



Engility / Stéphane Tourné

What Is the Impact of NERICA Rice on Yields and Nutrition in Sierra Leone? Evidence from a Randomized Control Trial



Independent
Science and
Partnership
Council

Standing Panel on Impact Assessment (SPIA)

May 2018

Brief Number 69

BACKGROUND AND CONTEXT

Rice is the main staple in Sierra Leone, where per capita consumption of rice totals more than 100 kg a year. More than 87 percent of rural farming households are rice farmers, but yields are low (484 kg per hectare in 2010). Households consume harvested rice (only 6 percent of rice harvest is sold), but their stocks often run out by the end of August, and they are forced to purchase imported rice at a high cost. As a result, 93 percent of agricultural households report periods of hunger in August. Improving farmers' rice yields in this context could help meet domestic demand, reduce food prices, and help the poor get through the hungry season, with immediate impacts on food security and nutritional outcomes, in particular of women and young children. [Innovations for Poverty Action \(IPA\)](#), in partnership with the [International Rescue Committee \(IRC\)](#) and the [Sierra Leone Agricultural Research Institute](#), conducted a randomized controlled trial (RCT) of NERICA-3 (an upland rice variety) in five districts of Sierra Leone to assess the effects on farmers' yields and child nutrition.

IMPROVING CHILD NUTRITION THROUGH AGRICULTURE

Improvements in agriculture may offer a decentralized way to address food security and child malnutrition, but there has been little causal evidence documenting this link in practice. To examine this issue, this study focused on an

improved rice variety known as NERICA-3 (New Rice for Africa), which results from crossing traditional African rice varieties with faster-maturing Asian varieties and has higher yields than traditional varieties. NERICA varieties are associated with an earlier harvest (which could help families smooth consumption through a period of food scarcity), lower purchases of imported rice during the hungry season (freeing up income for other uses including purchases of food), and higher rice production (which could lead to higher consumption of rice or, if sold, other food).

DATA AND METHODOLOGY

The study cross-randomized seed distribution with a training on NERICA (land preparation, crop husbandry and post-harvest activities), using a two-stage design. First, villages were randomized into three groups: (1) those receiving the seed with training, (2) those receiving the seed without training, and (3) a control group. Second, within each village ten farmers were selected to be part of the study and in treatment villages five of these were chosen at random to receive the assigned treatment. The seed (12.5 kg that would cover half an acre) was distributed in April and May 2012, and the training followed over the course of the year. The baseline survey was completed in March-April 2011, an endline survey in April 2013, and two nutrition surveys in September-October 2013 and June-July 2014¹. Then, to assess the nutrition impacts of the increase in yields generated by the combination of NERICA rice and training, the study stacked the two rounds of data and

¹ The second nutrition survey suffered from high attrition because the outbreak of Ebola prevented the safe collection of anthropometric data in 35 percent of sample communities; this attrition was not correlated with treatment.

added a dummy for the July 2014 round. It looked at three different anthropometric outcomes for children five and under: (1) weight-for-height (wasting indicator), (2) body mass index (BMI)-for-age, and (3) mid-upper-arm circumference (MUAC).

PROVIDING SEEDS AND TRAINING HAS POSITIVE IMPACTS BUT CAN PROVE COSTLY

Farmers readily adopted NERICA-3 seed and reduced their purchases of imported rice. Take-up was high, at 98 percent, in both the seed-and-training and the seed-only villages. About 85 percent of treatment households replanted NERICA by the endline survey. As expected, harvest came five weeks earlier for farmers in both treatment groups than it did the control group. Consequently, the seed-and-training group purchased 20 percent less imported rice than the control group, and the seed-only group purchased 29 percent less (these effects are not statistically different).

Yields rose, but only for farmers who received training with the seed. Households in the seed-and-training group saw a 23 percent increase in yield over the control group, whereas those in the seed-only group saw no increase in yields (the effect was, in fact, negative but not statistically different from zero). Other survey data supported the finding that training was key to farmers achieving improved yields with NERICA—this is plausible since NERICA is a little more sensitive to moisture during germination. The seed-and-training farmers were no more likely than the control (or spillover) group to report some crop failure, germination problems, or issues with insects—the three most commonly reported problems. However, seed-only farmers were significantly more likely to report crop failure (an increase of 15 percentage points) and germination issues (13 percentage points) than the control group (though not compared with the seed-and-training group).

Training was also key to nutrition improvements. For the weight-for-height and body mass index (BMI)-for-age indicators, children in the seed-and-training group experienced significant improvements in nutrition. The coefficients for the seed-only group were positive, not significant, and smaller (often significantly smaller) than those

for the seed-and-training group.

The benefits for child nutrition persisted. The impacts on child health were larger in the second round of nutrition survey (though not statistically so), suggesting that the beneficial effects of higher rice yields stemming from NERICA plus training persisted even two years after the initial distribution of rice.

Agricultural interventions that improve staple yields can have large impacts on child nutrition but are costly. The results of this study leave policy makers with a challenge: although NERICA can address child nutrition, without appropriate training, it—and potentially other technologies—can lower yields, at least in the short run. But providing high-quality training is difficult and expensive. In this case, the discounted stream of benefits from increased yields was estimated to be US\$ 226 per farmer, but the cost of the training outweighed these benefits. These training costs were inflated because the evaluation design meant economies of scale could not be exploited. However, the costs of alternative mechanisms to improve child nutrition by the magnitudes suggested here are also likely to be high.

SOURCE

Glennerster, R., and Suri, T. (2018). *Agricultural Technology and Nutrition: The Impacts of NERICA Rice in Sierra Leone*. Working Paper.

FUNDING ACKNOWLEDGEMENTS

Financial support for the development of NERICA rice varieties, including NERICA 3 (WAB450-IBP-28-HB), came from several sources— notably, the Ministry of Foreign Affairs (MOFA) of Japan and United Nations Development Program (UNDP) through the Interspecific Hybridization Project (IHP). African Development Bank (AfDB) also contributed to the diffusion of NERICA in African countries. The impact evaluation is part of the Agricultural Technology Adoption Initiative (ATAI) funded with generous support from the Bill & Melinda Gates Foundation and UK Aid from the British people.

