Photo by IFPRI/Milo Mitchell

What is the True Impact of Improved Cassava Varieties in Nigeria?

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BACKGROUND AND CONTEXT

Cassava, a nutrient-rich root crop of South American origin, is consumed daily in some form by over 100 million people in Africa and is vital to food security. The International Institute of Tropical Agriculture (IITA) has developed improved cassava varieties that are resistant to diseases, pests and droughts, are early maturing, and have lower cyanide content.

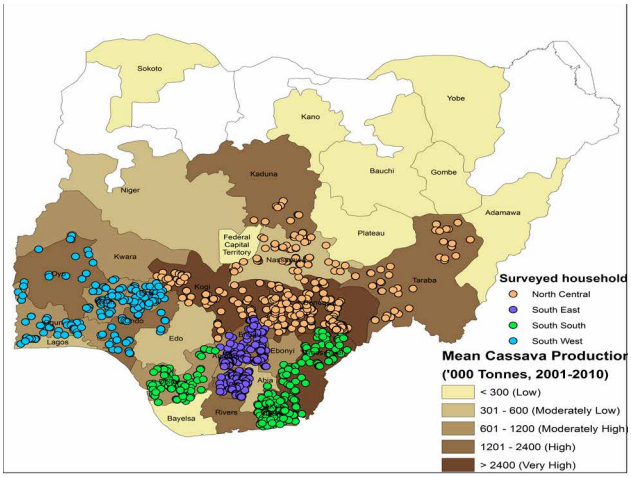
Nigerian farmers grow over 60 cassava varieties linked to the IITA research efforts. While yields and the area under cassava have increased over the past decade in Nigeria, there is a lack of rigorous impact evidence—this despite cassava being a major source of food and income. The extent to which an agricultural technology is adopted is a critical input to examine productivity and welfare impacts resulting from adoption.

The Cassava Monitoring Survey, implemented by IITA and the National Root Crops Research Institute (NRCRI)-Nigeria, addresses three policy-relevant research questions: True adoption rate of improved cassava varieties in Nigeria; the effects of adoption on productivity and poverty; and the extent to which self-reported adoption status (versus DNA fingerprinting) over- or under-estimates these effects.

BRINGING DNA INTO IMPACT ASSESSMENT

Proper measurement of the productivity and welfare impacts of cassava genetic improvement requires accurate identification of varieties and sound information on farmers' adoption status and farm size. Typically, researchers rely on farmers' self-reported adoption status and farm size estimates. As a substantive body of recent work illustrates[1], farmers are not necessarily reliable sources of this information.

Figure 1. Nigeria study area



This study implemented a household socio-economic survey, which included self-reported data, and used DNA fingerprinting to identify the cassava varieties grown in farmers' fields. Plot size was measured by both GPS and farmer estimation. An instrumental variable approach was used to estimate the impact of improved varieties on yield and an economic surplus model to estimate broader poverty impacts, assuming a closed economy with cassava considered a non-tradable food.

[1] Refer to publications on World Bank's LSMS-ISA webpage, or Strengthening Impact Assessment in the CGIAR (SIAC) 2013-17 program.

From each farmer-identified variety in each plot, samples of cassava leaves were collected for DNA extraction and genotyping (about 7,428 leaf samples). A standard tracking system was implemented to reduce possible introduction of human errors—sample mismatch and mix-ups during the collection of leaves from fields. Varietal identification was done by comparing varieties in the reference library (IITA genebank) with the genotyped data from farmers' fields.

GAINS IN CASSAVA PRODUCTIVITY AND REDUCTION IN POVERTY

Aggregate improved varietal adoption rates from self-reported data and DNA fingerprinting are close—however, farmer adoption status is severely mischaracterized by self-reporting, as are determinants of adoption. Of 2500 households, 60 percent (self-reported) to 66 percent (DNA data) grow improved cassava varieties. Using DNA-fingerprinted data as a benchmark shows that 20 percent of households reported improved varieties as local varieties (false negative), and 13 percent reported local varieties as improved varieties (false positive). Overall, 43 percent of samples were misclassified at the plot level. Education is positively and significantly correlated with adoption status using DNA data, but insignificant when farmer self-reports are used. High false positives and false negatives suggest that self-reported data should not be relied on to either track adoption of individual varieties or identify determinants of adoption.

Correct classification of improved and local varieties is associated with level of education, access to information, and location. Farmers who correctly reported improved varieties are more likely to be more educated, have access to extension, own mobile phones, and be members of cooperatives.

Misclassification stems partly from features of the cassava seed system in Nigeria. According to the survey, more than 70 percent of adopters obtained planting materials through informal local exchange, and most of them were not able to identify the varieties they grow by name. For example, the most popular improved variety, "TMS30572" has an adoption rate of 17.5 percent (based on DNA-fingerprinting). The survey found 237 different names for this variety. "Agric" is the most common name for this variety across villages, but there are 43 other varieties (DNA data)—15 of which are improved and 28 are landraces—that are also called "Agric".

Measurement error is prevalent in farm size estimation. Farmers overestimated the size of small plots and underestimated the size of large plots, as found by comparing self-reported and GPS data.

Misreporting of adoption status results in underestimation of the true productivity effects of improved varieties by 22 percentage points. Using DNA-fingerprinted adoption data suggests that improved varieties are associated with an 82 percent increase in cassava yields. When self-reported adoption data are used, that increase is only 60 percent. Although the use of DNA-fingerprinting addresses the problem of measurement error, farmers' own subjective self-assessments of their adoption status may result in behavioral adjustment-related bias[2]. Comparing the estimated yield gain from the full sample with the estimate from a sub-sample of households whose self-reported adoption status matches their DNA-based adoption status shows that misclassification underestimates the productivity impact by a further 7 percentage points.

Gains in cassava productivity are associated with reduced poverty. At a poverty line of US$ 1.25 per person per day and using adoption estimates from DNA fingerprinting, cassava productivity gains are associated with a reduction in poverty by an estimated 4.7 percentage points, implying that 8.4 percent of the rural poor cassava producers (1.8 million people) escaped poverty in 2015/16. No nutritional impacts from the current white-flesh varieties were found, despite productivity gains.

SOURCE

Wossen, T., Abdoulaye, T., Alene, A., Feleke, S., Rabbi, I., and Manyong, V. (2017). *Assessing the Impact of Improved Cassava Varieties on Food Security and Poverty Reduction in Nigeria*. Unpublished report submitted to the Standing Panel on Impact Assessment of the ISPC.

[2] Farmers may change cropping practices if they think they are using improved varieties or vice versa.

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