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Policy Brief: For a Climate Smart Potato Sector in Kenya

Promising business cases for potato smallholders in Kenya combining income increase and climate smart interventions

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I. Background information

Kenya's second largest horticultural sector after maize is the Irish potato sector. In 2019 the national potato production in Kenya was 2.0 million tons (versus 3.6 for maize) [1]. About 800,000 farmers are active in the sector, and 90% (720.000) of them grow potatoes on less than an acre [2]. Main challenges are high losses at farm level mainly due to poor harvest practices, and lack of certified seeds resulting in substandard yields [2, 3]. Global food loss and waste and associated greenhouse gas emissions (GHGE) are estimated at 2.5 Gt, which is 4% of total anthropogenic GHGE [4]. GHGE studies for potato in Kenya are rare, but for East Africa current emissions from the sector are estimated to vary between 0,16 – 0,25[1] kg CO_2-eq. per kg of potatoes [5]. Current GHGE from the Kenyan potato sector are therefore estimated to be at least 320,000.0 kt[2] CO_2-eq.

II. Key findings of this study

Wageningen University and Research (WUR) looked into the optimal and realistic combination of income increasing- and climate smart interventions for potato smallholders in Kenya. In four different scenarios WUR compared food losses and GHGE at various nodes of the potato value chain, and smallholder yields and profits. The results show that business and sustainability can go hand in hand for the ware potato supply chain in Kenya. **The alternative scenarios could potentially impact 720.000 smallholders through creating extra income from us much as 55% to even 460% compared to the reference scenario. Food losses can be reduced with 71% and nationwide GHGE with 109.9 kt[3] CO_2-eq. Additionally, food security can be enhanced with more than doubling the potatoes available for home consumption.**

III. Policy advice based on this study

Based on the work done by WUR the following policy advice can be given to the Kenyan government, the industry and supporting agencies:

1. Continue working towards guaranteed availability of certified seeds in the market and stimulate farmers to use certified seeds. **Certified seeds increase yields with 94% to 160% per hectare compared to the use of home-saved seeds.** This leads to **55% to 460% profit increases** for farmers. The **use of certified seeds also reduces GHGE with 26% to 51%.**
2. Facilitate farmers mechanization for instance via service provision, through demonstrations at farm level, and/or vouchers for farmers to hire a tractor with machinery. Manual harvesting with the fork jembe leads to damage on the potatoes resulting in high losses at farm level, therefore **mechanizing harvesting in combination with mechanized planting** (standardized depth and distance) **is critical for the presented scenarios**;
3. Explore use of alternatives for DAP fertilizer. Currently many smallholders use DAP fertilizer because it is subsidized by the government. This fertilizer is meant for maize production and not fully suited for potato cultivation, leading to both suboptimal production yields and environmental pressure. **Other** (more expensive) **fertilizers outperform DAP in yield and therefore might still financially be more attractive while reducing 33% GHGE per product kg through increasing yields.**
4. For seed producers and/or chemical companies: **engage in certified seed production** and accompanied plant protection activities in collaboration with/support of the Kenyan government.
5. Once groups smallholders start to professionalize, the competition in the market will force other farmers to do the same. After that, **next steps like storage or irrigation (preferably solar) may follow to upgrade the position of the Kenyan potato smallholder** and the country as a whole with respect to less GHGE and less food losses from the potato sector.

Finally, further research is desired to the implications of ongoing intensification of the potato sector in Kenya, specifically:

6. Local universities and research institutes such as CIP should study the effects of the adoption of practices associated with these alternative scenarios on gender equality. Kenya is an agriculturally based economy where land is the primary form of collateral through which there can be economic empowerment, and this essential requirement is unavailable for women.

IV. Four scenarios of this study

In relation to the main challenges of high losses at farm level mainly due to poor harvest practices, and lack of certified seeds resulting in substandard yields, four scenarios are developed with a focus on realistic interventions for potato smallholders. Starting certified seed production himself is not realistic for a smallholder because of the required economies of scale, but the Kenyan government is taking action on increasing the production of certified seed. A more obvious scenario is the shift towards buying certified seed (assuming increase of availability) instead of using home-saved seeds. For the same reasons investment in mechanization is not considered, whereas hiring equipment for on farm activities is included.

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[1] The variation depends on whether the effects of land use change are incorporated in the calculations or not, if so, GHGE are higher.

[2] Thousand metric tons.

[3] Thousand metric tons.

Additional relevant inputs required in potato cultivation are fertilizers and plant protection, resulting in the following 4 scenarios, where scenario 1 is the reference scenario based on current dominant practice:

Scen.	Farming	Seed	Fertilizer	Plant Protection
1	By hand	Home-saved	DAP at 150 kg/ha	Ridomil/Mancozeb 3x
2	By hand	Certified seed	DAP at 500 kg/ha	Ridomil/Mancozeb 4x
3	Hire equipment for some farm handling	Clean seed	DAP at 500 kg/ha	Karate,Ridomil gold, Revus, Mancozeb, 11 sprays
4	Hire equipment for some farm handling	Certified seed	NPK 16:8:22 at 500 kg/ha	Mixed spray

Table 1: Overview of scenarios

Clean seeds are an upcoming trend where seeds are produced outside the formal seed certification process using certified seeds. Fertilizer and plant protection amounts are derived from experts. Other inputs for the analysis are also derived from experts in combination with literature. A multi-indicator evaluation of the potato supply chain was performed, using innovative backward flow calculations to calculate *GHGE*, *FLW* and *economic viability* for the scenarios. These are the results:

Results	GHG (kg CO_2-eq) per ton edible potatoes at retailer	Difference GHG with reference scenario	Average losses in kg to get one ton of edible potatoes at the retailer	Difference losses with reference scenario	Difference profit with reference scenario
scenario 1	263	0%	257	0%	0%
scenario 2	195	-26% ↓	257	0%	+55% ↑
scenario 3[4]	195	-26% ↓	257	0%	
scenario 4	**128**	**-51% ↓**	**75**	**-71% ↓**	**+460% ↑**

Table 2: Results on GHG emissions and losses based on backward calculations (the arrows point at significant reductions)

For household income and food security we also expect tremendous improvements for scenarios 2, 3 and 4:

Results	yield at farm level (t/ha)	losses farm level (%)	losses until consumer (%)	available for human consumption (t/ha)	Profit in USD
scenario 1	8.3	13.4%	14.3%	7.12	16.40
scenario 2	16.1	13.4%	14.3%	13.80	25.42
scenario 3	17.8	13.4%	14.3%	15.26	
scenario 4	**21.6**	**4.3%**	**5.2%**	**20.48**	**91.79**

Table 3: Results on yield, losses and food security

Clearly, scenario 4 is the most optimal scenario.

V. Acknowledgements

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VI. References

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2. Technoserve, *Kenya Potato ISP.* 2018: p. 149.
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5. Nemecek, T., Weiler, K., Plassmann, K. and Schnetzer, J., *Geographical extrapolation of environmental impact of crops by the MEXALCA method.* 2011: p. 132

[4] The upcoming use of clean seed is a recent development, and the reference data for the scenarios are from 2016. Therefore, in the economic evaluation scenario 3 is excluded.