RESEARCH SUMMARY
Impact assessment of agricultural extension and input subsidies – research design for Eastern DRC

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Agricultural extension and input subsidies in Eastern DRC

The adoption of modern agricultural inputs is believed to be an important driver of increased agricultural productivity. Yet, adoption rates of e.g. commercial fertilizer and improved seeds tend to be (much) lower than expected, especially in many Sub-Sahara African countries. Imperfect knowledge about returns to these inputs may be a key factor explaining low adoption rates. Agricultural extension services have regained popularity in recent years as an effective tool to improve knowledge and adoption of new inputs and techniques and increase agricultural productivity. The current approach to extension services has a strong participatory focus that includes involving all stakeholders to identify constraints and opportunities for knowledge generation and dissemination of new crops, techniques and (or) inputs. Yet rigorous evidence on its effectiveness is still limited.

No access to credit may be another explanation for low levels of adoption. Recognizing this, input subsidy programs are increasingly being introduced, often in tandem with extension services.

Researchers from the Netherlands and DR Congo have partnered with local non-governmental organisations to implement and evaluate a set of interventions that aim to increase farmer take-up of improved inputs and new agricultural techniques in Eastern DR Congo.

Grain legumes (e.g. common bean, soybean, groundnut) are important staple crops for the majority of poor households in Eastern DRC, providing the (often) main source of protein, in the absence of affordable dairy, fish or meat products. Yet current yields comprise only a fraction of their potential due to poor soil fertility management and other stressors; including insufficient knowledge and limited access to new inputs and crop growing techniques.

The interventions are undertaken as part of the multi-country N2Africa programme (www.n2africa.org). The N2Africa program aims to generate and transmit knowledge about the use of agricultural inputs and techniques to grow N-fixing legume crop through training and experimentation, helping people adopt these new practices. The complementary subsidy scheme facilitates adoption through reduced costs of experimentation. This evaluation tests the extent to which the intervention has been successful in achieving these goals. The study will also investigate gender aspects of the program, analyzing to what extent impacts may differ by gender of the household head and whether it increased female decision-making.

Research objectives

1. Assessment of HH needs for improving agricultural yields in Eastern DRC
2. Impact evaluation of agricultural extension services on knowledge, attitudes and adoption of new inputs for grain legumes
3. Assess the impact of subsidized inputs on knowledge, attitudes and adoption of these inputs relative to receiving extension services only

Partners

This project brings together:

- Research partners: International Institute for Tropical Agriculture (IITA), International Center for Tropical Agriculture (CIAT), Consortium for Improving Agriculture-based Livelihoods in Central Africa (CIALCA), Catholic University of Bukavu, Wageningen University and UNU-MERIT
- Implementing organisations: PAD, DIOBASS, WOMEN for WOMEN, SARCAF, IPLCI & CDC/Kiringye

Research design

We worked with 905 households in 93 villages located along on of three 'axes' (northern, western and southern) in the province of North

Kivu, Eastern DRC.[1] The stratified sample of 93 villages was drawn from a sampling frame (list) comprising villages located along the northern, western and southern axes satisfying the following criteria: (i) located in area where at least one of the partners had contacts; (ii) accessible by motorized vehicles and (iii) had not been part of any N2 Africa intervention before.

Within our sample of villages, 35 received extension services only (group A) while another 35 randomly selected villages received both extension services and an offer to take part in the subsidy scheme (group B). 33 villages received neither intervention A nor B and are referred to as comparison or group C.[2]

Table 1: **Assignment of interventions across villages**

	Comparison	A	B
# villages	33	35	35

Table 2: **HH in baseline survey by axe and group**

Axis	Comparison	A	B	Total
North	39	57	57	153
West	61	88	78	227
South	176	180	169	525
Total	276	325	304	905

We drew a stratified sample with stratification based on axis. The Northern Axis stretches north from the provincial capital Bukavu along Lake Kivu, at an altitude of some 1500m. The Western Axis is located in the highlands, west of Bukavu. The Southern axis comprises the Ruzizi plain, south of Bukavu at 600m altitude. The Southern axis is more densely populated than the other two, with more and larger communities.

Communities are located in areas where one of the six local NGOs is active. Villages were assigned to the NGO with whom they had been interacting in the past. This ensured that the NGOs were knowledgeable about the specific communities, with whom they had built long-standing relationships of mutual trust and support.

Interventions

Group A
Community-based organizations select a 'master' farmer who is able to read and write, has access to (own) land, is able to diagnose soil nutrient problems and identify the need for specific inputs and has access to external sources for agricultural advice and supply of inputs and (improved) seeds. Master farmers receive training from extension workers in applying new techniques and inputs for growing grain legumes and act as a general coordinator between the group, the wider community and the extension worker(s). Experimental trials are set up in which production of legumes using traditional techniques is compared to legumes that were grown using new techniques and new inputs. Other farmers interested in applying these new practices can attend demonstration trial meetings (usually some 20-35 farmers per community).

Group B
Upon completion of intervention A, communities in group B were offered to buy one or multiple input packages. Local development committees (CLD) informed community members of the possibility to buy new inputs at (1) a reduced price (75% of the going market price) and (2) offer a delayed payback scheme (with an advance payment of 500 FC) after harvest where participants could choose to pay back in money or seeds. There were six types of input packages (each worth 26 USD) that all contain a combination of improved seeds, fertilizer and (or) inoculum. Input packages slightly vary according to local conditions and farmer preferences. CLDs were responsible for registering applications and coordinating the distribution of the packages.

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[1] Sample sizes vary somewhat across variables
[2] Due to various constraints group A and group C were not based on random assignment.

Group C

The remaining 33 villages participated in the research only and did not receive the N2Africa program or the offered subsidy scheme.

Table 3 Households by NGO and group

NGO	C	A	B	Total
CDC/Kiringye	84	30	38	152
Diobass	40	60	58	158
IPLCI	0	79	91	170
PAD	20	77	67	164
SARCAF	72	10	10	92
Women for Women	60	69	40	169
Total	276	325	304	905

Households in the sample have up to nine plots, with an average of two plots per household.

Table 4 Number of plots per household

Axis	Obs	Mean	Std. Dev.	Min	Max
North	153	2.01	1.35	1	8
West	226	2.08	1.09	1	8
South	525	2.33	1.53	1	9
Total	904	2.21	1.41	1	9

Baseline statistics: agricultural outcome indicators

Our core set of outcome indicators relates to agriculture and includes measurements of knowledge/experience, cropping patterns, land use practices and yields. Final impacts are measured by assessing changes in levels of food security, income and empowerment.

Main crops are cassava and beans. There is some regional variation regarding the third main crop. Soybeans are the third most important crop in the North; sweet potatoes in the West, and maize in the South.
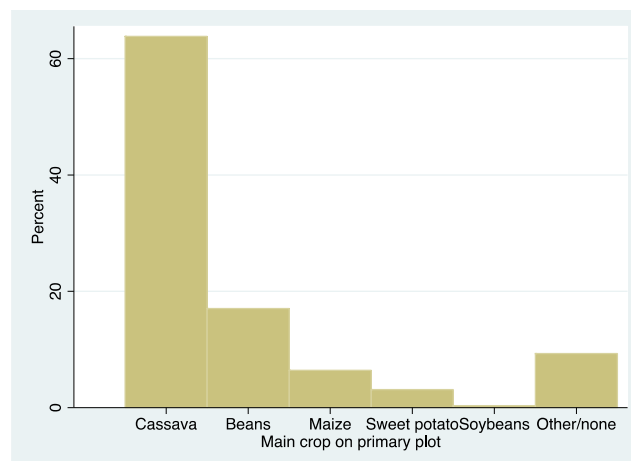

Figure 1 Main crop on primary plot (% of households)

Soil quality varies considerable across the axes and appears to be highest in the South while it is much worse in the West, with more than 55 percent of households indicating that their primary plot is infertile or very infertile.

Table 5 Soil fertility by axis

	Primary plot		
	North	West	South
Very fertile	7.2	3.1	12.0
Fertile	28.8	16.4	50.5
Normal	30.1	23.0	23.6
Infertile	27.5	39.4	13.1
Very infertile	6.5	17.3	0.8
Don't know	0.0	0.9	0.0
Total	100%	100%	100%
Obs.	153	226	525

For each plot (up to three in total) we asked for the main decision-maker. For about one third of the cases there's a female household member making the decisions.

Table 5 Female decision-maker (primary plot)

Axis	Obs	Mean (%)	Std. Dev.
North	153	32.0	0.468
West	226	32.7	0.470
South	525	31.4	0.465
Total	904	31.8	0.466

We asked households about the use of chemical and organic fertilizer and inoculant.[3] Fertilizer use is varied across the axes; there is only a small fraction of households in the South that use inorganic fertilizer compared while the majority in the North and West do. Differences are less pronounced for chemical fertilizer and inoculum that are only used by a limited proportion across all axes. Having limited knowledge about the potential benefits of commercial fertilizer and (or) inoculum may explain (in part) the low usage, though this may apply more to inoculum than fertilizer.[4]

Table 6 **Fertilizer or inoculum use (% households)**

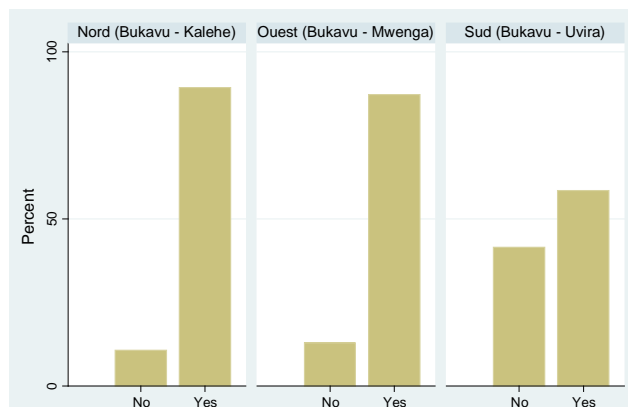| Axis	Obs	Organic fertilizer	Chemical fertilizer	Inoculum
North	153	88.9%	2.0%	2.6%
West	227	73.1%	4.0%	4.8%
South	525	12.8%	3.6%	1.3%
Total	905	40.8%	3.4%	2.4%

Figure 2 **Perceived necessity of using fertilizer to N-fixing legumes**

At baseline, more than 40 percent of the respondents indicated they never obtained any information about new agricultural methods.
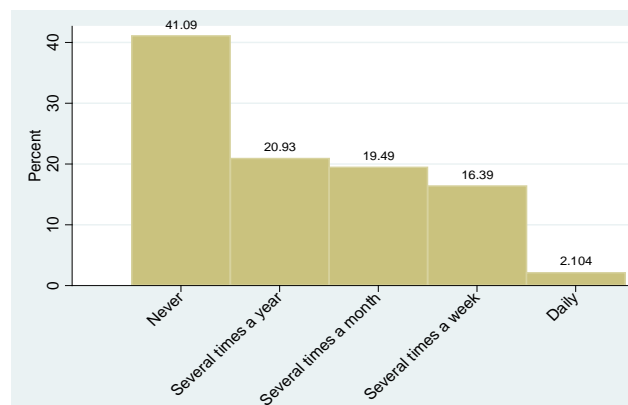

Figure 3 **Frequency of receiving information about new agricultural methods and (or) inputs**

Final outcome indicators include yields and levels of food security. Yields are calculated in kilograms per hectare in order to make comparisons of crop productivity across farmers with varying plot sizes feasible. Based on discussions with local partners, cassava production is below expected yields of 5,000 kg/ha, however it fits within the range of 2-15 ton/ha observed yields from an agricultural study undertaken in South Kivu in 2011. Large standard deviations relative to mean values for several crops indicated that some averages are probably biased upwards by outliers. Instances of minimum values of "0" are for crops that were planted but nothing was harvestable.

Table 7 **Complete harvest yields (kg/ha) by crop**

Crop Name	Mean	Std. Dev.	Min	Max
Cassava	4,067.7	8,747.4	0	56,600
Sweet Potato	16,605.4	28,107.5	249.9	120,000
Rice	8,985.4	35,530.5	100	200,000
Maize	3,260.5	12,009.9	0	100,000
Sorghum	396.0	216.2	100	600
Beans	1,944.3	14,966.5	0	222,222.2
Soy beans	3,697.4	12,064.8	0	50,000
Groundnuts	1,903.6	6,627.8	35.7	40,000
Coffee	667,100.0	1,154,325	50	2,000,000
Other	12,083.3	6,481.8	7,500	16,666

Assessing the impact of agricultural extension and input subsidies

This study evaluates the effectiveness of agricultural extension and a subsidized inputs scheme on adoption of modern inputs and

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[3] Inoculant refers to a commercially available product. Grain legumes are coated (inoculated) with bacteria that fix nitrogen gas from the air into a form usable by plants. The nitrogen fixation thereby contributes to the production of high-protein legumes, increases yields and improves soil fertility.
[4] Only 7% of our respondents know what inoculum is. Limited availability or credit constraints may be other explanatory factors.

agricultural techniques for growing legume crops in Eastern DRC. A key feature of our design is the provision of a subsidized inputs scheme offered to a random subset of communities that also received extension services. This enables us to assess the causal impact of a subsidy scheme for a range of outcome indicators beyond input use alone including yields, income, assets, food security and empowerment. Baseline statistics show low levels of modern input use, yields, food security and empowerment, with some variation across the different axes.