



**Training of Agro-Dealers in
Accessing, Managing and
Distributing Information on
Inoculant Use**

Milestone 5.4.3

Anne Turner, Paul Woomer

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N2Africa

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



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Email: n2africa.office@wur.nl
Internet: www.N2Africa.org

Authors of this report and contact details

Name: Anne Turner
Address: IITA-Malawi, PO Box 30258, Lilongwe 3, Malawi
E-mail: a.turner@cgiar.org

Partner acronym: IITA

Name: Paul Woomer
Address: CIAT-TSBF, PO Box 823-00621, Nairobi, Kenya
E-mail: plwoomer@gmail.com

Partner acronym: CIAT

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1 Milestone 5.4.3: By month 12 of years 2, 3 and 4, at least 30 agro-dealers are trained in accessing, managing and distributing information on inoculants use.

1.1 Background information

Training agro-dealers in how to access, manage and distribute information on inoculants and their use contributes to Objective 5 of the N2Africa (putting nitrogen to work for small scale farmers in Africa) project, namely to develop and strengthen capacity for biological nitrogen fixation (BNF) research, technology development, and application. Training of agro-dealers on information related to BNF and marketing legume inoculants was envisaged to be one of the key components for advancing wide-scale use of legume and inoculant technologies via existing non-governmental organizations (NGOs) working with farmers/farmer associations and their affiliated networks. Although the original goal was to have trained at least 30 agro-dealers in each N2Africa hub (West Africa, East and Central Africa and Southern Africa) by the end of year 2 of the project, this activity fell behind schedule with the result that a total of only 25 agro-dealers had been trained, with three countries having conducted agro-dealer training (Kenya, Ghana and Malawi). The lack of a training officer for most of Year 2 probably contributed to N2Africa's missing the agro-dealer training target. Agro-dealer training began to pick up in month 1 of the third year of the project, and more progress towards this milestone should be made throughout this year. Detailed explanation of agro-dealer training in N2Africa countries is provided below.

1.2 Agro-dealer training in western Kenya

In Year 2, intensive training was offered to seven agro-dealers in Kenya by N2Africa partner MEA Fertilizers Ltd.; topics covered included the handling as well as marketing of BIOFIX, a soybean inoculant produced by MEA. In the first month of Year 3, a two-day training workshop of 30 agro-dealers (including 12 women) from western Kenya, including the area covered within the N2Africa West Kenya Action Site. Financial support for this training exercise was provided through several projects of CIAT-TSBF, including N2Africa. Financial and logistical support was also provided by Dr Kristina Roing and the Swedish Agricultural University Integrated Soil Fertility Management (ISFM) Project. Dr Bernard Vanlauwe provided funds from the TL2 Project as well. Facilitators included Dr. Paul Woomer, Dr. Roing, Mr. Wycliffe Okumu (DAO/Ministry of Agriculture Maseno) Mr. Charles Kamidi (Agrodealer/AGMARK trainer), Ms Teresa Wafula (MEA Ltd), Dr Fred Baijukya (CIAT Maseno), Mr. John Mukalama (CIAT Maseno), and Laban Nyambega (CIAT Maseno). Ms. Josephine Olwal (N2Africa Administrative Officer) and Stanley Okoko provided logistical support. Topics discussed included ISFM, fertilization and pest and disease management of grain legumes, extending recommendations and testing products at the grassroots level and agro-dealership and grain legume enterprise, as well as BNF and legume inoculants. The training included demonstrations of seed inoculation methods and inoculated versus non-inoculated soybean roots showing enhanced nodulation and crop vigour. By the end of the training, the participants stated that they believed they needed to have demonstrations of inoculated vs. non-inoculated crops next to their shops, which would be an excellent way to boost use of legume inoculants by farmers.

A quick survey of the participating agro-dealers was conducted at the end of the training course, and some of the findings of greatest relevance to N2Africa activities are as follows:

- A relatively small proportion (17%) already marketed BIOFIX, the inoculant available in Kenya
- The majority (70%) marketed bean seed, while only 30% marketed soybean seed
- Most (97%) marketed seed in small (less than 1 kg) packages
- Most (97%) are linked to farmer groups, as well as local NGOs (93%), local extension agent (90%) and regulators (97%); moreover, 80% of the agro-dealers are certified by AGMARK (the Agricultural Market Development Trust of Kenya)



After discussion revealed that the agro-dealers felt the Kenya National Agro-Dealer Association (KENADA) was having little impact at the local stockist level, the need to establish a regional agro-dealer association was identified. An office comprised of chair, secretary and treasurer was selected on an acting capacity to implement with the main objective to be part of soybean value chain agents working closely with CIAT-TSBF in western Kenya.

As a follow-up to the agro-dealer training, it was agreed that N2Africa would fund MEA Ltd. to place inoculants and specialized fertilizer blends on the shelves of 10 member-agro-dealers, as well as promotional and information materials, prior to the 2012 long rains. An assessment of this activity will be conducted and the results evaluated by Kenyan co-operators and the N2Africa team.

1.3 Ghana

A partnership was forged in Year 2 between N2Africa-Ghana and the USAID-funded project ADVANCE (implemented by ACDI/VOCA) in northern Ghana, which targeted working with agro-dealers to disseminate soybean inoculants imported by N2Africa from LegumeFix in England. In month 7 of Year 2, seven agro-dealers (along with nucleus farmers and seed growers) from three regions of northern Ghana were trained in inoculants handling and use. When N2Africa imported inoculants to Ghana later in the year, four of these agro-dealers (along with the nucleus farmers and seed growers) purchased a total of 670 packets of inoculants (100 gm each) from N2Africa partner, SARI. The selling price to the agro-dealers was Ghana Cedi (Ghc) 4.50/packet, and the agro-dealers in turn sold the packets at Ghc 5.00/package, with the small mark-up to off-set any investments the dealer made into cold storage facilities for his/her shop. The agro-dealers and others involved in the Training of Trainers in inoculants handling and use provided training to farmers and out-growers so as to encourage proper use of the inoculants. Further collaboration along the same lines between ADVANCE and N2Africa is planned for the 2012 growing season in Ghana, with activities likely to be scaled up and more agro-dealers, nucleus growers and soybean seed growers exposed to inoculants as well as legume fertilizers.

The ADVANCE project has a market facilitation approach whereby the project encourages the leveraging and buy-in of the willing and able private sector at every stage of the value chain. As such, ADVANCE plans to invite a representative from LegumeFix to their planning meeting for the 2012 rainy season, along with agro-input importers from Kumasi and southern Ghana. They hope linkages will be made between LegumeFix (as well as other manufacturers of inoculants) and the importers so that the latter can directly import inoculants in the future, and become long-term inoculants suppliers beyond the life of the project.

1.4 Malawi

After meetings between N2Africa the Agri-Input Suppliers Association of Malawi (AISAM), plans were drawn and an agreement signed (in month 11 of Year 2) for AISAM to work with N2Africa on dissemination of legume technologies (soybean inoculants and legume fertilizer) through some of its member agro-dealers working in four of the districts where N2Africa is working in Malawi. Thirteen of AISAM's agro-dealers underwent a 1.5 day Training of Trainers on legume technologies, including handling and use of soybean inoculants, along with establishment of demonstration plots and the role of agro-dealers in N2Africa, during the last month of Year 2. Each was subsequently provided with soybean seed, inoculants and legume fertilizer (Sympal, imported from MEA in Kenya) to establish demonstration trials close to their shops. The level of interest generated in use of soybean inoculants by this activity was such that AISAM soon contacted MEA to commence discussing importation of MEA's BIOFIX inoculants to supply agro-dealers the following growing season. Several of the trainees have taken an active interest in working with N2Africa farmers in their areas, to ensure they understand the use and impact of soybean inoculants.



1.5 DRC

The Sud-Kivu Province of DRC, where N2Africa is operating, has only a few agro-dealers, and most of these are found in the town of Bukavu. In the last month of Year 2, a total of 13 agro-dealers were identified as potential candidates for a Training of Trainers on legume technologies, and plans were made to begin the training in Year 3.



2 Challenges faced and recommendations for working with agro-dealers on legume technologies

As noted above, agro-dealer training suffered a set-back with the loss of the N2Africa Training officer early in Year 2 of the project; activities are picking up, however, in several countries and some of the early results are encouraging. The following points should be taken into consideration when designing and implementing agro-dealer training programs and other activities, when possible, in the future:

1. Sustainability of access legume inputs by agro-dealers: Countries such as Kenya where inoculants are currently manufactured are better placed for dissemination and adoption of sales/use of inoculants. The efforts of the ADVANCE project in Ghana, in collaboration with N2Africa, to both build linkages between agro-dealers and farmers, as well as agro-input importers/dealers and inoculant manufacturers are more likely to succeed than merely training agro-dealers on use of legume technologies (as is the similar initiative of AISAM in Malawi).
2. Willingness of agro-dealers to stock legume inputs over the long term: Rather than simply supplying agro-dealers with free legume inputs to sell on to farmers, they are more likely to appreciate the value of the inputs and make regular purchases of same if the agro-dealers "invest" in the technologies, as occurred with the purchase of inoculants by ADVANCE's agro-dealers. If "seed inputs" are needed to create a lasting agro-dealer supply (assuming the farmer demand is also taken care of), then the profits from the sales of these initial inputs should be plowed back into a credit facility or revolving fund which can be used to facilitate purchase of inputs by new agro-dealers. A strong local agro-dealer network, as is being developed in western Kenya, is an important step towards building a lasting structure for sales of legume inoculants and other inputs, and building the capacity of the agro-dealers to provide extension advice on use of legume inputs.



3 Appendices

3.1 Agro-dealer Training In West Kenya

Prepared by Laban Nyambega, Fred Baijukya and Paul L. Woomeer
(27 – 29th November 2011, Maseno Club Hotel, Maseno, Kenya, CIAT-TSBF)

3.1.1 Background

Significant improvement of crop productivity is essential for household and national income growth. Kenya, like many other countries in Africa, has initiated programs to promote access to farm inputs such as its National Accelerated Agriculture Input Access Project (NAAIP). These are integrated programs that involve a wide spectrum of stakeholders, including local agro-dealers. It is important that these stockists understand what products are available and the conditions that warrant their use. Among these products are BNF technologies, particularly new varieties of legumes, specialized blends of fertilizers and the use of rhizobial inoculants. Enhanced input utilization can be achieved through enhanced technical capacities of agro-dealers and agro-service providers who are then better positioned to assist farmers in obtaining needed inputs as well as product instructions and dosage. A two-day training was organized by CIAT-TSBF, conducted at Maseno Club Hotel from 27th to 29th November 2011 and facilitated by scientists from MEA Ltd. and the Ministry of Agriculture. It was attended by 40 invited agro-dealers from west Kenya, including the area covered within the N2Africa West Kenya Action Site. Financial support for this training exercise was provided through several projects of CIAT-TSBF, including N2Africa. Financial and logistical support was also provided by Dr Kristina Roing and the Swedish Agricultural University ISFM Project. Dr Bernard Vanlauwe provided funds from the TL2 Project as well. Facilitators included Dr. Paul Woomeer, Dr. Roing, Mr. Wycliffe Okumu (DAO/Ministry of Agriculture Maseno) Mr. Charles Kamidi (Agrodealer/AGMARK trainer), Ms Teresa Wafula (MEA Ltd), Dr Fred Baijukya (CIAT Maseno), Mr. John Mukalama (CIAT Maseno), and Laban Nyambega (CIAT Maseno). Ms. Josephine Olwal (N2Africa Administrative Officer) and Stanley Okoko provided logistical support.



3.1.2 Agro-dealer Workshop Program

Time	Activity	Presenter (source material)
DAY ONE 28/11/2011		
9:00 – 9:30 AM	Roundtable introductions, training objectives and participant expectations	Laban
9:30 – 10:15 AM	Agro-dealership and grain legume enterprise	Fred Baijukya
10:15 – 10:45 AM	HEALTH BREAK	
10:45 – 11:30 AM	ISFM and new farm input products	Paul Woomer
11:30 AM – 12:15 PM	Biological nitrogen fixation and legume inoculants	Teresah Wafula: MEA Fertilizers
12:15 – 1:00 PM	Open discussion of morning topics	Laban
1:00 – 2:00 PM	LUNCH BREAK	
2:00 – 2:45 PM	Fertilization and pest and disease management of grain legumes: Practices and products	Maseno Agronomy Team/T. Wafula
2:45 – 3:30 PM	Extending recommendations and testing products at the grassroots level	Paul Woomer (based on ISFM book)
3:30 – 4:00	Open discussion: Strengthening agro-dealership	Laban
4:00 - 4:30PM	TEA BREAK	
4.30 – 5.15 PM	Beyond input supply: local stockists, farmer associations, county-level empowerment, produce collection points and value addition	Series of short presentations (5 minute) by different stakeholders
5.15 – 6:00 PM	Panel Discussion: Empowering local agro-dealers	Panelists to be selected
6:00 - 6:30 PM	Workshop evaluation	Laban
DAY TWO 29/11/2011		
8.30 – 10.30AM	Plant nutrient balances	Kristina Roing
10.30-11AM	HEALTH BREAK	
11.00AM – 12.00PM	Legume seed quality and storage	MoA
12.00 – 1.00PM	Agricultural input and output market	AGMARK/Charles Kamidi
1.00 – 2.00PM	LUNCH BREAK	Josephine
2.00 – 3.00PM	Fertilizer recommendation and use	Laban Nyambega
3.00 – 4.00PM	Discussions/Closure	ALL



3.1.3 Participants List

	Name	Sex	Business Name/Organization	Town	Cell phone No	Province
1	SHEM LUONGA	MALE	MALAHA AGROBUSINESS	MALAHA	0724338623	WESTERN
2	CHARLES MAULO	MALE	BUNYALA SELF HELP GROUP	MALAHA	0729051300	WESTERN
3	OSCAR WAUDO	MALE	NAVAHOLO AGRO BUSINESS	NAVAHOLO	0728312420	WESTERN
4	MARY N MATSI	FEMALE	BUNYALA SELF HELP GROUP	MALAVA	0710522170	WESTERN
5	WILLIAM SIMIYU	MALE	SINCERE WISH III NDEREMA	NDEREMA	0733286555	WESTERN
6	JOSHUA ONYANGO OKOTH	MALE	EVAPA AGRO VET	MIGORI	0721416463	NYANZA
7	OWINO VALENTINE	MALE	VALENTINE AGROVET	LUANDA	0725814271	WESTERN
8	HERBERT S.LUSENO	MALE	MUMIAS AGRO CARE	MUMIAS	0724518453	WESTERN
9	GEORGE OTIENO OKWARO	MALE	MAMANOX AGROVET	YALA	0712197638	NYANZA
10	JANE KHAUGANI	FEMALE	BUMU AGROVET	BUTERE	0720217366	WESTERN
11	LAWRENCE NGONGO	MALE	MTULIVU FARMLLET SPOT	BUTERE	0718390401	WESTERN
12	DAVID GEORGE MUKABI	MALE	FARMERS CENTRE	KHWISERO	0721591140	WESTERN
13	RAYMOND T O OBONDO	MALE	RACEL AGROVET	DARAJA MBILI	0720943936	NYANZA
14	VINCENT OGOLA	MALE	CROPSSET CENTRE	NYADORERA	0722297054	NYANZA
15	FLORENCE AMBASA	FEMALE	LELA FARM CARE	LELA	0717922232	NYANZA
16	ALEX O MAGAGA	MALE	HAGONGLO F I STORE	NDORI	0734849767	NYANZA
17	PL WOOPER	MALE	CIAT-TSBF	NAIROBI	0733972722	NAIROBI
18	FRANCIS O AKELLO	MALE	FIPS AFRICA	SIAYA	0723061544	NYANZA
19	ANTONY RADING	MALE	RADS AGROVET	BONDO	0722730250	NYANZA
20	BENEDICTO JOSEPH RADING	MALE	RADS AGROVET	BONDO	0700038545	NYANZA
21	WESONGA ROSE	FEMALE	RAB AGROVET	FUNYULA	0725773043	WESTERN
22	CLARE MUKABANAH	FEMALE	AGROWVET	MUMIAS	0728403133	WESTERN
23	ELIZABETH WANGILA	FEMALE	MUSALE AGROVET	WEBUYE	0735441075	WESTERN
24	NELSON OGOMBE	MALE	RAFIKI WA MKULIMA	NGIYA	0722881460	NYANZA
25	VERONICA OMITO	FEMALE	YALA FARMLAND STORE	YALA	0722625260	NYANZA
26	WILLIAM EJAKAIT	MALE	TESO CBO	TESO	0735319872	WESTERN



27	JOHN MUNGAI	MALE	GIATHI ENTERPRISES VET	BUSIA	0721800555	WESTERN
28	FREDRICK OCHIENG ODONGO	MALE	FROMA AGROVET	UGUNJA	0728628021	NYANZA
29	MARGARET ADHIAMBO OGARE	MALE	YENGA FARMERS CENTRE	YENGA	0721292736	NYANZA
30	TERESA WAFULA	FEMALE	MEA Ltd	NAKURU	0722688852	RIFT VALLEY
31	JEREMIAH O OBURE	MALE	RAVS AGROVET	EMUHAYA	0721747259	WESTERN
32	SELINE OGOLA	FEMALE	SELIBO AGROVET	SIAYA	0720272996	NYANZA
33	JONAH ANDANJE	MALE	HUDUMA AGROVET	KAKUNGA	0721867680	WESTERN
34	MOSES CHAMWADA	MALE	KESOPA	MIGORI	0715949344	NYANZA
35	IRESA M SAMSON	MALE	MWANAINCHI AGROVET	KEHANCHA	0726639569	NYANZA
36	FELIX ONYANGO	MALE	LUCKY VET SERVICES	NDORI	0718181787	NYANZA
37	ALBERT ALUMASA	MALE	CHAMA AGROVET	MPALE	0722378418	WESTERN
38	JOAN OKELLO	FEMALE	UGUNJA AGROVET	UGUNJA	0706028799	NYANZA
39	KALEHA CELISTER	FEMALE	RESOURCE PROJECTS - KENYA	MPALE	0721232835	WESTERN
40	CHARLES KHAMIDI	MALE	MAVUNO AGROVET	KAKAMEGA	0722864282	WESTERN
41	APOLLP KHABEKO	MALE	LUANDA AGROVET	LUANDA	0721801003	WESTERN
42	WYCLIFFE WANDO OKUMU	MALE	MINISTRY OF AGRICULTURE	MASENO	0722139176	NYANZA
43	FRED BAIJUKYA	MALE	CIAT - TSBF	MASENO		NYANZA
44	JOHN MUKALAMA	MALE	CIAT - TSBF	MASENO		NYANZA
45	JOSEPHINE OLWAL	FEMALE	CIAT - TSBF	MASENO		NYANZA
46	KRISTINA ROING	MALE	CIAT - TSBF	NAIROBI		NAIROBI
47	WYCLIF WASWA	MALE	CIAT - TSBF	MASENO		NYANZA
48	LABAN NYAMBEGA	MALE	CIAT - TSBF	MASENO		NYANZA



3.1.4 Training objectives

1. Provide agro-dealers with a better understanding of farm input products available to them, including those related to increasing Biological Nitrogen Fixation
2. Reinforce recommended ISFM options addressing low soil fertility through better awareness and use of available soil management products.
3. To strengthen the capacity of agro-input dealers to identify major farming constraints and engage the knowledge and inputs needed to address these economically.

3.1.5 Integrated Soil Fertility Management and New Farm Products

Integrated Soil Fertility Management (ISFM) may be defined as *the application of soil fertility management practices, and the knowledge to adapt these to local conditions, which optimize fertilizer and organic resource use efficiency and crop productivity*". Agronomic Efficiency measures how well fertilizers are used. ISFM practices necessarily include appropriate fertilizer and organic input management in combination with the utilization of improved germplasm. ISFM is not characterized by unique field practices or products, but is rather a new approach to combining available technologies in a manner that preserves soil quality while promoting its productivity. Different products have efficacies that may be compared using their agronomic efficiencies and benefit to cost ratios. Products that are available for soil and crop management in Kenya are listed in Table 1. These products, and their role in crop management include:

Notes on farm inputs. Fertilizer forms range from single granular types and their blends, to compound (combined), and complete kinds designed to provide balanced combinations of nutrients needed by specific crops. Agro-minerals are also commercially available for use as soil amendments and nutrient sources. Most notably these include agricultural lime to raise soil pH, sulfur to lower pH and rock phosphates. While organic inputs are sometimes marketed by farm input suppliers as compost, guano, manure and other nutrient-rich materials, they are more efficiently stockpiled, processed and applied as organic resources available within the farm. Other farm input products address soil moisture deficits including sprayed anti-transpirants that restrict leaf stomata and hydrogels that are supposed to increase soil water storage.

Herbicides with either broad or specific activities against unwanted plants are available for use in reduced tillage systems and in controlling weedy invasion. Legume inoculants are applied to seed before planting to ensure that the proper symbiotic rhizobial bacteria are present for root nodulation and biological nitrogen fixation. Other inoculants containing symbiotic mycorrhizal fungi, rhizosphere organisms and biological catalysts are also available but have irregular or unproven benefits. Care must be taken when evaluating new soil fertility management products because advertisement claims are sometimes exaggerated or based upon limited evidence. One class of farm product that warrants further distribution is diagnostic apparatus and kits that characterize soil acidity, moisture and nutrient status.

Let the buyer (and agro-dealer) beware. A proliferation of new chemical and biological products newly arrived on the market. Many claim to bring benefits across a wide range of crops, and to substantially improve both yield and produce quality. Scientific evaluation of these products is often lacking and the processes underlying claims are seldom explained. The proliferation of under-performing products must be prevented, so that effective new products capturing technological breakthroughs do not become lost among a pack bogus merchandize. Agro-dealers selling these poorly performing products are likely to disappoint customers

**Table 1.** Products available for soil and crop management.

Product	Role
Agricultural lime	Increase soil pH
Anti-transpirant	Reduce crop moisture loss
Blended fertilizer	Adjust nutrient ratios
Blood meal	Organic source of N
Boneimeal	Ca and P source
Broad spectrum herbicide	Destroy all weeds
Broadleaf herbicide	Destroy dicot weeds in cereals
Compost	Provide organic nutrients
Compound fertilizers	Combine fertilizer sources
Complete fertilizer	Apply all nutrients
Elemental sulfur	Lower soil pH
Free-living N-fixers	Improve plant nutrition
Foliar fertilizers	Correct nutrient deficiencies
Granulated fertilizer	Simple fertilizer source
Guano	Provides organic N&P
Hydrogel	Improves moisture holding
Legume inoculants	Improve legume BNF
Microbial catalysts	Stimulate microbial activity
Microbial control agent	Protect plants against pathogens
Micronutrient fertilizer	Correct micronutrient deficiency
Monocot herbicide	Destroy grasses in broadleaves
Moisture meters	Quantify soil moisture
Mycorrhizal inoculant	Improve root performance
Nitrogen fertilizers	Provide mineral N
P-solubilize organisms	Solubilize phosphorous
Pelleted fertilizers	Synchronize nutrient release
pH meters	Measure soil acidity
Plant Growth Regulator	Stimulate plant root growth
Potting mixture	Media for container plants
Pumice	Aerate soil, improve drainage
Rhizobial inoculant	Improve legume BNF
Rock phosphate	Provide P and other nutrients
Vermiculite	Improve water holding, K source

Fertilizers are often the best entry point for farm products. The recommendation of the **African Fertilizer Summit** (2006) 'to increase the fertilizer use from the current 8 to 50 kg ha⁻¹ nutrients by 2015' reinforces the role of fertilizer as a key entry point for increasing crop productivity and attaining food security and rural well being in SSA. The impact of this target will, however, vary depending upon the **agronomic efficiency (AE)** of applied fertilizer, defined as 'the amount of output (e.g. crop yield) obtained per unit of fertilizer applied'.



ISFM practices are associated with different fertilizers and placements

Fertilizer	Accompanying ISFM practice	Rationale for ISFM
DAP	<i>pre-plant</i> apply at least 0.5 t ha ⁻¹ of manure or compost	Manure and compost are rich in nutrient bases and micronutrients and improve nutrient retention
DAP	<i>pre-plant</i> periodically apply ground limestone	DAP is acid-forming and may require periodic pH adjustment (> 5.5)
urea	<i>pre-plant</i> retain some crop residues and incorporate with rock phosphate as a substrate for DAP	Decomposing crop residues solubilize rock P, promote N transformation and provide short-term immobilization preventing N loss
urea	<i>top-dressing</i> : apply in conjunction with later weeding	Incorporating urea and weed biomass prevents ammonia volatilization and improves use efficiency
CAN	<i>pre-plant</i> stimulate symbiotic legumes	Apply small amounts of starter N to legumes to stimulate root development, too large applications suppress BNF
CAN	<i>top-dressing</i> : apply to cereals in micro-dose placement, avoiding symbiotic legumes	More accurate placement of top-dressing improves N use supply and efficiency during peak N demand
KCL	<i>pre-plant</i> apply manure or dolomite	Maintain proper base nutrient ratios by supplementing K with Ca and Mg

Africa is richly endowed with agro-minerals including phosphate rocks, potassium- and sulphur-containing minerals, lime and dolomite. Deposits that can either be utilized directly as nutrient sources or serve as raw materials in fertilizer processing. Agro-minerals can offer a cost-effective alternative to processed mineral fertilizers but in others, agro-minerals are less reactive in soil and nutrient release requires accompanying technologies. Overall, these resources are under-utilized considering their

Soil biota are an essential component of "soil health". Services accrue through two basic approaches; indirectly by promoting beneficial soil biological processes and ecosystem services through land management or **directly through the introduction of beneficial organisms to the soil or crops**. Caution: many "soil health products" make excessive claims. Beneficial soil organisms include:

- **Root nodule bacteria and biological nitrogen fixation.** BNF allows many legumes to meet their nitrogen requirements from the atmosphere rather than the soil
- **Arbuscular mycorrhizal fungi.** AMF are common root-colonizing fungi forming symbioses with most plants, provide a greater absorptive surface than plant root hairs and benefit from carbohydrates provided by host plants
- **Soil Macrofauna.** Larger soil invertebrates, referred to as macrofauna (>1 cm in length and >2 mm in diameter) have greater mobility and the ability to manipulate their environment. Epigeic earthworms are used for rapid composting
- **Plant Growth promoting rhizobacteria and fungi.** Rhizosphere bacteria that favorably affect commercially important crops are grouped as Plant Growth Promoting Rhizobacteria (PGPR). These include plant growth regulators (PGRs), biological control agents and phosphate solubilizing organisms

Agro-dealers should consider opportunities addressing women's opportunity for better land management.



- **Distribute input samples.** Promotional fertilizers or seeds leads to increased fertilizer demand by poorer households and improved fertilizer marketing by local merchants and farm associations
- **Package fertilizer into smaller quantities.** Fertilizers that are packaged in smaller quantities are more useful to women.
- **Expand women's intercroops.** As ISFM involves greater reliance upon nitrogen-fixing legumes, and as many legumes are considered to be traditional women's crop, then intercropping with legumes is one means to provide greater equity within the farm.
- **Promote small animal enterprise.** Men control livestock, particularly cattle, while women are generally responsible for poultry and other small, domesticated animals. The manure from livestock may be similarly allocated with smaller animals producing higher quality by-products.
- **Introduce organic fertilizer production.** Women are engaged in many household activities that involve the processing of available organic resources, particularly handicrafts.
- **Channel incentives through women's groups.** Women's groups serve as an excellent platform to advance many ISFM technologies.

A major factor that limits widespread adoption of new farm products is lack of innovative policies. Government policy should ensure that farm input manufacturers and suppliers, farmers, commodity buyers and processors, and development agents work together. Public meetings periodically held to provide informed input into agri-policy formulation. Issues constraining access to inputs and markets inhibit investment in needed farm inputs. Several ISFM policy realms exist:

- **Beneficial policies or by-laws reinforcing ISFM that are not being followed or enforced** (e.g. prohibition of the burning of crop residues in Kenya).
- **Policies which are inimical to widespread adoption** (e.g. prohibition of fertilizer and seed repackaging)
- **Policies that offer incentives to the intended beneficiaries** (e.g. holding service providers more accountable)
- **Policies with positive and negative impact on ISFM depending upon how they are implemented** (e.g. farmers' right to form grassroots and larger associations, community-based seed production and marketing)
- **Policy vacuums that impede ISFM** (e.g. lack of tenure discourages conservation practice and tree planting, delayed bio-fertiliser act)

Key points

1. New soil management approaches opens the way for new input products
2. Not all products perform as advertised (excessive claims)
3. A major push to promote fertilizers and agro-minerals in Africa is underway
4. New products include beneficial organisms and plant growth promoters
5. Women farmers have special demands for farm inputs
6. Greater reliance upon farm inputs raises policy considerations

Biological nitrogen fixation and legume inoculants

This presentation included the nitrogen cycle, types of inoculants, role of inoculants, the inoculation process, types of fertilizer useful in legume production and inoculant and fertilizer storage and handling. Demonstrations included seed inoculation methods, inoculated versus non inoculated soybean roots showing enhanced nodulation and crop vigour. Materials were largely drawn from the Master Farmer Guidelines (Woomer, 2010). Many photographs were used to illustrate basic concepts that cannot be readily accommodated in this electronic communication.

Seed quality, packaging and storage

Separation of seed is based on difference in physical properties: size, length, weight, texture and colour. Seed is cleaned by winnowing where dry seed is separated from lower density plant debris. Lighter chaff blows away, leaving denser seed behind. Hand sorting then removes final foreign materials and off-grade seed. A representative sample is obtained from the seed lot by taking small portions at random from different positions in the seed lot and combining them into a submitted



sample. From this sample, purity analysis working sample is obtained. The working samples are subjected to physical purity analysis the results of which will determine if the processed seed is clean or not. Seeds are treated to protect them from infection by insects and plant diseases caused by micro-organisms. Benefits of seed treatment include disinfecting the seed against seed borne disease organisms and renders them harmless, protecting seed against soil borne organisms, including insects, prior to and during germination and seedling establishment and providing systemic protection against diseases or infection for the seedling.

Treated seed is packed in new clean bags of good strong material, paper can be used. Packing is done in containers of various sizes according to the customer market demand. Normally packing is done in 1 kg, 2 kg, 5 kg, 10 kg, 20 kg and 50 kg. Between harvesting until sowing, the seed is kept under storage. During storage, the seed must be stored under conditions which cause minimum reduction in viability. Reasons for seed storage include uneconomical to multiply small amounts of seed every season, it is not always possible to estimate seed yields, demands for seed may fluctuate and good seed stocks are valuable and can be difficult or costly to produce.

Quality seed is a product of several functions within the chain that must be adhered to in order to achieve a final quality product. The functions for realization of the product quality are carried out in different segments along the chain each of them imparting quality at every stage. The segments include input supply, production, processing and marketing. Select certified and appropriate inputs- seeds, fertilizers, crop protection chemicals and follow recommended agronomic practices for the particular seed namely: timely planting, correct spacing, correct fertilizer applied at recommended rates, keep a weed free field during crop growth, protect from pests and diseases and harvest at the correct time i.e. when fully mature



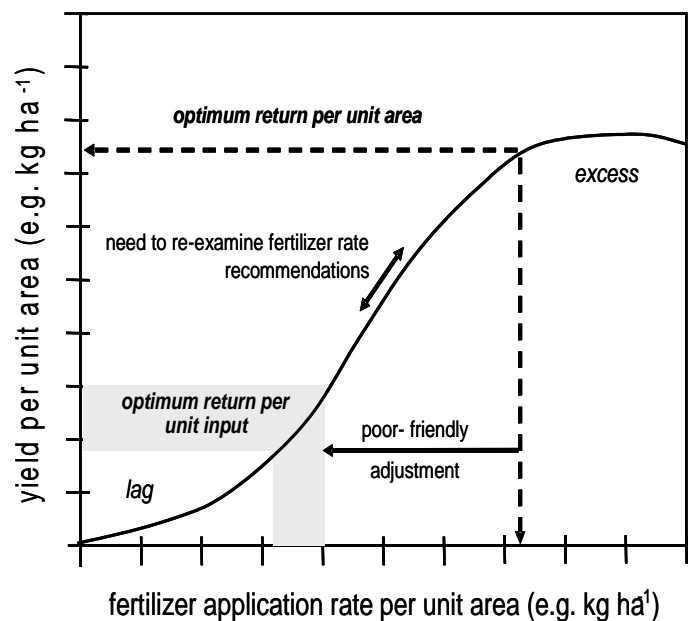
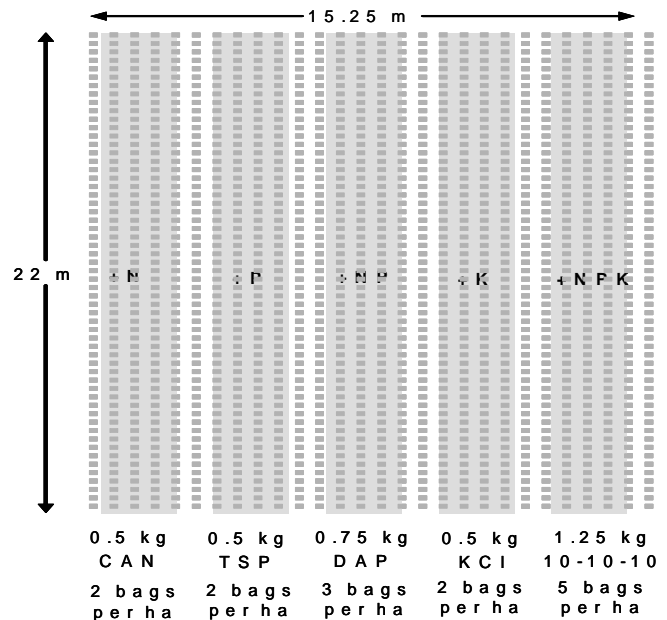
3.1.6 Extending Recommendations and Testing Products at the Grassroots Level

Perception of fertilizer recommendations.

Scientists formulating fertilizer recommendations regard them as approximations of an ideal, and as additional information is collected, that ideal is better approached. Empowered land managers understand that this is not the case, rather fertilizer recommendations represent an informed starting point that is adjusted to meet their changing site-specific conditions. The capacity for improvement by stakeholders is not fully acknowledged and this has led to the continuation of over-generalized blanket recommendations advanced by many extension systems.

Fertilizer recommendations may be formulated using two contrasting approaches. **Sufficiency** establishes production targets and calculates the nutrient additions required to meet them. It generates lower recommendations that are best applied to soils that are moderately infertile (most used in Kenya). **Build-up and maintenance** first establishes critical fertility conditions required to meet crop demands (build-up) and then replaces nutrients as they are lost over time (maintenance). It is best applied to the least fertile soils, and often requires massive initial fertilizer additions. The **sufficiency concept seems most consistent with the abilities and resources of small-scale farmers** and, if properly applied can also satisfy the nutrient requirements in the least fertile soils

Field test strips. Test strips of different mineral fertilizers assess which nutrients are limiting crop growth and which fertilizers best correct this condition. The technique is simple, small amounts of different fertilizers are incorporated into the soil, their placement is marked for later identification, the field is planted and the effects of fertilization noted later in the season. When N, P and K-bearing fertilizers are applied side-by-side, farmers can determine which nutrient is least available in their soil. It also raises awareness of plant deficiency symptoms. An example of fertilizer test strips installed at a moderate fertility level intended for on-farm diagnosis of fertilizer requirements. Each strip is equivalent to 0.005 ha containing 300 maize plants in four 75 cm rows. Test strips require that the correct fertilizers are available in small quantities because small-scale farmers are unlikely to purchase several different 50 kg bags simply to test them, the test strips are installed in a way that the fertilizer effects are clear and not confounded by other conditions, stakeholders have access to extension advice and illustrations that describe resulting nutrient deficiency symptoms and that farmers recognize that more than one fertilizer may be necessary because ameliorating the most limiting nutrient often results in expression by another. Finally, fertilizer recommendations formulated for small-scale farmers should be based not





upon maximizing return per unit area, as is customary, but rather optimizing return per unit fertilizer input.

3.1.7 Agro-dealer characterization and strengthening agro-dealership

A rapid survey was made of 30 participating agro-dealers (Table 2). A majority of those in attendance were men who owned their businesses although 30% of agro-dealer participants were women. On average, participants had been in business for slightly over 7 years. Most fertilizers marketed contained nitrogen although 13% marketed superphosphates. Very few marketed lime. A majority market IR maize seed (to kill striga) and bean seed, many market soybean seed but few sell groundnut seed. Most sell seed in small packages and bags, but 10% market seed in sacks 10 kg or larger. Many agro-dealers stock BIOFIX inoculant but few refrigerate it.

Stockists are well linked to extension agents, local NGOs and farmer groups and communicate with regulators. Most have received past training and 80% are certified by AGMARK. Credit relations vary, with 40% of agro-dealers receiving bank loans and 63% receiving inputs on credit from suppliers. Most agro-dealers extend inputs on short-term credit. Most agro-dealers seek further training, but few seek additional credit and equipment. These findings are preliminary, and based on a small sample, but offer direction to further enquiry. That so many stockists sell grain legume seed and inoculant is a very promising sign.

The operations of KENADA (Kenya National Agro-Dealer Association) was discussed. Its impact is not being felt at the local stockist level and there is need to establish more localized county and district chapters to spearhead development at the regions and advocate for the agro-dealers welfare. An office comprising of chair, secretary and treasurer was selected on an acting capacity to implement with the main objective to be part of soybean value chain agents working closely with CIAT-TSBF in western Kenya. Afterwards a series of presentations raised the following issues.

Agro-dealers must understand their potential relationships with players in the Agricultural value chain and improve the benefits to their businesses by the following:

1. The relevance of marketing to the agricultural and food sectors
2. The meaning of the marketing concept
3. Basic functions of marketing
4. Involvement of agro-dealers in agricultural output marketing to better serve smallholder farmers

Table 2. Agro-dealer characteristics.

AD owner	90%
AD employee	10%
AD women	30%
Years in business	7.2
Markets DAP	90%
Markets CAN	90%
Markets urea	87%
Markets organics	20%
Markets TSP	13%
Markets SSP	13%
Markets foliar feed	13%
Markets NPK	13%
Markets lime	3%
Markets IR maize seed	73%
Markets bean seed	70%
Markets soybean seed	30%
Markets groundnut seed	7%
Markets seed < 1 kg packages	97%
Markets seed 1-2 kg bags	60%
Markets seed > 10 kg sacks	10%
Markets BIOFIX inoculant	17%
Has access to refrigeration	23%
Stores inoculant in refrigerator	3%
Linked to local extension agent	90%
Linked to local NGO	93%
Linked to local farmer group	97%
Linked to regulators	93%
Received past training	93%
Certified by AGMARK	80%
Receives bank loan	40%
Receives credit from suppliers	63%
Extends credit to customers	90%
Requires training	73%
Requires credit	37%
Requires additional equipment	10%

Farmers use inputs to enhance their agricultural productivity. Inputs enable farmers to increase their produce if well applied. And this is supplied by the agro-dealer nearest to the farmer. Agricultural marketing can best be defined as a series of services involved in moving a product from the point of production to the point of consumption. This involves planning production, harvesting, grading, storage



and marketing. Such activities cannot take place without information (market price of commodities, transportation costs, demand for specific produce etc). This is heavily dependent on the availability of finance. The aim is to maximize production, know your market produce, quality as per the market demand and minimize on marketing costs.

The marketing concept, consumption is the sole end purpose of all production: production takes place only when there is a consumer for the product. Basic functions of marketing include financing, risk bearing and market intelligence. Agro-dealers link input suppliers to farmers on one hand and on the other hand could link farmers to output markets of traders, processors and users. Several value chain drivers exist.

Input Supply Chain	Output: Value Chain
<ul style="list-style-type: none">. Availing quality inputs. Establishing demo plots. Organizing field days. Access new technologies	<ul style="list-style-type: none">. Market specification. Quality assurance. Warehousing. Transportation. Contracting



3.1.8 Workshop evaluation

Training area	Observations/comments from participants
Agro-dealership and grain legume enterprise	Very revealing session. Well covered, there is need to have demos next to the shops with and without inoculants.
ISFM and new farm input products	More practical information necessary to allow the agro dealer to introduce the same to farmers. Nicely covered.
Biological nitrogen fixation and legume inoculants	Very well articulated, especially demo on inoculants. Well covered.
Fertilization and pest and disease management of grain legumes: Practices and products.	Knowledge if well imparted to farmers will improve farm productivity. Well covered.
Extending recommendations and testing products at the grassroots level	A bit too technical.
Beyond input supply: local stockists, farmer associations, county-level empowerment, produce collection points and value addition	A very helpful involvement by agro-dealer, there is need for an association to enable the agrodealer to serve farmer better.
Panel Discussion: Empowering local agro-dealers	Regional agro-dealer association needed.
Plant nutrient balances	Very well explained by the facilitator.
Legume seed quality and storage	The viability of some legumes is very short leading to poor germination which discourages farmers from investing in legume farming.
Fertilizer recommendation and use	More information should be availed by taking soil samples to make us understand the soil nutrient status and prescribe the right fertilizer.



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 soybeans, 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



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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



Partners involved in the N2Africa project



Nairobi University



Resource Projects-Kenya



Université Catholique de Bukavu



University of Zimbabwe

