Tracing seed diffusion from introduced legume seeds through N2Africa demonstration trials and seed-input packages

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N2Africa

Putting nitrogen fixation to work for smallholder farmers in Africa

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Summary

This report presents data on a series of rapid appraisals in four countries (Ghana, Kenya, Malawi and Zimbabwe) that explore the diffusion of seed and associated information given to farmers involved N2Africa's demonstration trials that took place between 2010 and 2012. Two appraisals were carried out in each country, focusing on different introduced legume varieties or crops. The first study appraisal showed that two to three years after the demonstration trials more than 90% of participating farmers who were given a seed-input package with 1-5 kg of legume seed had shared this seed, on average with four other farmers. The farmers ('second and subsequent generations') who received this seed from the original farmers ('the first generation') shared their seed less frequently. Eighty per cent of all the seed shares were of 1-2 kg of seed given as a gift. Only 5% of the seed sharing involved a cash transaction. More than half of the seed sharings were with family members and around a third were between friends. Data on seed sharing indicated that i) men shared at least as often as women and both men and women shared most with persons of their own sex. Men tended to be slightly 'better' sharers in terms of frequency and sharing with persons of opposite sex. Information about rhizobium as an associated input was shared in by more than one third of farmers; in most cases this information was shared by farmers who had participated in the demonstration trials.

The second study explored the use of soyabean seed introduced by N2Africa at sites at around 5 and 10-15 km distance from the original demonstration trial site. It showed that most farmers were familiar with soyabean, although not all of them grew it. The soyabean seed did well in some, but not all, study sites where it was introduced. Only half of the farmers had heard of rhizobium but it is not clear if they understood how it worked and, in most cases, it was not readily available for purchase. The exploratory character of the study limits the conclusions that can be drawn from it. There are few distinguishable patterns and the variations between the countries, sites and legume crops may be random. However, while the validity of the data may be limited, they provide a base for extrapolation. Prior to this study no figures concerning spontaneous seed diffusion were available. Data from this study indicate that in addition to the 250,000 farmers who participated directly in the N2Africa demonstration trials, another 1,400,000 farmers may have received seed of a new legume crop or variety. The data require more in-depth study in order to be more fully explained.

Keywords

seed diffusion, transactions, gender, relationships

1 General background information

N2Africa is a large-scale, science-based 'research-in-development' project that aims to encourage smallholder farmers growing legume crops in Africa to adopt nitrogen fixation techniques (www.n2africa.org). N2Africa is funded by the Bill & Melinda Gates Foundation and is led by Wageningen University together with the International Institute of Tropical Agriculture (IITA) and the International Livestock Research Institute (ILRI). The project had a first phase between 2009 and 2013 in Ghana, Nigeria, DR Congo, Rwanda, Kenya, Mozambique, Malawi and Zimbabwe. N2Africa introduced legume technologies to smallholder farmers in these countries. Seed of common bean, cowpea, groundnut and soyabean was disseminated together with phosphate-based fertilizer and, in the case of soyabean, with rhizobium inoculant. These technologies were introduced through a lead-satellite farmer model. In most cases the seed was distributed after farmers had seen a demonstration trial hosted by a lead farmer or by the farmers as a group. The exact combination of technologies and demonstration models varied within and between countries. Most demonstration trials had a standard lay out of 4 plots of 10 by 10 m each with four treatments: 1. the new legume variety without inputs (control); 2. the variety with a phosphate-based fertilizer (P); 3. the variety with inoculants and 4. the variety with a P-fertilizer and inoculants. The package of seeds and inputs that farmers received varied in terms of crop, variety, type of fertilizer and with or without inoculant, depending on the legume, the purpose of the demonstration and the availability of (the types of) inputs in the country. The amount of seed given to the farmers usually varied between 1-5 kg. In addition to the package, farmers also received training on biological nitrogen fixation, best practices for legume cultivation and post-harvest handling. An 'early impact' survey was carried out in all the countries in 2013, to establish the adoption of these technologies among the farmers who participated in the N2Africa project (Brand, in preparation).

The case studies in this report are complementary, and represent a first effort to explore how, and to what extent, seeds of new legume varieties or crops, and associated information (in particular on fertilizer and rhizobium) had spread beyond the farmers who were directly involved in the project. Generally, it is assumed that when a technology (i.e. a seed) performs well, the technology will spread from farmer to farmer, through the community and, through links with relatives, friends and others, beyond the community. However, little is known about how seed and information sharing actually takes place. There are a number of unanswered questions: How many farmers share their seeds with other farmers? What volumes are involved? What are the mechanisms through which such transactions occur? What is the impact of gender and other social boundaries: do they represent any barriers to seed diffusion? This report presents the results of the case studies which address these issues. The case studies were carried out simultaneously in Ghana, Kenya, Malawi and Zimbabwe in the second half of 2013. In each country two studies were carried out. Study 1 traced the seed and associated information that farmers who had been directly participating in the demonstration trials had received from the technician. We studied how much of the received seed and associated information had been shared and with whom. Study 2 examined how far the seed and information had travelled beyond the site of the original demonstration trial.

2 The design of the studies and the composition of the sampled groups of farmers

Study 1

The main objective of the study was to generate indicative data on a series of questions for the N2Africa project (see below) which will allow us to make an estimation of the diffusion of seed and information beyond the farmers who directly participated in the project (i.e. those who received seeds and inputs from the project). Since no data of earlier studies of this type are available, this study has an exploratory character and aims to identify patterns in the diffusion of seeds and information. The research involved a rapid appraisal study in four countries, with two sites per country. In all four countries the researchers identified sites where in 2010, the first season of the N2Africa project, a demonstration trial had been implemented with one of N2Africa's legumes, preferably in one single season and with just one farmer group. Access to the sites was a criterion for the final selection of the sites. The plan was for the researcher to identify in each of these sites ca. 10 farmers who had directly participated in visits and explanations about the N2Africa demonstration trials and treatments, and who had received a seed package. This was not possible at all sites and here fewer farmers were interviewed. The farmers who directly participated in the demonstrations, and had received packages with seeds and fertilizers were identified as 'first generation' farmers. These farmers were interviewed and an inventory was made of the farmers they had shared seed with (the 'second generation'). It was possible to trace a sample of these farmers within the limited timeframe of the study, and they were also interviewed to assess their seed sharing with 'third' and 'fourth' generations. A number of third generation farmers were traced in Kenya, Malawi and Zimbabwe. In Ghana however this was not possible as none of the second generation farmers shared their seed. In Kenya, the research traced two fourth-generation farmers.

The design of data collection was similar in each of the four countries. Because many different crops and varieties were used in the demonstration trials and distributed to the farmers, the studies were adapted where needed.

From the 8 communities in the 4 countries, a total of 270 farmers were interviewed (Table 1), of whom 131 had passed on seed (82 women and 49 men) and 149 did not. We recorded 406 instances of 'seed being shared' from the interviews, i.e. 406 transactions (although not all of these were fully described). The central questions we asked are listed below.

- How many farmers pass on seed and to how many other farmers?
- What relationship do the farmers who share seed have with the people they share with, i.e. relatives, friends, others?
- Under what conditions is the seed shared: is it a gift, a cash transaction or do farmers have other sharing mechanisms?
- How much seed is shared, i.e. a handful or a couple of kg?
- Does gender play a role in these seed sharings?

The data from the three farmer groups in Kenya (who were of mixed gender) were not taken into account for a number of variables: i) the seed transactions, ii) data on gender, ii) the type of relationship with those who they shared seed with. Members of these three groups shared seed with 32 individual farmers. Unless indicated otherwise, the averages in the tables are weighted averages: calculated with the aggregated total of farmers and seed sharings over the countries and generations It should be noted that the time period over which the seed was shared varied for farmers of different generations and between countries: first generation farmers had obviously had a longer period over which they had been able to share seeds than later generation farmers. When comparing the seed

sharings between farmers of different countries it should be realised that the western Kenyan sites have two cropping seasons whereas the other sites have one.

Statistical analysis of the number of seed transactions per farmer as a function of country, generation and gender, was done using a generalized linear model with a quasi-Poisson link function. Analysis of the nature of seed transactions, in terms of family relations, gender and type of transaction was done using a generalized linear mixed model, with farmer as a random factor and a binomial link function. Significance of explanatory factors (gender, country) was tested by analysis of deviance. The amount of seed involved in the transactions was analysed by a linear mixed model on the log transformed reported amounts.

Table 1a. The composition of the sample population of interviewed farmers from the first to fourth generation.

	Ghana		Kenya		Malawi		Zimbabwe		Total
	Sung	Pishigu	Butula	Malakisi	Mnusu	Lumwira	Goromonzi	Mudzi	
Women	11	11	26	32	21	21	20	32	174
Men	9	10	23	15	12	7	2	15	93
Groups*			1	2					3
Total	20	21	50	49	33	28	22	47	270

* These groups of farmers were analysed as a single interviewee.

Study 2

This rapid appraisal study focussed solely on soybean because asking information about a relatively new crop, with few available varieties, was more straightforward than asking about new varieties of commonly grown bean, cowpea or groundnut crops. Data were collected from a random selection of farmers, to assess the extent to which farmers were growing soyabean, from whom they had acquired it first time and if they knew about rhizobium inoculants. These data were used to enrich and support the data from study 1: a selection of the same variables were used, i.e. gender, type of relationship and character of the transaction. For this study two villages were identified at different distances from the site where the demonstration trials had been held: one at around 5 km distance and (where feasible) another at around 10-20 km distance from the source village. In these villages there had been no demonstration trials (Table 1b), in contrast with the source village. In the study area in Kenya, however, demonstration trials had been so numerous that no site with 10 km or more distance to a demonstration trial could be identified. In Zimbabwe, this study was only carried out in Goromonzi; in the other site, Mudzi, soybean had not been the focus of N2Africa dissemination in this site.

The researchers based themselves at water points, market places or bus stops and randomly stopped farmers for interviews. The researchers in Malawi and Zimbabwe used a quota sampling to arrive at around 10 female and 10 male farmers. In Ghana and Kenya the researchers encountered difficulties in achieving a gender balance of farmers to interview at the selected sites, and some samples, while using quota sampling, had more male respondents, while one had more females.. Study 2 yielded 414 interviews from Ghana (n=112, 64 female, 48 male farmers), Kenya (n=119, 38 female, 80 male farmers), Malawi (n=120, 57 female, 63 male farmers) and Zimbabwe (n=63, 34 female, 29 male farmers).

Properties of individual transactions were analysed using a generalized linear model with a binomial link function and significance of explanatory factors (gender, country) was determined by analysis of deviance.

Table 1b. Interviews carried out at the source sites in each country (study 1) and at sites at different distances from the source sites (study 2), showing the number of female (F) and male farmers (M) interviewed. The distance from the source sites is given in brackets.

Ghana				
Site 1		Sung	Tuyini (5 km),	Sandugu (20 km)
	F	3	15	12
	M	18	4	9
Site 2		Pishigu	Assem House (7 km)	Languogu (16 km),
	F	14	6	14
	M	7	3	7
Kenya				
Site 1		Bukhalalire	Murumba (3-5 km)	Kingandole (3-5 km)
	F	8	3	3
	M	13	22	18
Site 2		Malakisi	South Kulisiru (5 km)	North Kulisiru (10-15km)
	F	7	3	14
	M	13	9	6
Malawi				
Site 1		Mnusu	Kamponje (5 km)	Chisepu (15 km.)
	F	9	9	10
	M	11	11	10
Site 2		Lumwira	Chendula (5 km)	Nyangu (15 km)
	F	9	10	10
	M	11	10	10
Zimbabwe				
Site 1		Mollife area Ward 5	Pote area Ward 5 (6 km)	Munyawiri (bus stop) Ward 1 (11 km)
	F	10	11	13
	M	11	11	7

3 Study sites

In **northern Ghana**, two communities in Karaga District (Sung and Pishugu) were selected. The demonstration trials in the selected communities took place in 2010. As northern Ghana has a single growing season (May-October), data collection took place 3 growing seasons (and harvests) after the first demonstration trials had taken place. The demonstration trials were planted with soyabean in Sung (two varieties: Jenguma or Quarshie) and soyabean or cowpea in Pishugu. In both places the demonstration trials with soyabean had the 'standard' trial design, including treatments with inoculum and P-fertilizers. Soyabean was not (entirely) new in the area at the time of the trials. It was introduced in the area in the early 1990s and it is quite commonly cultivated and consumed in the area. Most common however was the production for selling to the processing factory or traders. The processing factory was closed down at the moment of this study.

The study sites in **western Kenya,** Butula and Malakasi, have two growing seasons per year: a long rainy season of around 3 months (March-June) and a shorter rainy season of about 2 months (August-October). Farmers plant legumes in both seasons. N2Africa distributed seeds to farmers in those sites in 2010, so 5-6 growing seasons would have passed since the farmers had participated in the demonstration trials and received seed to sow themselves. There have been many other seed introductions in the area over the years, done by different organisations and involving different types of seed (but predominantly soyabean) and demonstration trials. This complicated the documentation and assessment of N2Africa's activities here since it was not possible to precisely document where and when these activities had taken place. All data in this study relate to soyabean, which was relatively new in the area. Its introduction is one of the objectives of the N2Africa project. Other major crops in the area are maize, beans and groundnut.

In Malawi, the study sites Mnusu, in Salima district, and Lumwira in Dedza district, both in the **central part of Malawi** have one growing season. The N2Africa trials involved two varieties of soyabean (Makwacha and Nasoko) and two varieties of groundnut (CG7 and Nsinjiro) in combination with inoculant (for the soya) and P fertilizer. The legumes in the trials were planted as mono-crops. Planting in the areas where the study sites are located normally takes place mid-November. The seeds for the trials were distributed after a training session in December 2010. Assuming that - despite the late distribution in the season – farmers may nevertheless have planted some of the seed, three growing seasons had passed when data were collected. Most data in this study are on soyabean, although some cases of common bean have also been included. Soyabean was still not commonly grown in the area. The dominant planting pattern is mixed cropping of maize with legumes.

The study sites in **north-eastern Zimbabwe,** Goromonzi in Mashonaland Central Province and Mudzi**,** in Mashonaland East Province, both have one growing season from November to March. In the study sites in Zimbabwe N2Africa introduced packages of seed of common bean (varieties Cardinal and Variety), groundnuts (Natal Common), cowpea (IT18, CBC1 and CBC2) and soyabean (Safari), with and without fertilizer (all crops) and inoculant (for soya). Different crops and varieties were distributed to different groups in 2010, 2011 and 2012, in variable amounts (0.25 kg of cowpea and up to 5 kg of beans, depending on the variety). Thus, at the time of data collection, the number of growing seasons that had elapsed varied by farmer group. Data used in this study relate to soyabean, common bean, cowpea and groundnut. Soyabean was relatively new in the study sites.

4 Study 1

4.1 Seed sharing

4.1.1 The frequency of sharing

A high percentage of first generation farmers had shared seeds that they initially received from the N2Africa project. On average, farmers shared seeds with four other farmers (i.e. second generation farmers). Sharing was least frequent in Zimbabwe (2.7 and 2.2 times in Goromonzi and Mudzi, respectively) and most frequent in Malakasi, Kenya (5.7 times) and Mnusu, Malawi (5.6 times). Of the 270 farmers interviewed 131 (around 50%) shared seed with others, and they did so a total of 406 times.

Table 2 shows the data on sharing of seeds by farmers who had received seeds from the N2Africa program through participating in the demonstration trials and those who we called 2nd, 3rd and 4th generation farmers. The average number of sharings and the proportion of farmers who shared decreased significantly with the generations (for both: $p < 0.001$) and also differs between country ($p < 0.001$) and gender ($p < 0.01$) The average number of sharings was highest in Malawi; Ghana was excluded from the analysis as no second generation farmers shared seed. The average number of sharings by male farmers is higher than by female farmers, although these differences were only significant in the second generation. These data indicate that the encouragement to pass on seed by N2Africa-staff worked quite well for the first generation farmers, i.e. those who participated in the management of demonstration trials or got the seeds after visited them. The sharing of seed with others by later generation farmers may have been influenced by them having had the seed for a shorter time span. This gave them less time to evaluate the seed ànd to reproduce it so that they had enough to share. This issue played an important role in Zimbabwe. The first generation farmers in Zimbabwe said they received relatively large samples of seed, so they could harvest enough to eat as well as to share with others. The second generation farmers only got on average 0.5 – 1 kg of seed: not enough to plant and eat. They said that before they could share with others they would need more time to bulk up their stock, assess the crop and its culinary quality. This implies one or two seasons at least before they would consider sharing with others. In addition, soyabean did not perform very satisfactory in the Zimbabwe sites. In Goromonzi the climate did not allow for good performance of the soyabean crop whereas in Mudzi farmers, mostly women, said that it was difficult to find a market for small quantities of soyabean and for which they have few household uses. In the Ghana sites the use and planting of soyabean was more common, but the farmers explained that the low crop productivity in the region was the reason for not sharing seed: they said they simply did not have enough to share. Of the second generation farmers in Ghana (most of whom had probably already planted soyabean twice), none had yet shared seed with others at the time of the study.

Table 2. The number of 1st, 2nd, 3rd and 4th generation farmers interviewed (#), the percentage of these farmers passing on seed to another farmer by country and the average % and number of 'sharings' by generation.

Country	Ghana		Kenya		Malawi		Zimbabwe		Average % of farmers passing on seed*	Average no. of seed samples passed on per farmer who shared
Generation										
	#	%	#	%	#	%	#	%		
1st	11	100	15	93	19	100	31	87	95	4.0
2nd	30	0	60	45	28	36	32	31	28	2.1
3rd	n.a.	n.a.	20	40	14	36	6	17	31	1.8
4th	n.a.	n.a.	4	25	n.a.	n.a.	n.a.	n.a.	25	2.0**

*Average of percentages over the 4 countries. **One person only.

4.1.2 **The gender aspects of seed sharing**

Considering the total number of interviewed farmers, aggregated over the different generations, the majority were women: 65% (36% in Ghana, 58% in Kenya, 69% in Malawi and 75% in Zimbabwe). Of all women in the study (n=156), 52% shared seeds with others (Table 3). The percentage of men in this study (n=82) that shared seed was at least as high (59%), and they shared on average with at least as many other farmers as women (Table 3):on average women shared 2.5 times with others, men did so with on average 3.4 others. The differences between male and female farmers were not significant. This means that the hypothesis that women might share seed more often than men because 1) legumes are often considered a women's crop and 2) women are more reliant on social relationships could not be confirmed through this study.

Another gender aspect of sharing is with whom men and women shared. Sharing took place predominantly between farmers of the same sex ($p < 0.001$). Women were more likely to share with farmers of the same sex then men ($p < 0.001$): 87% of all women-sharings were with other women, whereas men shared 55% with men (Table 4). There were significant country-specific differences ($p < 0.05$), with differences between sexes being low in Ghana compared to other countries: in Ghana the proportion of sharing with members of the same sex was highest. In the Ghana sites, women mostly shared with other female relatives as gifts, whereas most of the 40 sharings by the men in the study were gifts to male friends. The tendency of men in Kenya, Malawi and Zimbabwe to share relatively often with women – as compared to women with men – may be due to legumes and seeds being viewed mainly as female domains.

Table 3. Percentage (%) of women (n=156) and men (n=82) who shared seed, and the number of farmers with whom they shared seed (#).

	Ghana (n=41)		Kenya (n=96)		Malawi (n=61)		Zimbabwe (n=70)		Average* (n=268)	
	%	#	%	#	%	#	%	#	%	#
Women	18	4.0	45	1.9	57	3.7	53	2.0	52	2.5
Men	36	5.0	55	2.8	53	4.0	59	2.6	59	3.4

* Weighted average over 268 farmers. Data from the 3 farmer groups in Kenya are not included.

Table 4. The percentage of seed sharings between farmers of same sex, i.e. women with women and men with men (n=374)*.

	Ghana	Kenya**	Malawi	Zimbabwe	Total
Women who shared with women	87%	87%	85%	91%	87%
Men who shared with men	95%	44%	47%	35%	56%

* 32 transactions from the 3 farmer groups in Kenya are not included.

4.1.3 **The relationships between those who shared**

About 90% of the seed originating from the N2Africa project was shared among relatives and friends; only 10% was shared with others (Table 5). Significant differences in the proportion of sharing with relatives, friends were observed between countries ($p < 0.001$), with sharing with relatives being significantly higher in Malawi compared to the other countries and significantly lower in Ghana. In the latter country a significantly higher proportion of seed sharing was with friends.

However there was considerable variation in the percentages of those sharing with relatives or with friends between the sites, also within a single country. There was also no consistency when comparing with whom women and men shared their seeds. In some sites women shared more with friends than with family, whereas in others sharing with family dominated. Similarly, men in some sites shared more with friends, in other sites more with family.

Table 5. Percentage (%) of seed sharings with friends, relatives and others, by country and gender.

	Country				Gender		
	Ghana	**Kenya(*)**	**Malawi**	**Zimbabwe**	**Women**	**Men**	Total
	(n=56)	(n=107)	(n=129)	(n=82)	(n=209)	(n=163)	(n=374)
With Relatives (n=210)	13	62	75	48	61	49	56
With Friends (n=125)	88	11	22	44	30	39	33
With others (n=39)	0	26	3	9	9	12	10

* 32 transactions from the 3 farmer groups in Kenya are not included.

The proportion of transactions involving farmers of a different sex differed according to relationship type ($p < 0.001$). This proportion was significantly lower for transaction involving friends, compared to those involving relatives or others.

There were also strong variations, both by site and by country, in the gender of the relative or friend with whom women and male farmers shared seed. Nevertheless, the percentage of farmers sharing with farmers of another sex was significant lower when sharing with friends than when sharing with relatives or others ($p<0.001$). Or, in other words, when women shared seed with men, they were mostly related (Table 6). And also when men shared with a woman it was mostly with a female relative. Men tended to share more often with female rather than male relatives. This means that the relation with relatives is the only major seed-sharing-relationship where substantial seed sharing across the gender barrier takes place.

Table 6. The percentage of women and men who shared seeds with female and male relatives, friends and others*.

		Female (n=209)	Male (n=165)	Total* (n=374)
With relatives	Female	51	31	43
	Male	10	18	14
With friends	Female	29	5	18
	Male	1	33	15
With others	Female	8	8	8
	Male	1	4	3
Total		100	100	100

4.2 The conditions of sharing

4.2.1 Offering seed or asking for it?

According the information given by the farmer who provided the seed, 60% of all the seed sharings were on the basis of 'asking for seed' and 40% of the seed was 'offered' (Table 7). There were significant differences between countries ($p < 0.001$): in Kenya and Zimbabwe 'asking for seed' was more pronounced (72 % and 74%, respectively), while in Ghana and Malawi, seed was more often 'offered' than 'asked for' (76 % and 59 %, respectively). This concurs with information from women farmers in the Zimbabwe study who said that giving seed without the person asking for it is not a normal practice. Some women farmers in Ghana mentioned this as well, but our data do not confirm this. Although there was no significant difference, totalled over the four countries, in each of the four generations, a larger percentage of women had been asked for the seed, while men gave seed as often they were asked. The first generation farmers were encouraged by N2Africa researchers to share seed with others, but this did not express itself in higher percentages of 'giving' (rather than waiting to being asked for) than in other generations: the proportion of seed that was offered increased significantly with generation ($p < 0.01$).

Table 7. The sharings by women and men on the basis of 'offering' and 'asked for' in the different generations of farmers (% per category, weighted averages).

Generation	Women who passed on seed		Men who passed on seed		Total (N=371)	
	Gave (n=70)	Were asked (n=138)	Gave (n=79)	Were asked (n=84)	Gave (n=149)	Were asked (n=222)
1st	31	69	48	52	38	72
2nd	30	70	48	52	41	59
3rd	67	33	50	50	62	38
4th						
Total	34	66	49	51	40	60

4.2.2 The transactional characteristics of the seed sharing

To further explore the character of the seed sharings, we differentiated between gift, exchange and cash payment. Of the total number of seed sharings (n=406), it was not possible to identify the character of 22 transactions in Ghana (Table 8). Of the remaining cases, the large majority of all the transactions were described by the providing farmer as 'gifts' ($p<0.001$). There were no significant differences due to gender or country in the proportion of gifts versus other transaction types. In Kenya, 14% of the seed sharings were in exchange for cash. In Malawi, the implementing N2Africa agencies used a 'loan-based' transaction: the receiving farmers were asked to return the same or twice the amount of seed provided. This is apparently a common practice in the sharing of seeds in central Malawi. In 24% of the seed sharings in Malawi farmers used this transaction form as well (all were transactions between first and second generation farmers). Exchange and paying with labour was only reported for six cases (three in Malawi and three in Zimbabwe). There were 14 cases (4%) reported as 'other transactions'. Of all sharings of seed by women, 81% were reported as gifts, whereas only 70% of men shared as a gift. Seeds were shared with cash payment (i.e. were 'sold') in 5% of the cases, with no difference between men and women. Because of the variation between countries and sites for the small number of non-gift sharings, it is difficult to see a pattern. All the sharing by the three groups in Kenya (n=32) was in the form of gifts.

Of the 19 cash payments (1 in Ghana, 16 in Kenya and 2 in Malawi, representing 5% of all transactions), there were 11 with 'others' (15% of all transactions with others), five with friends (4% of all transactions with friends) and 3 with a relative (1% of all transactions with relatives).

Table 8. The transactional characteristics of seed sharing by country and gender (%).

	Country				Gender		
	Ghana	**Kenya**	**Malawi**	**Zimbabwe**	**Female**	**Male**	**Total**
	(n=34)	(n=107)	(n=129)	(n-82)	(n=205)	(n=147)	(N=352)
Gift	97	83	63	96	85	73	80
Cash	3	14	2	0	5	5	5
Exchange	0	0	3	3	2	1	2
Return	0	0	24	0	6	12	9
Other	0	3	9	0	1	8	3

4.2.3 When and how much did farmers share?

We also wanted to know what the time lapse for sharing was. We tried to find out if farmers mostly shared after the first growing season that they had the new variety, or if sharing took place over several seasons. The first generation farmers had presumably received the seed between 36 and 48 months before. In the Ghana sites, 60% of the transactions between the 1st and 2nd generation farmers (n=56) took place 36 months ago, i.e. in the season after which the farmers had grown the seed for the first time. Other times of sharing by these first generation farmers were 24 and 6 months earlier. In Kenya, 70% of the seed sharing of the first generation farmers (n=68) took place between 24-48 months earlier. The other 30% was spread over the following months. In Malawi, 75% of the sharings of first generation farmers (n=96) took place 36 months earlier, and the other 25% 24 months earlier. In Zimbabwe, 50% of the seed sharings of first generation farmers took place 24 and 36 months earlier. The other seed sharings were spread out thereafter. These data indicate that most seed was shared in the first or second season after farmers first got the seed from N2Africa, but that substantial sharing took place later as well.

Of all the sharings, 75% involved 1-2 kg of grain (Table 9a). The overall average amount of seed shared was 2.0 kg. The sharings as gifts were on average 1.7 kg, the cash transactions were on average for 5.5 kg of seed. With an average gift 200 - 400 m^2 could be planted, depending on the

legume and the variety. In only 15 occasions (4%) more than 5 kg of seed was shared: three of these were provided by women and 12 by men. These sharings involved seven gifts, five cash transactions and four cases of otherwise exchanged seed (barter or loan), none for labour. On average men shared more seed than women (2.5 kg as opposed to 1.6 kg) but this difference was not significant: the pattern did not hold in all countries. In Zimbabwe men and women shared almost equal amounts and in Ghana women tended to share more seed than men (Table 9b). The surveys from the four countries indicated that sharing 'a handful' of seed was not widely practiced in any of the cases.

Table 9a. The percentage of farmers sharing a certain amount of seed with other farmers, by country.

	Ghana	Kenya*	Malawi	Zimbabwe	Total
	(n=33)	(n=137)	(n=129)	(n=82)	(N=381)
0.25-0.5 kg	-	10	4	17	9
1.0 kg	45	42	73	35	51
1.5-2.0 kg	42	23	18	29	24
3-5 kg	9	17	3	17	12
> 5kg	<1	7	2	1	4

* includes data from 2 farmer groups

Table 9b. The average amount of grain/seed (kg) shared with other farmers, by country and gender.

	Ghana	Kenya	Malawi	Zimbabwe	Total
	(n=33)	(n=105)	(n=129)	(n=82)	(N=349)
Women	2.6	2.0	1.1	2.0	1.6
Men	1.6	2.6	1.9	1.9	2.5
Average	1.9	2.4	1.7	2.0	2.0

4.3 **Information sharing**

The majority of the farmers (60%) said they had shared information about the seed together with the actual seed itself, others said they first had talked about the new seed with the person they shared it with, and shared the seed later (21%), or they had first given the seed and gave information later (17%). However, it is not clear what information was actually shared, i.e. just about the variety or also on fertilizer treatments they had seen in the demonstration trials. Conversations with farmers in Zimbabwe indicated that often the seed is asked for or given (typically 1-2 kg) without specifying whether it was for consumption or sowing. Overall, 35% of the farmers said they had also given information on rhizobium inoculants to the person they gave the seed to (Table 10). This sharing of information on rhizobium was mostly done by first generation farmers who shared seed with second generation farmers, i.e. farmers who had received inoculant in the distributed packages of seed and inputs or who had seen it in demonstration trials. Later generation farmers shared information less often (Table 10). In Malawi, none of the first generation farmers referred to inoculant when sharing seed with others, nor did any of the later generations (Table 10). The differences between generations and countries were however not significant. In all study sites the only available inoculant, to the farmers' knowledge, was that in the initial packages provided by N2Africa's collaborators.

Table 10. Percentage of sharings of which the farmers said they also talked about the rhizobium inoculum when they shared the seeds (by country and generation of farmers)

Generation	Ghana (n=56)	Kenya (n=137)	Malawi (n=129)	Zimbabwe (n=82)	Total (N=404)
1st	82	48	0	38	39
2nd	0	41	0	7	25
3rd	n.a.	14	0	0	9

5 Study 2

Of all farmers interviewed in study 2, the majority knew about soyabean as a (crop) technology: 94% of the farmers in Ghana, and 100% in Malawi, and Zimbabwe said they knew the crop. In Kenya only 73% of the farmers said they knew soya. There was no difference in this respect between female and male farmers. Not everybody who knew about soyabean actually grew it. In Zimbabwe, only 22% of the farmers interviewed were growing soya: 10 women and 4 men. In Malawi slightly more of the male farmers (71%) than female farmers interviewed (54%) said they grew the crop, which could indicate the commercial value of the crop, making this legume crop less of a women's crop than in Zimbabwe. In Kenya 58% and in Ghana 71% of the interviewed farmers said they grew soya; gender did not influence the percentage of farmers growing soya in these two countries.

Not many farmers knew about rhizobium inoculant. Of those interviewed and from whom the researchers got an answer on this question (n=374 over the 4 countries), around 52% said they knew about rhizobium inoculant and 48% said they did not. The distance between the place where the demonstration trials had been held (three seasons earlier) and the point where interviews were taken did not seem to have an influence on this pattern. In Zimbabwe, women seemed better informed, but in Malawi more men knew about it, in Ghana and Kenya there was no consistent gender difference. In the situations where a gender difference seemed to exist, the effect may be explained by the importance of the crop for either women or men, or because the organisations promoting the use of rhizobium employed differentiated gender targeting for their information campaigns.

Overall, half of the farmers (49%) obtained their first soyabean seed as a gift (Table 11). The proportion of sharings as a gift differed significantly between countries ($p < 0.0001$), being significantly higher ($p<0.05$) in Ghana and Zimbabwe (73 % and 71 respectively) compared to Kenya and Malawi (42 % and 25 % respectively). A considerable number of farmers, both male and female, obtained their first seed in return for labour (8%), had to return an agreed amount of seed after harvest (25%) or bought their first seed from the market, an agro-chemical dealer or a middleman (36%). In Kenya, 50% of farmers bought their first soyabean seed.

This first amount of soyabean seed was obtained from relatives (covering most of the gifts), friends and others: none of these relations was consistently more important as source of the first seed (Table 12). The percentage of seed sharings involving relatives differed significantly between men and women ($p < 0.05$) in Ghana and Kenya, but not in Malawi and Zimbabwe. The percentage of seed sharings between friends differed significantly between countries ($p < 0.01$) and is particularly common in Ghana, and is more common among men in Kenya ($p <0.05$). The proportion of seed received from others is different between countries ($p <0.001$), mostly due to the reported absence of this type of transaction in Ghana. The 'others' include markets, agro-chemical shops and remarkably many organisations, i.e. government agencies and NGOs, including reference to a relationship with N2Africa .

The proportion of seed that was asked for differed significantly between countries ($p < 0.001$), mostly due to Ghana where asking was least common. There was no significant effect of gender or interaction between gender and country. (Table 13). Most seed sharings (71 %) involve seed received from someone of the same gender ($p < 0.001$): men predominantly got their first seed from men and women from women (Table 14). Although this difference in percentages for male and female farmers was not significant, overall, like in study 1, more women obtained the first seed from another woman. Again Kenya presented another pattern: here the majority of women got the first seed from men, resulting in gender differences being country specific ($p < 0.001$).

In 44% of cases where we have data (n=250) the first amount of seed was between 1 and 2 kg. In 71% of cases it was 4 kg or less.

None of the information we collected indicated any obvious spatial trend related to the distance from the demonstration trials. Nor was there a very obvious gender pattern in any of the countries. The data largely supports the findings of study 1 on the sharing of seeds and information.

Table 11. How farmers in Ghana, Kenya, Malawi and Zimbabwe obtained their first soyabean seed.

Transaction (%)	Ghana (n=86)	Kenya (n=66)	Malawi (n=84)	Zimbabwe (n=14)	Total (N=250)*
Gift	73	42	25	71	49
Buy	23	50	36	21	35
Return	0	0	25	0	0
For labour or otherwise	3	7	8	7	7

* Only including those farmers from whom an answer was obtained.

Table 12. From whom farmers obtained their first soyabean seed, by country and gender.*

	Ghana		Kenya		Malawi		Zimbabwe		
	F (n=64)	M (n=48)	F (n=33)	M (n=53)	F (n=31)	M (n=44)	F (n=4)	M (n=5)	Total (n=282)*
Relative	19	6	33	2	25	25	75	20	19
Friend	81	94	12	40	23	25	0	40	50
Others	0	0	55	60	48	0	25	40	31

* Only including those farmers from whom an answer was obtained.

Table 13. The percentage of farmers who obtained seed by asking for it, or were given, by country and gender.

How they got the seed	Ghana		Kenya		Malawi		Zimbabwe		Total*.
	F (n=64)	M (n=48)	F (n=31)	M (n=51)	F (n=28)	M (n=41)	F (n=17)	M (n=5)	(n=284)
Had asked for it	20	17	51	66	67	78	6	100	45
Had been given	80	83	49	34	33	22	94	0	55

* Only including those farmers from whom an answer was obtained.

Table 14. The gender aspect of sharing: the percentage of transactions between farmers of the same sex.*

	Ghana (n=112)	Kenya (n=39)	Malawi (n=49)	Zimbabwe (n=7)	Total (N=207)
Women who got seed from another woman (n=100)	65	42	90	100	67
Men who got seed from another man (n=107)	73	70	67	100	72

6 Discussion and preliminary conclusions

6.1 The study, data and the technology

As indicated in the introduction, this study is a first exploration into the diffusion of seeds given out as part of a technology and information package introduced by N2Africa. While many seed introduction programmes have been carried out, there are, to our knowledge, no data on how seed actually spreads beyond its introduction to an initial group of farmers, and what mechanisms are involved in the diffusion processes. Literature on seed flows in informal seed systems also give no quantitative data on seed sharing that could be used, but it did serve the formulation of research questions on the sharing of seed. The decision to collect the data through short rapid rural appraisal methodologies in two sites in four countries limited the sample size and data set. It does however yield indicative figures and the existing variations. This data set is a first exploration of these questions and has limited explanatory power. It does however allow us to make initial estimates of the extent to which seeds and information are disseminated after the point of introduction and identifying further relevant questions about the diffusion of technology. The results also raise new questions: are the variations we found random or are there mechanisms and factors that can explain these variations between sites and countries? And how relevant are these variations for the design of technology introducing interventions?

6.2 The spreading of technology: seeds and information

The farmers who attended the N2Africa demonstration trials were the best sharers of seed: a larger percentage of them shared seeds with others (more than 90%) and shared their seeds with more other farmers than did farmers among the later generations. The multiplier effect/impact for diffusion of the technology is thus mostly shaped by these farmers. The encouragements from N2Africa collaborators for participants to share their seeds with others seem to have worked well. But other factors seem to have contributed to farmers' proclivity to share their seeds as well: the amount of time that farmers have their seeds and, sometimes, the amount they received . The data collected by the research teams focused on farmers sharing seeds with other farmers. The approach left little opportunity to delve deeper into the sharing of other components that formed, together with the seeds, the 'technology package', i.e. information about and consequent application of fertilizer recommendations and planting distances. The information on rhizobium inoculant did not seem to have spread well. This is perhaps not surprising given the complexity of this component of the technology, the difficulty that farmers might have in understanding it and its limited availability. Only the first generation farmers seemed to pass on information about it, later generation farmers did so much less. It is not clear however how the farmers who received the information have understood it. Since some of the knowledge, such as that regarding rhizobium, is fairly complex, we assume that the knowledge component of the technology (the 'software') travels much less easily than the seeds (the 'hardware'). Despite this, about half of the farmers interviewed in study 2 said that they 'knew about it', although this could also just mean they 'have heard about it'. One finding worth noting is that the percentages of farmers that said that they knew about rhizobium inoculant were not clearly affected by the distance of the point of interviewing from where the original demonstration trials had been held. This could indicate that the information had spread via radio or other mass communication channels rather than from farmer to farmer, together with the seed.

If we can take these results as being representative, and extrapolate them to other areas in these four countries and other countries where N2Africa is active, we can estimate how many farmers the project may have reached in addition to the farmers who participated in the original demonstration trials. N2Africa has been working in eight African countries and directly reached a total of about 250,000 farmers between 2010 and 2013 (Woomer et al., 2014), with a year-on-year increase (Table 15). Farmers who received seeds in 2010 could have reached three generations in countries that have one

season per year (Ghana, Nigeria, Malawi, Mozambique and Zimbabwe). In countries such as Kenya, which like the Democratic Republic of Congo (DRC) and Rwanda has two growing seasons per year, we managed to track seed exchanges through to the fourth generations, but were not able to track down any fifth generation farmers (although they did exist as some fourth generation farmers also passed on seeds. Our failure to locate fifth generation farmers was due to the rapidity of the appraisal). Similarly farmers who participated in trials in 2011 could have reached two generations in countries with one season, and four in countries with two seasons. We assume that the farmers reached directly were proportionally distributed between countries with one and two growing seasons (i.e. five countries with one growing season and three countries with two growing seasons). If we multiply the number of farmers participating in the project by the percentage of farmers who shared seed and the number of people they shared with, per generation, and then by the potential number of generations reached, we calculate that a total of 1.4 million additional farmers might have been reached between 2010 and 2013. This is a rough estimate, which greatly depends on the representativeness of the data. However, it does indicate that many more farmers have benefitted from the improved varieties distributed by the project. In addition, it should be noted these figures are only calculations for the course of the project; sharing of seeds with others may continue over longer periods of time, although this study does not provide evidence on this point.

Table 15. The number of farmers directly participating in N2Africa, by year, and the estimated number of additional farmers reached (from the season after the first generation's participation until 2013) through the spontaneous diffusion of seed.

Year	Farmers participating directly (#)	Additional farmers reached (#)
2010	50,000	-
2011	75,000	380,000
2012	125,000	500,000
2013	-	530,000
Total	250,000	1,400,000

6.3 **Barriers to diffusion**

One possible obstacle to the informal spreading of a new technology from farmer to farmer is that of social barriers. One of the focal points of this study has been gender which can play an important role since, in many African countries, legumes are considered to be a 'women's crop', and the spreading of the seeds could therefore be mostly limited to female networks. The data from this study indicate that this possible gendered-ness of the crop appears to have had little effect on the spreading of the seed. N2Africa invited male and female farmers to participate in the demonstration trials. Male and female farmers, in different sites and countries, shared their seed with a similar number of others. In contrast to our expectations, the men in this study tended to be 'better seed sharers' than the women: they shared seeds with others more often and they shared them more often with women than that women shared with men. Only in Ghana men showed a different pattern of sharing and here the number of farmers involved in sharing was very low. This means that even if N2Africa's projects were biased towards male participation the seeds easily reach women, mostly through men sharing them for free (i.e. as a gift) with their female relatives.

The diffusion process was mostly driven by people making gifts of 1-2 kg of seed. In study 1 the sharing with relatives dominated whereas in study 2 the sharing with friends was most frequently mentioned. The first generation farmers in study 1 most frequently shared their seeds in the first and

second seasons after the demonstration trials. It is not clear if these farmers first grew the seed themselves in the same year as the demonstration trials, or the following year. In any case, the assumption that farmers would prefer to evaluate the new crop or variety for several seasons did not seem to apply to first generation farmers (who had also been able to assess the seeds' performance in the demonstration trials), nor for the second and third generation farmers who shared their seeds with others. It is not clear how and how much the N2Africa collaborators encouraging the participating farmers to share their seeds with others influenced behaviour of first and possibly later generation farmers. The study does not tell us how many seasons farmers continued to share, but our hypothesis is that they provide relatives and friends with seed in the first few seasons after the first time they plant themselves, obtained some encouraging yields and possibly tested the culinary quality. After this, in later seasons, sharing seeds with others is more limited because they shared the novelty already with those they regularly meet. Equally we do not know if the quantity of seed that farmers receive in the first exchange influences their sharing behaviour. Farmers who get a small amount of seed can either eat it or sow it. But, if they are short of food (the majority of the farmers who were interviewed had to buy maize every year for 1 month or more), it is unlikely that they will have much surplus to share: the priority is likely be to 'bulk up' their supply so they can sow more land themselves or for domestic consumption.

Information from other studies indicates that 'asking for seed' might be something that farmers do not easily do, and that 'giving seed unasked' is, in some cases (in particular in Zimbabwe), associated with the possibility of witchcraft. The data in this study did not identify any pattern related with these phenomena. It is possible that these cultural issues do not play an important role in the diffusion of seeds of a new variety, that the differences in wealth status between the sharers were small (all were relatively poor), and that the relationship with friends and relatives, who were the main beneficiaries of shared seeds are less subject to such social restrictions.

6.4 **Conclusions**

Inviting farmers to demonstration trials, providing them with 1-5 kg packages of legume seeds, inputs and information, and encouraging them to share their seeds and newly acquired knowledge across 8 sites in 4 countries where N2Africa collaborators operated, has generated an important multiplier effect for access to new legume seeds. An extrapolation made from the data gathered for this study indicates that in addition to the 250,000 farmers reached directly through the N2Africa project, about 1.4 million more farmers may have been reached through the spontaneous diffusion of seed over the course of the project. Although sharing seeds as a gift was the dominant transaction form, a considerable number of farmers shared seeds through loans or by selling them. These later forms indicate an interest among other farmers to try and plant the new seeds.

Packages of 1-2 kg seem to be sufficient to start farmers off, allowing them to taste some and plant the rest. There are no indications from this study that, with such amounts, farmers require several seasons to evaluate the seed and bulk it up so as to have enough to share. However, in situations of scarcity, it may be more logical to consume (the majority of) the seed rather than keeping it for planting. Overall this study indicates that, when a new crop variety or crop is interesting for farmers, the diffusion of seeds is not likely to be a limiting factor. If the new crop or variety is only interesting with additional inputs or (knowledge of) management practices, the situation might be more challenging: some information – such as that about rhizobium inoculum – seems to spread reasonably well, but this does not necessarily imply that farmers understand it well or have access to it.

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Appendices

Table 1. Study 1: The number of farmers, by generation who shared (Y) and did not share seed (N) by site and country.

	Ghana			Ghana Total	Kenya		Kenya Total	Malawi			Malawi Total	Zimbabwe				Zimbabwe Total	Grand Total
	Pishigu		Sung		Butula	Malakissi		Lumwira		Mnusu		Goromonzi		Mudzi			
Row Labels	Cowpea	Soya	Soya		Soya	Soya		Com bean	Soya	Soya		Soya	Com. Bean	Cowpea	Groundnut		
Y	**1**	**3**	**7**	**11**	**32**	**18**	**50**	**6**	**10**	**18**	**34**	**3**	**9**	**15**	**11**	**38**	**133**
1	1	3	7	11	8	6	14	5	7	7	19	3	7	8	9	27	71
2					18	9	27	1	3	6	10		2	6	2	10	47
3					5	3	8			5	5			1		1	14
4					1		1										1
N					**18**	**31**	**49**	**1**	**11**	**15**	**27**	**2**	**8**	**9**	**12**	**31**	**107**
1						1	1					2			2	4	5
2		14	16	30	10	23	33	1	11	6	18		8	5	9	22	73
3					6	6	12			9	9			4	1	5	26
4					2	1	3										3
Grand Total	**1**	**17**	**23**	**41**	**50**	**49**	**99**	**7**	**21**	**33**	**61**	**5**	**17**	**24**	**23**	**69**	**270**

Table 2. Study 1: The number of transactions of farmers, by generation, who shared seed, by site and country.

	Ghana			Ghana Total	Kenya		Kenya Total	Malawi			Malawi Total	Zimbabwe				Zimbabwe Total	Grand Total
	Pishigu		Sung		Butula	Malakissi		Lumwira		Mnusu		Goromonzi		Muzi			
Row Labels	Cowpea	Soya	Soya		Soya	Soya		Com. bean	Soya	Soya		Soya	Sug. bean	Cowpea	Groundnut		
1	6	14	36	56	35	33	68	19	48	29	96	7	20	22	16	65	285
2	0	0			37	18	55	1	4	22	27		2	11	2	15	97
3					11	3	14			6	6			2		2	22
4					2		2										2
Total	**6**	**14**	**36**	**56**	**85**	**54**	**139**	**20**	**52**	**57**	**129**	**7**	**22**	**35**	**18**	**82**	**406**

Table 3. Study 1: The average number of transactions per farmer* by generation, per site and country

	Ghana			Ghana Total	Kenya		Kenya Total	Malawi			Malawi Total	Zimbabwe				Zimbabwe Total	Grand Total
	Pishigu		Sung		Butula	Malakissi		Lumwira		Mnusu		Goromonzi		Muzi			
Row Labels	Cowpea	Soya	Soya		Soya	Soya		Com. bean	Soya	Soya		Soya	Sug. bean	Cowpea	Groundnut		
Y																	
1	6	4.6	6	5.6	4.4	5.5	4.9	3.8	6.8	4.1	5.1	2.3	2.8	2.8	1.8	2.4	4.0
2				0	2.0	2.0	2.0	1.0	1.3	3.6	2.7		1.0	1.8	1.0	1.5	2.1
3					2.2	1.0	1.8			1.2	1.2			2.0		2.0	1.6
4					2.0		2.0										2.0

(*) of those who shared

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
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