

Putting Nitrogen Fixation to Work for Smallholder Farmers in Africa

MSc. Internship Report

PPS-70424 MSc Internship Plant Production Systems



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PREFACE

I would want to express my appreciation to my supervisors; Professor Ken Giller Chairing the Plant Production Systems (PPS) of Wageningen University and Research Centre (WUR) and Judith de Wolf the Country Coordinator of N2Africa project to Zimbabwe. Professor Giller, thank you for facilitating the possibility of having this internship with the project. Madam de Wolf, thank you so much for guiding me through all the work and advising during the whole internship period. I would also like to give special thanks to Chabata Isaac the N2Africa project Farm liaison officer for tolerating me in area of work throughout the internship period on tasks that I carried out especially the field work. To the other colleagues from N2Africa; Byron, Isabella and Talk more, thank you so much for all the morale support and cooperation that you showed during my stay and work at the project. To my family, thank you for supporting me throughout the internship period. Thank you all.

ABBREVIATIONS USED

CIAT	International Centre for Tropical Agriculture
IITA	International Institute of Tropical Agriculture
TSBF	Tropical Soil Biology and Fertility Institute
CIMMYT	International Maize and Wheat Improvement Centre
COMESA	Common Market for Eastern and Southern Africa
FAO	Food and Agriculture Organization
AMITSA	Regional Agricultural Input Market Information and Transparency System
AGRITEX	Agricultural Technical and Extension Service
DR&SS	Department of Research and Specialist Services
ZFU	Zimbabwe Farmers' Union
DA	District Administrator
DIP	District Innovative Platform
MoU	Memorandum of Understanding
D&D	Delivery and Dissemination
M&E	Monitoring and Evaluation
BNF	Biological Nitrogen Fixation
D&D	Delivery and Dissemination
M&E	Monitoring and Evaluation
ToTs	Training of Trainers
NGO	Non-Governmental Organisations
N	Nitrogen
P	Phosphorus
P ₂ O ₅	Phosphate
K ₂ O	Potash
S	Sulphur
Bo	Boron
SSP	Single Super Phosphate
ha	hectare
kg	Kilograms
cm	Centimetres

SUMMARY

This is an academic report that was written in fulfilment of the academic requirements pertaining to guidelines for an Internship in the Plant Production Systems at Wageningen Universiteit and Research Centrum of the Netherlands. This internship was carried out in Zimbabwe with N2Africa which in Zimbabwe is implemented by the International Centre for Tropical Agriculture (CIAT). It was a four month long internship where I was involved in day to day duties as shown in my proposed work plan (See appendices). I worked closely with the Farm Liaison Officer in most of the tasks that were carried out. These tasks included:

1. Preparation of training materials
2. Proof reading of the materials and translation of some material
3. Training of farmers
4. Preparing budgets
5. Preparing some pro forma invoices for inputs procurement
6. Co-authoring of Podcasters
7. Farm visits
8. Reports on work progress
9. Minute writing on attended meetings

INTRODUCTION

This report starts with an introduction of the N2Africa project. This will be followed by the materials and methods section that will cover the information on how the implementation of the project was done. Under this section the protocols that were used during this 2012/2013 season have been shown. This is followed by a literature review on forage legumes which was part of the internship. The section that follows is the commodity price linkage which was work that was done on searching for linkages that gave information about the commodity markets. In the results section that follows, there are explanations on the work which I was involved in. This is then followed by a discussion on the work, challenges that are faced by the farmers, implementers of the project and I as an intern. Thereafter conclusion and recommendations on the raised challenges are then given. A reflection paper on the internship is included thereafter followed by references and appendices respectively.

N2Africa is a large scale, science research project focused on putting nitrogen fixation to work for smallholder farmers in Africa by growing legume crops. N2Africa is funded by 'The Bill & Melinda Gates Foundation' and 'The Howard G. Buffet Foundation' through a grant to Plant Production Systems, Wageningen University, in the Netherlands. It is led by Wageningen University together with CIAT-TSBF, IITA and has many partners in eight countries.

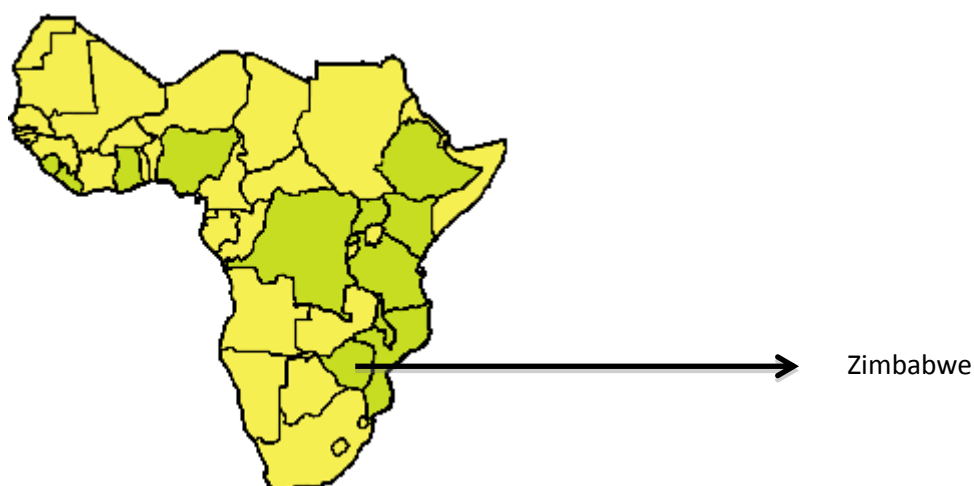


Figure 1. The map of Africa with the green colour showing countries of project implementation. Adopted from the N2Africa website.

This is a research led development project whose focus is on putting nitrogen fixation to work for smallholder farmers. This is being achieved by selecting legumes that are being used in selected districts where demonstrations are being carried out. These demos are meant for the farmers to learn from them how improved/certified seed together with inoculant plus fertilisers can work together to improve the yields of these legumes. This increase in yields will go a long way in improving food security as well as improving the livelihoods of these farmers after they sell their produce. Figure 1 shows the project organisation.

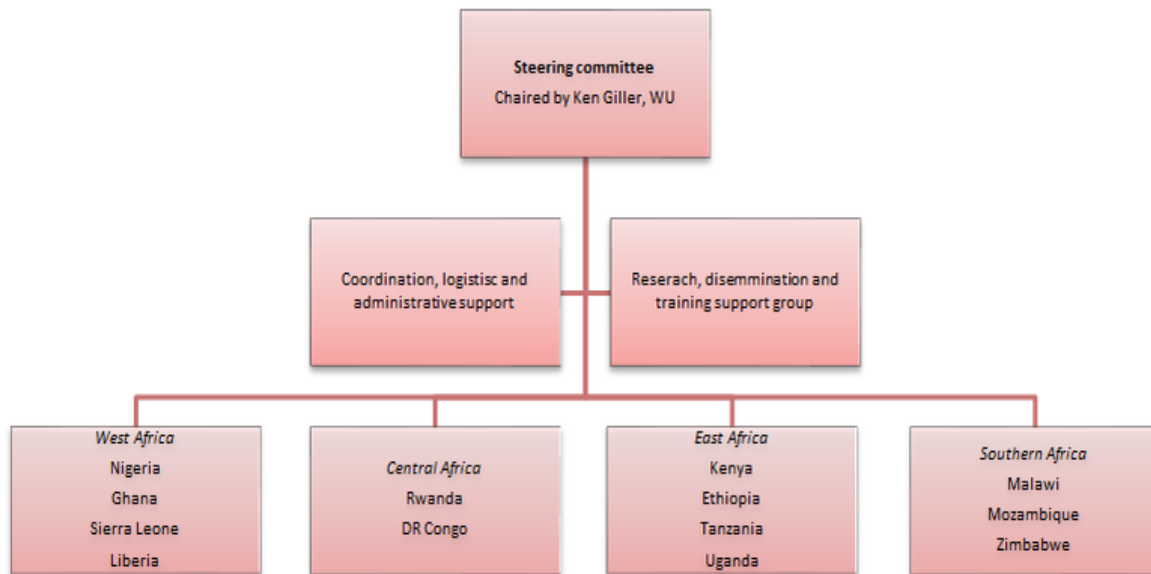


Figure 2. N2Africa project organisation. Adopted from the project website.

The first part of the project is running for four years and is now in its final year. N2Africa has five broad objectives:

Objective 1: To establish a baseline of the current status of N2Africa; identify niches for targeting N2 fixing legumes in the impact zones, M&E and impact assessment.

Objective 2: To select multi-purpose legumes (food, fodder, stakes and soil fertility management) for enhanced Biological Nitrogen Fixation (BNF) and integrate these into farming systems.

Objective 3: To select superior rhizobia strains for enhanced BNF and develop inoculum production capacity in sub-Saharan Africa, including private sector partners.

Objective 4: To deliver legume and inoculant technologies to farmers throughout sub-Saharan Africa.

Objective 5: To develop and strengthen capacity for BNF research, technology development, and application.

The reason why these objectives were formulated is due to the need to have sustainable crop production and also bearing in mind the issue of food security. The need for biological nitrogen fixation has come as a result of the identification of a challenge that the local farmers have faced. This is the low yields from legume crops and also the inability to supply enough nitrogen for their crops in the fields to achieve high yields. These objectives have certain specific goals to be fulfilled which are:

1. Identifying niches for targeting nitrogen fixing legumes
2. Testing multiple purpose legumes to provide food, animal feed, and improved soil fertility
3. Promoting the adoption of the improved legume varieties
4. Supporting the development of inoculum production capacity through collaboration with private sector partners

5. Developing and strengthening capacity for legumes research and technology dissemination
6. Delivering improved varieties of legumes and inoculant technologies to more than 225,000 smallholder farmers in the eight countries of sub-Saharan Africa.

Project implementation in Zimbabwe

The project is premised on three workstreams namely Research and data, Monitoring & Evaluation (M&E) and Delivery & Dissemination (D&D).

Research and data

This section covers activities such as:

1. selection of best varieties of all legumes involved in the project for high N fixation capacity and adoption to abiotic and biotic stresses,
2. exploring on N fixing potential of multipurpose forage legumes for intensive meat and milk production and environmental services,
3. identifying best fit agronomic practices maximising potential benefits of legume and inoculant technologies on increasing and stabilising productivity,
4. identifying superior strains across the impact zones
5. Establishing rhizobium germplasm bank in the impact zones, developing cost effective production methods, expand and upgrade inoculant production capacity in sub-Saharan Africa.

Monitoring and Evaluation

1. quantifying current N fixation in the target farming systems and impact on livelihoods
2. monitor impact of investment and adoption of the technology
3. evaluate impact of the technology on farmers' livelihoods (income, health, productivity)
4. evaluate contributions of best fit agronomic practices to system productivity and livelihoods(trade-off analysis between competing enterprises)

Delivery and Dissemination

1. develop planning documents and identifying the project sites with impact zones
2. Identifying new opportunities for targeting legumes and inoculant technologies to increase BNF and enlarge the production areas of prioritised grain legumes.
3. Conduct and advocate for policy review on inoculant quality and cross border movement
4. Creating strategic alliances for facilitating dissemination of technology
5. Produce specific dissemination tools including inoculant packets, adapted to the needs of farmer groups, agro-dealers and development partners.
6. Engage with other legume seed production and activities, farm input, commodity marketing and processing initiatives and nutrition programmes.
7. Conduct collaborative technology dissemination campaigns and create awareness in rural communities of the impact zones.
8. Developing strategies for empowering women to benefit from the project products.
9. Provide short term, high level technical training in essential skills and BNF technologies.
10. Training of trainers workshops on legume and inoculant technologies for AGRITEX workers and NGO staff.

11. Training workshops on technologies for agro-dealers and officers of farmer associations and community based organisations.

The internship was more to do with the D&D which is also much involved in working on objective 4 'To deliver legume and inoculant technologies to farmers throughout sub-Saharan Africa'. Figure 3 shows how these three are interlinked with each other in the implementation of the project.

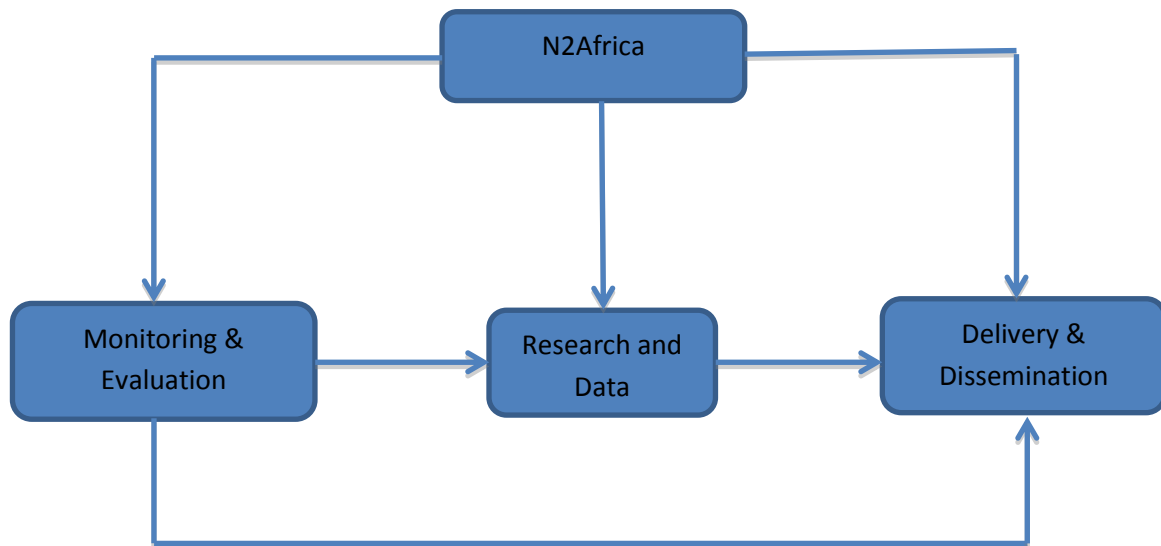


Figure 3. The interlinkages of the three facets of N2Africa project.

Districts chosen for project implementation

N2Africa has selected some mandate areas and action sites in Zimbabwe. These are Mashonaland East Province (Goromonzi, Hwedza, Mudzi and Murehwa districts), Mashonaland West province (Chegutu district), Mashonaland Central province (Guruve district) and Manicaland province (Makoni district). Mudzi and Guruve districts fall in natural region IV and are therefore dry and hot. The two are also far away from urban centres in comparison to the other districts where the project is being implemented (Franke *et al.*, 2011). Chegutu falls under natural region III whereas Goromonzi district is under natural region IIa. Murehwa has wards falling either in region IIa or IIb while wards in Makoni and Hwedza are under either natural region IIb or III. Districts in natural region IIa, IIb and III 700mm-850mm and therefore suitable for semi-intensive arable farming. In all these districts maize has been grown as the staple food while legumes have been grown in some areas but to a lesser extent.

The project has managed to identify four legumes that have been used for the BNF. These are sugar beans *Phaseolus vulgaris*, cowpeas *Vigna unguiculata*; soyabeans *Glycine max*, groundnuts *Arachis hypogaea*. Although these crops have already been growing in the chosen districts; there was a challenge in that the farmers have been using retained seed from the previous seasons and not buying in new or certified seed for the production of these crops. They have also been reluctant to use fertilisers on these legumes. They have been usually grown in unspecified intercrops where it was not systematic. They also have not used the inoculants for enhancing the biological nitrogen fixation. All these challenges have therefore accrued to a reduction in the potential yield of these

crops rendering them to be regarded as inferior crops. This has then led to the crops being regarded as the women’s crop and have since received less attention and usually grown on lands that have also been considered unproductive giving priority to other crops like maize, tobacco, cotton and other crops they may consider more important.

N2Africa partners in Zimbabwe

N2Africa in Zimbabwe is working with five partners that are listed in *Table 1*.

Table 1. Partners working with N2Africa

Partner	Area of work
Department of Research and Specialist Service (DR&SS)	A government research institute in Rhizobiology work.
Cluster Agricultural Development Society	A community based development agent working on Delivery and Dissemination in Goromonzi.
Community Technology Development Trust	A community based development agent working on Delivery and Dissemination in Chegutu and Murehwa
Lower Guruve Development Agency	A community based development agent working on Delivery and Dissemination in Guruve
Agricultural Technical and Extension Services (AGRITEX)	Government department working on the Implementation of the project in Makoni, Hwedza and Mudzi.

Every season a Memorandum of Understanding (MoU) is signed with every partner involved in the project implementation. This will work as a guideline on who will do what to achieve the implementation of the project. These partners are already working in the districts on other community development projects. They will then disseminate the technology together with N2Africa within the community. These partners except for the AGRITEX which is government extension services and DR&SS which is a government research institute; are Non-Governmental Organisations (NGOs) which are mainly working on Community Based Development. This therefore makes it easier to work with them since they are already in the communities. The government institutions will facilitate sustainability of the technology even after the project implementation by N2Africa since they are resident in the areas.

MATERIALS AND METHODS

D&D is one of the three facets of the N2Africa project. It is fulfilling objective 4 of the five global objectives which is *to deliver legume and inoculant technologies to farmers throughout sub-Saharan Africa*. During the internship period five roles of D&D were covered. These were:

1. Conducting collaborative technology dissemination campaigns and create awareness in rural communities of the impact zones.
2. Developing strategies for empowering women to benefit from the project products.
3. Provide short term, high level technical training in essential skills and BNF technologies.
4. Training of trainers workshops on legume and inoculant technologies for AGRITEX workers and NGO staff.
5. Training workshops on technologies for agro-dealers and officers of farmer associations and community based organisations.

The internship involved working hand in hand with the Farm Liaison Officer in the Delivery and Dissemination. To achieve this delivery and dissemination, some training materials had to be designed for the agro-dealers and other materials for the farmer trainings. For the farmer trainings the materials were both in English and in vernacular language (Shona). Farmers who lead other farmers in the implementation of this project (Lead farmers) were trained so they could train the other farmers. These farmers will be referred to as the lead farmers in this report. The lead farmers were chosen by their colleagues in the district to represent them in training and later establish some demonstration plots on their fields which would be used as sources of inspiration for the other farmers through the field days. In this 2012/2013 season; 115 lead farmers per district were chosen of which each lead farmer 19 follower farmers had. The lead farmers would train their follower farmers on and impart this technology to their colleagues through establishing demo plots.

The method of selecting the lead farmers has proven to be working well for the project. This is because these leaders have managed to follow the protocols during planting. They have also managed to have their demo plots planted on time as well as having them managed well in terms of weeding. Choosing the lead farmers by fellow farmers cultivates some sense of belonging to both the lead and the follower farmers. It also instils some confidence with each other as they work together on their demo plots and share experiences. If leaders are imposed for projects like these, chances are that there will be no team spirit within the farmers and this may have a negative implication on the results. The projects may even fail to take off or to continue if they will have started due to the possible incompatibility of the parties involved. When the follower farmers see the technology working for their colleagues they then accept it more than just hearing it being implemented on an environment which is far from their own. This participatory approach seems to work well for the project. It also helps in empowering the local farmers by giving them responsibility to teach their fellow colleagues as well as that privilege of nominating their own leader. This will be helpful even after the life of this project because what they would have grasped during the time of the project will remain with them. They can then continue to benefit from the trainings.

Different protocols have been developed for this season whereby different numbers of farmers are going to work on different legumes in a move to see how best these legumes can be used for the

biological nitrogen fixation process to improve soil fertility for the smallholder farmers in Africa. Following is a table which shows a summary of how the legumes were distributed amongst the districts:

Table 2. Distribution of farmers growing each legume amongst districts.

District	Sugar beans	Soyabeans	Ground nuts	Cowpeas	SSP	Soya blend	Soya inoculants
<i>Chegutu</i>	10	5		5	20	5	5
<i>Goromonzi</i>	10	10			20	10	10
<i>Guruve</i>	10	10			20	10	10
<i>Hwedza</i>		5	10	5	20	5	5
<i>Makoni</i>		5	10	5	20	5	5
<i>Mudzi</i>			10	10	20	0	0
<i>Murehwa</i>	5	5	5	5	20	5	5

Each crop had a separate protocol which was handed to the farmer who was responsible for taking up the demonstration as per the district plan. Soyabeans had one protocol in which we intend to study the effects of SSP, Soyblend and inoculants on the yield of the crop. Soyblend is an inorganic fertiliser that was prepared by the Zimbabwe Fertiliser Company. The composition of the fertiliser is 6% N, 11.78% P, 16.60% K, 7% S and 0.25 % Bo respectively. This will give a P content of and for 20% K2O its. By having this we wanted to learn the option that would facilitate and support the best BNF. For sugar beans there are two protocols where in the first protocol we intend to study the effect of interaction of maize and sugar beans in an intercrop on the yield of sugar beans; and for the second protocol we intend to study the effects of SSP and manure on the yield of sugar beans. For the latter experiment we are not specific on the type of manure that was used. This is going to affect how we interpret the results to be obtained. In cowpeas we are studying the effects of inter-row spacing (spatial pattern) on the yield of cowpeas and also the effects of Intercropping on the yield of cowpeas. Groundnuts are the fourth legume in which we want to study the effect of SSP and Gypsum on the yield of the groundnuts.

PROTOCOLS USED

Tables 3-Table 8 shows the different protocols that we used for each legume. The different treatment plots will be 10 m length by 10 m width each.

Soyabeans

The effects of SSP and inoculants on the yield of soyabeans

The main objective is to observe the effect of SSP and inoculant on the yield of soyabean crop. N2Africa has previously focused on testing inoculants on soyabean and will now explore the effects of the combinations of SSP and inoculant on the yield of soyabeans. P will be applied at a rate of 20kg/ha. The treatment plots will be 10 m length by 10 m width each.

Table 3. Treatment combinations for observing effect of soyblend and SSP on soyabean yield

Treatment	Treatment combinations
1	No fertiliser, No inoculants
2	Inoculants and SSP
3	Inoculant only
4	SSP only

Sugar beans

a. The effect of interaction of maize and sugar beans in an intercrop on the yield of sugar beans

This demonstration has been designed to observe the effects of intercropping maize and sugar beans on the yield of sugar beans. The protocol and design will be as follows:

Table 4. Treatment combinations for maize sugar bean intercrop.

Treatment	Treatment combinations
1	Maize intercropped with sugar beans in the ratio of 1:1 maize to sugar beans
2	Maize intercropped with sugar beans in the ratio of 1:2 maize to sugar beans
3	Maize intercropped with sugar beans in the ratio of 2:2 maize to sugar beans
4	Sole sugar beans (control)
5	Sole maize (Control)

The fertilizer treatments to be used will be Compound D since that is the main fertilizer used in the production of maize and usually farmers apply the fertilizer to their sugar bean crop. Ammonium nitrate will be used as top dressing for maize.

b. Effects of SSP and manure on the yield of sugar beans

Zimbabwean farmers usually use kraal manure as a substitute for inorganic basal fertilizers. Since manure is readily available among farmers who own cattle, goats or sheep, it will be good for the farmers to observe the different effects of SSP and manure on the yield of the sugar bean crop.

Table 5. Treatment combinations for SSP and manure on sugar bean yield.

Treatment	Treatment combination
1	SSP
2	Manure
3	SSP and manure
4	Zero (control)

Cowpeas

a. Effects of plant inter-row spacing (spatial pattern) on the yield of cowpeas

Traditionally, farmers are used to planting cowpeas at a relatively high plant density. However from research we have learned that lower plant densities give more biomass (leaves for relish) while the production of grain is not negatively affected. The objective of this demonstration is to show the effects of using different crop spacing on the yield of both biomass and grain in cowpeas.

Table 6. Treatment combinations for effects of spatial pattern on yield of cowpeas.

Treatment	Treatment combinations
1	45 x 20 cm
2	60 x 20 cm
3	75 x 20 cm
4	90 x 20 cm

b. Effects of Intercropping on the yield of cowpeas

Farmers are used to intercropping cowpeas with grain crops since they consider the cowpea as a minor crop. It will be thus ideal to observe the effects of intercropping on the yield of cowpeas. Since there are indeed benefits to be derived from intercropping maize with a legume, this demonstration has been designed to observe the effects of intercropping maize and cowpeas on the yield of cowpeas. The protocol and design will be as follows:

Table 7. Effects of intercropping on yield of cowpeas.

Treatment	Treatment combinations
1	Maize intercropped with cowpeas in the ratio 1:1 maize : cowpeas
2	Maize intercropped with cowpeas in the ratio 2:1 maize : cowpeas
3	Maize intercropped with cowpeas in the ratio 2:2 maize : cowpeas
4	Sole cowpeas
5	Sole maize

Groundnuts

Effect of SSP and Gypsum on the yield of groundnuts

The Delivery & Dissemination demonstrations for the groundnuts will be done to show the effects of SSP and Gypsum.

Table 8. Effects of SSP and gypsum on ground nuts yields.

Treatment	Treatment combinations
1	SSP and Gypsum
2	SSP
3	Gypsum
4	Zero (control)

LITERATURE REVIEW

This was meant to cover a review on research work that was done on forage legumes in Zimbabwe. This research work was carried out by CIMMYT SoilFertNet project. Many legumes were tested at numerous sites for green manure, the same species as used for forage. The aim of this review was then to gather all the information that emanated from this project. Following is the partial review work that was done on a self-suggested title during the internship period.

Forage legumes for improving soil fertility for smallholder farmers in Zimbabwe

Forage legumes have been found to be a potential solution for the soil nutrients problem being faced by most smallholder farmers in Zimbabwe. This is because of the research that has been done in the past few years by CIMMYT and other stakeholders in this field (Rowe and Giller, 2003). The reason why the soil nutrients have been so much a limitation and interesting to research about is mainly because of the financial constraints associated with the purchasing of the required amounts of the mineral fertilisers by these farmers (Hikwa and Mukurumbira, 1997; Hikwa *et al.*, 1998) and the need for the low cost solution for production. The other reason could be due to the inefficient use of the available resources such as manures, fertilisers and the legumes. Apart from the grain legumes that have been traditionally used in the intercropping by these farmers; research has moved on to investigate on the suitability of the forage legumes as a source of nitrogen required by the plant for growth.

Grain legumes and green manures have been successfully used to improve the soil fertility (Waddington *et al.*, 1998). Fodder legumes have also been used as tree fallows. Multipurpose trees have often been chosen and are more ideal for the farmers. Although legumes have been used for more than a decade now they have always been contributing less than their potential nitrogen fixation (Rowe and Giller, 1998). This is because of the size of land to which these are planted which is caused by the poor market development for the legumes in question. The farmers then find it unattractive to grow something that will not give them a direct benefit.

Table 9. A summary of N₂ fixation potential from different categories of tropical legumes

Legume system	% Nitrogen fixation	N fixed (kg N/ha)	Time (Days)
Grain legume	60-100	105-206	60-120
Pasture	45-98	115-280	120-365
Green manure	50-90	110-280	45-200
Trees	56-89	162-1063	180

Source: (Giller, 2001) cited by Mapfumo, 2011.

Leaves of forage legumes like the *Cajanus cajan* have been found to supply approximately 90kg/ha of N (Sakala *et al.*, 2002). In his research work he however concluded that they have a tendency of immobilising N for two weeks due to low N (1.8%) and high lignin content (16%). This will therefore mean that for the companion intercropped maize that is growing with the *Cajanus cajan* there is no direct benefit but to the subsequent crop on the field.

From another research work that was done, (Palm *et al.*, 1997) has concluded that the usefulness of the forage legumes will depend on their quality; amount of lignin and N. Table 2 summarises their findings and the best way to utilise these legumes.

Table 10. Summary of properties and options on the usefulness of forage legumes.

Quality	Properties	Utilisation options
High N and low lignin	Rapid decomposition	Direct application nutrient supply
Low N and high lignin	Slow decomposition without N release	Apply as mulch
High N and high lignin	Immobilisation of the available soil nutrients	Mix with fertilisers or high quality organic material before application
Low N and low lignin	Immobilisation of the available soil nutrients	Mix with fertilisers or high quality organic material before application

Source: (Palm *et al.*, 1997)

These types of nutrient supplies have been recorded to have been used in the country since the 1920s (Meterkamp, 1988). According to Hikwa *et al.*, (1998) the green manures have been used in the large scale commercial farms and also have been informally reported to be used in the smallholder farms. An example is where the *Mucuna puriens* have been used tree fallow technique. The management options and choice of the appropriate technologies is at times complicated by the climate variations (Shamudzarira, 2003). In the two scenarios that were studied by Shamudzarira (2003), at 50% probability level, there was the *Mucuna puriens*-maize rotation and the *Mucuna puriens*-maize-maize rotation. Yields rose from the 200 kg/ha for a sole crop maize to 3.5-4t/ha for the earlier practice and from 300kg/ha for a sole maize crop to 3.5-4.5t/ha for the latter rotation. In northern Malawi on fair soils a single green manure crop has managed to increase maize yields from 200-300 kg/ha to 4t/ha. Some unfertilised maize crops have managed to yield up to 2-3t/ha in a *Mucuna puriens* -maize rotation and 5-8t/ha in a *Mucuna puriens*-maize-maize rotation. Muza and Mapfumo (1998) reported a trebling in the maize yields after incorporating *Mucuna puriens* compared to a 466 kg/ha from the unfertilised crop. Where the rainfall is less than 350mm the average maize yields are higher in the *Mucuna puriens*-maize-maize rotations than with *Mucuna puriens*-maize and vice versa when the rainfall is more than 350mm.

Despite the benefits derived from the use of the legume technology; most farmers according to the research results do not seem to be keen to adopt this practice. Their reasons have been mainly due to the loss in the production of the maize from the piece of land to which the *Mucuna puriens* will have been planted (Kumwenda *et al.*, 1997).

COMMODITY PRICE LINKS

This was work that I did to get an overview of the information that is available in terms of prices of the agricultural commodities. The detail that was available was somehow limited. There was one site that was really helpful for the farmers which supplies the detail of the market status on a weekly basis. Farmers would use this as a guide on how much they expect to sell their crops for without being exploited. This search of prices is not a simple task as such since some of the links showed some limited stock and at times things that are not specific to Zimbabwe.

http://famis.comesa.int/#tab_production1

This link is based on COMESA and showing prices for all commodities grouped as Crops, livestock, fisheries and fertilisers for Uganda, Zambia and some other countries.

<http://faostat.fao.org/site/345/default.aspx>

This is showing a main homepage from FAO where there are many other links associated with this page and pricing of different agric. commodities. This website covers almost all countries including the ones currently working with N2Africa. Sierra Leone is however not included in the country list. Crops covered include cowpeas, soyabeans, dry beans, groundnuts and maize which are our crops of interest. It is covering years since 1991-2012.

<http://www.amitsa.org/>

This is showing data on monthly national and international prices on fertilisers, pesticides and seeds on Burundi, Malawi, Kenya, Mozambique, Rwanda, Tanzania, Swaziland, Zambia and Rwanda. Zimbabwe is not included here.

http://213.193.193.214/IFDC_ReportServer/Pages/ReportViewer.aspx?/AMITSA_Reports/Monthly+Prices+For+Seeds&rs:Command=Render

This is the expansion of the AMITSA link above: <http://www.ama.co.zw/>

Weekly commodity market bulletins on almost all agricultural products.

http://www.zfu.org.zw/index.php?option=com_content&view=article&id=69:sources&catid=40:demo-roktabs-fp-2

Zimbabwean website showing the weekly market guide on prices of all the crops that we are using in the project.

<http://www.thecropsite.com/reports/>

Market reports of global crop industry for many countries including Zimbabwe.

RESULTS

In this section results of the work that was done during the internship period are going to be discussed. Key observations are to be highlighted. The results will be based on two activities i.e. training of trainers and farm visits on demos.

Training of Trainers

This involved training of three specific groups of people who would go and train others in the communities. These were:

Agro-dealers – stakeholders who are responsible for stocking and selling of agrochemicals within the impact zones where the project is being implemented.

Lead farmers – those farmers who are chosen to represent other farmers as leaders in their communities and trained to later train other (follower) farmers in those communities on how the demonstrations are to be implemented.

Partners – It also involved the training of the representatives from the partners who are involved in the dissemination of the technology. Under this group the Extension Officers from AGRITEX were also trained.

Extension workers – These were also among the groups of the trained people. Whenever we had a training they were represented there. The reasons why we also had them being trained was that:

For sustainability purposes- these workers are community based and in the event that the N2Africa project is no longer in the area there is a possibility of continuity because they would know what to do and be able to continue teaching the new farmers on how to use the inoculants and the important aspects of fertiliser use on legumes as well as the importance of using certified seed during planting.

Generally the trainings would take about 6 hours of one day for each group. Training would start at around 9 am and finish at 4 pm with an hour long lunch break at 1 pm. Some reading materials were given during the training. There were some books that had information on legumes and information about N2Africa. These were printed in Shona and some in English. On handing the materials over to the people, the people would choose the language they would feel more comfortable on reading. To the partners some registers were given and they were supposed to capture some details from the farmers. This was information such as the date of birth and sex. These would help us to assess the continuity of the project implementation and also to see gender balance within each districts. Protocols were also explained during these trainings to have the lead farmers understanding how these were to be used. A separate protocol for each crop was given to each farmer according to the planning on which crop one was to grow.

Key observations during the trainings

Agro dealers

- It revealed during the trainings that the agro-dealers had no adequate knowledge on fertiliser requirements of the legume crops. They mostly stocked fertiliser for traditional crops like maize, tobacco and cotton. This has not been worked out to give the exact quantitative value but roughly 75 % of the agro dealers explained that they have not stocked fertilisers specifically for legumes.
- None of these agro-dealers stocked certified seed for the legume crops. This also showed that they did not know the importance of having the certified seed in stock for the farmers thereby promoting its use.
- The agro-dealers also showed that they had no adequate knowledge about the inoculants and their use hence the reason why they did not stock them for resale to the local farmers.

Extension workers

- It showed during the trainings that before project implementation the extension workers had not emphasised on the use of the basal fertilisers for the legumes during their trainings with farmers.
- It also revealed that before the N2Africa project they had not taught much about the importance of using certified seed for legumes to improve on yield.
- Although it showed that they had some knowledge on inoculants and how they work, they had neither highlighted the use of inoculants to their farmers nor teach them how they work for improving the BNF.

Lead farmers

- They showed ignorance on the use of fertilisers for legume crops except for groundnuts which they were aware that it required top dressing using gypsum.
- They also indicated their lack of knowledge on the use of improved or certified seed for these crops as well. They have always been borrowing and sharing the seeds retained from their previous crops for planting.
- They did not know about the inoculants and how they are used in legume crop growing to boost the BNF and hence the yields of the crops.

Other general observations

- Farmers were not aware of the economic importance of the legumes and that they would improve their income if they would grow them on a larger scale and achieve good yields.
- Application of basal fertilisers was also a 'new' thing to them.
- Not many of the farmers had used certified seed before on growing these legumes. They had always been using the retained seeds.
- The knowledge about the certified seed among the farmers was very limited.
- National farmers' representative from ZFU also attended the training in Mudzi. In Hwedza and Guruve the commodity association team was also present during the training. In Guruve another exception is that the Councillor also attended the training as a Lead farmer.

- Interest in legume growing was high in women as judged by the attendance during trainings in the past seasons.
- More men are now coming for the training sessions when compared with the earlier seasons of the project.
- From the available records of trainings from the current season, it shows that the issue of men to women ratios participating in the training differed from district to district. Figure 4 shows the distribution of men and women who attended the trainings in different wards.

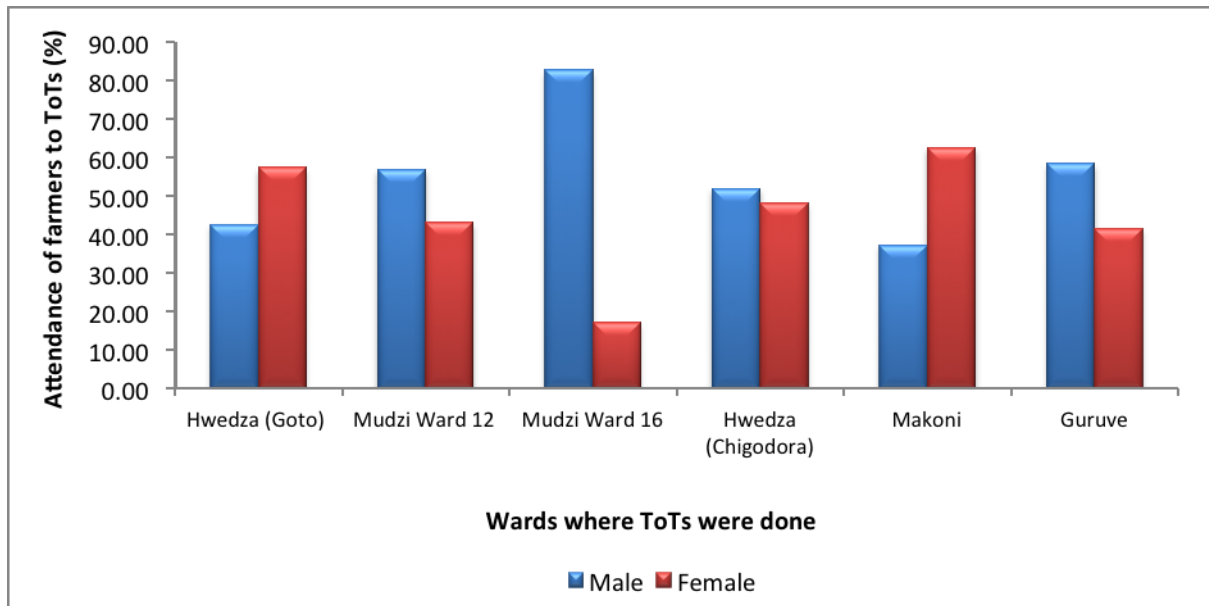


Figure 4. The comparison of males and females who participated in the Train of Trainers (ToTs) of 2012/2013 in the various districts.

Farm visits on demos

Monitoring visits were made to districts after the onset of the rain season. The timing was about three weeks to a month after the start of the season. The purpose of these visits was to go and see what was happening on ground in terms of land preparations and planting of the demonstration plots. Three districts were visited i.e. Hwedza, Mudzi and Makoni. The visit in Hwedza was during the land preparation period while in Mudzi some planted demo plots were already emerging while the crop in Makoni was even much older than the crop in the rest of the districts.

These visits were also meant to see whether the farmers managed to follow the protocols as intended on planting. There was also need to see how the farmers valued the demo plots. From previous seasons it has shown that when farmers are to plant demo plots they usually start with their own crop as priority then later attend to project work. There was also need to know how the farmers planted, were they on their own or they had the extension workers planting with them. Challenges that were met during the planting of the demos were also to be noted and discussed and if possible assist the farmers.

General observations

- The visit to Mudzi district enabled us to see the emerging demo plots in the two wards of the district. Figure 5 shows the plots in Mudzi and the problem pest that affected their stand in some areas of Ward 12. Planting was still in progress. Most farmers who were visited had small crops; some were still emerging and therefore could not be pictured.



Figure 5. Pictures showing the maize:cowpea intercropping demo plots in Mudzi.

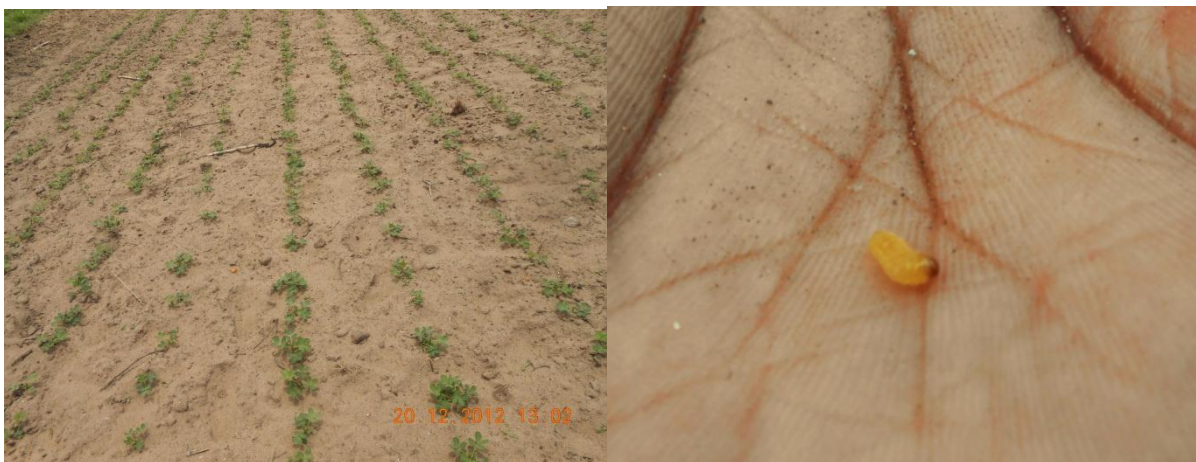


Figure 6. Left picture is a groundnut crop showing the fertilisation demos. The right picture shows the white grub that has caused problems on some of the plots that we visited. It is cutting from below the plant in the soil.

- Makoni had the most advanced development stage of the crop compared to the other districts. This was because most farmers seem to have given priority to their demo plots and rains started earlier compared to Mudzi district.
- Most of the farmers managed to follow the planting protocols except in Mudzi where one farmer used a spacing meant for maize on planting cowpeas. The spacing were too wide for the legume thereby wasting space.
- In Ward 16 of Mudzi district the farmers were planting alone and thereby resulting in some confusion on interpreting the protocols.

DISCUSSION

- ✚ Not all farmers are aware of the fact that legume crop growing can be a profitable enterprise. They have also been growing the crop from retained seed which made it very difficult to harvest high yields that would warrant taking the legumes for commercial crops. The farmers had also not known the use of the basal fertilisers for legume cropping. This is because the agro-dealers and the AGRITEX department have not managed to publicise the use of these fertilisers on other crops besides maize cotton and tobacco. This could have been caused by lack of adequate knowledge from the extension agents and the agro-dealers themselves. This also includes the use of the inoculant to enhance BNF. The farmers had no adequate information on how the inoculant works. Another issue besides knowing it is the distribution of the inoculant.
- ✚ Ordinarily before the project, the inoculant has been availed to farmers at district level. This then make it very difficult for other farmers who are normally located far away from the district offices to access the inoculant. At district level the supply is also not very reliable, resulting in cases where some farmers would fail to get the inoculant despite having the money to buy it. In some cases the inoculant has not been enough for all farmers. This has mainly been caused by the reason that we have a sole player in the inoculant production industry; which in some cases lacks funding enough to produce adequate inoculant for all the farmers who might need to buy it.
- ✚ Generally, the smallholder farmers in Zimbabwe have always been growing the legume crops as minor crops on their fields. The legumes have yielded poorly in most cases (Nhamo *et al.*, 2003). The reasons why this is so is because most of the farmers have not taken buying of certified seed as important for these crops. This has been caused by the limited financial resources of which they opt to buy certified seed for crops like maize instead which really quickly show deterioration of quality and yield if grown from retained seed. The other reason is also that most farmers have not used fertilisers or inoculants for these legume crops. This is due to the same reason of lack of finance to buy the inorganic fertilisers. This project was then introduced to the farmers with these problems in mind. The demos are meant to show and teach the farmers on their fields the benefit of using certified seed and also inoculants on growing their legume crops. Before the introduction of the project most farmers expressed their ignorance of the inoculant.
- ✚ This project has worked out well in all districts where it has been implemented. The farmers have managed to follow the protocols as required. They have also managed to plant the legume crops on time. For example, according to the farmers in Guruve district where we managed to discuss with the farmers implementing the project, they are happy in having this project introduced into their area. They said in the previous season they have managed to harvest more sugar beans that they sold and realised high profits.
- ✚ In the season 2012/2013 115 lead farmers were chosen for every district. According to the records available in the review and planning meeting for Zimbabwe (de Wolf, 2012) for the project; it has showed that generally more women are participating in agricultural activities except in two districts; Mudzi and Guruve. These two districts had higher yields of legumes and are now planting more than just the demo plots. Legume growing has been has been

found to be rewarding leading many men registering to participate in this project. Guruve is a district where sugar beans have performed well and thus resulting in high yield from the farmers and a high quantity of surplus which resulted in big sales that brought in cash for the farmers. This motivation then led to men also taking the growing of legumes as a business rather than just some work to be done. The income obtained from cultivating legumes as promoted by N2Africa project has resulted in the farmers leading some improved type of life through food security.

- ✚ In Mudzi as we discussed with the AGRITEX personnel, sentiments that we got were that farmers are happy with the project. This is because the project has enabled the farmers to get yields that are higher than the old yields that they were getting before the introduction of the project. The technologies that they learnt from this project are the buying in of certified legume seed which they have not been doing in the past. The seed for these crops has always been an issue of borrowing from one another and the seed keeps circulating for unspecified periods of time. This has led to the deterioration of yields as time progresses. This technology has actually led to the growing of legumes especially groundnuts to go commercial and as a cash crop rather than just growing the crop for home consumption.
- ✚ Another technology the farmers have learnt is that of using inoculants for improving the biological nitrogen fixation (BNF) by the legumes. They have realised through the research demonstrations that they have done on their farms that it indeed improves the yield of the legume crops. As we discussed with the farmers they actually commended this technology and promised to continue using it even in the life after N2Africa.
- ✚ In Goromonzi district the farmers are also appreciating the introduction of inoculant use and buying in of certified seed for their fields. From the discussions that were done with some of the farmers, they also indicated their pleasure in participating in the legume growing. They mentioned benefits that they have derived from the projects which include among others getting higher yield than before thereby improving their livelihoods by having more income from the legume sales.

CHALLENGES

- ✚ During the internship period, it was observed that most agro-dealers are not aware of the right type of fertilisers for legume growing. They are also not aware of the inoculants and their importance to legume growing. This lack of adequate knowledge has therefore resulted in them not stocking these products in their shops for resale to farmers in their areas.
- ✚ The lead farmers were also neither aware of the use of basal fertilisers nor the use of inoculants on legume crops. They also did not appreciate the use of certified or improved seed for their legume crops. They have always been growing legumes but from certified seed and without fertilisers except for groundnuts where they would apply some gypsum as top dressing.
- ✚ Farmers were not aware that the legumes are a profitable enterprise if well implemented. They always took it as a secondary enterprise giving much priority to other crops like maize, cotton and tobacco.
- ✚ In Mudzi there is a challenge of the political instability. During the time that we visited it was difficult to freely discuss with the farmers. When in the district one has to report to the Government offices first where we are supposed to see the District Administrator to ask for permission to go into the field. In some cases you have to take some Officers from the Ministry of Youth and Information whom you will walk around with. By so doing it then becomes difficult for the farmers in this area to open up and share their feelings openly for fear of victimisation. Some of the farmers feel afraid to participate in the project and even other projects associated with the Non-Governmental Organisations (NGOs). Only farmers registered with the ZFU may participate in the project. Farmers are therefore forced to join the Zimbabwe Farmers' Union. This requires money for them to join. The money sounds minimal but for them it is a barrier and many potential farmers are then left out of the project because they will not be members of this organisation. The group is also not doing many tangible things and also lacks transparency hence the reason why most people would shun the group.
- ✚ On the other hand, farmers in Mudzi district have now turned more focus onto gold panning in the Rwenya River in Ward 16 which comprises of Kanyoka and Gozi. This development has affected in the sense that a farmer will go away for gold panning for days and camping there for some time while the fields are left unattended. During the visits to see the plantings of demos we observed that despite the late start of the season, other farmers had already planted whilst others had not done so because of conflicting interests.
- ✚ The personnel from AGRITEX have other obligations that they have to do from their work place. N2Africa is not the only organisation who needs their services in their areas of operation. There are other organisations that are also coming up with projects which also need their attention. At times it ends up being difficult for them to fulfil the requirements of

all projects. It then requires people who are dedicated to their work to be able to meet all deadlines and having the work done as per expectation.

- ✚ Another challenge that some of the farmers are facing is that of lack of draft power. This has resulted in the farmers either delaying to plant or maybe using the conservation agriculture technique to allow early planting. Farmers were a bit sceptic to plant their groundnuts in December citing that it was too late for groundnuts but they however did. Related to this challenge is the harvesting of crops like the soyabean. The crop when it matures starts to shatter of which it will make it difficult to harvest. It is either one has to use the sickles to cut the crop and heap it up for thrashing or pulling it out. The process is rather cumbersome.
- ✚ From all districts, a few farmers that I managed to talk to register their concern on the size of the package they get for the project. While they appreciate our idea of having small packages to reach more people; they were indicating that at times it takes energy and effort to work on the demos but what you get end of day is also a small quantity.
- ✚ The full potential of biological nitrogen fixation (BNF) can only be realised when the farmers have been linked to the markets. This is because if we would promote a technology that would result in them having difficulties in marketing the high quantities of produce they would have achieved it will be pointless. While farmers have appreciated the beauty of the project, they still have challenges in disposing their harvested crops. In Zimbabwe it has been easier for the farmers to market their soyabean crop when they have big tonnage unlike when they have small packages of the crop. In our case, we are giving the farmers small packages of seed from which end up yielding unsalable quantities. Above all, we are giving the farmers different varieties whilst they are in the same area. They cannot be pooled together for marketing purposes because most buyers would want to buy the same variety at a time. Another thing is that some of the legume crops being used have limited uses at household level; especially soyabean and therefore not a much desirable crop in comparison to sugar bean, groundnuts and cowpeas.
- ✚ The project life at this stage is limited to only four years. This seems rather short for a project like this because real results seem to be long term. It therefore means that by the end of this period the conclusions that we would have obtained are rather superficial and may not be the clear or realistic results that we should obtain had it been allowed to run for longer.
- ✚ During the internship period I found out that training of trainers requires concentrated effort. What I have seen is that the farm liaison officer does it alone. Depending on districts, some wards are far apart from each other and during the trainings these farmers have to be brought together at a central point. The trainer has to wake up very early and drive to all these places to ferry the farmers. After all these people are at the central place then he has to immediately start on a training that has to continue through the day. I have realised that this is a hectic exercise to the trainer. It ends up compromising the quality of training because the trainer will be already tired. After the training the trainer is also supposed to take back the people to their homes before he goes to rest for the day. What I have seen is

that in some cases it will limit time scheduled for the training and there will be no ample time for questioning and in-depth discussions of scheduled topics by the farmers. It therefore means that a driver should be provided for such programmes as training so that the trainer only concentrates with training and not working also as a driver.

- ✚ As an intern, the plan of work that I did was partly dependant on other factors like communication, input availability, start of the season etc. for instance, the availability of people to help me on literature review. The person I was to work with was on leave and hence made it difficult to communicate with her or seeing her for discussions. My plan was also season dependant. As the rains came late, it affected the work plan and could not really follow the schedule as it were but had to operate according to the schedule imposed by the environment and input availability.
- ✚ The internship also involved some non-agronomic aspects that I had to report on e.g. reporting on the presence of Counsilors at trainings which I had not considered important. This in the initial stages of the internship had an effect on my output. I was mainly focussing on the agronomic part of the project and forgetting to also consider how the project was being received by the farmers and their communities. After some guidance from my supervisor this became clearer to me and made it easier to follow as I became aware of what I was supposed to focus on.

RECOMMENDATIONS

1. Since the trainings and group discussions have revealed that most agro dealers and the farmers have no adequate knowledge about the use of fertilisers and inoculants in legume growing, the training should therefore be continued to reach out to those who have not heard about it. This can be achieved by expanding into new districts or wards in the same districts that the project has been implemented. It also sounds worthwhile for the project or through other partners whom we are working with to showcase during the times like the National Agricultural Show where we will be able to reach out to more people during that show week in a more relaxed environment. Encouraging the inoculant factory to also advertise their product like the seed companies do may also help.
2. For the political influence in the districts affected I recommend that the N2Africa project have meetings with the DIP of the concerned districts and have all the concerned stakeholders represented there. This meeting will be a platform where the purpose of the project and the order of work will be explained and avoid the hassle of introducing the project representatives every time they get into the area. This should be organised by N2Africa and not to go as partners of other on-going projects. This however will cost money and time to the project. This money will be for snacks during the meeting and seating allowance after the meeting for everyone present. This is because for example, in Makoni district the DIP insisted that the N2Africa project has not introduced itself to the stakeholders in the district because to them they say we hijacked another project's day to introduce ourselves. MoUs between the project and the districts should also be signed every season.
3. On the issue of the farmers having other priorities to their farm work my recommendation is that the N2Africa and the AGRITEX should have a plan of activities that should be also availed to the farmers showing the plans that lie ahead. This will help all concerned parties to be well aware of what is expected of them at any point in time and therefore will result in a sense of responsibility by all concerned. We should allow them room for other activities than expect them to be always working on our plots.
4. About the issue of draught power the farmers should be encouraged to form some work teams where they would pool their resources and rotationally do the land preparations for each other. I also recommend this even for the harvesting problems especially on soyabeans. They could come together in groups so as to increase the labour force for harvesting and harvest for each other since they do not all have the crop ready for harvesting on the same day.
5. The size of package for the project has to be continuously emphasised that it is only for the farmers to grasp the concept of inoculation, fertiliser use and see and reap the benefits of certified seed. After they appreciate the concept they then have to go ahead and purchase for themselves inputs enough for their desired areas of planting.

6. On the issue about linking farmers to the markets we still have to find ways of continuing to assist the farmers to fairly dispose their produce without hassle. For example in Mudzi where the legumes like groundnuts have been produced in large tonnages, the project assisted in having the buyers going into the area to buy from the farmers. This would reduce the transport and other marketing logistics costs.
7. I also recommend that the project if possible be extended further in terms of time. This is because the nature of the project is such that we do not see the benefits of the BNF so shortly. It requires some more time so that we really see the technology adoption and implementation by the smallholder farmers.
8. On the training issue of having the farmers living far away from each other for training purposes I suggest it would be better if there could be a driver who will be responsible for bringing the people to the training centre and back to their homes after training so that the trainer is only responsible for the training and have ample time for his trainings rather than rushing against time.
9. On my part as an intern, I recommend that when making a work plan it should have room for adjustment depending on situations and still have it achievable. It should also be a work plan that is flexible to allow any changes that might arise.

CONCLUSION

This internship to me has been an eye opener as far as implementation of projects and working with partners is concerned. At the beginning of the internship, I had drafted my work plan in which I had included some activities that I intended to carry out. To me the work plan that I drafted seemed achievable but later I then realised that it was an overzealous plan in which I had included a lot of things to be done. I managed to do many things excluding the literature review that I had allocated quite some considerable amount of time. This was as a result of some communication problems with the person who was supposed to be giving me guidance on what exactly she wanted to be done so I could proceed. The major hick-up was that she was on leave and therefore making it difficult to find her in her office for discussions.

On the other hand, the other people who I was referred to kept on referring me further of which it then made it more difficult because of the differences in priorities. This gave me the opportunity to learn to work independently on the literature work. I managed to read around and summarise what I was reading until it was time for me to be travelling around with the Farm Liaison Officer to deliver the training materials, inputs and conducting Training-of-Trainers. During the internship, we had to travel around the districts with the Farm Liaison Officer to make sure that everything that is needed for the trainings that were to be done was in order. From this I learnt the aspect of planning ahead and organising. We had to deliver the training materials as well. During these trips I learnt how to effectively communicate with the partners with whom we were working. I also learnt how to deal with arising situations and problem solving during the execution of the duties.

In some occasions we would meet some conflicts with people working on the ground. One example was in Murehwa where one of the personnel from AGRITEX was not willing to co-operate either with us or people from our partners. In this case I learnt how to manage conflicts but at the same time having the work done. I also learnt to work under pressure. At times it would be difficult to meet targets but we would really have to make up the time so we could achieve our goals. An example is when we would have to go and see farmers in wards where they were stationed far away from each other or when we would want to wake up very early to travel to places where we would pick and bring people to a central place for training, train them and taking them back to their homes afterwards.

The other interesting thing I learnt was on formulating questionnaires. This was through the proof reading of the already existing ones and making adjustments required. We did this by going for trial surveys which gave us opportunities to learn how easy or how difficult the questions were. On returning from these trial surveys we had to adjust the questions in such a way that they would be answered in a way that would give us answers to what we really wanted to know. Through this trial survey I also learnt how one is supposed to probe an interviewee in the event that they are not getting the expected answers to the questions.

I also had a chance to work on a literature review. Although this did not continue to the end; I managed to learn how to read many articles that are talking about the same subject and taking ideas from each one and putting them together in one paper. I also learnt how to search for some information on market linkages. This was meant to see and compare commodity prices so that we advise our farmers. This would help in having them empowered so that they are not exploited by the commodity middlemen.

REFLECTION PAPER: Self-reflection on internship

Specific learning outcomes

During the internship period I laid down some learning outcomes that I wanted to fulfil during the course of the internship period. Below are the specific learning outcomes that I had for the four month period I carried out the internship:

1. Understanding the possibility of introducing legumes as an option for soil nitrogen improvement, improving food supply and cash income in the smallholder farming sector.
2. Applying communication skills during the interaction with farmers, development agents and research on the implementation of the programme to achieve innovations.
3. Documentation of all the data generated from the liaison with farmers and farmer groups and analysing the best possible options for legume implementation by farmers in different niches.
4. Evaluating the results obtained from the programme implementation and possibly judges the possibility of using these to curb the problem of lack of nitrogen in agriculture using the participatory approach.

Most important learning outcomes

- ✚ Applying communication skills during the interaction with farmers, development agents and research on the implementation of the programme to achieve innovations. In some cases there would be issues that raise conflicts with the people involved in the project. There was need to know how to deal with each case in a peculiar way by applying communication skills.
- ✚ Documentation of all the data generated from the liaison with farmers and farmer groups and analysing the best possible options for legume implementation by farmers in different niches. There was need to be
- ✚ Evaluating the results obtained from the programme implementation and possibly judge the possibility of using these to curb the problem of poor nitrogen supply in agriculture using the participatory approach. This we used so that we could involve the farmers in the project unlike having it as an imposed project on them. We wanted to at least have them to be part and parcel of the whole project.

Activities performed to attain these learning outcomes

1. **Farmer trainings** – the farmer trainings involved travelling around the districts and conducting trainings on the lead farmers. I participated in two trainings. This was a good opportunity to interact with farmers and hear what they think about the project.
2. **Farmer discussions** – we had time to discuss with farmers on their sentiments about the project. These have been further discussed in the full internship report.
3. **Setting up of demonstration plots** – we managed to go for demonstration plots in Murehwa with the personnel from CTDT. This was to make sure that as the plantings start the demo plots will be set up correctly.

4. **Preparation of some training materials for the farmers and proof reading of some training and M&E materials** – this we did by preparing some basic information on legume production concentrating on the four legumes that we are using for our project. These were basic notes that we prepared for every farmer who is participating in the project. These are there to work as back-up for them in case they may need some information on certain agronomic aspects of the legumes.
5. **Follow-ups on demos through phone calls and visits** – on some occasions I had to phone around the districts asking for information on the progress of the demos. This made it possible to know what was on ground without always travelling to the places. We would follow up with visits to see whether the information we get over the phone tallies with what will be on ground. During these visits we would provide technical backup for the farmer groups. In some cases we would see some pest infested crops, and give possible suggestions on how to deal with them. Examples are when we saw that the maize crop used for intercropping demos was being affected by some larvae in Mudzi and another in Makoni where the cowpeas were affected by aphids.

Evaluation of my performance on these activities

- ✚ According to my personal evaluation my participation in these activities contributed positively. This is because when I look back onto my work plan, I managed to do much of the things I had planned to do. I managed to be there and stand as an independent person from the project of which I managed to ask the beneficiaries of the project how they feel towards the project. I managed to have discussions with some of the farmers and ask whether they see it better for the project to continue to discontinue. The feedback that I got from the farmers at least gave a hint on what is expected of the farmers and also highlighted on areas that requires revisiting within the project.
- ✚ This was through the backing up of people who were already on the ground- reinforcing the team with the Farm Liaison Officer and the M&E Scientist/Country Coordinator also enabled some tasks to be completed on time. This includes things like the proof reading of scripts and even preparing them with cutting and stapling to have them ready for delivery to the various districts. To me my presence made a difference in that when the Farm Liaison Officer was not there I could stand in for him to do some of the work that was on schedule e.g. sorting out materials for delivery and making follow ups on the phone.
- ✚ I also at some point prepared some order forms for buying in seed for the demonstrations in the absence of the Farm Liaison Officer. This would make the work much easier and improve the pace of work rather than waiting for the return of the Farm liaison officer.

Could I have done things in another way? And if so how?

As I see it, there are a few things that I could have done differently.

1. I could have adjusted the workplan to make it more realistic when I realised that there were some hiccups in the proposed workplan.
2. I also took time to learn to step forward to the country coordinator-something that I learned to do later on during the internship.

3. I also got a little stuck on the literature review. After I communicated with Professor Maarsdorp who was supposed to give me direction on what exactly was supposed to be done, it took time to get response. After her response to see some researchers from CIMMYT on work that had been done on forage legumes it was also difficult to get this information or seeing the people who were responsible. On this I should have then decided to work on another literature review, maybe the work being done by the N2Africa project.
4. It took me time to really understand that I could have a sort of independent communication with farmers and extension workers. This could have helped in getting more information from them on how they are valuing or seeing the project.
5. It also took me time to understand that results are not only results of e.g. agronomy trials but even social aspects of the project.

Things that could be changed

The only thing that I feel was good if it could be changed was an extension of the internship period. This is because I would have wanted to see the agronomic results of the demo plots that were established during my internship period.

I would also have loved to have more time to visit the farmers as an independent person and really have more time for discussion with them. By this we were going to get some valuable information from them on how we could have things improved or done better than we are doing now if there is need. Much of the time because of the tight schedules when we travel around or the inconveniencing environment some of these issues could not be freely discussed. I could also have the chance to see the results of the agronomy trials from the farmer managed demo plots.

What I experienced as my strong and weak points in this working environment

Strong points

- ✓ The ability to communicate at the different levels with different farmers to ensure their understanding on the issues communicated to them.
- ✓ The ability to cope with the sometimes tight schedule especially when we were visiting the farmers in their districts. At times it involved waking up very early and working till late to ensure that the scheduled work target would be achieved.
- ✓ The ability to tackle the training sessions in a lively way that would result in the farmer groups enjoying the trainings and grasp the message to be driven home end of day.
- ✓ The ability to keep up to date typed and hand written records on proceedings and write the minutes of meetings that we held during the internship period.
- ✓ The ability to ask questions in cases where I was not sure on the way to do things to be done rather than pretending to be knowledgeable where I required clarification.
- ✓ The ability to make gross margin budgets for the crops that are being used in the project implementation.
- ✓ Being able to organise some stuff that required to be dispatched into various districts and having them sorted out on time.

Weak points

- The ability to quickly adjust to a given environment which may end up compromising on the use of limited time.
- Having no adequate social scientist's background; I at some point in time failed to cope with the requirements for making up and updating some questionnaires.
- Being overzealous and preparing a work plan that was difficult to cope with at the end of day.
- The inability to drive alone, I think this made life somehow complicated in that I could not go out alone into the field and always had to wait for someone who could drive me around.

How to improve the weak points

- Learning to quickly adjust to any given environment to save on time
- Having more time to look up how questionnaires are made and to know their requirements in case the information is needed for my work.
- Making a plan that is achievable in the limited space of time available. Making an ambitious plan will result in me having less achievable a plan which end of day will be undesirable.
- On the issue of driving I feel I just need to build confidence in myself since I am already licenced to drive.

Gaps I identified in my knowledge and skills in my professional development

- questionnaire construction
I need more exposure on this aspect for me to function well in a set up like this where there is a social aspect in the research work. This is the major gap that I identified that requires some attention.

What was the contribution of results to the goals of the organization/the larger project the internship was a part of?

The contribution that I managed to give for the project was through my participation in the day to day running of the activities that were meant to have the 2012/2013 season kick off. There was need for some preparatory work to be done which included:

1. Preparation of training materials
2. Proof reading of the materials and some translation
3. Training of farmers
4. Preparing budgets
5. Preparing some proforma invoices for inputs procurement
6. Co-authoring of Podcasters
7. Farm visits
8. Reports on work progress
9. Minute writing on meetings held during the internship period

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APPENDICES



Internship Monthly Report - October

WEEKLY PLAN FOR THE FULL INTERNSHIP PERIOD.

Week	Dates	Activity
1	24-28 September 2012	Familiarisation discussions and reading of project materials
2	01-05 October	Conducting review of literature on (nitrogen fixing) forages working with Prof Maasdorp
3	08-12 October	Conducting review of literature on (nitrogen fixing) forages working with Prof Maasdorp
4	15-19 October	Conducting review of literature on (nitrogen fixing) forages working with Prof Maasdorp
5	22-26 October	Facilitation and assisting with input distribution to the farmers in different districts
6	29-02 November	Compilation of databases plus compilation of end of month report.
7	05-09 November	Assisting with preparations of dissemination and training materials and compilation of databases
8	12-16 November	Implementation of M&E data collection and training
9	19-23 November	Collaborate with N2Africa Agronomist in putting up agronomy trials
10	26-30 November	Putting up agronomy trials and following up on already established trials and implementation of the Field Book. Compilation of databases plus end of month report.
11	03-07 December	Analysis of databases in collaboration with Farm Liaison Officer and M&E scientist; plus compilation of reports
12	10-14 December	Analysis of databases in collaboration with Farm Liaison Officer and M&E scientist; plus compilation of reports
13	17-21 December	Compilation of databases plus compilation of reports.
14	24-28 December	Compilation of databases plus compilation of reports.
15	31-04 January	Internship report writing
16	07-11 January	Finalising on internship report writing
17	14-18 January	Internship report power point preparation and presentation

WEEK 1

Day	Date	Activity	
1	Monday	24-Sep-12	Familiarization discussion with work my supervisor
2	Tuesday	25-Sep-12	Familiarisation study on materials provided and updating the contract forms
3	Wednesday	26-Sep-12	Studying of the agronomy and Delivery and Dissemination protocols; formulation of my internship work plan
4	Thursday	27-Sep-12	Studying the price search for commodities on internet
5	Friday	28-Sep-12	Working on the 2012/2013 protocol

The first week comprised of the familiarisation discussions and study of the materials to do with the project. This was important for me to understand the expectations of the project in general and how I was going to work to achieve the laid down goals and objectives. I had an opportunity to work on my contract forms:

- i. College contract form
- ii. CIAT contract form

I managed to finish with the contract forms and formulating my work plan for the internship period with the assistance from my supervisor. I also had a chance to start the study of the protocols that had already been prepared for the oncoming summer season. After studying the protocols I worked with my supervisors to alter some of the protocols to suit what we intend to achieve this season. This included the altering the design of the experiments. I also started on the commodity prices from the internet. This was not very easy though I managed to a few links that would show some information on the commodity pricing. Below are the links that I managed to get during this search.

http://famis.comesa.int/#tab_production1

<http://faostat.fao.org/site/345/default.aspx>

<http://www.amitsa.org/>

http://213.193.193.214/IFDC_ReportServer/Pages/ReportViewer.aspx?/AMITSA_Reports/Monthly+Prices+For+Seeds&rs:Command=Render

<http://www.ama.co.zw/>

http://www.zfu.org.zw/index.php?option=com_content&view=article&id=69:sources&catid=40:demo-roktabs-fp-2

<http://www.thecropsite.com/reports/>

WEEK 2

Day	Date	Activity	
8	Monday	01-Oct-12	Finalising on the Delivery and Dissemination protocols
9	Tuesday	02-Oct-12	Working on Delivery and Dissemination protocols
10	Wednesday	03-Oct-12	Revising the production notes on legumes
11	Thursday	04-Oct-12	Working on crop budgets
12	Friday	05-Oct-12	Working on crop budgets

Week 2 involved the finalising of the Delivery and Dissemination protocols and the production manuals for the legumes involved in the research work. This involved the proof reading of the production manual and working together with my supervisors to check on any typographical errors and any other relevant corrections before the final printing of the books. I also started working on

the budgets for the crops involved in this research which are ground-nuts, sugar beans, soyabeans and cow peas. I started on the communication with Professor Maarsdorp on the way forward on our scheduled literature review on forage legumes.

WEEK 3

Day	Date	Activity	
15	Monday	08-Oct-12	Working on the training material for the districts
16	Tuesday	09-Oct-12	I was not well and did not report for work
17	Wednesday	10-Oct-12	Working on the training material for the districts
18	Thursday	11-Oct-12	Working on the training material for the districts
19	Friday	12-Oct-12	Working on the training material for the districts and working on commodity prices

This week was mainly the printing, photocopying and stapling of the training materials. After this was done I also was involved in the counting and packing of these materials to be ready for delivery to the 7 respective districts where they are to be used. In the meanwhile I was still waiting for the response from Professor Maarsdorp on the literature review issue.

WEEK 4

Day	Date	Activity	
22	Monday	15-Oct-12	Packing of training and research materials
23	Tuesday	16-Oct-12	Communication on lit, review and Hwedza trip
24	Wednesday	17-Oct-12	Back from Wedza and left for Guruve for pre-season meetings
25	Thursday	18-Oct-12	Back from Guruve
26	Friday	19-Oct-12	Finishing preparation of extra materials

During this week I continued with the packing of training materials for the districts and also prepared to go out to the field for the pre-season meetings. We went out to Hwedza district and to Guruve district. The field work stretched from Tuesday to Thursday. The last day of the week involved the finalisation of the preparation of materials to be taken to Mudzi district and Goromonzi district. I received the communication on literature review from Professor Maarsdorp during this week.

WEEK 5

Day	Date	Activity	
29	Monday	22-Oct-12	Consultation with CIMMYT on forage legumes; Photocopying of training materials for the remaining districts and cutting the papers.
30	Tuesday	23-Oct-12	Counting and packing of the training material
31	Wednesday	24-Oct-12	Literature review at CIMMYT library
32	Thursday	25-Oct-12	Literature review at CIMMYT library
33	Friday	26-Oct-12	Literature review at CIMMYT library

This week involved the start of literature review by visiting the CIMMYT library and personnel working on forages to ask and gather information on the progress of forages as a solution to nitrogen in the small holder farming sector. I searched for literature from the library and found one text book that has some information on the experiments that have been done a few years ago and

summarizing the information. This took much of the time during that week. There were also some training materials that required printing and photocopying cutting and packing for the delivery to other districts. These were the instructions on use of inoculant and also the Shona introduction papers for the districts.

WEEK 6

Day	Date	Activity	
36	Monday	29-Oct-12	Making budgets for the sugar bean and cow peas Delivery and Dissemination trials. Continue with reading literature.
37	Tuesday	30-Oct-12	Reading and summarising literature. Budgeting for the TOTs. Monthly report writing.
38	Wednesday	31-Oct-12	Report writing and buying of input (requisition forms)
39	Thursday	01-Nov-12	Finalisation on the monthly report
40	Friday	02-Nov-12	

Week 6 mainly involved the compilation of my monthly report. I also worked on the budget for the requirements for maize and sugar bean intercrop and the maize and cowpeas intercrop. I also worked on the budgets for the Train of Trainers (TOTs). This budget comprised of the stationery and the demonstration materials for inoculation. I also worked on the requisition forms for the inputs required for the research. These included the seed for the crops used for the research work.

Compiled by
Chipomho Caroline.



Internship Monthly Report - November

WEEKLY PLAN FOR THE FULL INTERNSHIP PERIOD.

Week	Dates	Activity
1	24-28 September	Familiarisation discussions and reading of project materials
2	01-05 October	Conducting review of literature on (nitrogen fixing) forages working with Prof Maasdorp
3	08-12 October	Conducting review of literature on (nitrogen fixing) forages working with Prof Maasdorp
4	15-19 October	Conducting review of literature on (nitrogen fixing) forages working with Prof Maasdorp
5	22-26 October	Facilitation and assisting with input distribution to the farmers in different districts
6	29-02 November	Compilation of databases plus compilation of end of month report.
7	05-09 November	Assisting with preparations of dissemination and training materials and compilation of databases
8	12-16 November	Implementation of M&E data collection and training
9	19-23 November	Collaborate with N2Africa Agronomist in putting up agronomy trials
10	26-30 November	Putting up agronomy trials and following up on already established trials and implementation of the Field Book. Compilation of databases plus end of month report.
11	03-07 December	Analysis of databases in collaboration with Farm Liaison Officer and M&E scientist; plus compilation of reports
12	10-14 December	Analysis of databases in collaboration with Farm Liaison Officer and M&E scientist; plus compilation of reports
13	17-21 December	Compilation of databases plus compilation of reports.
14	24-28 December	LEAVE LEAVE LEAVE LEAVE LEAVE
15	31-04 January	Internship report writing
16	07-11 January	Finalising on internship report writing
17	14-18 January	Internship report power point preparation and presentation

Week 7

Day	Date	Activity
Day 43	05-Nov-12	Travelling to Murehwa and Makoni with TOT materials
Day 44	06-Nov-12	Travelled to Rukweza and Chakuma for TOTs and left for Wedza
Day 45	07-Nov-12	Hwedza TOT and back to Harare
Day 46	08-Nov-12	Went to Seed-Co for collection of soyabean seed to CTDI and travelling to Makoni with seed and extra TOT materials
Day 47	09-Nov-12	Meeting with the DIP in Makoni and back

During this week there were some TOTs that were scheduled for Makoni and Hwedza districts. Training materials and allowances for this had to be taken to the respective places. There were two training days in Makoni at Rukweza and Chakuma villages for the 6th and the 7th of November respectively. We took the training materials and delivered these to the two sites. We managed to attend the first training at Rukweza village.



Figure 1. Mr Chabata of N2Africa greeting the farmers and introducing himself to them just before he introduced N2Africa and its objectives to the farmers.

We did not manage to wait until the end since we also had to leave for Hwedza that same day. In Hwedza we went to Chigondo and Goto villages after we had received guidance from their District office. We travelled to these places with the Supervisors from the District office. The same week we went back to Makoni with the soyabean seed. On our way we had the privilege to see one lead farmer already training his group in the Rukweza area and we had a stopover to just cheer them up before we proceeded to Rukweza and then left for Hwedza where they also had their trainings during that same week.



Figure 2. Pictures of the farmer training organised and led by one lead farmer in Makoni (Ruombwe).

Week 8

Day	Date	Activity
Day 50	12-Nov-12	Travelling to Guruve for TOTs
Day 51	13-Nov-12	TOT in Guruve Chipangura school
Day 52	14-Nov-12	TOT in Guruve Muzika school Travelling back to Harare and travel to Mrehwa (Musami-Rhodes) and back;
Day 53	15-Nov-12	training materials delivery
Day 54	16-Nov-12	Travelling to Chegutu district.

The TOTs in Guruve district went on well. We held two day training in two wards at Chipangura and Muzika schools. Farmer turn-up was good though it was difficult having them in place on time for the training.



Figure 3. Train of trainers' session in Gurube district (Day 1 and Day 2 respectively).

During these trainings the farmers showed a lot of zeal in wanting to know more about their crops and other issues to do with the programme itself. There was some explanations and emphasis to the farmers on the knowledge of the crops they grow. This covered things like the growth habits of the crops and major pests and diseases that are problematic to the crops they will be growing. This therefore raised a lot of questions during the trainings which we all answered and clarified all they wanted to know in advance of the season. Examples of some questions being raised are listed below:

1. Choice of varieties to grow- they highlighted an example of the bean variety they used last season which later gave them some challenges during the marketing period. They were citing possible reasons which make the variety unpopular with most buyers and consumers such as;
 - Low protein content compared to other available bean varieties
 - Takes long to cook
 - Taste is not favourable to most people
 - Appearance is not attractive on the plate
2. Trailing varieties despite being generally high yielding, they are;
 - Invasive
 - Difficult to market since they do not mature at the same time
 - Difficult to harvest due to the entangling during growth

3. The farmers talked about the possibility for exchange visits to other districts during the season so that they see how others are performing and learn through these look and learn tours.
4. They raised another issue about the possibility of getting some certificates of attendance after they complete the season. They said this would be an inspiration on their part and would also benefit them even in future as proof of attendance to such programmes as the one offered by N2Africa.

Week 9

Day	Date	Activity
Day 57	19-Nov-12	Compilation of information for my report on TOTs
Day 58	20-Nov-12	Podcaster preparation and writing
Day 59	21-Nov-12	Discussion of the impact survey questionnaire to be administered in May next year
Day 60	22-Nov-12	Meeting with ZFC representative on demo plans and feedback and report writing
Day 61	23-Nov-12	Pre-testing the early impact survey questionnaire in Goromonzi and feedback

In this week I started by the compilation of the work that I had already done for the month. I also worked on a Podcaster that had been originally started by Isaac. We discussed the podcaster with Judith and later on discussed the early impact survey with Judith and Isaac. We proposed some adjustments on some parts of the questionnaire to suit the nature of the farming activities carried out here in Zimbabwe. This was also in preparation for the pre-test of the survey that we were going to do in Goromonzi by the end of that week. We also had a meeting with Mazvita (ZFC- Agronomist) discussing on the possibility of having combined demo-plots where there will be showcasing of agronomic technology of legume growing. On Friday we went for the pre-testing of the early impact survey in Goromonzi. We managed to interview two farmers; one man and one woman who happened to be both 62 years old. Both of them were not lead farmers.

In this pre-test survey we wanted to evaluate the possibility of asking the questions on the questionnaire and the ease with which they could be answered by the interviewees. We also wanted to take note of the time we would require per person as question time. When we discussed what we had experienced during this pre-test it helped us to see how best some of the questions could be asked or probed so as to get adequate information. This information will be helpful especially during the time when the actual survey is carried out.

Week 10

Day	Date	Activity
Day 64	26-Nov-12	Working on the podcaster corrections
Day 65	27-Nov-12	End of month report writing
Day 66	28-Nov-12	Discussion of the memorandum of understanding with Makoni Rural District Council
Day 67	29-Nov-12	Hwedza-Harare monitoring progress on demos
Day 68	30-Nov-12	Finalising on monthly thesis report.

I worked with the corrections on the podcaster during the beginning of the week and also worked on the end of month report for November. We also went to Makoni district for the MOU meeting with the personnel from Makoni Rural District Council (see minutes). We managed to see the District Administrator. Thereafter there was a delivery of inputs to Rukweza and then proceeding to Hwedza for demo monitoring and evaluation. We later travelled to Hwedza where we ended up working on transportation of seed from Chigondo ward to Goto ward and some from Goto to Chigondo.

The season has started in some parts of Makoni and in some parts of Hwedza. In both districts the demo plots have not yet been established but seed already distributed except for the seeds that were in one ward when they were supposed to be planted in the other. Otherwise farmers are awaiting a good start of the season so that they plant and get good emergence.

Compiled by Chipomho Caroline.