N2Africa Podcaster no. 7

June/July 2011

Introduction

This issue of the Podcaster reports on results from the research work stream. We have some interesting findings showing really stunning responses to inoculation and phosphorus in some countries with soyabean, although such responses are not found everywhere. The baseline studies are now available from most countries and are providing some interesting insights into gender and legume use. We include reports from MSc students who have conducted their research thesis work within the N2Africa project. We hope you will enjoy reading some of these interesting reports - and look forward to receiving your contributions for forthcoming issues!

Ken Giller

Research, dissemination and monitoring and evaluation teams to work together to understand applicability of N2Africa technologies in heterogeneous conditions of smallholder farmers

Agronomic trials conducted for two seasons in East and Central Africa and for one season in West and Southern Africa are yielding interesting results. We have observed a lot of variations in crop yields within treatments, between farms and across agro-ecological zones. We attribute this huge yield variation with the existing soil fertility and management gradients as well spatial and temporal environmental differences. For example, at Mushomo site in-DRC soybean yields in the control treatments varied enormously between different farmers; from 200 kg/ha to 2500 kg/ha. The application of P fertiliser led to 43% of the fields having a yield increase of more than 10%, relative to the control treatment (Figure 1A). However, in 20% of the cases, yields were actually decreased by more than 10% in treatments with phosphate application only. Soybean treated with inoculant gave a grain yield that was more than 10% higher than that in the control treatment in 83% of the fields. The application of P fertiliser and inoculant gave a yield increase of more than 10% in 94% of the fields. The results show that, at this site, the use of inoculant alone had a stronger and more consistent impact on grain yield than the use of P fertiliser only, while the combination of P fertiliser and inoculant inputs gave the highest yield increases.

Almost the same trend was observed in Nigeria in villages within Kano state (Figure 1B). There are other sites where soybean grain yields were generally low (less than 1.2 t/ha) and no consistent impact from P fertiliser or inoculant inputs and others where low yields coincide with a lack of response to P and inoculant inputs, probably because other limiting factors are overriding.

However, data reported above have been collected from relatively few sites, which is not sufficient to allow us to confidently provide information that will help scientists and farmers to understand the importance of the crop variety (G_L), the use of inoculum (G_R), the type of soil and climatic conditions etc (E) and then the farmer management practices such as use of fertilizer, date of planting, plant spacing, weeding and harvesting (M). The plan is that the N2Africa team of Agronomy, Rhizobiology, Dissemination and Monitoring and Evaluation teams work together on about 200-300 farmers' fields per country and take good records and observations of farmers practices (using the farm monitoring book) to collect the most important management practices in relation to the (G_L x G_R)x E part of the equation. This rigorous team approach in data collection will start in Ghana and Nigeria this growing season and will extend to East and Central Africa in September, then later to Southern Africa in December.

By Freddy Baijukya and Linus Franke

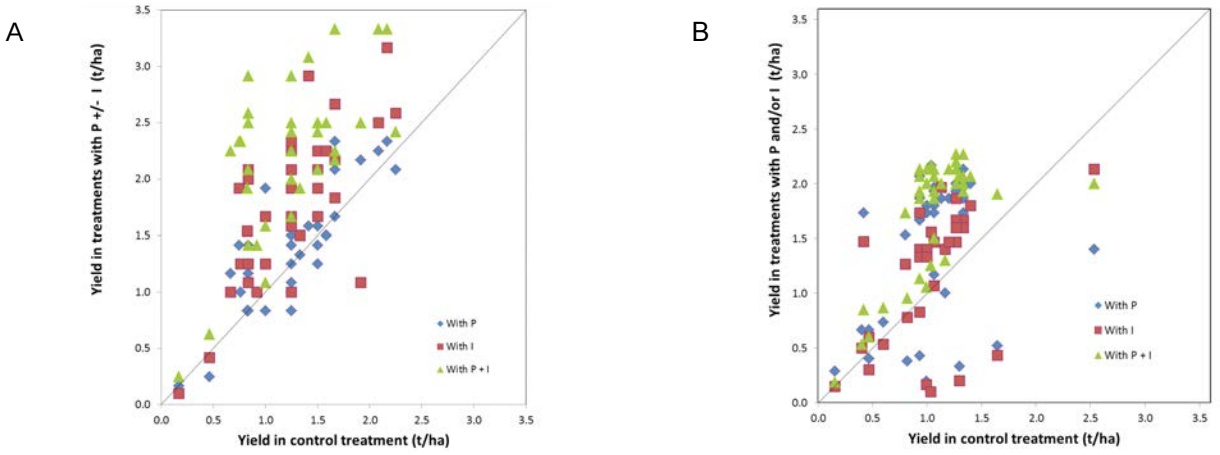

Figure 1. Yield response of soybean to phosphate (P) fertiliser and/or inoculant (I) at Mumosho site (A) in DR Congo and in villages in Kano state Nigeria (B).

Gender research in N2Africa - going beyond target numbers for reaching women

The N2Africa acknowledges the importance of women in agricultural production, household food security and income. The project recognizes that in aiming to ensure long-term sustainable impact it is of crucial importance to address explicitly the needs of women farmers, processors and marketers and to develop specific strategies for meaningful inclusion of women in project activities to ensure women benefit from the project. The project team has therefore embraced the target of at least 50% women involvement in all farmer-related activities of the project, as formulated in the project proposal. Moreover, the NGO WOCAN has recently provide a report on improving the gender responsiveness in the N2Africa project.

In each of the areas where N2Africa works, the situation regarding gender and agriculture, and legume production and processing in particular, is different. The baseline survey in N2Africa has provided useful insights in the different roles of women and men in the control land and produce from this land. Baseline data from Nigeria for instance (Table 1), suggested that men almost entirely control land use and the use of the produce from the land, especially in the action sites in the north (Kano State and northern Kaduna State). In Rwanda on the other hand (Table 2), women more often control the use of land and the use of the harvest from the land than men, while men are more frequently involved in off-farm income generation.

Table 1. Control over land use and harvest by household members in different action sites in Nigeria (% of all fields)

	Kano State		Kaduna State (north)		Kaduna State (south)	
	Land use	Harvest	Land use	Harvest	Land use	Harvest
Wife	0.0	0.5	0.0	0.0	4.9	5.3
Husband	99.9	99.4	97.9	94.8	58.5	54.7
Both	0.1	0.1	0.8	5.2	34.3	37.7
Owner	0.0	0.0	1.3	0.0	2.3	2.3

Table 2. Control over land use and harvest by household members in Rwanda (% of all fields).

	Land use	Legume crop harvest	Non-legume crop harvest
Wife	24.5	32.4	28.4
Husband	9.2	4.4	6.1
Both	62.1	59.1	64.4
Others (e.g. child)	0.7	0.7	1.1

A project such as N2Africa widely promoting the cultivation of grain legumes for domestic consumption and sale is likely to affect gender balances. This impact is likely to greatly differ between the areas where N2Africa works. In northern Nigeria where men strongly dominate farm activities, it can be hypothesised that men are likely to capture most of the direct benefits from increased sales of legume grain, even if activities specifically targeted to women farmers are undertaken by the project. In the more southern mandate area in Nigeria (southern Kaduna State) women probably have more opportunities to directly benefit from increased legume production and sales. In Rwanda, where legumes are primarily grown for domestic consumption, the benefits from increased legume cultivation are likely to spread rather equally over women and men. The impacts are unlikely to be static over time. Past experience demonstrated that when production of the grain legumes increases in response to market opportunities – and substantial amounts are sold by farmers – men often take over the cultivation and marketing of the grain legumes. Thus typical women's food security crops become men's cash crops. This may also become the case as a result of N2Africa's activities aiming to improve the marketability of legume grains in the target countries.

Given the large investment in dissemination activities and the scale of the activities, N2Africa offers unique opportunities to learn more about how agricultural development projects affect gender disparities, household income and assets across different countries. Such understanding will be helpful in current and future legume-based development projects to improve targeting of technologies and reach gender targets. Such work will also contribute to the general understanding of gender relationships in rural Africa. A number of key research questions that could be addressed with such studies have been formulated:

1. How does the promotion of legume-based technologies affect income and assets of households of smallholder farmers in different parts of Africa and how does it affect disparities between sexes within the household?
   - Who in the household controls and who carries out the various steps involved in legume production, processing and sale?
   - What is the role of grain legumes for household nutrition and income generation?
   - How is the income generated by the sale of legume products re-invested in the household?
   - How do changes in household income translate in changes in assets and how is this affected by the sex of the household member who controls sale and income?
2. How can legume-based technologies be targeted to specific groups of farmers or in specific environments to enhance the impact of the current and future legume-based projects on gender inequalities and asset disparities?
   - Where do opportunities exist within the N2Africa project to have a strong impact on these issues?
   - What are the underlying factors (e.g. related to type of technology, market access, agro-ecology, culture, extension approach) determining the project's success in addressing these issues?
   - How can this knowledge be used to improve the

design of future proposals?

3. Which indicators related to changes in assets or (control over) household income are most suitable to assess the project's impact on people's lives and ability to escape poverty?
   - o Do indicators of child nutrition give strong evidence for women's control of income? Given that child nutrition indicators can reveal change within months of dietary improvement these could be more sensitive than income indicators.
   - o Does re-investment of income – in farming, in education or in alternative enterprises – give the best insights into farmers strategies to escape from poverty?

The project aims to set up a series of detailed gender studies in a number of contrasting action sites could provide such learning in the next year. The depth and the number of sites targeted with these studies will depend on funding and available human resources.

Linus Franke, Judith de Wolf

Detailed farm characterisations to explore the adoption potential of grain legumes in Malawi

Introduction

Legume technologies are often promoted to increase nutrition, livelihoods and soil fertility of sub-Saharan smallholder farmers. Differences between regions as agro-ecological potential, market access and off-farm income opportunities and differences between farmers in terms of resource endowment and livelihood strategy imply that blanket recommendations for legume technologies are unlikely to be effective. In this MSc research, legume technology niches were identified through detailed system characterization, with the use of a farm typology to deal with the large diversity in smallholder farms. The results of farm characterizations, covering diverse farm types in Mchinji and Salima district in central Malawi, were used to gain insights in the possibilities of legumes to improve nutrition, livelihoods and soil fertility.

Farm typology

A survey was conducted to identify different types of farmers with variation in resource endowment, production orientation and source of income. The stratification of farms based on wealth and production criteria resulted in a descriptive typology with five farm types. Most household belonged to farm type 2 or 3 (Table 1).

Farms of type 1 were low resource endowed (LRE), small-scale farms where one or more family members worked casually for other farmers to generate additional income and food, since they were too small to be self-sufficient. However, casual labour generated low wages and sometimes created a labour shortage within the own household. Farms of this type hardly owned assets like radios or bicycles and, except for some chickens and the occasional goat, usually did not own livestock. Farms of type 2 were in terms of resource endowment mainly similar to type 1. However, these farmers did not depend on casual labour but had some small temporary businesses and were sometimes able to sell a little farm produce. Also, they owned more livestock, but not necessarily more household and farming assets. The household head had received in general more years of education than the household heads of type 1 farms. Farms of type 3 were mainly medium resource endowed (MRE). Income was usually generated through a combination of farm surpluses and small enterprises that generated more income than those found in type 2. The high resource endowed (HRE) farms of type 4 had typically large landholdings and a wide range of assets including furniture and sometimes even a car. The farmers of this type usually owned some larger livestock (e.g. cows) and produced for markets. Most of the farms within this type relied on hired labour. Some farms also had other enterprises such as renting out houses, but still generated the largest part of their income on-farm. In farms of type 5, one of the household members worked outside the farm and earned a fixed monthly salary. The rest of the household members worked on the farm. The income generated off-farm was always larger than the income generated from farming. These farms sometimes owned some larger livestock since the animals can be used to store wealth. Household heads from the farms falling in type 4 or 5 had received on average more years of education than the household heads from the farms falling in type 1.

Land allocation

Maize was grown across all farm types and the majority of the farmers allocated it the largest proportion of their cultivated area (Figure 1). Although farmers of the 1st, 2nd and 3rd type occasionally sold a small amount of maize within the village, only the larger-scale farmers of type 4 and sometimes 5 considered maize to be a cash crop as well. The typical cash crops tobacco and cotton were mostly grown by the market oriented farmers of type 4, who allocated large areas to these crops. Only small areas of cash crops were grown by the farmers of the other types. Groundnuts were grown across all farm types, especially in Salima. In some cases, groundnuts were considered as a prime cash crop, but most of the farmers cultivated groundnuts for both home consumption and income generation. Soyabean, cowpea and beans were cultivated very little compared to the other crops and fullfilled roles in both home consumption and generating cash.

In terms of adoption rate and allocated land, maize seemed to be the most important crop for all farm types, followed by the tobacco, cotton and groundnuts, whereas other legumes like soyabean, beans and cowpea only played a minor role and were hardly grown by the low resource endowed farmers of type 1 and 2.

Table 1. Characteristics of farm types in Mchinji and Salima district of Malawi

Farm Type	n	Education HH (years)	Family size	Farm size[b] (ha)	Cultivated area (ha)	Total value livestock[c] (US $)	Total value assets[d] (US $)	Source of income	Production orientation
Mchinji									
1	4	0.50 (0.50)	5.75 (0.48)	0.51 (0.12)	0.51 (0.12)	0 (0)	38 (21)	Off-farm	subsistence
2	20	5.15 (0.95)	4.70 (0.56)	1.30 (0.17)	1.24 (0.18)	130 (54)	89 (19)	Mixed	subsistence + low market
3	38	6.49 (0.53)	5.71 (0.34)	2.56 (0.52)	1.85 (0.18)	679 (317)	160 (16)	Mixed	subsistence + low market
4	2	6.00 (2.00)	9.00 (3.00)	7.00 (3.00)	3.84 (3.80)	22628 (21185)	20407 (20039)	On farm > off farm	market
5	6	8.33 (2.03)	7.17 (1.35)	4.43 (1.27)	3.30 (0.51)	3464 (1722)	1322 (999)	Off farm > on farm	subsistence + low market
Salima									
1	7	2.86 (1.39)	5.14 (1.18)	1.32 (0.33)	1.01 (0.19)	28 (17)	92 (45)	Off farm	subsistence
2	28	6.18 (0.62)	4.54 (0.38)	1.36 (0.17)	1.21 (0.10)	41 (12)	49 (9)	Mixed	subsistence + low market
3	27	5.59 (0.78)	5.70 (0.38)	2.74 (0.38)	1.94 (0.19)	255 (54)	133 (16)	Mixed	subsistence + low market
4	4	9.25 (1.70)	5.00 (1.08)	11.10 (3.32)	6.00 (0.82)	953 (344)	978 (524)	On farm > off farm	market
5	5	8.40 (2.20)	5.40 (0.75)	1.53 (0.31)	1.53 (0.31)	921 (713)	309 (181)	Off farm > on farm	subsistence + low market

[a] HH = household head.

[b] farm size and cultivated area are farmer estimates.

[c] including chickens, ducks, pigs, goats and cattle. Prices are 2010 sale prices.

[d] including farming tools, oxcart, wheelbarrow, radio, mobile phone, television, bicycle, car, excluding furniture

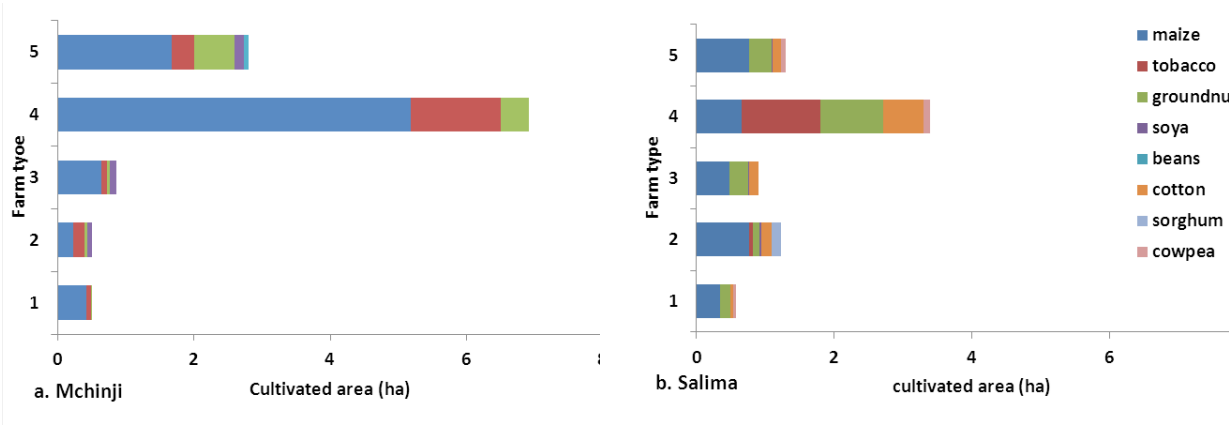

Figure 1. Land allocation to the different crops averaged per farm type for a. Mchinji and b. Salima.

Maize had a higher labour use efficiency (LUE) than groundnuts (Table 2). No significant correlation was found between labour inputs and yield of any of the crops. Energetic returns to land depended on the energetic value of a crop and the yield of the relevant crop. In Mchinji, maize gave the highest energetic returns to land. In Salima energetic returns of maize were much lower than in Mchinji due to lower yields of this crop. In Salima, energetic returns of groundnut to land and labour were comparable with those of maize.

Table 2. Average labour use efficiency and energetic returns of maize and groundnut to land and labour.

	maize	groundnuts
Mchinji		
Labour use efficiency (kg grain hour^{-1})	3.33	0.70
Energetic returns to land (kcal ha^{-1})	11 234 219	7 194 459
Energetic returns to labour (kcal hour^{-1})	8 577	3 699
Salima		
Labour use efficiency (kg grain hour^{-1})	1.55	0.96
Energetic returns to land (kcal ha^{-1})	8 402 952	8 806 500
Energetic returns to labour (kcal hour^{-1})	4 275	4 068

Partial budgeting analysis

Net benefits of maize were generally low or negative and worse than those of most other crops (Table 3). Although grain-prices for groundnuts varied strongly over the two years, in both locations net benefits were positive for the two years. With the good market prices of 2010, tobacco had the ability to generate the highest net benefits. However, because prices fluctuated heavily, average net returns became negative the following year. Even with the high 2010 market prices some farmers had negative returns to inputs due to low yields. Cotton generated relatively high net benefits with both price scenarios. However, market prices for cotton were considered high in both 2010 and 2011, relative to the preceding years. Soyabean in Mchinji generated only slightly positive or even negative net benefits, depending on the market price. Beans and cowpea always gave positive net benefits.

Table 3. Economic net-benefits per crop, based on average values on a per hectare basis. Sorghum is not included because no yield data were available. Soya is not included in Salima, since it was only cultivated in trials.

crop	costs				grain value	net benefits	grain value	net benefits
	purchased inputs	hired labour	family labour	total costs	2010 grain prices		2011 grain prices	
Mchinji								
maize	125	27	264	416	526	109	394	-22
tobacco	263	181	490	933	1796	863	1437	504
groundnuts	9	52	327	387	1377	990	455	404
soyabean	8	47	147	202	173	-29	215	125
beans	67	0	93	160	499	339	375	215
Salima								
maize	152	27	410	589	369	-220	295	-294
tobacco	459	144	1114	1717	4310	2593	1690	-27
groundnuts	24	30	451	505	1082	576	1406	901
cotton	61	0	297	358	1094	736	1844	1487
cowpea	31	0	144	175	1282	1108	648	473

Discussion

Farmers themselves defined the boundaries within which legumes can expand on their farm by food security and income. These were bordered and influenced by highly dynamic socio-economic, agronomic and biophysical factors. In Salima, groundnut could compete with maize in terms of energetic returns to land and labour, unlike other legumes (not given here) and groundnut in Mchinji. However, legumes were economically more profitable than maize. Since maize is perceived as the main food security crop, the majority of the farmers indicated that legumes can only be expanded when domestic maize production is sufficient to satisfy household demand. Low resource endowed households were generally less food secure than medium or high resource endowed households and mentioned lack of cash for seeds and lack of land and labour as the major production constraints to expanding legume production. The results indicated that targeting low resource endowed farmers who cannot be self-sufficient in maize production with legume technologies is only likely to be successful if legumes can compete with maize in terms of contributing to food security, which was only the case for groundnut in Salima. The high cultural value attached to maize in Malawi probably also impede an expansion of the area under legumes, although his was not formally assessed in this study.

Although legumes did not have the potential to generate as high net benefits as the typical cash crops tobacco and cotton, they were less risky in terms of possible negative net benefits and establishment costs. Therefore, cultivating legumes can be an option to generate some cash as well as to improve diets with good quality protein for subsistence oriented farmers who are self-sufficient in maize production. Marketability of legumes other than groundnut was often a major constraint for market oriented farmers to expand their production. Farmers of all types were less interested in the potential soil fertility benefits of legumes than their direct benefit for food or sale. Current contributions of legumes to soil fertility are likely to vary among farms and fields due to (1) variations in biomass accumulation by legumes and associated biological nitrogen fixation, notably due to varying soil fertility within farms and the preferential allocation of legumes to less fertile fields and (2) differences in residue management affecting the carry-over of nutrients in residues over the dry season.

Greta van den Brand, Linus Franke

Understanding the role of legumes and their significance in Biological Nitrogen Fixation (BNF) in smallholder farming systems of Zimbabwe

I am a MSc student at Plant Sciences at the University of Wageningen in the Netherlands and have recently done field work in collaboration with TSBF-CIAT under the N2Africa project in Zimbabwe. I worked in two of N2Africa targeted areas; Murehwa, an area with high agro-ecological potential, and Mudzi, an area with low agro-ecological potential. In these two districts, I determined the differences in adoption of different legumes as well as the different agronomic practices of farmers of different resource endowment.

The findings showed that farmers in Murehwa grew a variety of legumes including soybean, common bean, bambara nut, cowpea and groundnut and these crops performed very well, while Mudzi was best suited for bambara nut, cowpea and groundnut only. It was noted that both resource endowed and resource constrained farmers give priority to cereals, mainly maize, at the expense of legumes.

Picture showing some of the most grown legumes in Mudzi which include groundnuts, cowpea and bambara nut.

The priority included agronomic practices such as fertilizer application, early weeding, early planting, and even land allocated to the different crops. Most farmers appreciate the significance of legumes as a good protein source for humans and livestock as well as cash crop. They were also conscious of the significance of intercropping legumes with cereals, or rotating legumes with cereals. It was noted that farmers recycle their nutrients whereby some crop residues are incorporated into the fields, while some are fed to livestock, which in turn provide manure which will be used again in to add fertility to the fields.

Another objective of the study was to quantify legume productivity in the two areas and to compare their productivity with that of cereals. It was noted that areas under cereals far outweighed those under legumes. Yields of legumes relative to cereals were also quantified per targeted household and it was shown that for most farmers cereals outweighed legumes in Murehwa while in Mudzi most farmers harvested more groundnuts than cereals.

I took plant and soil samples for analysis of different chemical parameters and the results are not yet ready. My work is part of the N2Africa project and it gives an opportunity to determine the significance of different legumes in different agro-ecological regions and how best production could be improved.

I would like to thank all my colleagues at TSBF-CIAT, Zimbabwe as well as my supervisors for making this field work a success. Thanks also to the farmers I worked with for their cooperation.

Brenda Tsungai Manenji

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The Soya team from TechnoServe sent us their latest newsletter in Portugese.

The Podcaster is published each month – we look forward to receiving news and contributions – particularly from partners. Please send in contributions by the third week of each month. Contact address for this newsletter is: N2Africa.office@wur.nl

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