



**The role of legumes in
sustainable intensification –
priority areas for research in
western Kenya**

Stakeholder workshop report

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Submission date: July 2016

N2Africa

**Putting nitrogen fixation to work
for smallholder farmers in Africa**

This report is produced in collaboration with





N2Africa is a project funded by The Bill & Melinda Gates Foundation by a grant to Plant Production Systems, Wageningen University who lead the project together with IITA, ILRI, University of Zimbabwe and many partners in the Democratic Republic of Congo, Ethiopia, Ghana, Kenya, Malawi, Mozambique, Nigeria, Rwanda, Tanzania, Uganda and Zimbabwe

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Wytze Marinus, Esther Ronner and Fred Kanampiu (2016). The role of legumes in sustainable intensification – priority areas for research western Kenya, Stakeholder Workshop Report, www.N2Africa.org, 31 pp.



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Summary

A fruitful one day stakeholder workshop was held in Kisumu, western Kenya on June 21, 2016 as part of N2Africa's selection as case study in the PROIntensAfrica project. The workshop aimed to verify results obtained from a case study (literature study, stakeholder interviews and household survey) on drivers of change, legume intensification and sustainability of agriculture in western Kenya, and to identify priority areas for research on the role of legumes in sustainable intensification. The workshop was attended by participants including farmers, farmers associations, NGO's, the Ministry of Agriculture, research institutes and the seed sector.

Key **drivers of change** identified during the case study were: population density & population growth; changing markets; external development agencies/projects; government policies; climate change; and yield reducing factors in maize and beans.

During the workshop participants added that:

- Local differences within western Kenya in e.g. agro-ecological conditions, market access and intensification levels should be considered.
- Classic cash crops (sugar, tobacco, tea) are diminishing and replaced by horticulture, maize, and soybean.
- For soybean, smallholders' access to inputs and markets remains an issue.
- Maize is an important staple crop and therefore receives much attention although it might not be a profitable crop.
- Yield reducing factors are important as driver of change in legumes but less in other crops.
- Dairy farming is an option for intensification through increased crop-livestock integration.
- Youth has a different interest in farming than their parents: they do not want to go into farming anymore, or only focus on profitable crops.

Next, case study results on the **current status of legume cultivation and sustainable intensification** of agriculture in western Kenya were discussed:

- In Vihiga (population density ~1,200 people/km²) dairy farming and off-farm income were more sources of income than in Migori (~300 people/km²), which might be related to the higher land pressure in Vihiga. Stakeholders added that intensification options like dairy farming might be less interesting in Migori due to longer distance to markets than Vihiga.
- Stakeholders confirmed that poorer households generally cultivate less legumes than better-off households. Intercropping legumes in maize, however, is common for all types of households. The relatively high price of legume seeds (as compared to maize) and the large quantities (bags) in which legume seed is sold were potential reasons.
- Value addition was mentioned as option to enhance profitability of legumes.
- Legumes other than soybean (e.g. groundnut, Bambara nuts, green gram, climbing bean) could be attractive as well but little is known about these crops.

Priority areas for research on the role of legumes in sustainable intensification identified during the workshop were:

- Increasing land pressure
- Legume intensification
- Legumes as alternative cash crops
- Markets for legumes

The role of government was discussed as cross-cutting theme. Additional important topics that emerged from the discussion were:

- The difficulty of transferring knowledge and information to farmers. ICT solutions (mobile phones, smart phone platforms) could be promising.
- The need for mechanization for more profitable legume cultivation.
- The need for a (government) body at national or county level to enhance and support legume cultivation and e.g. provide subsidized legume inputs.

Keywords: PROIntensAfrica, western Kenya, sustainable intensification, indicators



1 Introduction

N2Africa is a large scale, science-based “research-in-development” project focused on putting nitrogen fixation to work for smallholder farmers growing legume crops in Africa (www.n2africa.org). The project’s vision of success is to build sustainable, long-term partnerships to enable African smallholder farmers to benefit from symbiotic N₂-fixation by grain legumes through effective production technologies, including inoculants and fertilizers. With funding from the Bill & Melinda Gates Foundation, N2Africa began a second phase on the 1st of January 2014. The project will run for five years and is led by Wageningen University (WUR) together with the International Institute of Tropical Agriculture (IITA) and the International Livestock Research Institute (ILRI). The project works through many partners in Ghana, Nigeria, Ethiopia, Tanzania and Uganda (Core countries), and in DR Congo, Rwanda, Kenya, Mozambique, Malawi and Zimbabwe (Tier 1 countries).

N2Africa was selected as a case study within the PROIntensAfrica initiative (www.intensafrica.org). PROIntensAfrica aims to build a long-term research and innovation partnership between Africa and the European Union, focusing on the improvement of food and nutrition security through sustainable intensification. N2Africa as case study focuses on the potential role of legumes in sustainable intensification. The case study was conducted in two of the N2Africa countries, Kenya and Ghana, and involved literature research, stakeholder interviews and a household survey. An important part of the case study also involved the discussion and verification of the results with a range of stakeholders during workshops in Kenya and Ghana.

This report describes the results of the one day stakeholder workshop held in Kisumu, western Kenya on June 21, 2016 (Appendix I). The objectives of the workshop were twofold:

1. To verify and deepen the understanding on drivers of change in agriculture in western Kenya and to discuss results of the household level case studies that were done to describe the relation between legume intensification and sustainability.
2. To identify priority areas for research on the role of legumes in sustainable intensification, building on the results of objective one.

The workshop was attended by 31 participants, including farmers, farmers associations, the Ministry of Agriculture, NGO’s (local and international), research institutes (national and international) and the seed sector. A full list of participants can be found in Appendix II.

This report focuses on stakeholders’ contributions during the workshop and the joint development of four priority areas (including key knowledge gaps, intensification options and research questions) for the role of legumes in sustainable intensification in western Kenya. Presentations of the initial case study results can be found in Appendix III.

Results of this workshop will be used to develop a research agenda for the PROIntensAfrica project.



2 Workshop report

Workshop opening

The workshop was opened by Dr. Fred Kanampiu, N2Africa Project Coordinator, who welcomed all participants and initiated a round of introductions. This was followed by a brief introduction on the N2Africa project (Appendix III).

Introduction to PROIntensAfrica and the day program

Esther Ronner, WUR, presented the objectives of IntensAfrica and the PROIntensAfrica case studies (Appendix III). The presentation included the question: “What does sustainability mean to you?”. After a brief discussion, participants mentioned: continuity of a system, keeping the fire burning, producing enough for now and for the future, availability and accessibility, consider the environment, and using less inputs.

Drivers of change and agricultural development in western Kenya

As a warm up, participants were asked what a sustainable farm would look like for them. After a few minutes discussion the following aspects were mentioned: sustainability today and tomorrow, mixed farming including nutrient cycling and the use of manure, not depleting soil fertility, soil and water conservation, viable farm size, giving land to children as a right, profitable farming, crop rotation, and maintain/improving yields. Next, Wytze Marinus, WUR, presented a study on important drivers of change and their effects for western Kenya, which was based on stakeholder interviews and literature research. The presentation can be found in Appendix III.

Breakout session on drivers of change

The importance of the presented drivers of change was discussed during breakout sessions. Sticky notes were used for voting on the importance of the different indicators. These votes were then discussed in plenary afterwards.

- **Population growth and pressure** was seen as an important issue in Vihiga and similar areas with high population densities, but was considered less important in Migori.
- **Changing market conditions** and their effects (more interest in milk and soybean and reduced market demand/interest in classical cash crops like sugar, tea and tobacco) was indeed seen as an important driver of change. Market access for smallholder farmers was also seen as an important issue.
- **External development projects and agencies** were seen as important, although some groups rated it as less important. The focus of many projects on maize could be explained by the interest of farmers in maize (they invest in it as most important food crop). It was mentioned however that maize is not a profitable crop and that continuous maize cropping (current practice) is indeed an issue. Alternative food crops like banana and sweet potato could be an option. Dairy cattle were confirmed as important (alternative) income source from farming.
- **Government policies** were seen as important by three groups as they have been very ineffective for smallholder farmers (although they play an important role). Two groups voted for not important, but for the same reason: government policies have been very ineffective.
- **Climate change** was voted as least important as it might be less of an issue in western Kenya than in other areas.
- **Yield reducing factors in maize** were seen as less important, as maize lethal necrosis was less of an issue in western Kenya than in other areas and because there are solutions to Striga (IR maize). **Yield reducing factors in legumes** were seen as important as they occurred more often in legumes than in other crops and because for e.g. root rot in beans there are still no good solutions.



Additional drivers of change and effects that were mentioned were often already geared towards solutions or options for improvement. Livestock (dairy) is becoming more important and this could be an option for closer crop-livestock integration. Youth does not want to go into farming anymore, and when they are farming this often causes conflict as they want to cultivate more profitable crops, whereas their parents find staple crops more important. Mechanisation was mentioned by two groups as opportunity for smallholder farming due to the current high labour costs and lack of mechanisation. Other opportunities for agricultural development in western Kenya that stakeholders identified were capacity building of agro-input dealers on which maize breeds can be grown where, improving the available knowledge on intercropping arrangements/spacing and enhanced credit provision for smallholders. Conservation agriculture was mentioned as a solution to reduce erosion and reduce labour demand (chemical weed control) that might have potential and for which the options in combination with legumes needs further research. Current crop diversity on farms was seen as an entry point in which legumes could also fit as farmers are already used to cultivating multiple crops.

Current status of legume cultivation and sustainable intensification in western Kenya

The second presentation given by Wytze Marinus focused on the current status of sustainability of farming systems on household level (Appendix III). Some comments were given on the presented list of indicators. It was said that farm size might not be a very important indicator as the income that can be generated from that piece of land depends on the type of enterprise [NB: this was a reason why also other indicators like farm gross margin were included in the analysis]. It was also noted that crop rotation was only incorporated as share of legumes in the farm, but not in other ways [NB: good addition, but difficult to capture in a survey]. Following this general discussion on the methodology, the results of the current status of sustainability of farming systems as related to legume cultivation were presented and discussed. The main discussion points raised and resulting comments from the workshop participants are discussed below.

Comparing results of Vihiga and Migori

Results from the case study that were presented indicated that food security at household level in Vihiga and Migori was similar, whereas food self-sufficiency in Vihiga was much lower due to the small farm sizes. A discussion point was which other reasons than income from dairy farming could cause this. Participants mentioned remittances (from e.g. Mombasa, Nairobi), the larger prevalence of small businesses and value adding activities, and the importance of horticulture in Vihiga.

Another point of discussion was whether the current mode of intensification as practiced in Vihiga (more dairy cattle, higher yields) could be an option for other areas in western Kenya. Participants commented that Vihiga is closer to urban markets (e.g. Kisumu), which provides different opportunities than in Migori. The larger farm sizes in Migori also allow for other cropping systems with a stronger focus on surplus production (e.g. soybean), while in Vihiga the small farm sizes leave many farmers to focus on food self-sufficiency (through maize) first.

It was also noted that it would be more appropriate to mention the specific research sites in Vihiga (Mudete) and Migori (East Kanyamkago) when discussing the results of this study. There are large differences within these counties, and specific areas within a county might require specific solutions.

The reported reduction of classical cash crops like sugar, tobacco, and tea was confirmed by the participants and also mentioned for other areas like Bungoma. A general trend was noted that farmers replaced these crops with horticulture, maize and soybean.

Decreasing farm size was confirmed to be a major issue. A government policy was implemented (fields smaller than 0.25 acre are not allowed to be sub-divided any further) but this is still far from effective. People will always continue to subdivide. Stronger policies would be needed to stop this trend. One of the effects of decreasing farm sizes that was noted was the ongoing process of intensification. In Vihiga farmers started to cultivate banana on the borders of their fields and dairy farming has increased as well.



Comparing households with more and with less legumes

Results from the case study suggested that better-off households cultivate a larger share of their farm with legumes than poorer households. Participants stressed that intercropping maize with legumes is practiced by all types of households. However, poorer farmers cultivate legumes mostly for home consumption and they are therefore often less interested in buying inputs for legumes. For these households it might also be more difficult to buy legume seeds as they are more expensive than maize seed. A representative of SeedCo also confirmed based on their sales data that better-off households buy more legume seed than poorer households. A participant mentioned the need for smaller packages of seed (currently 2 kg), to make them affordable for poorer households. Better off farmer tend to grow legumes more for commercial purposes. Very large commercial farms however tend to grow only one crop, they specialize usually in maize only. Some however also specialized in soybean.

Are legumes more profitable than other crops?

Profitability depends on the type of legume. Bush bean for instance might less profitable as production costs can be high and root rot is a risk. Soybean can be profitable especially through value addition (e.g. soy yoghurt). Selling small volumes of grains however might be less profitable. Value addition is therefore particularly important in areas like Vihiga, where due to small farm sizes only small volumes can be produced. One of the farmers commented that other legumes like groundnut, Bambara nuts, green gram, climbing bean, Calliandra or Desmodium can also be profitable – why is there such a strong focus on soybean? We should know for all these legumes where they could be planted and when it is profitable to use inputs in order to come up with diverse solutions for different areas.

What role is needed for extension?

Alternatives for the 'traditional' extension system were mentioned: training master farmers (e.g. as in N2Africa) can be an option as master farmers can take over part of the government extension. Options for reaching the poorest farmers should be sought as they might not have the time to come to meetings. Another option, used by the SIMLESA project, is the use of innovation platforms. In these platforms stakeholders like farmers, credit organizations and seed companies meet and discuss potential innovations. The experience of SIMLESA is that it works well for exchanging knowledge and initiating new activities. Some platforms, for instance, started seed multiplication for companies.

Designing a research agenda

The afternoon program focused on the identification of priority areas for research on legumes and their role within farming systems. Four priority areas were identified based on the morning sessions (Appendix III). Workshop participants discussed key issues for a priority area of their choice. A fifth priority area – the role of government – was initially identified but left out as specific priority area and taken on board as cross-cutting theme in the four other priority areas. The section below highlights some key research questions identified for each of the four priority areas:

Population growth

One of the participants in this group asked the question: "Can a farmer break-even with using inputs on soybean when obtaining a yield of 1 t/ha?" After some moment of silence the answer was given by the same participant as no one in the audience could answer this question: "No... And not even all farmers get 1 ton". A lot of specific information is required to assist farmers, transferred to them by appropriate extension tools (e.g. through ICT platforms?).

Key questions that arose from here were:

- What legumes and legume varieties can do well and where can they do well?
- What inputs do these varieties need, what are the expected yields and what can be the profit? (NB: this was done for soybean and common bean under N2Africa Phase I and is the basis of current soybean promotion in western Kenya)
- With which yield and at what price will farmers break even with inputs? And how sensitive is this to changes in either prices or yield? Cost of production and market price are known already.
- How can we use the available knowledge to move from proof of concept to upscaling? NB: scaling is taking place already.



This could lead to specific options for specific areas. In densely populated areas with considerable land pressure, high value crops are needed. Climbing bean could be an option for its large yields on small acreages. Climbing bean is not yet common in western Kenya and therefore the following questions were suggested:

- How can climbing bean be integrated in current farming systems of densely populated areas in western Kenya? Bush bean are highly affected by diseases
- What are optimal agronomic practices and possible intercropping arrangements for climbing beans?

In 2003 a government policy was proposed: people cannot subdivide their land into less than 0,25 acres. But still people subdivide their land up to 1/8th of an acre – land will always be subdivided. With the increasing population pressure the question arises: should everyone participate in farming, or only a few committed people? And related questions:

- Land consolidation – how can we achieve this in western Kenya considering culture of land ownership. How will all social groups (women, youth) within the household be involved in the legume value chain?
- How can part of the people that are currently still in farming be employed in the legume value chain?
- How do we align our agenda with government?

Dairy farming becomes more and more important in the current farming systems of western Kenya. Legumes could play a role as feed.

- How can crop-livestock integration be improved, including legumes?
- Mineral and organic fertilizer: what is right combination for legumes? NB: Sympal fertilizer is already developed for beans in Kenya

Legumes can have a role in addressing soil fertility issues (high BNF potential), e.g. soybean.

- What are the options for intercropping of soybean and maize, while still maintaining high benefits of BNF?

There is a big demand for soybean on the world market, and also in Kenya there is still a soybean deficit. At the same time, farmers fail to find a market for their produce. This can be one of the reasons why soybean has been promoted for a while but is currently not really moving. Better information provision to farmers through various sources – input suppliers, extension, mobile phones, ICT – could be an option to enhance the information flow from universities or other researchers to extension and farmers. ICT could play an important role in this.

- How do we link production with market? How do farmers make decisions on prices?
- How can we use ICT to provide market information to farmers?

Legume intensification

Availability and accessibility of inputs for legumes was considered problematic for smallholder farmers. Compared with maize for instance, inputs for legumes are not subsidized (while fertilizers for maize are) and legume seeds, in particular soybean and groundnut, are not available with most agro-dealers. For seeds the reason might be that farmers are often using their own seeds, so agro-input dealers expect low demands and therefore they do not keep legume seeds in stock. Agro-input dealers are also hesitant to stock soybean seed due to its limited shelf-life. As legume inputs have never been subsidized it is also not know how and whether farmers would use this type of subsidies.

- How can we improve the (formal) market of legume seeds?
- How can the match between demand (from farmers) and supply (by agro-input dealers) be optimized to enhance the availability of legume inputs for the farmers who need them? How could ICT help?
- To what extent would farmers make use of legume input subsidies?

Smallholder farmers were also said not be aware of the benefits and need for input-use on legumes (“legumes don’t need fertilizer”). Also the impact on legume yields of different biotic factors (e.g. root rot in bush bean) is not known, nor how this could be reduced.

- What can be the right combination of inputs to obtain desired yields?
- What biotic factors affect legume yield most and how can they be overcome?



Many options for intensification of legumes could go through farmer groups. Farmers could for instance bulk their harvest and sell to big buyers or they could collectively learn about best management practices in legumes. The current experience is however that there is a lack of trust and farmers do not want to work together. Options could be to have workshops on group governance or to have benchmarking/exchange visits in which groups that are working well could be showcased.

- How to increase trust among farmers and farmer groups?

Legume intensification could also increase if farmers would have a more entrepreneurial mind-set and therefore invest in legume inputs. To make legumes an attractive option however, there is a need to understand, in particular for soybean, the weakest links in the current value chain and how these could be improved.

- How could smallholder farmers in western Kenya be encouraged to become more entrepreneurial?
- What are the weakest links between smallholder soybean farmers and buyers and how could these be strengthened?

Legumes as alternative cash crops

Classical cash crops (sugar, tobacco, tea) have been diminishing due to market difficulties (see Appendix III). This breakout group however also presented that legumes could also be more sustainable than classical cash crops. Classical cash crops are often heavy feeders, depleting soil fertility and requiring high crop protection inputs and therefore affecting the environment. Legumes on the other hand could have multiple benefits, providing income, livestock feed, nutritious food, and improved soil fertility.

Legumes could be (better) integrated in the crop-livestock system and thereby be part of the upcoming importance of dairy farming and improved integration of crop-livestock systems (in which for instance also manure management could be improved).

- What is the economic viability of legumes as part of improved crop-livestock systems and in comparison with classical cash crops?

Labour requirements of legumes are an important constraint. In particular, options for mechanization of groundnut harvesting and harvesting and threshing of soybean should be investigated.

- What are the best options for mechanization of legume cultivation and how cost-effective are they?

Classical cash crops and other important crops like maize (cereal board) have government bodies to support their cultivation. For legumes there is no such national or sub-national body to provide or lobby for subsidies on legume fertilizers.

- What government structures could help for long term support of legume cultivation and how could these be initiated? Should this be on county level (more flexible, easier to setup) or on national level?

This group also raised the question why farmers are recycling their own seed and what incentives there would be to encourage farmers to buy certified legume seeds.

- How much yield is lost by recycling seed? For how long can you recycle seeds before yields are reducing too much?

Markets for legumes

Key benefits of legumes could be the options they provide for value addition. Farmers however are not always aware of this yet. Organized farmers/marketing groups would be needed to make use of these benefits. They could setup or cooperate with small to medium sized enterprises (SMEs) to process their production. Current efforts in this have failed due to different reasons. Some local groups for instance try to keep managing their enterprises as a group and do not trust the management in the hands of a commercial partner or a professional manager. Other enterprises are part of government institutions (e.g. KIRDI) that do not invest in them or have no stake in their continuation.

- How can we make local processing of products viable and sustainable?
- What type of PPPs do we have and what are their weaknesses? How can we professionalize them?



- Where are products currently sold? Could certification (Kenya Bureau of Standards) be an option?

Increased regional competitiveness for soybean from western Kenya is needed as big buyers have now started to buy soybean from Tanzania and DRC.

- What issues need to be addressed in western Kenya to compete with produce from abroad?
- To cut down on production cost, why are existing options for mechanization not used and how could they be improved?

There could be several roles for the government in supporting marketing of legumes. Import barriers for low quality grains could for instance be an option to protect local markets. The government could also setup a system of communicating market information (prices) to support farmers in decision making on when to sell for what price (currently farmers often do not know realistic prices, sometimes expecting too high prices).

- Dissemination models of county governments e.g. in terms of pricing. Which models can they use to pass information to farmers?

It is also important to understand the different roles of government, private sector/NGO's and projects. Extension services, for instance, are becoming semi-private (like One Acre Fund) and government extension is reduced: is this desirable? What role can government play in crop insurance, or should this be left to private parties?

Population growth should be addressed through multi-sectoral approaches: e.g. population growth also needs to be addressed by the Ministry of Health. Is this Ministry aware that population growth also affects agricultural production? What are they doing about population growth? Is this adequate? Will this affect farm sizes in future?

3 Way forward

The lively discussions and valuable additions to the case study work so far led to the identification of four priority areas for research and related key research questions. The priority areas and key questions will be translated, together with the results from a similar case study in Ghana, into a research agenda on the potential role of legumes in sustainable intensification of agriculture in sub-Saharan Africa. This research agenda forms part of N2Africa's contribution as case study within the PROIntensAfrica project. Ultimately, PROIntensAfrica serves as input for the development a long-term partnership between Africa and the European Union.



Appendix I – Workshop program



Stakeholder workshops ProIntensAfrica, Kenya



21st June 2016
Imperial Hotel, Kisumu, Kenya

Workshop objectives

The objectives of the ProIntensAfrica stakeholder workshop are to:

- Discuss important drivers of change / agricultural development in Western Kenya
- Achieve a common understanding of criteria and indicators to measure sustainable intensification of agriculture through legume production
- Develop a research agenda around sustainable intensification through legume production

Tentative programme

9.30-9.00	<i>Arrival</i>
9.00-9.15	Welcome and introductions (<i>Fred Kanampiu</i>)
9.15-9.45	Introduction to ProIntensAfrica (<i>Esther Ronner</i>)
9.45-10.15	Drivers of change and agricultural development in Western Kenya (<i>Wytze Marinus</i>)
10.15-10.45	<i>Coffee break</i>
10.45-11.15	Break-out sessions to reflect on drivers of change; plenary feedback session
11.15-11.45	Legume intensification as pathway for sustainable intensification (<i>Wytze Marinus</i>)
11.45-12.30	Break-out sessions to reflect on criteria and indicators for sustainable intensification through legumes; plenary feedback session
12.30-13.30	<i>Lunch break</i>
13.30-14.00	Introduction research agenda for sustainable intensification through legumes (<i>Fred Kanampiu</i>)
14.00-14.45	Break-out sessions to identify knowledge gaps around sustainable intensification
14.45-15.15	Arrive at a common research agenda for sustainable intensification through legumes in Western Kenya (<i>Fred Kanampiu</i>)
15.15-15.30	Closure and way forward



Appendix II – Participants list

	Name	Institution / Organization	Locality/ county
1	Dr. Martin Odendo	KARLO (AGRA)	Kakamega
2	John Mukalalma	CIAT	Maseno
3	Dr. George Ayaga	KARLO	Busia
4	Wycliffe Waswa	WeRATE	Western Kenya
5	John Onyango	Equitorial Nuts / KESOFA	Migori
6	Stephen Kasamani	MUDIFESSOF (Local partner)	Mumias
7	Okalo Dobi	Western Seed Growers Association	Khwisero
8	Anthony Bakari	Seedco (seed company)	Western Kenya
9	Christine Ndinya	KARLO seed unit	Kakamega
10	Martin Kumbe	SOFDI (NGO)	Vihiga
11	James Wathiru	Syngenta limited (Agrochemical)	Nairobi
12	Charles Ogada	UCRC (NGO / WeRATE Partner)	Ugunja
13	Doris Anjawa	ROP (NGO / WeRATE partner)	Vihiga
14	Bonface Wamalwa	BUSSFO (WeRATE partner)	Bungoma
15	Zipporah Mugonyi	ASDSP (county government)	Kakamega
16	Francisca Onyango	MOA	Migori
17	Immaculate Adiga	KENNAFF (NGO)	Kisumu
18	Magaret Musambi	MOA	Mumias
19	Dismas Wamalalu	AKOA CBO	Teso
20	David W. Nyangaria	KFG (WeRATE Partner)	Migori
21	Dick Morghan	MFAGRO (NGO)	Vihiga
22	Macdonald Wesonga	WeRATE / ARDAP	Busia
23	Josephine Ongoma	KHG/ Anapolis Wonder	Vihiga
24	Philip Ngolop	Western Seed Company	Kitale
25	Mukhovi Abraham	Kenya seed company	Kakamega
26	Esther Ronner	WUR	Netherlands
27	Wytze Marinus	WUR	Netherlands
28	Fred Kanampiu	IITA	Nairobi
29	Linda Wangila	IITA	Nairobi



Appendix III – Presentations

- Fred Kanampiu – Workshop opening
- Esther Ronner – Introduction to PROIntensAfrica and the day program
- Wytze Marinus – Drivers of change and agricultural development in western Kenya
- Wytze Marinus – Current status of legume cultivation and sustainable intensification in western Kenya
- Esther Ronner – Identifying priority areas for research on the role of legumes in sustainable intensification




Stakeholder workshops PROIntensAfrica, Kenya

21 June 2016
Imperial Hotel, Kisumu, Kenya

Putting nitrogen fixation to work for smallholder farmers in Africa



N2Africa - www.N2Africa.org

- Led by Wageningen University; main partners IITA, ILRI, AGRA and **many national partners**
- Implemented in 11 countries – Ghana, Nigeria, Ethiopia, Tanzania, Uganda (**Core countries**) and DRC, Kenya, Malawi, Mozambique, Rwanda, Zimbabwe (**Tier 1 countries**)
- 1st Phase 2009-2013 – Proof of concept
- 2nd Phase 2014-2018 – Scaling through partnerships; institutionalisation



Putting nitrogen fixation to work for smallholder farmers in Africa



How to increase the inputs from N₂-fixation

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

Putting nitrogen fixation to work for smallholder farmers in Africa



N2Africa – target legumes

West Africa

- Cowpea, groundnut, soybean

East & Central Africa

- Common bean, groundnut, soybean, cowpea plus chickpea and faba bean in Ethiopia

Southern Africa

- Common bean, groundnut, soybean, cowpea

N.B. Soil fertility improvement is a secondary goal – farmers have consistently rejected green manures, cover crops and fertilizer trees

Putting nitrogen fixation to work for smallholder farmers in Africa



Goals of N2Africa

- Focused on enhancing **agricultural productivity** (for smallholder farmers) for **grain legumes and other sequential crops** through nitrogen fixation
- Aims to improve **food and nutrition security** of households
- Promoting grain legumes to serve as **cash crops (improved household incomes)** by providing access to output markets
- Institutionalization of national capacity** for 'development to research'

Putting nitrogen fixation to work for smallholder farmers in Africa



Some advances and surprises

- Accumulating evidence for need for inoculation of common bean, groundnut, cowpea
- Residual benefits of legumes much larger than can be explained through N alone (e.g. *Striga* control)
- Farmer preferences for varieties driven largely by taste, cooking time and market opportunities
- Seed diffusion studies show that farmers shared seed with at least five other farmers multiplying N2Africa's reach five fold!
- Working through public-private partnerships (PPPs) is a strong approach...

Putting nitrogen fixation to work for smallholder farmers in Africa

Partnerships: A model for sustainability



- **Capacity building:** Stakeholders' capacity building on improved legume technologies, agribusiness, gender mainstreaming, legume value addition and nutrition
- **Input supply:** Input demand information and delivery (seed, inoculant, fertilizer, agronomic and business support services)
- **Dissemination:** Delivery of proven legume technology, organizing technology promotional and dissemination campaigns
- **Market access:** Bulking and pulling marketable surplus, strengthening collective marketing, linking with lead firms and stimulate home consumption as an alternative

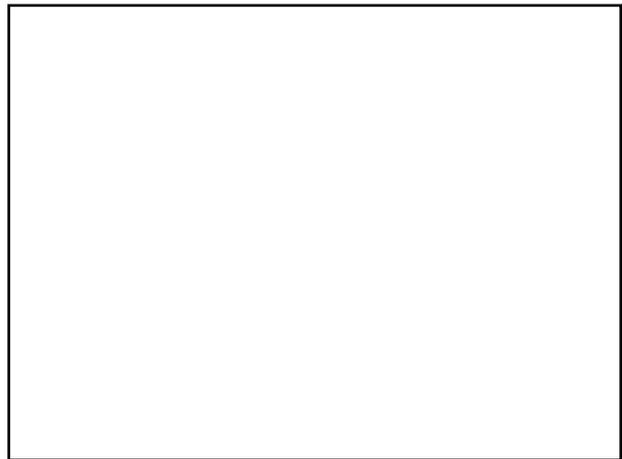
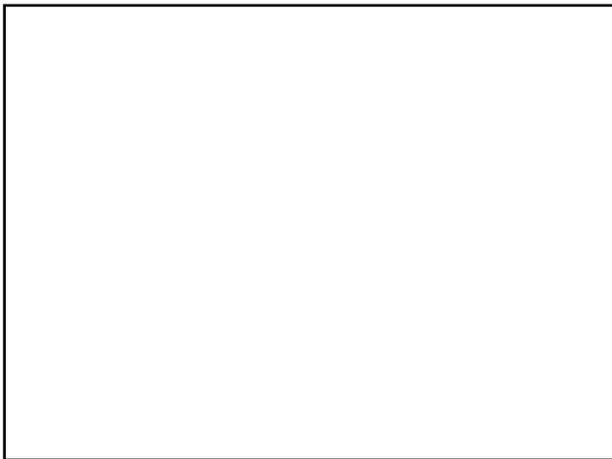
Putting nitrogen fixation to work for smallholder farmers in Africa

Research agenda/gaps



- What?
- Where?
- When?
- By whom?

Putting nitrogen fixation to work for smallholder farmers in Africa



N2Africa case study for PROIntensAfrica
Putting Nitrogen fixation to work for smallholder farmers in Africa

Wytze Marinus, Esther Ronner, Fred Kanampiu, Samuel Adjei Nsiah, Ken Giller, Gerrie van de Ven, Greta van den Brand



Background PROIntensAfrica

- IntensAfrica: long-term research and innovation partnership between Europe and Africa:
 - Improve farmers' livelihoods, food and nutrition security...
 - ...with support of the relevant policy environment
- PROIntensAfrica: development of proposal for this partnership
 - How can we exploit the potential of African agriculture?
 - Diversity of pathways

Background PROIntensAfrica

- PROIntensAfrica is funded by EU, led by FARA, CIRAD (France) and Wageningen University (Netherlands)
- Development of a partnership proposal:
 - What do we still need to know to identify and implement effective pathways for agricultural development (what)
 - What is the added value of a partnership for both continents in addition to ongoing partnerships? (why)
 - What financial and governance structures can adequately support the partnership? (how)

Background PROIntensAfrica

- Understand *diversity* and *effectiveness* of current agricultural systems
- How can we exploit the potential of agriculture, without depleting resources?

Sustainable intensification



Sustainable intensification

What does sustainability mean to you?



Diversity of pathways...

- What do we need to know to identify and implement effective pathways for agricultural development
- Case studies in East, West, Southern and Central Africa, e.g. on...
 - Mixed crop-livestock farming systems
 - Cocoa production in Central Africa
 - Highland production systems in Madagascar
 - Seed potato production in Eritrea

N2Africa as a case study

- N2Africa: grain legumes
- What is the role of legumes in sustainable farming systems?
 - 'Sustainability' of farms with or without legumes
 - If we want to enhance production in a sustainable way, how would legumes play a role?



Northern Ghana & Western Kenya



Why Kenya and Ghana?

- East and West-Africa
- Involved since 2010

Why are we here?

- Bottom-up, creative ideas from different perspectives
- Priority areas/ key questions for research on legumes in western Kenya
- Opportunity to showcase N2Africa in Western Kenya
- Potential long-term investment in similar work

What have we done so far?

- Literature study:
 - How do others define sustainability
 - How can we measure this?
- Household surveys in Ghana and Kenya
 - How do households (not) cultivating legumes 'score' on sustainability?
- Stakeholder interviews
 - How has agriculture changed from the past?
 - What trends do we see in agriculture and rural development?





What are we going to do today?

- 'Stakeholder workshop'
 - Reflections from different perspectives
- Verify what we have found
 - Changes in agricultural/ rural development in western Kenya
 - Sustainability of current farming systems
 - Did we measure the most important things?
 - How can we explain differences between farmers?
- Where do we want to move in future?
 - Defining priority areas for research on role of legumes in sustainable intensification

Questions?



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N=N 

Drivers of change Western Kenya

N=N 

Future of farming in western Kenya

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N=N 

Future of farming in western Kenya

What is a desirable future?

- How would you see the future for your children if you were a farmer?
- What are sustainable farming systems according to you?

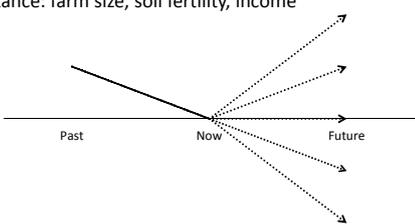
→ Discuss with your neighbour, 2min, how should this look like?

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Change

For instance: farm size, soil fertility, income

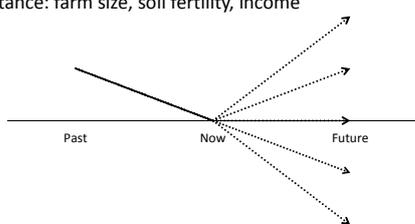


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Change

For instance: farm size, soil fertility, income



What is driving this?

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N=N 

What are drivers of change?

'any natural- or human-induced factor that brings change in an agricultural production systems'

Objective:

- To identify where we come from,
- Where we are now and,
- To understand how to move to desirable future in a sustainable way

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What are drivers of change?

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Methods

- Stakeholder interviews
 - Migori (East Kanyamkago)
 - Vihiga (Mudete)
- Household survey
- Literature research

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What are drivers of change?

Drivers of changes in western Kenya?

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Drivers of change in western Kenya

- Population density & population growth
- Changing markets
- External development agencies/projects
- Governmental policies
- Climate change
- Yield reducing factors in maize and beans

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Population density and growth

- More intense land use
- Maize as most important crop
- Alternative pathways
 - Migration
 - Dairy farming
 - Other sources of income
- Intensification of cropping systems vs. reduced soil fertility

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Changing markets

- Changing demands and prices
 - Milk
 - Soybean
- Reduced interest in classic cash crops
 - Sugar
 - Tabaco
 - Tea
- Market access

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External development agencies

- Input packages on loan (One Acre Fund, Agrics)
 - Focus on maize
 - Promoting farmer groups, best agronomic practises, shared labour, etc.
- Market linkages
 - Projects (N2Africa) promoting soybean and market development
 - Weak links between farmers, associations, and buyers

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Market linkages – Soybean in Migori



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Government policy

- County governments looking for options
 - Soybean as alternative cash crop
 - Other options?
- Weak parastatal companies
 - Farmers demotivated to cultivate sugar and tea
- Demand driven extension services
 - Less people on the ground
 - Alternatives?

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Yield reducing factors

- Maize
 - Maize lethal necrosis disease
 - Striga
- Bush bean
 - Root rot
- Groundnut
 - Rosette disease

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What do you think?

What are important drivers and their effects?

What are we missing?

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Drivers of change in western Kenya

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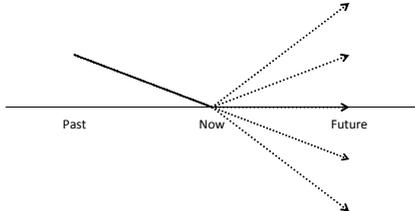

Current status of legume cultivation and sustainable intensification in western Kenya






Analysing farming systems

- Where are we now?
- Where do we want to move?



Past Now Future

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Analysing farming systems

- What are important aspects of sustainability?
- How can we monitor change?

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Principles for sustainable farming systems

Principles: fundamental aspects of sustainable farming systems

PROIntensAfrica:

- Productivity
- Viability
- Resilience
- Social wellbeing
- Environment

Do we consider everything?

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Analysing farming systems

Indicators: to assess the impact on principles

Household survey

- Vihiga, Mudete (10 households)
- Migori, East Kanyamkago (10 households)

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Analysing farming systems

Indicators: to assess the impact on principles

What are important indicators?

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Indicators

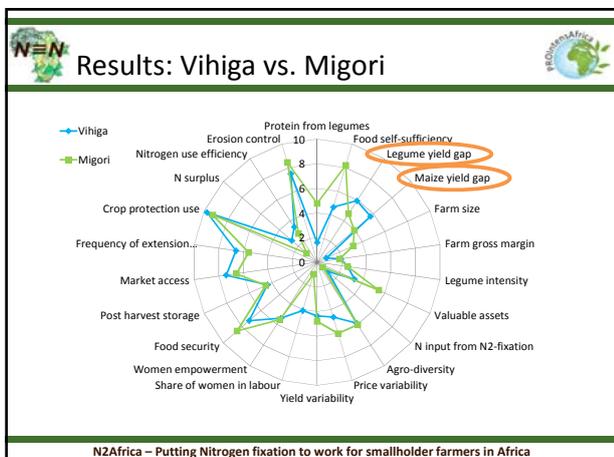
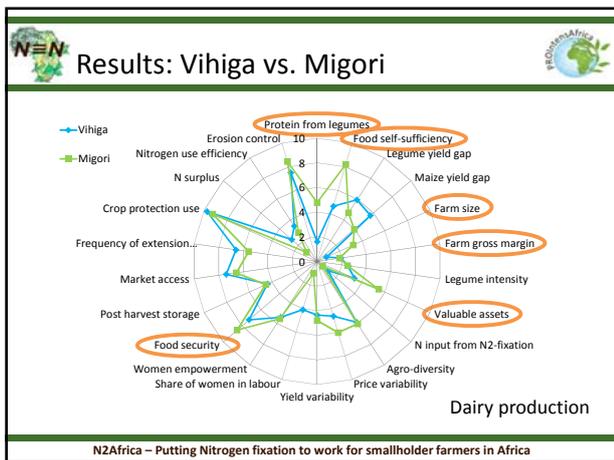
Productivity		Social wellbeing	
Protein from legumes	% of required in diet	Share of women in labour	%
Food self-sufficiency	% of months	Women empowerment	Score
Legume yield gap	%	Food security	%
Maize yield gap	%	Post harvest storage	Score
Viability		Environment	
Farm size	ha	Crop protection use	Score
Farm gross margin	Ksh/AE/minimum wage	N surplus	kg N/ha
Legume intensity	%	Nitrogen use efficiency	%
Valuable assets	Score	Erosion control	Score
Resilience			
N input from N2-fixation	kg/farm area		
Agro-diversity	Simpsons diversity index		
Price variability	Score		
Yield variability	Score		

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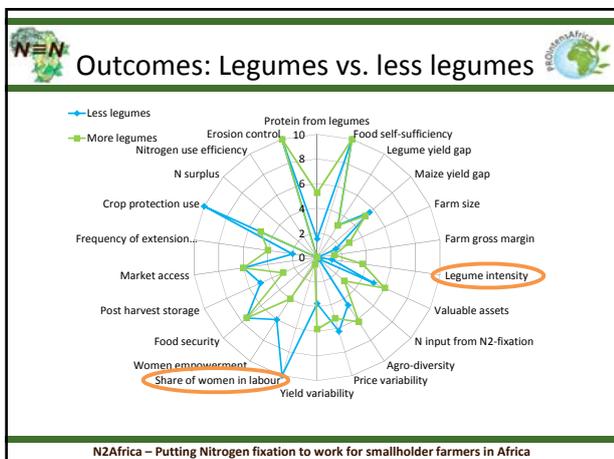
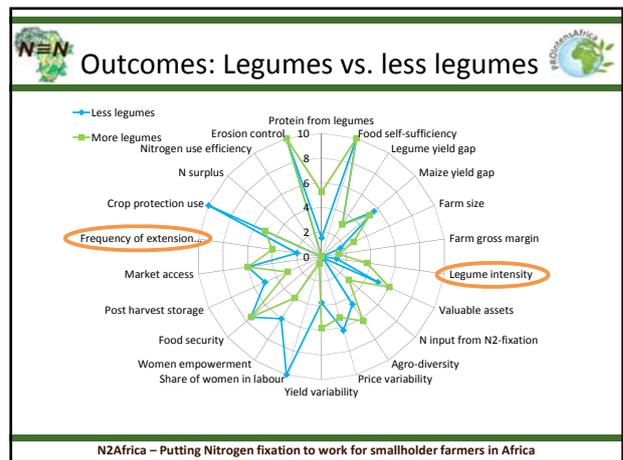
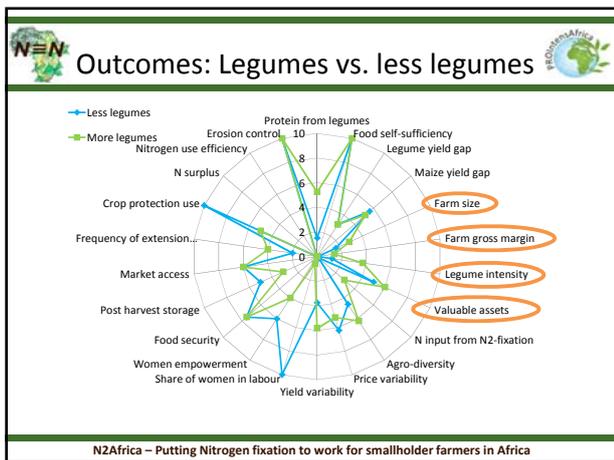
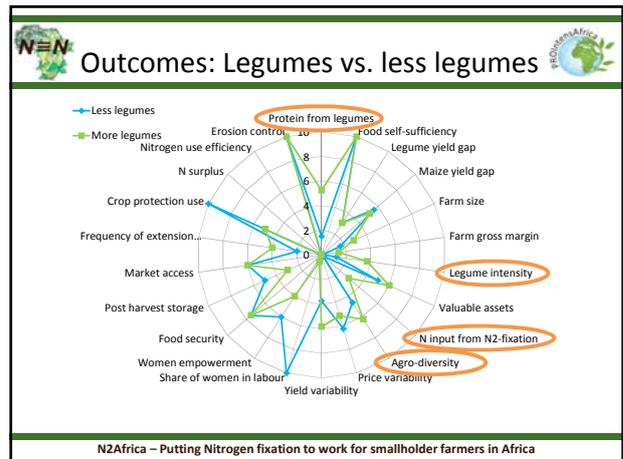
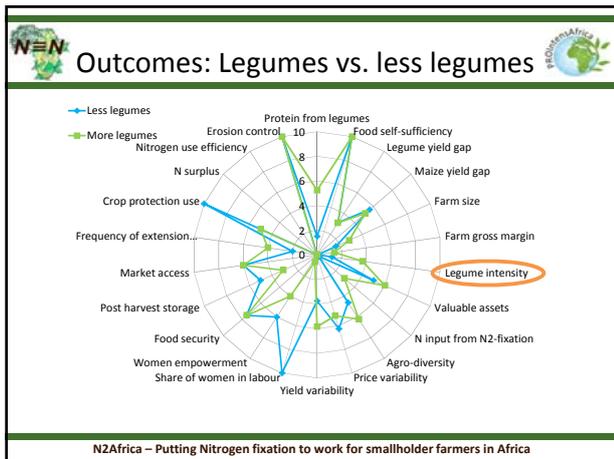
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Yield variability	Score		

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- ### Discussing results
- Apart from dairy, what is important for food security in Vihiga?
 - Is Vihiga more intensified than Migori?
 - Will farm size continue to decrease?
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Discussing results

Are better-off households cultivating more legumes?

Are legumes more profitable than other crops?

What is the role of extension work in legume cultivation?

Are legumes cultivated more by women than by men?

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N=N Other outcomes from survey

Vihiga:

- Only common bean intercropping with maize
- Some farmers received soybean, stopped because:
 - Maize is most important
 - Soybean difficult to sell
- No active farmers association for soybean in Mudete

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N=N Other outcomes from survey

Vihiga:

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- Some farmers received soybean, stopped because:
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N=N Other outcomes from survey

Migori:

- Some farmers cultivated soybean
- Many farmers used to cultivate more soybean
 - Difficult to sell
 - Project not active anymore
- Only one farmer used Sympal and Biofix

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N=N Other outcomes from survey

Bush bean

- Most farmers cultivated Roscoco (KK8) and local type
- Bush bean has high value and easy market
- Yields of bush beans were low (only intercropping)
- Large presence of One Acre Fund in both area

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N=N Discussing results

Why is bush bean cultivated in intercropping only?

Is root-rot the only constraint for bush bean, other constraints?

What are other options for intensification of bush bean?

And other options for intensification of soybean?

Why are farmers not using inputs on legumes?

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N=N Lunch time!



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N=N PROInnovAfrica

Developing a research agenda

WAGENINGEN UNIVERSITY
WAGENINGEN

IITA
Research in Northern Africa

N=N PROInnovAfrica

Developing a research agenda

Objective

What type sustainable intensification

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1) Population growth

Small farm size
Mono-cropping of maize
Reducing soil fertility

Desirable future?
Role for legumes?

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2) Legume intensification

How to deal with:

- Use of inputs for legumes (currently focus on maize)
- Farmer groups/associations
- Linking farmers, groups, and buyers

Are legumes worth investing in?

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3) Legumes as alternative cash crops

Search for alternatives for classic cash crops
Search for more economical production systems: dairy, soybean?

What are desirable production systems?
Role for legumes?

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4) Markets for legumes

Are farmers able to profit from legume benefits?
Poor linkages between farmers and buyers

How can linkages between farmers and buyers be strengthened?
What role for NGO's and/or the government?

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 5) What role for government? 

How to facilitate agricultural development in western Kenya?

Support for soybean markets?

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 Four groups 

- 1) Population growth
- 2) Legume intensification
- 3) Legumes as alternative cash crops
- 4) Markets for legumes
- 5) What role for government?

What is a desirable future for farming in western Kenya?
How can legumes play a role?

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List of project reports

1. N2Africa Steering Committee Terms of Reference
2. Policy on advanced training grants
3. Rhizobia Strain Isolation and Characterisation Protocol
4. Detailed country-by-country access plan for P and other agro-minerals
5. Workshop Report: Training of Master Trainers on Legume and Inoculant Technologies (Kisumu Hotel, Kisumu, Kenya-24-28 May 2010)
6. Plans for interaction with the Tropical Legumes II project (TLII) and for seed increase on a country-by-country basis
7. Implementation Plan for collaboration between N2Africa and the Soil Health and Market Access Programs of the Alliance for a Green Revolution in Africa (AGRA) plan
8. General approaches and country specific dissemination plans
9. Selected soyabeans, common beans, cowpeas and groundnuts varieties with proven high BNF potential and sufficient seed availability in target impact zones of N2Africa Project
10. Project launch and workshop report
11. Advancing technical skills in rhizobiology: training report
12. Characterisation of the impact zones and mandate areas in the N2Africa project
13. Production and use of rhizobial inoculants in Africa
18. Adaptive research in N2Africa impact zones: Principles, guidelines and implemented research campaigns
19. Quality assurance (QA) protocols based on African capacities and international existing standards developed
20. Collection and maintenance of elite rhizobial strains
21. MSc and PhD status report
22. Production of seed for local distribution by farming communities engaged in the project
23. A report documenting the involvement of women in at least 50% of all farmer-related activities
24. Participatory development of indicators for monitoring and evaluating progress with project activities and their impact
25. Suitable multi-purpose forage and tree legumes for intensive smallholder meat and dairy industries in East and Central Africa N2Africa mandate areas
26. A revised manual for rhizobium methods and standard protocols available on the project website
27. Update on Inoculant production by cooperating laboratories
28. Legume Seed Acquired for Dissemination in the Project Impact Zones
29. Advanced technical skills in rhizobiology: East and Central African, West African and South African Hub
30. Memoranda of Understanding are formalized with key partners along the legume value chains in the impact zones
31. Existing rhizobiology laboratories upgraded
32. N2Africa Baseline report
33. N2Africa Annual country reports 2011
34. Facilitating large-scale dissemination of Biological Nitrogen Fixation



35. Dissemination tools produced
36. Linking legume farmers to markets
37. The role of AGRA and other partners in the project defined and co-funding/financing options for scale-up of inoculum (banks, AGRA, industry) identified
38. Progress Towards Achieving the Vision of Success of N2Africa
39. Quantifying the impact of the N2Africa project on Biological Nitrogen Fixation
40. Training agro-dealers in accessing, managing and distributing information on inoculant use
41. Opportunities for N2Africa in Ethiopia
42. N2Africa Project Progress Report Month 30
43. Review & Planning meeting Zimbabwe
44. Howard G. Buffett Foundation – N2Africa June 2012 Interim Report
45. Number of Extension Events Organized per Season per Country
46. N2Africa narrative reports Month 30
47. Background information on agronomy, farming systems and ongoing projects on grain legumes in Uganda
48. Opportunities for N2Africa in Tanzania
49. Background information on agronomy, farming systems and ongoing projects on grain legumes in Ethiopia
50. Special Events on the Role of Legumes in Household Nutrition and Value-Added Processing
51. Value chain analyses of grain legumes in N2Africa: Kenya, Rwanda, eastern DRC, Ghana, Nigeria, Mozambique, Malawi and Zimbabwe
52. Background information on agronomy, farming systems and ongoing projects on grain legumes in Tanzania
53. Nutritional benefits of legume consumption at household level in rural sub-Saharan Africa: Literature study
54. N2Africa Project Progress Report Month 42
55. Market Analysis of Inoculant Production and Use
56. Identified soyabean, common bean, cowpea and groundnut varieties with high Biological Nitrogen Fixation potential identified in N2Africa impact zones
57. A N2Africa universal logo representing inoculant quality assurance
58. M&E Workstream report
59. Improving legume inoculants and developing strategic alliances for their advancement
60. Rhizobium collection, testing and the identification of candidate elite strains
61. Evaluation of the progress made towards achieving the Vision of Success in N2Africa
62. Policy recommendation related to inoculant regulation and cross border trade
63. Satellite sites and activities in the impact zones of the N2Africa project
64. Linking communities to legume processing initiatives
65. Special events on the role of legumes in household nutrition and value-added processing
66. Media Events in the N2Africa project
67. Launch N2Africa Phase II – Report Uganda



68. Review of conditioning factors and constraints to legume adoption and their management in Phase II of N2Africa
69. Report on the milestones in the Supplementary N2Africa grant
70. N2Africa Phase II Launch in Tanzania
71. N2Africa Phase II 6 months report
72. Involvement of women in at least 50% of all farmer related activities
73. N2Africa Final Report of the First Phase: 2009-2013
74. Managing factors that affect the adoption of grain legumes in Uganda in the N2Africa project
75. Managing factors that affect the adoption of grain legumes in Ethiopia in the N2Africa project
76. Managing factors that affect the adoption of grain legumes in Tanzania in the N2Africa project
77. N2Africa Action Areas in Ethiopia, Ghana, Nigeria, Tanzania and Uganda in 2014
78. N2Africa Annual report Phase II Year 1
79. N2Africa: Taking Stock and Moving Forward. Workshop report
80. N2Africa Kenya Country Report 2015
81. N2Africa Annual Report 2015
82. Value Chain Analysis of Grain Legumes in Borno State, Nigeria
83. Baseline report Borno State
84. N2Africa Annual Report 2015 DR Congo
85. N2Africa Annual Report 2015 Rwanda
86. N2Africa Annual Report 2015 Malawi
87. Contract Sprayer in Borno State, Nigeria
88. N2Africa Baseline Report II Ethiopia, Tanzania, Uganda, version 2.1
89. N2Africa rhizobial isolates in Kenya
90. N2Africa Early Impact Survey, Rwanda
91. N2Africa Early Impact Survey, Ghana
92. Tracing seed diffusion from introduced legume seeds through N2Africa demonstration trials and seed-input packages
93. The role of legumes in sustainable intensification – priority areas for research in northern Ghana
94. The role of legumes in sustainable intensification – priority areas for research in western Kenya



Partners involved in the N2Africa project

