds are available to meet project objectives.

- Distribution of a small grain legume "starter kit" consisting of improved seed, phosphorus and where beneficial, inoculants and adhesives. This action is best conducted during years 1 and 2 and any time the project moves into new areas.
- Initiating community-based seed production in Years 1 and 2 that provides the much larger quantities of seed required for the scaling-up during Years 3 and 4 (see Table 1). Incentives for initiating community-based seed production may be offered by providing P fertilizer to farmers agreeing to produce seed for their members or for the project.
- With the high grain yields achieved by the farmers that are using the improved grain legume production technologies they can usually achieve at least a 20 fold increase in seed each season. When this multiplication rate is combined with appropriate community-based seed production we are assured that there will be enough seed available to meet our goals of number of farmers and area planted.

- For farmers to continue to have high grain yields that give these high seed multiplication rates farmers must be able to purchase appropriate fertilizers and inoculum close to their farm. The project must start working directly with agro dealers, fertilizer companies and inoculum producers as soon as possible.
- Promotion of a cost effective, more advanced "production package" where farmers invest in locally proven grain legume production enterprises designed by the findings of the agronomic and microbiology activities, and that includes the best legume varieties, proven adhesives, strains and seed coating technologies and needed fertilizer. These packages or components of them are best extended on credit through farmer associations or marketed by local stockists. Further improving rhizobial inoculants in terms of strain persistence, carriers, handling procedures and shelf life and promoting these breakthroughs as an inoculant retailers "sales kit" so that needed inoculants are sold at the time and place of legume seed purchase.
- It is possible to plan the exact seed production activities that will need to be implemented during years 2, 3, and 4. However, what we learned at the end of the first growing season in Kenya was that these plans must be reviewed at the end of each growing season. One example will be given to illustrate this. 1) Five of the 12 organizations that we work with were multiplying seeds of climbing bean during the first season. The plan was for the project to purchase seeds from each of these five organizations to distribute to the other seven. However four of the organizations that multiplied were so impressed with this new technology that there members decided that they must keep all of the seeds for distribution within their organization. The project has now been able to source more climbing bean seeds from other sources for distribution to the other seven organizations.
- The detailed planning for seed multiplication activities in years 2, 3, and 4 will be given top priority after the harvest when planning begins for the next season.

6.1 Country-specific implementation plan: Kenya

Inputs Secured. Sources of seed, inoculants, adhesives and fertilizers were identified as:

1. ***Seed:*** soybean var SB 19, bush bean var New Rosecoco, climbing bean var Kenya Mavano. Soybean was obtained from TSBF (850 kg) and beans from TL2/UoN (260 kg). Presently 755 kg of seed are being multiplied by outreach cooperators in west Kenya. Seed of SB 20 (450 kg) was also purchased ($1.20 per kg) for outreach activities during the 2010 long rains.

Photograph 1 Components of the N2Africa: West Kenya Outreach Dissemination Tool.

Field protocols developed. Next three field protocols were developed and materials assembled, one each for legume enterprise, soybean inoculation requirements and climbing bean management. The legume enterprise is considered the core field demonstration that describes six "best practice" legume management technologies for bean and soybean, inoculated and not inoculated, with each demonstration packaged into a 20 liter bucket assembled at two different distribution points. Thirty (30) of these demonstrations were prepared for distribution in 16 administrative districts of west Kenya and 50 satellite farmers provided "take-away" kits from each one. These "take-away" kits consisted of 400 g of recently inoculated seed, 2 kg of fertilizer and instructions translated into Kiswahili. Report forms were also developed to formalize information collected from these demonstrations. Laminated signs describing legume technologies for use in upcoming farmer field days were prepared by a local printer. These demonstration packages and accompanying information (Photograph 1) represent a

prototype dissemination tool described in Activity 4.2, and its deployment a central feature in the Year 1 extension campaign targeting 1500 households in West Kenya (Activity 4.4).

Technologies Deployed. The outreach effort established 52 demonstrations, established community-based seed production with 652 kg of seed and provided 1550 farm households with BNF technology test packages intended for 200 m^2 each. These 48 ha of soybeans and beans are expected to produce 130 tons of grain worth $70,530.

Table 5: N2Africa Kenya Outreach partners and their involvement in field campaigns during the 2010 long rains growing season

Organization	Role[1]	Demonstrations			Seed production		Member households	
		core	CB	SB	CB	SB	N2A participants	total
		---------- no ----------			---------- kg --------		---------- no ----------	
Hagonglo	CBO	2	0	1	0	50	100	2100
SCC	WG	2	0	0	0	0	100	500
Kleen H&G	CBO	2	1	1	20	35	100	500
BuSSFFO	FA	3	1	1	0	90	150	1230
BSFF	FA	2	1	1	20	0	100	1000
MUDIFESO	CBO	2	1	1	0	0	100	1000
URIRI	FA	2	0	1	10	100	100	1105
CYEEP	CBO	2	1	1	0	35	100	600
RPK	NGO	1	1	1	22	0	50	5500
KenSOFA	FA	2	1	1	0	100	100	10000
BFFS	FA	2	1	0	0	35	100	500
ARDAP	NGO	1	1	1	20	40	50	1000
Maseno	UOP	2	0	0	0	0	100	300
ACCAUN	FA	2	1	0	10	70	100	1600
SCODP	NGO	1	0	0	0	0	0	na
UCRC	NGO	1	0	0	0	0	50	na
Nambale	WG	1	0	0	0	0	50	50
AVENE	FA	1	0	0	0	0	50	na
Mwangaza	FA	1	0	0	0	0	50	na
19 organizations		32	10	10	102	555	1550	26985

[1] Roles: CBO = Community-based Organization, FA = Farmer Association, NGO = Non-governmental Organization, UOP = University Outreach Program and WG = Women's Group.

Table 6: N2Africa Kenya Outreach partners and their involvement in field campaigns during the 2010 long rains growing season.

Organization	Role[1]	Demonstrations			Seed production		Member households	
		core	CB	SB	CB	SB	N2A participants	total
		---------- no ----------			---------- kg ----------		---------- no ----------	
Hagonglo	CBO	2	0	1	0	50	100	2100
SCC	WG	2	0	0	0	0	100	500
Kleen H&G	CBO	2	1	1	20	35	100	500
BuSSFFO	FA	3	1	1	0	90	150	1230
BSFF	FA	2	1	1	20	0	100	1000
MUDIFESO	CBO	2	1	1	0	0	100	1000
URIRI	FA	2	0	1	10	100	100	1105
CYEEP	CBO	2	1	1	0	35	100	600
RPK	NGO	1	1	1	22	0	50	5500
KenSOFA	FA	2	1	1	0	100	100	10000
BFFS	FA	2	1	0	0	35	100	500
ARDAP	NGO	1	1	1	20	40	50	1000
Maseno	UOP	2	0	0	0	0	100	300
ACCAUN	FA	2	1	0	10	70	100	1600
SCODP	NGO	1	0	0	0	0	0	na
UCRC	NGO	1	0	0	0	0	50	na
Nambale	WG	1	0	0	0	0	50	50
AVENE	FA	1	0	0	0	0	50	na
Mwangaza	FA	1	0	0	0	0	50	na
19 organizations		32	10	10	102	555	1550	26985

[1] Roles: CBO = Community-based Organization, FA = Farmer Association, NGO = Non-governmental Organization, UOP = University Outreach Program and WG = Women's Group.

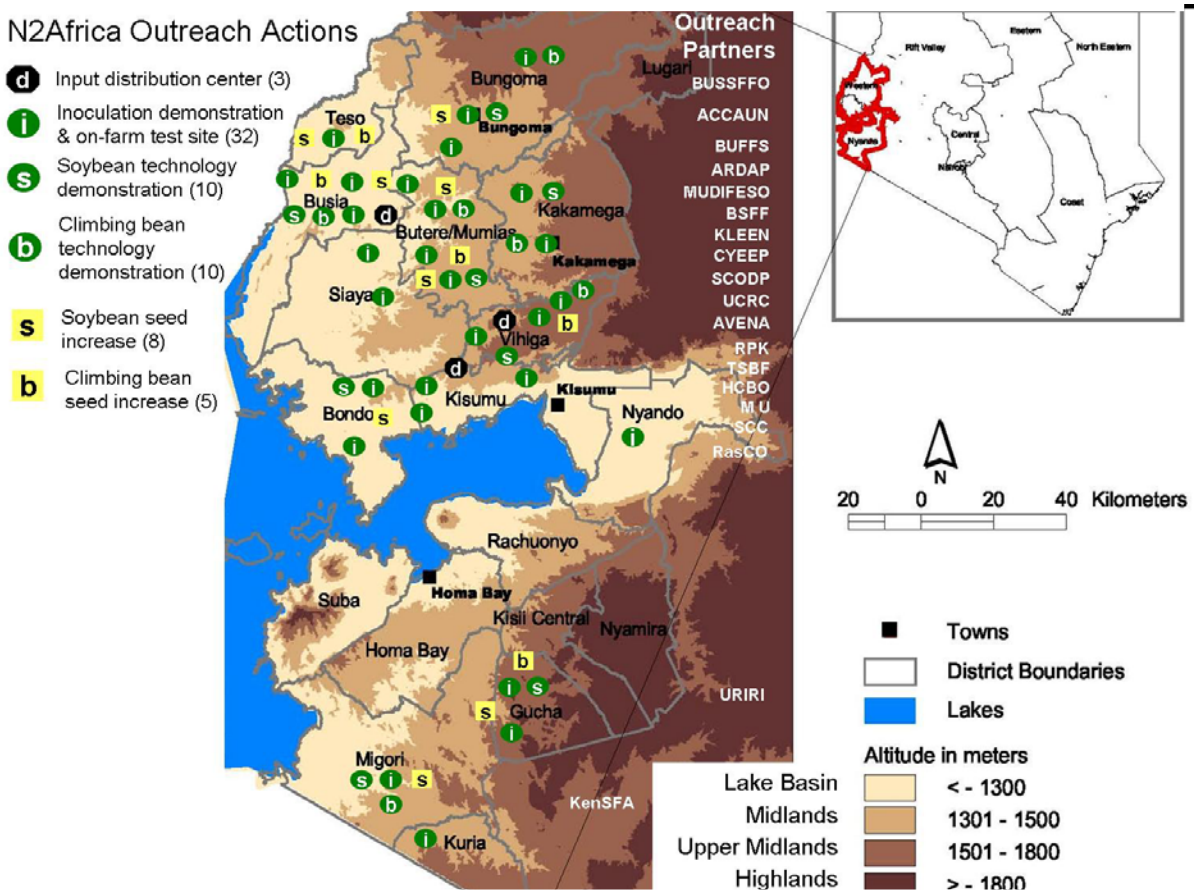


Figure 1: Map of west Kenya showing the locations of different N2Africa Kenyan Outreach activities during the 2010 long rains growing season

1. ***Activity 4.3.2. Seed production initiated.*** This goal was achieved during Year 1 and will continue into Year 2. The project has agreed to provide farmer groups engaged in grain legume seed production with P fertilizer and BIOFIX inoculant as an incentive.

6.2 Country-specific implementation plan: DR Congo

With currently weak agricultural extension services in DR Congo, and no extension service in south Kivu, dissemination of legume and inoculants technologies is done by three NGOs supported by TSBF- CIAT office in Bukavu. The NGOs are Service and Capacity of Self Promotion of Women in South Kivu (SARCAF), Program Support to Sustainable Development (PAD) and PLATFORM DIOBASS. The NGOs are platforms of smallholder community organizations (CBOs) that struggle to solve agricultural challenges in their ecosystems. The dissemination activities will rely upon these NGOs who have capacity to engage 18,750 farming households by year four of the project.

Step 2: Inputs Secured

2. ***Seed:*** soybean varieties PK 6, Imperial, SB 19 and SB 24; bush bean varieties CODMLB 001, AFR 10; MORE, RWK 10 and Murungi; climbing bean varieties VCB 81012, AND 10, MUSALE, Kiangara and Nyiramyhundo. Soybean was obtained from CIALCA a project co-jointly implemented by TSBF and IITA (180 kg) and beans from the Institute of Agricultural Research (INERA) Mulungu (40 kg). Although INERA is committed to continue supply of bean seeds at USD 2 /kg, it is planned that each partner NGO arrange to multiply 1500 kg soybean and 900 kg beans in each season.

Step 3: Field protocols developed. In the first season three field protocols were developed and materials assembled, one each for legume enterprise, soybean inoculation and P requirements; climbing bean and bush bean management and input (P,K) requirements. The soybean inoculation and P requirement demonstrations were considered the core field demonstrations. These will add knowledge to communities that have been in production of legumes several decades. One hundred and eighty (180) take away kits (consisting of 1 kg soybean seeds, 10 g inoculants and 270 g TSP) were prepared for distribution in 7 administrative territories of south Kivu.

Step 4: Technologies Deployed. In the long rains season 2010, the outreach efforts established a total of 172 demonstrations, in all 7 administrative territories and were implemented by 72 farmer associations. These were built around 28 adaptive trials (4 in each territory). The adaptation packages are expected to increase to 1,500 in the short rains season 2010, where they will expand to include legume variety inoculation and system interactions. The increased number of packages requires having about 500 kg soybean seeds, 500 kg bush beans and 500 kg climbing beans seeds. Arrangements have been made to multiply these seeds as indicated in Table 7.

Table 7: Plan of partners to multiply soybean, bush beans and climbing bean seeds

Partner	Site	Area Soybean (ha)	Area Bush bean (ha)	Area Climbing bean (ha)
DIOBASS	Kabare	0.25	0.25	0.25
	Muezi	0.25	0.25	0.25
PAD	Mulamba	0.25	0.25	0.25
	Biriava	0.20	0.20	0.20
	Kalehe	0.20	0.20	0.20
SARCAF	Ikoma	0.20	0.20	0.20
	Mimosho	0.20	0.20	0.20
Total		**1.55**	**1.55**	**1.55**

2. ***Activity 4.3.2. Seed production initiated.*** This goal will be achieved in the 2010 short rains season and will continue into Year 2 and 3. The project has agreed to provide farmer associations, through lead NGOs initial seeds and P fertilizer an incentive.

6.3 Country-specific implementation plan: Rwanda

Dissemination activities in Rwanda are mainly implemented by three NGOs; Consultative Council of Women (COCOF); Rwanda farmers Federation (IMBARAGA) and Sustainable

Rural Development (DRD), -and are coordinated by the country project field liaison officer based in Kigali. The dissemination activities in Rwanda started during 2010 long rain season (March-June) building on experiences of partners of different mandate areas.

Inputs Secured

Seed: soybean varieties PK 6, Soprosoy, SB 19, SB 24 and Yezumutima; bush bean varieties RWR1668, RWR 2076, RWR 2154, RWR2245 and RWR 1180; climbing bean varieties Gasilida, RWV 2070, MAC44, Mamesa and CAB2. Soybean was obtained from CIALCA project (190 kg) and beans from National Agricultural Research Institute (ISAR) and Harvest plus (60 kg).

Field protocols developed. In the first season three field protocols were developed and materials assembled, one each for legume enterprise, soybean inoculation and P requirements; climbing bean and bush bean management and input (P,K) requirements. The soybean inoculation and P requirement was considered the core field demonstration. These will add knowledge to communities that have been in production of legumes several decades. Two hundred thirty (230) take away kits (consisting of 1 kg soybean seeds, 10 g inoculants and 270 g TSP) were prepared for distribution in five administrative districts, 2 in the north, 1 in the south and 2 in the eastern part of Rwanda.

Technologies Deployed. In the long rains season 2010, the outreach efforts established a total of 190 demonstrations, in 12 action sites. These dissemination activities were built around 30 adaptive trials, about 4 trials in each district. The adaptation packages are expected to increase to 1,600 in the short rains season 2010, and they will include legume variety inoculation, climbing beans-maize rotation, soybean-maize rotation as well as cassava-legume intercropping. To ensure availability of seeds for technology up scaling, different partners have developed a plan to bulk seeds as indicated in Table 8. The amount of seed to be produced will increase year after year to meet the demand of additional farmers reached by the project

Table 8: Details of seed multiplication by different partners in Rwanda

Organization	Site	Area soybean (ha)	Area bush bean (ha)	Area climbing bean (ha)
DRD	Kinoni	-	-	0.20
	Nemba	-	-	0.20
	Kivuruga	-	-	0.20
	Cyabingo	-	-	0.20
COCOF	Musambira	0.25	0.25	-
	Nyamiyaga	0.25	0.25	-
	Nyambaka	0.25	0.25	-
IMBARAGA	Rukara	0.25	0.25	-
	Nyamirama	0.25	0.25	-
	Rwinkwavu	0.25	0.25	-
	Musenyi	0.25	0.25	-
	Mareba	0.25	0.25	-
Total		2.00	2.00	1.40

Activity 4.3.2. Seed production initiated. In Rwanda, basic seed requirements of soybean, bush beans and climbing beans are available through other initiatives inducing the CIALCA project, Harvest plus and ISAR. Moreover, all farmer associations working under partner

institutions are already involved in seed multiplication and have plans to produce 2000 kg of soybean seeds, 1,500 kg of bush bean seeds and 1,500 kg of climbing bean seeds every season. Partner organizations are developing a strategy for seed multiplication within each of associations at various action sites.

6.4 Country-specific implementation plan: Nigeria.

There is a thin presence of NGOs in Northern Nigeria that are involved in dissemination of agricultural technologies. Hence, government extension agencies, at both state and local government levels, are the major organs involved in dissemination. The project's major partners in the implementation of the dissemination and extension activities are the Agricultural Development Projects (ADPs) and the Local Government (LGAs) of both Kaduna and Kano States. These are being complemented by Sasakawa Global 2000 (SG2000). These organizations work with farmers at the grassroots and have the capacity to directly engage 27,000 farm households.

Inputs Secured. Procurement of seeds, inoculants, adhesives and fertilizers will be organized as follows:

Seed: About 800 kg each of soybean and groundnut seeds and 1 t of cowpea were procured for the dissemination activities of the 2010 rainy season. Soybean varieties TGX 1830, TGX 1835, TGX1485, and TGX1987 are being disseminated in the Sudan savanna of the mandate areas, while the Northern and Southern Guinea savanna areas have been provided with varieties TGX1904, TGX1935, TGX1945 and TGX1951. Cowpea varieties IT90K-277-2, IT97K-499-35, IT89KD-391, and IT99K-573-1-1 are being disseminated in the Sudan and Northern Guinea savanna parts of the project; while varieties IT90K-277-2, IT97K-499-35, IT93K-452-1, IT99K-573-1-1 and IT89KD-288 were deployed in the southern Guinea savanna. Groundnut varieties SAMNUT 21, 22, 23, and RMP 12 are being extended across all agro-ecologies, with variety ExDakar to be used as check.

Seeds were procured from different sources; 360 kg of five soybean varieties and 620 kg of 4 cowpea varieties were procured from TLII scientists at IITA while community-based seed producers organized and trained by the TL-II project and the Sub-Saharan Africa Challenge Programme (SS-KKM) were the source of 420 kg of soybean seeds, 590 kg of cowpea and 150 kg of groundnut. Additional seeds were procured from Seed Project Nig. Ltd, a private sector seed producer which has just received a grant from AGRA. About 330 kg of soybean seeds, 50 kg of cowpea and 700 kg of groundnut were sourced from this company. The West African Seed Alliance (WASA) also provided about 3 kg of groundnut seeds of various varieties for seed multiplication.

Field protocols developed. Field protocols were developed and materials assembled for legume enterprise (three each for cowpea, groundnut and soybean). The protocol describes "best practice" legume management technologies for cowpea, and groundnut as well as soybean, inoculated and not inoculated. Forty two (42) demonstrations were prepared for soybean with each demonstration packaged into a 20 liter bucket. Fifty five (55) demonstrations were developed for cowpea and forty three (43) for groundnut. The demonstrations have been distributed in 8 local governments in Kano State and 5 in Kaduna State. Fifteen (15) satellite farmers were provided with "take-away" kits from each demonstration. These "take-away" kits consisted of 1 kg seeds of one of the several varieties being extended at each action site and 5 kg of SSP fertilizer. Report forms have also been developed to formalize information collected from these demonstrations.

Technologies Deployed. The outreach effort established a total of 140 demonstrations and provided 2240 farm households (1072 in Kaduna and 1168 in Kano) with BNF technology test packages intended for 200 m^2. These 67 ha of cowpea, groundnut and soybeans are expected to produce 106 t of grains worth $92,074 that fix 2,047 kg of N with a fertilizer substitution value of $2,792.

Anticipated activities in Years 2, 3 & 4.

Activity 4.3.2. Seed production initiated. Small scale seed producers under the TL-II and SS-KKM projects abound within and in close proximity to the mandate areas. There are also about 5 AGRA grantees within the seed sector that are within the mandate areas. Seeds for dissemination activities were, therefore, procured largely from these sources and plans will be put in place to scale up collaboration with these seed partners during the duration of the project. The project will partner with certified community seed producers to ensure secure seed source. However, where seeds of a particular variety are not sufficient to meet demand, as is currently the case with groundnut variety ACIAR 19BT, seed multiplication will be organized to meet the shortfall. The project could provide farmer groups engaged in grain legume seed production with P fertilizer and rhizobial inoculant as an incentive.

We have also put in place a seed recovery framework in place whereby each farmer that is given I kg of seed is expected to give the project 3 kg of the same seed after harvest. This will generate an expected seed stock of 1,890 kg of soybean, 2,500 kg of cowpea and 1,000 kg of groundnut.

At least 3 farmers in each of the communities were supplied with extra 3 kg of seeds and SSP fertilizers for seed multiplication. Additionally, some of the lead and satellite farmers in 5 of the Local Government Areas have been identified for seed production. Seed certification officers will be invited to monitor the farms of these farmers so that those that successfully pass the certification test will have their seeds procured by the project.

6.5 Country-specific implementation plan: Ghana.

Dissemination of legume and inoculant technologies is being conducted by the trained extension agents supplied by three NGOs and supported by extension agents from the Ministry of Food and Agriculture (MoFA). The three NGOs are UrbNet, Association of Church Development Programmes (ACDEP), and UpperwestAgro. The lead farmers are expected to assist the extension agents. These organizations work with farmers at the grassroots and have the capacity to directly engage 27,000 farm households.

Participation. The implementation plan for Ghana was developed at the National Planning Meeting which took place on 26-27 April 2010. Over 30 representatives of grassroots organizations, research institutes, universities, input dealers and other potential partners attended the two-day workshop at the Modern City Hotel in Tamale, Ghana to present cooperators, expectations and opportunities for collaboration with N2Africa in Northern Ghana and to decide on tasks, proposed activities and time frame for the 2010 rainy season.

Inputs Secured. Procurement of seeds, inoculants, adhesives and fertilizers is being organized as follows:

Seed: About 1.2 t of soybean seeds, 720 kg of groundnut and 490 kg of cowpea are required for the dissemination activities of the 2010 rainy season. Soybean varieties Anidaso, Salentuya 1, Jenguma, Quarshie and TGX 1834-2E have been recommended for dissemination. Cowpea varieties to be used are ‘Apagbala’, ‘Brown_eye’, ‘Bengpla’, ‘Bawutawuta’ and ‘Omondoo’, while ‘Chinese’, ‘Manipinta’ and ‘Nkatiesari’ are the groundnut varieties to be disseminated. Seeds will be procured from certified agro-dealers within the 3 regions of the project operation. In Northern Region, seeds will be procured from an AGRA seed producer grantee, Savanna Seeds Tamale, while the seed supplier in Upper West will be ‘Antika Enterprise’.

Field protocols developed. Field protocols will be developed and materials assembled for legume enterprise (one each for cowpea, groundnut and soybean). The protocol will describe “best practice” legume management technologies for cowpea, groundnut and soybean, inoculated and not inoculated (for soybean), with each demonstration packaged into a 20 liter bucket. Sixty seven (67) of these demonstrations will be prepared for soybean; twenty seven (27) for cowpea and forty (40) for groundnut and will be distributed in 2 districts in each of

Northern, Upper East and Upper West Regions. Fifteen (15) satellite farmers will be provided with "take-away" kits from each demonstration. These "take-away" kits will consist of 1 kg (inoculated or uninoculated for soybean) of one of the several varieties being extended at each action site, 1 kg of SSP fertilizer and instructions translated into the local language. Report forms will also be developed to formalize information collected from these demonstrations.

Technologies Deployed. The outreach effort will establish a total of 134 demonstrations and provide 2134 farm households. (800 in Northern Region, 656 in Upper West and 688 in Upper East) with BNF technology test packages intended for 200 m^2. These 56 ha of cowpea, groundnut and soybeans are expected to produce 102 t of grains that fix 1,923 kg of N.

Anticipated activities in Years 2, 3 & 4. In the following years, the remaining activities and milestones will be addressed as follows:

Activity 4.3.2. Seed production initiated. There are already 2 AGRA grantees within the seed sector that are within the mandate areas. These are Savanna Seeds in Tamale, Northern Region, and Antika Enterprise in Wa, Upper West Region. It is, therefore, expected that some of the seeds for dissemination activities will be procured from these sources during the duration of the project. The project will also partner with AGRA's Seed Production and Dissemination program to organize community seed producers and seed enterprise within the context of the project. The project could provide farmer groups engaged in grain legume seed production with P fertilizer and rhizobial inoculant as an incentive.

Farmers that were provided with 1 kg take-away kits during year 1 activities are expected to return 3kg of the same seed after harvest. It is expected that this recovery program will result in about 950 kg of soybean seeds, 1,200 kg of cowpea and 700 kg of groundnut.

6.6 Country-specific implementation plan: Malawi.

Building Partnership

Seed-co, and ASMAG will provide most of seed required, ICRISAT, DARS and IITA will provide breeder seed where ever needed.

Inputs secured

Seed. ASMAG reported that seed producers have planted seeds of improved varieties of soybean, groundnut and bean and this can be made available to N2Africa on request. Dr Kananji is contacting seed producers developed in collaboration with ASMAG in the TL-II project for improved seeds of soybean, groundnut and bean.

Table 9: Inputs for Technology Dissemination Activities in Malawi 2010/2011

Inputs	Soybean	Cowpea	Groundnut	Bean	Total
Number of demos	64	8	56	47	175
Number of farmers	1024	128	896	752	2800
Total land area (ha)	24.32	5.6	21.28	25.38	77
*Seed needed (kg)	1945.6	140	1064	1776.6	4926
**Fertilizer (kg)	4864	1120	4256	5076	15316
Fertilizer (bag)	97.28	22.4	85.12	101.52	306

Insecticide (l)	26.32	7.6	0	0	34
***Inoculum (g)	608	0	0	0	61

*Seed rate: Soybean 50 kg/ha, cowpea 25 kg/ha, groundnut 50 kg/ha and bean 70 kg/ha

**Fertilizer 200 kg/ha

***Inoculum 1 g/kg seed, half of the seed will be inoculated

Seed need for 2010/2011 cropping season were met through the list in table 10 below.

Table 10: Quantity of seed accessed for 2010/2011 Dissemination campaign in Malawi:

Groundnut

Organisation	**CG7**	**Chalimbana**	**Nsinjiro**	**Kakoma**	**Chikala**	**Total**
ASMAG	100	100	100	0	0	300
SeedCo	0	0	0	0	0	0
DARS	100	50	50	100	50	350
ICRISAT	100	100	100	100	100	500
Total	**300**	**250**	**250**	**200**	**150**	**1150**

Soybean

	Makwacha	**Nasoko**	**Ocepara**	**Total**
ASMAG	200	200	200	600
SeedCo	100	0	100	200
DARS	400	400	400	1200
ICRISAT	0	0	0	0
Total	**700**	**600**	**700**	**2000**

Common bean

	Napilira	**Maluwa**	**Kholophere**	**Total**
ASMAG	200	200	200	600
SeedCo	100	0	0	100
DARS	300	300	300	900
ICRISAT	0	0	0	0
Total	**600**	**500**	**500**	**1600**

Cowpea

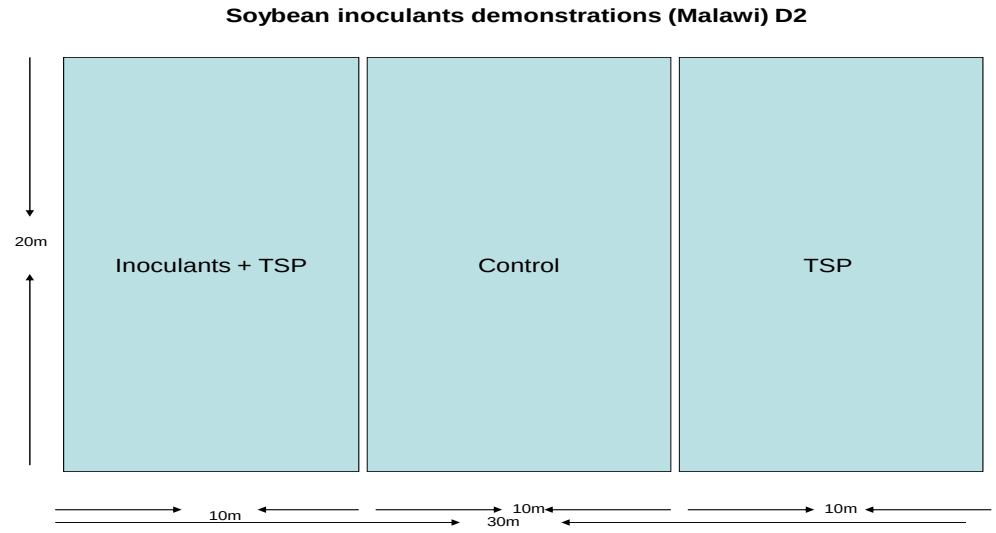
	IT18	**Sudan**	**Total**	
ASMAG	0	0	0	
SeedCo	0	0	0	
DARS	80	80	160	
ICRISAT	0	0	0	
Total	**80**	**80**	**160**	**4910**

Technologies deployed.

Demonstration plots

The technologies and varieties that will be included in the demo plots are given in Table 11. The lists given in the table are not exhaustive. The project has had fantastic cooperation from TL-II partners, Seed-co and ASMAG who have assured the project of seed supply and therefore the project may not need to set up seed producers, however if in the course of implementation we receive feedback from some communities with respect to seed access the project may decide to set up community seed production in those communities and link them with other seed producers. Each demo plot will be 20 m x 30 m (600 m^2) with maximum of 2 new treatments to compare with a traditional control. A template demo plot layout is given in Figure 2.

Figure 2: N2Africa Demo plot layout



Log book and plot layout will accompany the inputs.

Table 11:Technologies and crop varieties in demonstrations:

Crop	Technologies	Varieties
Soybean	Inoculants	Makwacha, Nasoko, Ocepara-4,
	Varieties	
	Planting date	
	Fertilizer	
	Insecticide spray	
Groundnut	Planting date	Chalimbana-2005, Nsinjiro, CG7, Chikala, Kakoma
	Varieties	
	Fertilizer	
Bean	Varieties	Napilira, Maluwa,

	Fertilizer	Kholophere
Cowpea	Planting pattern	Sudan-1, IT81E-16
	Planting date	
	Varieties	

6.7 Country-specific implementation plan: Mozambique.

The numbers of demonstrations per crop, extension agents that will be involved, number of target communities and farmers are given in Table 12. In addition 10 farmers will be selected per district; each of these farmers will receive 5 kg of seed and enough fertilizer for seed multiplication especially of the newly released soybean varieties. This activity will be led by IKURU who will also provide market linkages for the seed.

Table 12: Number of demonstrations per crop, extension agents needed, communities and farmers in Mozambique, 2010/2011 planting season.

Number of Demonstration							
Province	District	Soybean	Groundnut	Total	*No EAs	Farmers	**Total number of farmers
Zambesia	Gurue	15	0	15	3	225	240
Manica	Sussundenga	15	2	17	3	255	272
Tete	Angonia	15	0	15	3	225	240
Nampula	Mogovolas	0	18	18	3	270	288
Niassa	Mandimba	10	5	15	3	225	240
	Total	**55**	**25**	**80**	**15**	**1200**	**1280**

*EAs: Extension agents/technicians, each EA is in charge of 5 to 6 demos/lead farmers

**Total number of farmers: 1 lead farmer plus 15 group members

Training Post harvest (storage, drying etc)

This will be conducted during the TOT scheduled for September.

Building Partnership

The major partners who will be involved in the implementation of the dissemination and extension components within the districts are given in Table 13. IKURU will provide bulk of seed required, IIAM and IITA will provide breeder seed where ever needed. Over 500 kg of 5 newly released soybean varieties have been source from the TL2 project through IITA. These varieties will be used in dissemination trials and also be given to seed producers linked through IKURU.

Table 13: Major N2Africa partners in Mozambique and their area of coverage in the project

Province	District	Partners
Zambesia	Gurue	CLUSA
Manica	Susudenga	IIAM
Tete	Angonia	CLUSA
Nampula	Mogovolas	IIAM
Niassa	Mandimba	SAN
	Other activities	
	Nutrition training	CLUSA/IITA
	Agronomy training	IIAM
	Agro-dealer training	IIAM
	Agro-Inputs	IKURU
	Marketing	Technoserve soybean value chain
	Seed production	IKURU, TL-II

Inputs secured

1. **Seed:** IKURU and IITA
2. **Inoculant:** Inoculants will be sourced from Zimbabwe for the first year of the project.
3. **Fertilizers:** IKURU

The inputs needed for demonstrations (Table 14.) include; a total of 2147 kg of seed comprising of 1672 kg of Soybean seed, and 475 kg of groundnut seeds will be required. Other inputs include over 4.5 tons of fertilizer, twenty-three liters of insecticides, and 836 g of inoculants.

Table 14: Inputs for Dissemination Activities in Mozambique 2010/2011

Inputs	Soybean	Groundnut	Total
Number of demo	55	25	80
Number of farmers	880	400	1280
land (ha)	20.9	9.5	30
*Seed needed (kg)	1672	475	2147
**Fertilizer (kg)	3135	1425	4560
Fertilizer (bag)	62.7	28.5	91
Insecticide (l)	22.9	0	23
***Inoculum (g)	836	0	84

*Seed rate: Soybean 80 kg/ha, cowpea 25 kg/ha, groundnut 50 kg/ha and bean 70 kg/ha

**Fertilizer 200 kg/ha

***Inoculum 1 g/kg seed, half of the soybean seed will be inoculated

Field protocols developed

The project will facilitate seed production of 5 newly pre- released soybean varieties. This will be implemented through IKURU who will link up with 10 farmers per district to produce seed as well as facilitate the marketing of seeds. Partners are encouraged to adopt proven extension methods in addition to the extension method design by the N2Africa; however this should be documented to allow for comparisons and up scaling.

Table 15: Technologies and crop varieties in demonstrations

Crop	Technologies	Varieties
Soybean	Inoculants	5 newly pre-released varieties to be supplied by IITA with Storm or Santa as control
	Varieties	
	Planting date	
	Fertilizer	
Groundnut	Varieties	JL24, Nametil, CG7
	Fertilizer (Ca and P)	
	Fertilizer	Cal (IKURU), SSP/TSP

6.8 Country-specific implementation plan: Zimbabwe.

Building Partnership Seed-co Pannar, Progene and Agriseeds will provide certified seed; and the Crop Breeding institute (CBI) will provide breeder/foundation seed where ever needed.

Inputs secured.

Seed. Soybean seed will be purchased from Seed Co who has excellent high yielding varieties that respond strongly to inoculation. New improved rust tolerant soybean varieties developed by SeedCo will also be accessed for agronomic trials. The new promiscuous TGX varieties released in 2009 will also be imported for testing in Zimbabwe. A seed company Agriseeds is currently contracting smallholder farmers in Wedza to produce cowpea (varieties IT18 and CBC2) and groundnut seed. This linkage has been made through SOFECSA and hopefully can be expanded in the future. Varieties of common bean will be accessed through Agriseeds.

The inputs needed for demonstrations in Zimbabwe in the 2010/2011 season are given in Table 16. A total of 3468 kg of seed comprising of 1520 kg of Soybean seed, 350 kg of cowpea seed, 950 kg of groundnut seeds and 648 kg of bean seed will be required for the demonstration and dissemination activities. Other inputs include 14.72 tons of fertilizer, thirty-three liters of insecticides and fungicides, and 760 g of inoculants.

The collaborating partners (CTDT, CADS, and ZNSCA) under the dissemination objectives will also organise seed producers in each district to initially cater for seed needs of N2Africa farmers but mainly to produce seed as a business and be linked to the various seed

companies as out growers. In view of this larger plot sizes are being encouraged whereever possible so that those plots can also serve as seed multiplication plots.

Table 16: Inputs for Dissemination Activities in Zimbabwe 2010/2011

Inputs	Soybean	Cowpea	Groundnut	Bean	Total
Number of demos	50	20	50	40	160
Number of farmers	800	320	800	640	2560
Total land area (ha)	19	14	19	21.6	74
Seed (kg)	1520	350	950	1512	3468
Fertilizer (kg)	3800	2800	3800	4320	14720
Fertilizer (bag)	76	56	76	86.4	294
Insecticide (l)	19	14	0	0	33
Inoculum (g)	760	0	0	0	760

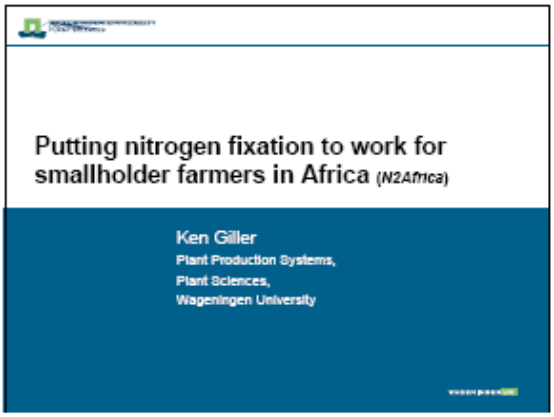
References

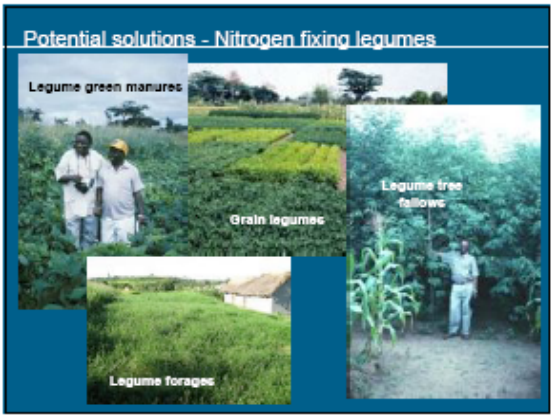
Baijukya, F. K.E. Giller, K.E. Dashiell, and P. Woomer, Selected soybean, common bean, cowpea and groundnut varieties with proven high BNF potential and sufficient seed availability in target impact zones of N2Africa Project, www.N2Africa.org, 36pp.

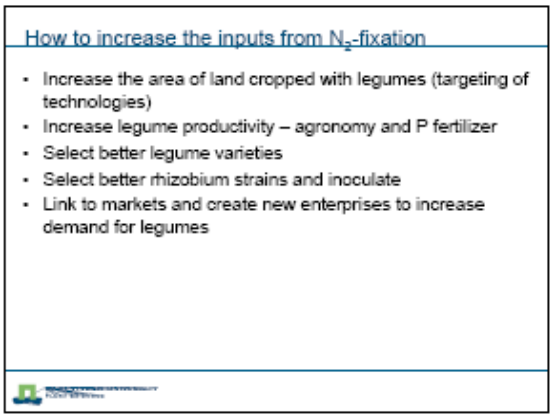
ICRISAT (2009) Enhancing grain legume productivity and production and the incomes of poor farmers in drought-prone areas of sub-Saharan Africa and South Asia. Second Annual Report to the Bill & Melinda Gates Foundation: September 2008 – December 200. International Crops Research Institute in the Semi-Arid Tropics, Andhra Pradesh, India

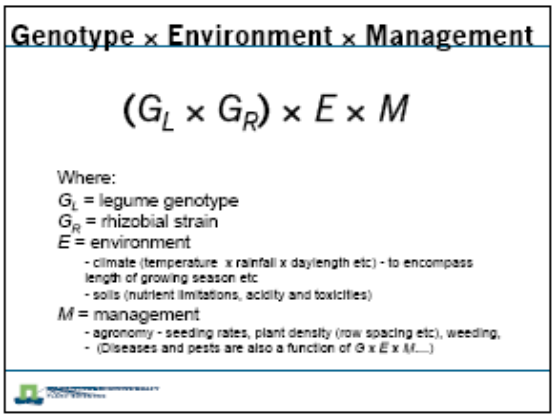
Appendices

Slide presentation by Ken Giller presented during the TLII annual meeting in Bamako, Mali from 15-20 November 2009:









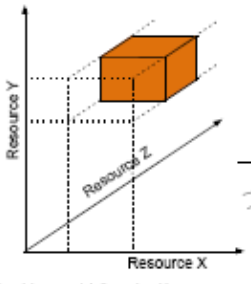
How to increase the inputs from N_2-fixation

- Increase the area of land cropped with legumes (targeting of technologies)

Legume technologies in Western Kenya

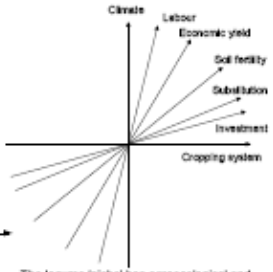
"But what can we use these crops for?

The 'niche' for legumes



The niche as an 'n'-dimensional hyperspace
Hutchinson (1957)

The socio-ecological niche



The legume 'niche' has agroecological and socioeconomic dimensions

Ojiem, de Ridder, Vanlauwe & Giller (2006) *Int. J. Agric. Sust.* 4, 79-93.

On-farm comparisons of legume technologies

Chikowo, Mapfumo, Nyamugafata & Giller (2004) *Agric. Ecosyst. Environ.* 102, 109-131

Participatory evaluation of legume technologies

- First choice – grain legumes
- Second choice – multi-purpose grain legumes
- Third choice – fodder legumes, fodder trees
- Fourth choice – woody legumes

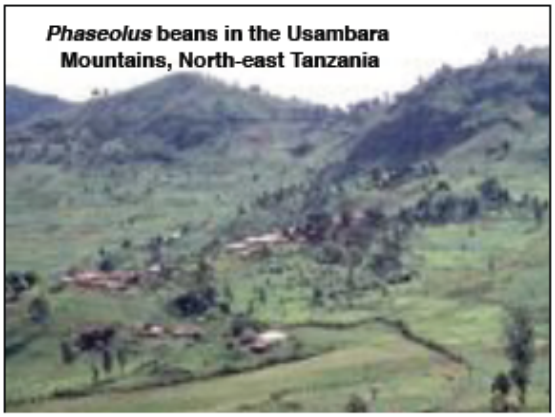
- …very last choice – green manures, cover crops and fertilizer trees
- 'pseudo-adoption' due to artificial market for seed of green manures or trees

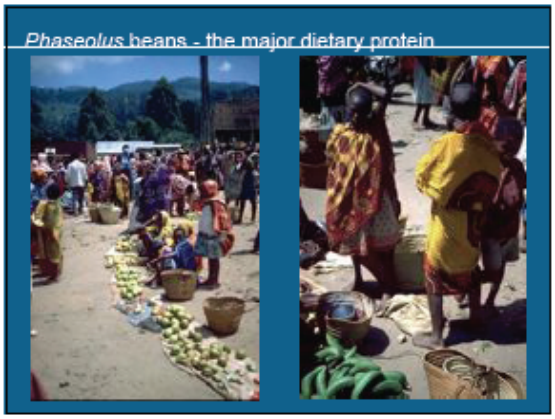
Evaluations conducted in Ghana (Adjei-Nsiah), Kenya (Ojiem), Uganda (Ebanyat), Rwanda (Bucagu), Zimbabwe (Chikowo)

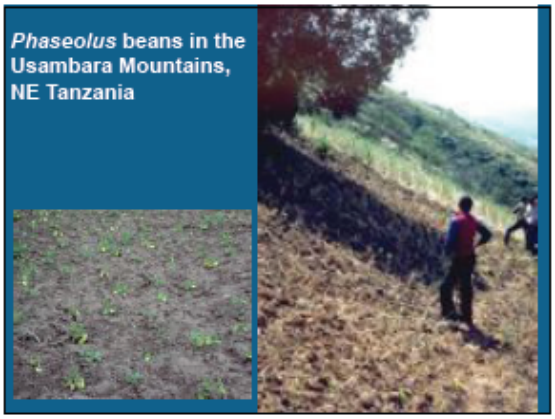
How to increase the inputs from N_2-fixation

- Increase the area of land cropped with legumes (targeting of technologies)
- Increase legume productivity – agronomy and P fertilizer


The need for good agronomy
Groundnut on a smallholder farmer's field in Malawi
Wide row-spacing means the crop uses less than half of the available radiation


Phaseolus beans in the Usambara Mountains, North-east Tanzania


Phaseolus beans - the major dietary protein


Phaseolus beans in the Usambara Mountains, NE Tanzania

Genotype x Environment x Management

$$(G_L \times G_R) \times E \times M$$

1. All important, but $E \times M$ overriding
2. G_L can be improved by adaptive breeding for nitrogen fixation
3. G_R can be improved by strain screening and inoculation

How to increase the inputs from N_2-fixation

- Increase the area of land cropped with legumes (targeting of technologies)
- Increase legume productivity – agronomy and P fertilizer
- Select better legume varieties

Impact of 'MwaSole', an acid soil tolerant bean variety in DRC

New improved bean varieties contributed to people's livelihoods, especially:

- ✓ in securing food availability
- ✓ purchasing building materials
- ✓ paying health care & school fees
- ✓ buying domestic animals
- ✓ hiring labor

Participatory evaluation of cowpea in the transition Guinea savanna, Ghana

Adjei-Nsiah et al. (2008) *Nut. Cyc. Agroecosyst.* 80, 189-208.

Promiscuous multi-purpose soyabeans

Southern Africa
- Magoye
  (small yellow seed)

IITA Nigeria
- TGX varieties
  (large white seed)

How to increase the inputs from N_2-fixation

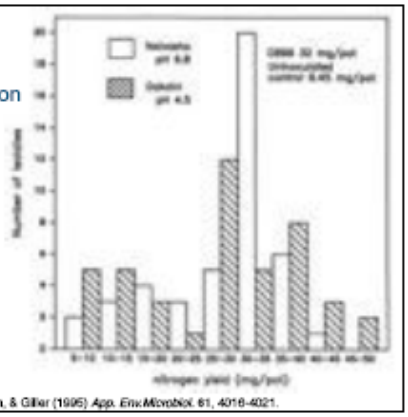
- Increase the area of land cropped with legumes (targeting of technologies)
- Increase legume productivity – agronomy and P fertilizer
- Select better legume varieties
- Select better rhizobium strains and inoculate

Inoculation trials with *Phaseolus*

- No significant effect of inoculation in most individual trials
- Combined significant 10% yield increase with inoculation across 30+ trials combined

Amijee, F. & Giller, K.E. (1998) *African J. Crop Sci.*, 6, 159-169.
Giller, K.E., Amijee, F., Brockwell, S.J., & Edje, O.T. (1998) *African J. Crop Sci.*, 6, 171-178.
Smithson, J.B., Edje, O.T., & Giller, K.E. (1993) *J. Agric. Sci. Camb.*, 120, 235-240.

Variation in efficiency of nitrogen fixation in *Phaseolus* rhizobium populations

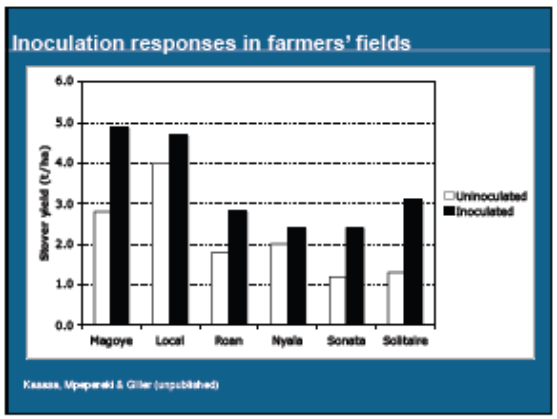


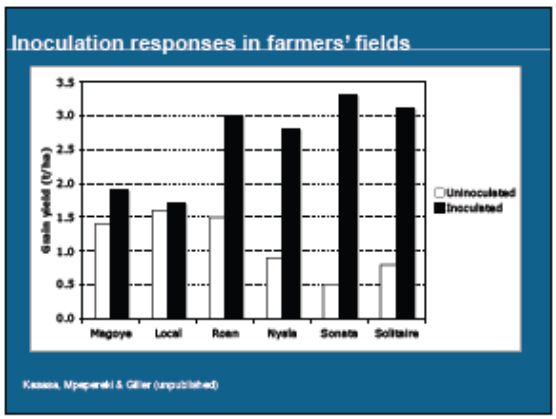
Anyango, Wilson, Beynon, & Giller (1995) *App. Env.Microbiol.* 61, 4016-4021.

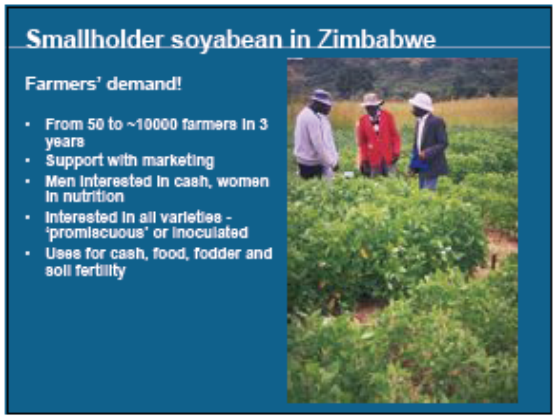
How to increase the inputs from N_2-fixation

- Increase the area of land cropped with legumes (targeting of technologies)
- Increase legume productivity – agronomy and P fertilizer
- Select better legume varieties
- Select better rhizobium strains and inoculate
- Link to markets and create new enterprises to increase demand for legumes

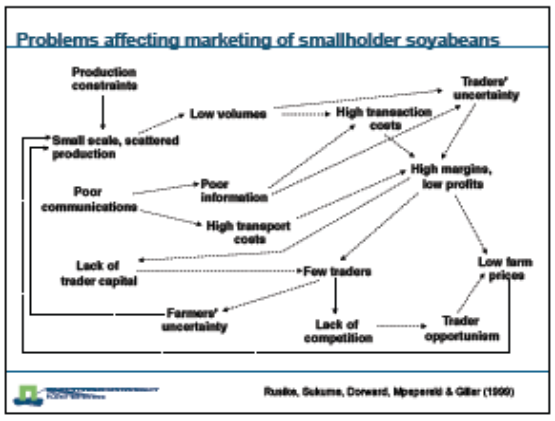
Soyabean in Southern Africa

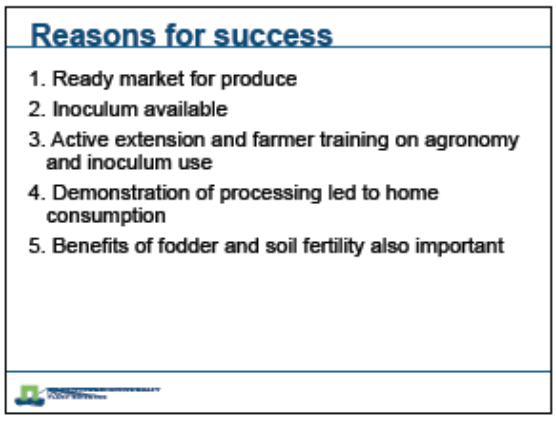

Inoculation responses in farmers' fields
Stover yield (t/ha)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Magoye
Local
Roan
Nyala
Sonata
Solitaire
Uninoculated
Inoculated
Kasasa, Mpepereki & Giller (unpublished)

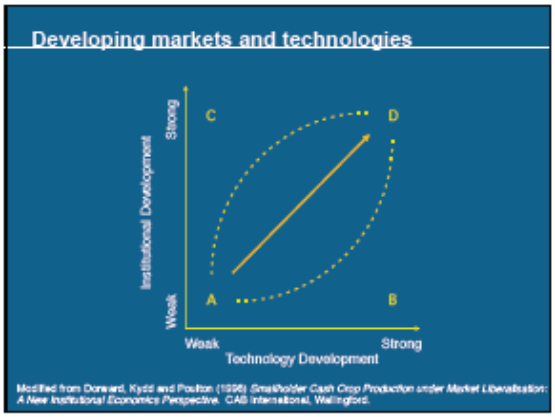

Inoculation responses in farmers' fields
Grain yield (t/ha)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Magoye
Local
Roan
Nyala
Sonata
Solitaire
Uninoculated
Inoculated
Kasasa, Mpepereki & Giller (unpublished)

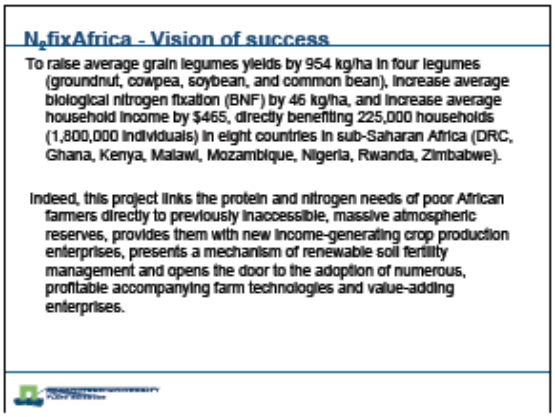

Smallholder soyabean in Zimbabwe
Farmers' demand!
From 50 to ~10000 farmers in 3 years
Support with marketing
Men interested in cash, women in nutrition
Interested in all varieties - 'promiscuous' or inoculated
Uses for cash, food, fodder and soil fertility

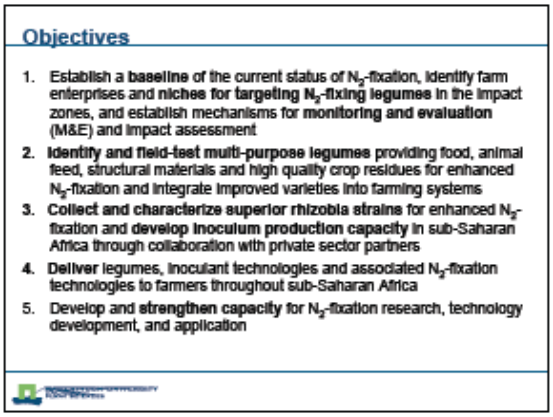

Soyabean on sandy soils in Zimbabwe
Control - no amendments
With dolomitic lime and P
(0.6 t/ha)
(12.6 kg/ka)

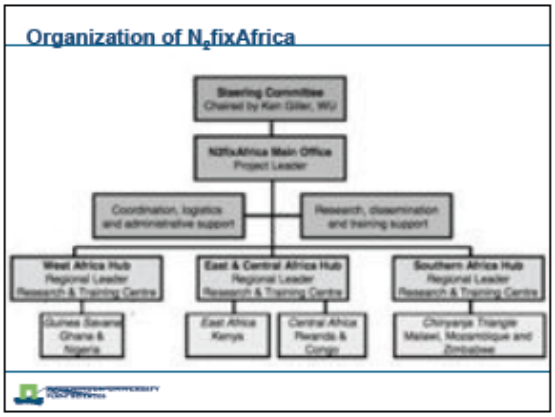

Problems affecting marketing of smallholder soyabeans
Production constraints
Low volumes
Traders' uncertainty
High transaction costs
Small scale, scattered production
High margins, low profits
Poor communications
Poor information
High transport costs
Lack of trader capital
Few traders
Low farm prices
Farmers' uncertainty
Lack of competition
Trader opportunism
Rusike, Sakuma, Dorward, Mpepereki & Giller (1999)

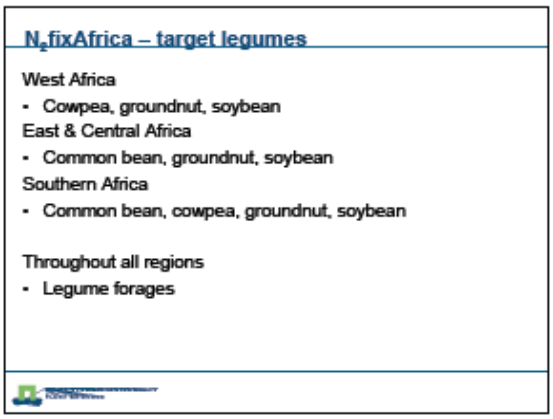

Reasons for success
1. Ready market for produce
2. Inoculum available
3. Active extension and farmer training on agronomy and inoculum use
4. Demonstration of processing led to home consumption
5. Benefits of fodder and soil fertility also important

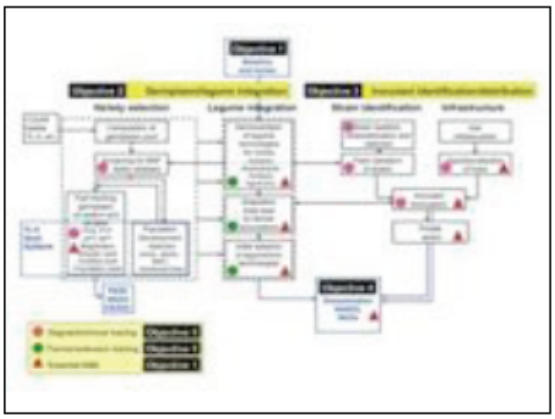

Developing markets and technologies
Institutional Development
Strong
Weak
C
D
A
B
Weak
Strong
Technology Development
Modified from Dorward, Kydd and Poulton (1998) Smallholder Cash Crop Production under Market Liberalisation: A New Institutional Economics Perspective. CAB International, Wallingford.


N_2fixAfrica - Vision of success
To raise average grain legumes yields by 954 kg/ha in four legumes (groundnut, cowpea, soybean, and common bean), increase average biological nitrogen fixation (BNF) by 46 kg/ha, and increase average household income by $465, directly benefiting 225,000 households (1,800,000 individuals) in eight countries in sub-Saharan Africa (DRC, Ghana, Kenya, Malawi, Mozambique, Nigeria, Rwanda, Zimbabwe).
Indeed, this project links the protein and nitrogen needs of poor African farmers directly to previously inaccessible, massive atmospheric reserves, provides them with new income-generating crop production enterprises, presents a mechanism of renewable soil fertility management and opens the door to the adoption of numerous, profitable accompanying farm technologies and value-adding enterprises.


Objectives
1. Establish a baseline of the current status of N_2-fixation, identify farm enterprises and niches for targeting N_2-fixing legumes in the impact zones, and establish mechanisms for monitoring and evaluation (M&E) and impact assessment
2. Identify and field-test multi-purpose legumes providing food, animal feed, structural materials and high quality crop residues for enhanced N_2-fixation and integrate improved varieties into farming systems
3. Collect and characterize superior rhizobia strains for enhanced N_2-fixation and develop inoculum production capacity in sub-Saharan Africa through collaboration with private sector partners
4. Deliver legumes, inoculant technologies and associated N_2-fixation technologies to farmers throughout sub-Saharan Africa
5. Develop and strengthen capacity for N_2-fixation research, technology development, and application


Organization of N_2fixAfrica
Steering Committee
N2fixAfrica Main Office
Project Leader
Coordination, logistics and administrative support
Research, dissemination and training support
West Africa Hub
East & Central Africa Hub
Southern Africa Hub
Regional Leader
Research & Training Centre
Guinea Savanna
Ghana & Nigeria
East Africa
Kenya
Central Africa
Rwanda & Congo
Chinyanja Triangle
Malawi, Mozambique and Zimbabwe


N_2fixAfrica – target legumes
West Africa
- Cowpea, groundnut, soybean
East & Central Africa
- Common bean, groundnut, soybean
Southern Africa
- Common bean, cowpea, groundnut, soybean
Throughout all regions
- Legume forages



Partnership between TLII and N2fixAfrica

- No separate breeding activities will take place within the N2fixAfrica. N2fixAfrica will screen for nodulation and N_2-fixation ability.
- Project leaders from TL-II and N2fixAfrica will develop a joint implementation plan and attend each others' annual planning meetings
- N2fixAfrica will develop a protocol of methods for breeding conditions to ensure optimal selection for N_2-fixing ability (no N fertilizer, rhizobial inoculation, adequate P availability etc).
- N2fixAfrica will provide advice on methods for routine screening for N_2-fixation.
- N2fixAfrica will test elite rhizobial strains with the selected varieties to identify appropriate rhizobial strains for scaling-up as inoculants.
- TL-II will advise on seed multiplication approaches.
- N2fixAfrica will provide inoculants of elite rhizobial strains for use in breeding and seed multiplication.

Milestones

2.1.1, 2.2.1, 2.3.1	At least 3 existing varieties of each of the key crops (Soybean, Bush/Climbing bean, Groundnut, Cowpea with proven high BNF potential and sufficient seed availability identified for the impact zones	month 6, year 1
1.2.9	Approval of detailed implementation plans in milestones 1.2.1-1.2.7 by BMGF (extension, Phosphate, AGRA, TL-II, seed access)	month 6, year 1

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

Partners involved in the N2Africa project

Diobass

Université Catholique de Bukavu

University of Zimbabwe

- Programme d'appui au developpement durable **PAD** (DRC)
- Service d'Accompagnement et de Renforcement des capacities d'Auto promotion de la Femme en sigle – **SARCAF** (DRC)