INITIATIVE ON
Fragility, Conflict, and Migration

Promoting a Bundle of Biofortified Seeds and Agricultural Inputs in Northeastern Nigeria

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Context

Smallholder farmers in northeastern Nigeria face the triple threat of food insecurity, climate volatility, and conflict. Northeastern Nigeria has some of the highest levels of food insecurity in Nigeria (UNICEF, 2023). Additionally, delayed, shorter, and more volatile rainy seasons have led to massive floods, depleted soil quality, and disrupted agricultural growing seasons which ultimately constrain agricultural productivity. Moreover, conflict between pastoralist livestock herders and settled agricultural communities over land use, as well as extremism, has led millions of people to flee from their homes (International Crisis Group, 2023)

These threats are closely interrelated. As in much of sub-Saharan Africa, climate change has extended dry seasons in Nigeria. This change in seasonal rainfall patterns both limits local agricultural production and disrupts long-standing symbiotic relationships between pastoralist livestock herders and settled agricultural households, leading to conflict between these groups (McGuirk and Nunn, 2023). Exposure to conflict itself contributes to reduced agricultural production (Adelaja and George, 2019) and increased food insecurity (George et al., 2020). With limited social safety nets available, many households exposed to conflict either turn to informal self-employment while reducing agricultural labor (Bloem et al., 2023) or migrate domestically in search of safety, peace, and security.

Desertification and depletion of soil quality results in a cycle of yield and nutrition losses and adverse health effects associated with poor food micronutrient quality. As a result, this area suffers from high levels of anemia and zinc deficiency which can together adversely affect both cognitive, physical development and immunity (NPC and ICF, 2019). A key hurdle to productivity and risk management is that farmers do not simultaneously adopt an appropriate mix of improved agriculture technologies, choosing instead to perhaps expand area under cultivation or invest in discrete inputs that are more affordable—such as improved seed or specific pesticides—and rarely applying these inputs together on the same plot (Christiaensen, 2017)

In this project note, we describe an ongoing randomized control trial that aims to address these interrelated challenges by promoting the adoption of a bundle of agricultural inputs, including: biofortified seeds,

fertilizer, information, and insurance among smallholder farmers in Gombe state, Nigeria. The goal of bundling agricultural inputs together is to leverage agro-ecological complementarities that are critical for optimal crop production. These bundles address recent research that finds differences in estimated yield gains between agronomic trials and farmers using the same inputs under real-life conditions (Laajaj et al., 2020). One explanation for these differential yield effects is the limited adoption of complementary agricultural inputs and practices among smallholder farmers (Liverpool-Tasie et al., 2022). Thus, promoting complementary agricultural inputs together as a bundle holds the potential to close the gap between yield effects measured in agronomic trials and those measured under real-life conditions when adopted by smallholder farmers. Additionally, across northern Nigeria, availability of micronutrient enriched biofortified varieties has increased significantly since 2019 with support from the Agriculture Food Security Nutrition Strategy, Government of Nigeria and the Nigeria Agriculture Technology Innovation Policy (Birol et al., 2023). The availability of these seeds provides a real opportunity to address nutrition challenges while promoting the uptake of complementary agricultural inputs.

Our objective is twofold: (i) to assess smallholder farmer demand for these agricultural inputs marketed as a bundle, and (ii) to evaluate the effect of receiving this agricultural input bundle on farm productivity and nutritional uptake among participating households. The implementation of this study, designed to estimate smallholder farmer demand for a bundle of biofortified seed and other agricultural inputs, will provide policy-relevant insights about how to effectively promote the adoption of agricultural technology, and possibly in turn improve farm productivity and nutrition outcomes among vulnerable populations in a fragile setting.

Study Design

The objective of this study is to assess the impact of the promotion of biofortified agricultural input bundles on farm productivity and the nutritional status of farmers in a fragile context. To achieve this objective, we design and implement a cluster randomized control trial in Gombe state, Nigeria. Gombe is one of four states where bundles of biofortified seeds and other agricultural inputs are being rolled out under an existing HarvestPlus project. Additionally, Gombe state has the largest population of internally displaced people among these states. We implement our study in the following five local government areas (LGAs), which were selected based on their relatively high concentration of internally displaced people: Akko, Dukku, Yelmaltu Deba, Kaltungo, and Kwami.

Our study specifically implements a multi-staged intervention. In the first stage, rural villages in each of the LGAs will be randomly assigned into treatment and control groups. Within treatment villages, in partnership with a local agricultural input supply company, the bundle of biofortified seeds and other agricultural inputs will be made available. This first stage of our intervention addresses critical constraints on the supply of improved technologies to smallholder farmers. The bundle of improved agricultural inputs costs approximately 120 USD, which might limit adoption by possibly liquidity-constrained and risk-averse smallholder farmers. Therefore, in the second stage of our intervention, we conduct a lottery to randomly allocate vouchers for a discount on the agricultural input bundle. Between 1,000 and 1,500 farmers will be offered a discount voucher on their purchase of this bundle. The bundle will not be available in the villages assigned to the control group.

We address two key research questions:

1. Does providing discount vouchers for a bundle of agricultural inputs promote the adoption of these inputs?

2. What is the effect of adopting these agricultural input bundles on farm productivity and nutritional status of smallholder farmers?

Comparing adoption indicators between farmers in control villages and farmers who did not receive the discount voucher in villages reveals the effect of providing access to the supply of these agricultural input bundles. Comparing adoption indicators within treatment villages between farmers who received and did not receive a discount voucher reveals the effect of providing a discount voucher and allows us to estimate the demand curve for these agricultural input bundles. If supplying access and providing a discount voucher increases the adoption rate of these input bundles, then we will be able to compare indicators of farm productivity and nutritional status of smallholder farmers.

A key source of heterogeneity in our analysis is to assess differential effects between internally displaced people and pre-existing local residents. Therefore, we will specifically examine the research questions discussed above among the sub-set of our data that are internally displaced people and the sub-set of our data that are pre-existing local residents of Gombe state, Nigeria.

What is in the Bundle?

Preliminary discussions with extension agents in the selected LGAs revealed that smallholder farmers tend to grow a mix of pearl millets and cowpea, intercropped together, in rotation with maize. The bundle, therefore, includes three varieties of biofortified seeds: (i) 2 kgs of pearl millet seeds, (ii) 6 kgs of cowpea seeds, and (iii) 5 kgs of vitamin A maize seeds. Each of these seed varieties are well tested for the agro-ecology of Gombe state, Nigeria, and are draught tolerant, disease resistant, high yielding, early maturing, and provide relatively high amounts of iron and zinc. The quality of these seeds is tested in a lab environment before the distribution of these bundles.

The bundle also includes fertilizer, given that fertilizer costs have increased considerably in Nigeria following Russia's war in Ukraine. Specifically, the bundle includes 50 kgs of NPK fertilizer, 50 kgs of urea fertilizer, and one liter of organic fertilizer. Additionally, the bundle includes crop protection products (i.e., weedicide, pesticide, and herbicides). Specifically, the bundle includes one liter of cypermethrin, one liter of pendimethalin, and three sachets of seed dressing. The bundle will be applicable for a quarter hectare plot, and pictorial and verbal information will provide detailed instructions on crop management strategies. The bundle is offered by a commercial agricultural input supply company which has a multinational presence in Africa and can directly distribute its product through depots in our study areas.

The final component of the bundle is insurance. The insurance offer is included in the bundle package as a m-voucher. Farmers can use a unique number on the voucher to activate the policies via basic SMS text message. The insurance itself is based on a recently developed area yield model informed by multiple sources of weather and yield data. This helps to avoid the relatively high level of basis risk in weather-based indices. The insurance product will offer comprehensive coverage based on yield performance rather than individual risk parameters such as drought, flood, hurricanes, etc. to protect against adverse shocks including pests and disease.

Baseline Data

We collected baseline data in November 2023. Table 1 below presents descriptive statistics about our baseline sample. Approximately 84 percent of the households in our sample live in rural communities. The average age of household heads, and consequently the primary respondents, is 43 years old. The

majority, 94 percent, of households are headed by a male. The predominant religion among respondents is Islam, with 88 percent identifying it as their household's primary faith. The remaining 12 percent identify as Christian. Within our baseline sample, 17 percent of farmers are classified as an internally displaced person, due to their reported relocation within Nigeria at some point in the past. Close to half of the households indicate ownership or cultivation of at least one irrigated plot. Analysis of crop cultivation patterns reveals that cowpea is the most commonly grown crop, with almost 90 percent of farmers cultivating it on at least one plot in the last dry and/or wet season. Other prevalent crops, cultivated by over half of the households, include sorghum, millet, rice, and maize.

Table 1: Descriptive Statistics

	Mean (standard deviation)
Rural settlement	0.84 (0.37)
Male household head	0.94 (0.23)
Age of household head	42.66 (13.46)
Religion	
Islam	0.88 (0.33)
Christianity	0.12 (0.33)
Internally displaced household	0.17 (0.37)
Household cultivates/owns at least 1 irrigated plot	0.47 (0.50)
Share of households cultivating	
Cowpea	0.89 (0.31)
Sorghum	0.70 (0.46)
Millet	0.68 (0.47)
Rice	0.64 (0.48)
Maize	0.64 (0.48)
Groundnut	0.36 (0.48)
Beni seed	0.24 (0.43)
Soybean	0.22 (0.41)
Cotton	0.04 (0.21)
Number of plots per household cultivated with:	
Sorghum	2.10 (1.32)
Cowpea	2.02 (1.21)
Rice	1.83 (1.10)

Source: Authors' calculations of baseline data. Total sample size = 2,300.

Next Steps

In this next phase of this project, we will begin implementing our two-stage intervention prior to planting in Nigeria's wet season. Planting in the Nigeria's wet season typically extends from April through June. Thus, we will begin marketing agricultural input bundles in March. After the implementation of the intervention, we will conduct a post-harvest survey in July, in which we will collect information on farm productivity and the nutrition status of participating farmers.

In addition to this quantitative data collection and analysis, we will implement a qualitative data collection exercise to inform farmer preferences for agricultural input bundles more holistically. The qualitative study will target a total of 100 households (i.e., approximately 20 per LGA) and will include two modules. The first module aims to elicit preferences for different types of bundles (i.e., a bundle of only biofortified seeds, a bundle of biofortified seeds and fertilizer, and a bundle of biofortified seeds, fertilizer, and insurance). The second module aims to understand the risk preferences, future investment strategies, and what factors may impede or encourage future investment in agricultural input bundles.

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