



Assessment of the impact
of **Improved Pigeonpea
Development** in Northern Tanzania

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The main report is available [here](#)

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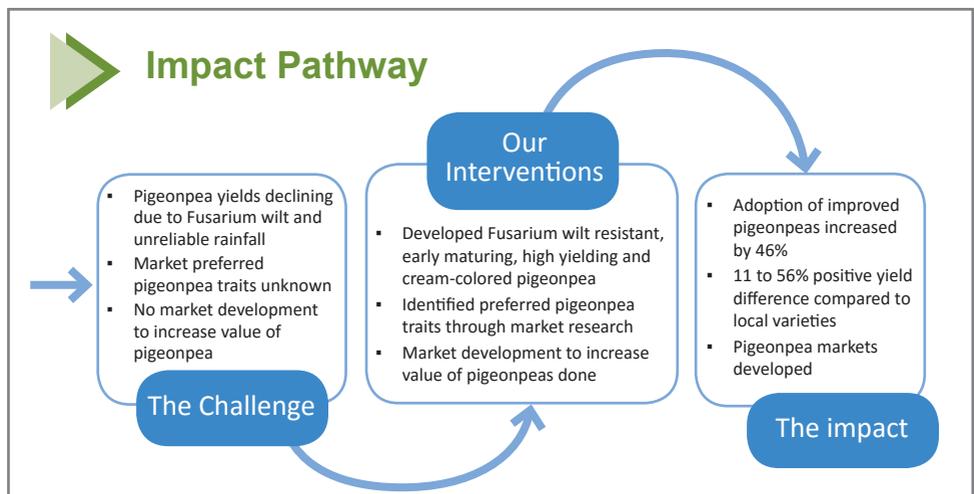
Assessment of the impact of Improved Pigeonpea Development in Northern Tanzania

► Key Fact

The promotion of pigeonpea in Tanzania by ICRISAT in collaboration with the Selian Agricultural Research Institute, TechnoServe and Catholic Relief Services has led to a **46% adoption rate** and **11% to 56% positive yield differences** compared to local varieties.

► Summary

Pigeonpea yields in Tanzania have been declining over time due to Fusarium wilt and unreliable rainfall patterns. Furthermore, market preferred traits and value of pigeonpeas were unknown. ICRISAT worked with the Selian Agricultural Research Institute, TechnoServe and Catholic Relief Services to develop and promote Fusarium wilt resistant, early maturing, high yielding and cream-colored pigeonpea in northern Tanzania. Smallholder farmers were linked to the market through producer marketing groups and received business and marketing training.



► Who Helped Us (Funding)

The pigeonpea breeding program received funding from **the African Development Bank**, and subsequently a **consortium of donors**.

► Return on Investment

Under the intermediate and optimistic scenarios the **internal rates of return range from 21.9% to 25.5%, and benefit-to-cost ratios range between 4.9 and 6.8 times the cost of public investment**. Between US\$1.03 million and US\$5.06 million of net social benefits are generated with the largest proportion accruing to consumers, consistent with previous studies. The lowest benefit-to-cost ratio is 2.18. Even under highly unrealistic and extremely conservative assumptions on the conditions affecting the calculation of net social benefits, the public investment in pigeonpea improvement and market development is justified.

Impact Summary

Introduction

Pigeonpea yields in Tanzania have been declining over time due to Fusarium wilt and unreliable rainfall patterns. Furthermore, market preferred traits and value of pigeonpea were unknown. Since 1991, ICRISAT has worked with the Selian Agricultural Research Institute (SARI), TechnoServe and Catholic Relief Services to develop and promote Fusarium wilt resistant, early maturing, high yielding and cream-colored pigeonpea in northern Tanzania. Along with this research program, ICRISAT also developed a strategy focusing on increasing the value of pigeonpea through market development. ICRISAT intervened in several different areas to reduce the transaction costs limiting farmer participation in markets. Activities had focused on strengthening the role of the marketing sector by identifying varieties with desirable end-use characteristics in the export market and aligning these middlemen with farmers in order to stimulate an increase in the volume and quality of pigeonpea supply. This effort has produced numerous new varieties with desirable traits that have been highly or moderately adopted by smallholder farmers in northern Tanzania, and more specifically, in Arumeru, Babati, Karatu and Kondoa districts. The end-use traits are valued by brokers, assemblers and middlemen who often resell the varieties on the international market. Smallholder farmers were linked to the market through producer marketing groups and received business and marketing training.

In 2008, 2010 and 2012 ex-post impact assessments were conducted in northern Tanzania. The study analyzed the factors affecting the adoption of improved pigeonpea varieties and the decision to market pigeonpeas. In addition, the study analyzed the impact of pigeonpea on productivity, profitability, food security and social returns to investment.

Data

This brief is based on household survey data with additional information about pigeonpea marketing and preferred traits drawn from key informant interviews, vendor and market surveys. In 2012, a total of 731 households were surveyed in a random sampling of villages in Arumeru, Babati, Karatu and Kondoa districts in northern Tanzania. Data was collected in November and December 2012 by experienced enumerators in collaboration with ICRISAT-Nairobi and SARI. This survey captured the same information as similar studies that took place in 2008 and 2010 in order to create a panel data set. The household survey collected information on household characterization, pigeonpea adoption, production and marketing and other income generating activities.

Impact

Survey data revealed that the adoption of improved pigeonpea varieties (number of plots cropped to pigeonpea) increased from 23% to 46%, in 2008 and 2012, respectively. In Karatu district, the number of plots cropped to pigeonpea increased from 20% to 80%; in Arumeru the plots increased from 42% to 82%. As of 2012 about 23.9% plots were cropped to improved pigeonpea varieties in Kondoa district (Figure 1).

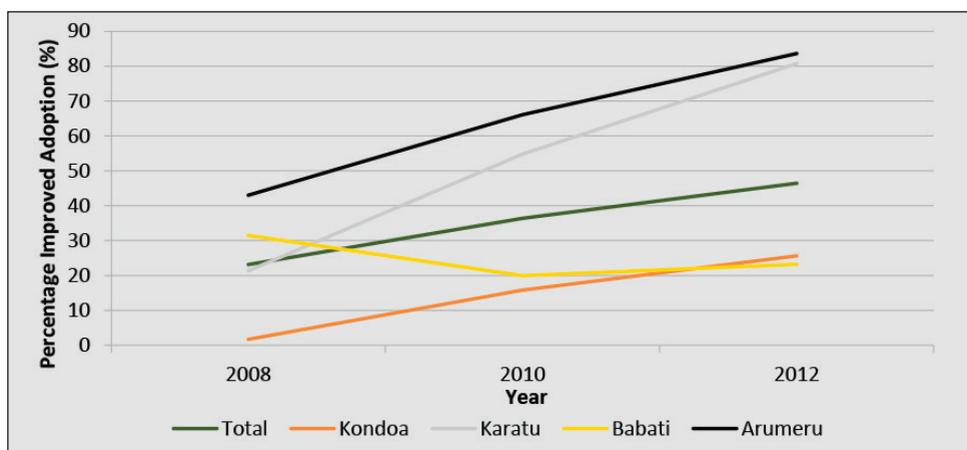


Figure 1. Pigeonpea variety adoption by plot in Arumeru, Babati, Karatu and Kondoa districts.

In order to estimate average yield effects, the predicted yield levels were calculated for improved and local varieties and tests of mean differences were calculated (Table 1). The econometric results based on the production functions show that differences in the predicted yields were heterogeneous – in most cases positive and significantly different from zero. Positive yield differences ranged from 11% to 56%. In one case, local varieties out-yielded the improved varieties by approximately 14% and there were cases where the yields of the improved and local varieties were not significantly different.

Under the most optimistic scenario, where yield and cost-saving effects occur, the estimated internal rate of return is 25.5% for the program (Table 2). Moreover, if we assume consistent yield effects to the varieties without cost savings, the rate of return drops to 21.9%. Under the most restrictive assumption, where there is no yield effect and only a cost savings (for which the evidence is weak), the rate of return drops to 13.5%. Under all of these assumptions, between US\$1.03 million and US\$5.06 million of net social benefits are generated with the largest proportion accruing to consumers, consistent with previous studies. The lowest benefit-to-cost ratio is 2.18. Even under highly unrealistic and extremely conservative assumptions on the conditions affecting the calculation of net social benefits, the public investment in pigeonpea improvement and market development is justified. It is even more strongly justified when highly conservative assumptions are relaxed. Under the intermediate and optimistic scenarios, the internal rates of return range from 21.9% to 25.5%, and benefit-to-cost ratios range between 4.9 and 6.8 times the cost of public investment.

Table 1. Mean difference of yield (kg ha⁻¹) of improved varieties over local varieties.

	2008	2010	2012
Kondoa	na	69.0*	132.6***
Karatu	123.2***	-4.6	118.3***
Babati	286.4***	40.8	187.4***
Arumeru	39.6**	-67.2***	21.7

Table 2. Simulation results of social benefits to pigeonpea improvement under three scenarios.

Present value of benefits (B) to and Costs (C) in USD '000								
Region	Producers	Consumers	Government	Total	Costs	(B-C)	B/C	IRR
Yield and cost-saving effects								
Kondoa	746.5	0.6	3.4	750.6	171.4	579.1	4.37	21.20%
Babati	858.8	0.6	3.9	863.4	257.9	605.4	3.34	18.20%
Karatu	3545.1	0.6	14.6	3560.4	221.4	3338.9	16.07	36.40%
Arumeru	706.5	0.6	3.2	710.3	221.4	488.8	3.2	17.80%
Rest of world	-5174.3	5231	0	56.7	0	56.7		
Rest of Tanzania	-34.6	21.9	-0.1	-12.8	0	-12.8		
Total	648.1	5255.4	25	5928.6	872.2	5056.3	6.79	25.50%
Yield effect but no cost-saving effect								
Kondoa	637.3	0.4	2.9	640.7	171.4	469.3	3.73	16.20%
Babati	714.4	0.4	3.3	718.2	257.9	460.3	2.78	32.60%
Karatu	2580.6	0.4	11.1	2592.2	221.4	2370.7	11.7	8.10%
Arumeru	283.9	0.4	1.3	285.7	221.4	64.3	1.29	
Rest of world	-3843.9	3885.2	0	41.3	0	41.3		
Rest of Tanzania	-25.7	16.3	-0.1	-9.5	0	-9.5		21.90%
Total	346.7	3903.3	18.6	4268.7	872.2	3396.5	4.89	
No yield effect but a cost-saving effect								
Kondoa	142.9	0.2	0.6	143.8	171.4	-27.5	0.83	3.60%
Babati	198.2	0.2	0.9	199.4	257.4	-58	0.77	2.80%
Karatu	1100.7	0.2	5.1	1106	221.4	884.6	4.99	22.70%
Arumeru	439.5	0.2	2	441.7	221.4	220.3	1.99	12.70%
Rest of world	-1811	1829.9	0	18.9	0	18.9		
Rest of Tanzania	-12.1	7.6	0	-4.5	871.7	-4.5		
Total	58.3	1838.4	8.7	1905.5	0	1033.7	2.18	13.50%

Conclusion

Improved pigeonpea varieties exhibit higher yield potential. The adoption of improved pigeonpea had a positive yield difference ranging from 11% to 56% compared to local varieties. The rate of return to investment in pigeonpea technology and market development generated an internal rate of return that could be as high as 25.5% per year. Under the most restrictive set of assumptions, the rate of return was 13.5% per year while an intermediate result was 21.9% per year. Based upon the quantitative estimates of benefits and costs, the results suggest that investment in the pigeonpea improvement program associated with social benefits is 4.9 to 6.8 times the cost of the program. The results also show that traders prefer pigeonpea of uniform quality, free of foreign matter, impurities and damaged seeds.

The results have important policy implications. Improved pigeonpea varieties have associated yield benefits and is preferred by local and export markets. Improved pigeonpea is a welfare enhancing technology. The development and promotion of improved pigeonpea needs to be strengthened and up-scaled in Tanzania and other developing countries.



**International Crops Research Institute
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We believe all **people** have a **right** to **nutritious food** and a **better livelihood**.

ICRISAT works in agricultural research for development across the drylands of Africa and Asia, making farming profitable for smallholder farmers while reducing malnutrition and environmental degradation.

We work across the entire value chain from developing new varieties to agri-business and linking farmers to markets.

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