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Internal Displacement and the Promotion of Bundled Agricultural Technologies

Evidence from a Fragile Setting in Nigeria

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Motivation and Context

Fragile regions within Nigeria face multiple, overlapping challenges including climate volatility, violent conflict, widespread displacement, and persistent malnutrition. These pressures can constrain agricultural production and compromise household welfare, particularly for internally displaced households, who face depleted assets and repeated exposure to shocks. Within the context of Nigeria, addressing these constraints requires interventions that improve access to agricultural technologies and strengthen food systems. This brief summarizes experimental evidence from Gombe State, Nigeria, where we implemented an intervention promoting the adoption of a bundle of agricultural technologies.

The intervention specifically disentangled the effects of price discounts and information campaigns on bundle adoption. We collected data on the use of each of the bundle components as well as the implementation of agronomic practices recommended for achieving agricultural intensification benefits, enabling us to document adoption beyond the initial purchase of the bundle in a detailed way. The bundle—which includes biofortified seeds, fertilizers, crop protection products, and weather-risk insurance—was designed to generate an intensification response among farmers and address micronutrient deficiencies among adopting households. In principle, biofortified crops—such as vitamin A maize and high-iron millet—offer a dual benefit: improved crop

productivity and improved access to nutritious foods. While Nigerian agricultural policies encourage biofortification, sustained adoption remains limited, and existing studies overwhelmingly focus on peaceful and stable settings. We aim to address existing knowledge gaps by implementing a randomized control trial in Gombe State, Nigeria—a fragile and conflict-affected setting with a relatively large displaced population.

Existing evidence shows that bundled input packages, rather than interventions promoting a single agricultural input, can generate productivity gains associated with agricultural intensification (Bulte et al. 2020; Carter et al. 2021; Boucher, et al. 2024; Liverpool-Tasie et al. 2025). Adoption is often hindered by liquidity constraints, perceived risk, and weak extension systems. Moreover, displaced households can face additional barriers due to asset loss and insecure land tenure. This motivates us to specifically investigate whether displaced households respond differently to our intervention than households from the host population.

Study Design

We implemented this experiment in 230 rural communities across five local government areas in Gombe State, Nigeria. Each of these communities have a high concentration of IDPs. Communities were randomly assigned to one of three treatment groups and a control group:

1. **Information only:** Pamphlets and marketing messages; bundle offered at full price
2. **50% discount:** Marketing information as in T1 + 50% discount vouchers
3. **75% discount:** Marketing information as in T1 + 75% discount vouchers
4. **Control:** No marketing information or discount vouchers

We surveyed a total of 2,300 households with our baseline survey conducted prior to the intervention. After the intervention, we were able to survey 2,252 households. Attrition was relatively low and not related to treatment assignment. Most households live in rural communities, and women play a limited role in formal agricultural decision-making. Nearly one in five households reported being recently displaced, and exposure to climate and natural shocks is widespread, affecting most farmers in recent years. Access to formal savings is limited among households in our sample, and use of insurance is almost nonexistent. Consequently, investment in modern agricultural technologies remains low: fewer than one in four farmers had previously used both improved seed and fertilizer.

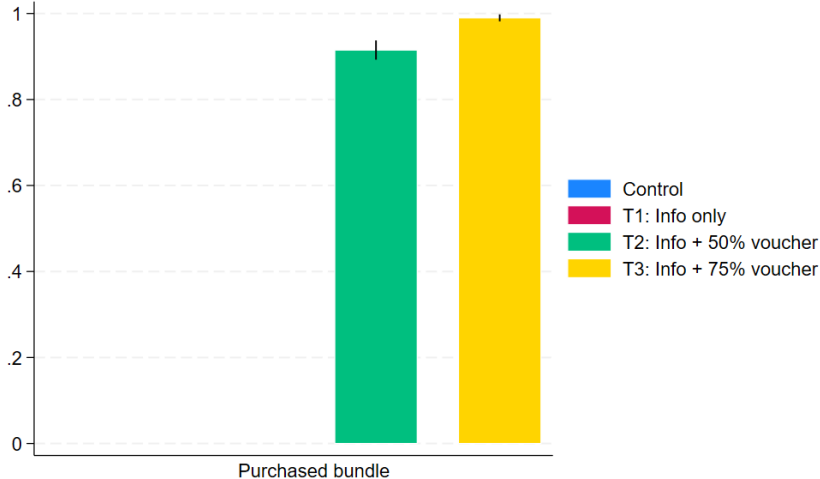
The bundle includes biofortified seeds (i.e., high-iron pearl millet, high-iron cowpea, and vitamin A maize), fertilizers (i.e., NPK, urea, and organic fertilizer), crop protection products, and weather-index insurance activated via SMS. The full-price cost of the bundle was approximately 81 USD at the time of the intervention, compared with about 107 USD if all components included in the bundle were purchased separately. To encourage adoption, enumerators visited households to explain the bundle and provide guidance on application. Farmers in the discounted groups received vouchers redeemable at local agro-dealers, with compliance monitored through voucher verification and follow-up calls.

We analyze the effect of these promotion efforts on detailed adoption data, crop productivity, and household nutrition outcomes. We measure adoption beyond a simple binary indicator of bundle purchase. Specifically, we measure the use of each of the components included in the bundle and the implementation of recommended practices. We measure crop productivity both the household and plot level using self-reported measures of harvested yields. Nutrition outcomes indicate household consumption of biofortified maize, millet, and cowpea grown from the seeds included in the bundle. We also examine differences between internally displaced and host households to understand heterogeneity driven by a household’s displacement status.

Key Findings

As documented in Amare et al. (2024), providing price discounts led to near-universal rates of adoption. 86 percent of farmers who received a 50% discount purchased the bundle, while 98 percent of farmers who received a 75% discount purchased the bundle. Farmers generally used complementary inputs, although adherence to recommended agronomic practices, like fertilizer timing and microdosing, was incomplete. None of the farmers in the information-only treatment group purchased the bundle according to our sales data. These results are illustrated in Figure 1 below.

Figure 1: Bundle Purchase by Treatment Assignment



Note: Figure reproduced from Amare et al. (2024).

Detailed data on adoption show evidence of “incomplete adoption” (Abate et al. 2018). Although the intervention was successful in promoting the near universal initial purchase of the bundle, compliance with the use of all complementary bundle components and recommended agronomic practices was more limited. Table 1 reports means for variables generated from a module of questions included in our endline survey where we asked farmers who report purchasing the bundle if they used each of the complementary inputs included in the bundle and if they followed the recommended agronomic practices. These results show that most of the farmers who report

purchasing the bundle also report using the complementary components included in the bundle. For farmers receiving a 75% discount who report purchasing the bundle, 84 to 86 percent report planting the biofortified varieties of the seeds included in the bundle, 95 and 96 percent report using urea and NPK fertilizer respectively, and 90 and 92 percent report using pendimethalin and cypermethrin respectively. These results show that bundling complementary inputs together can successfully promote the use of complementary inputs necessary for agricultural intensification. It is also worth noting that the use of complementary inputs seems to increase with the discount amount. Conditional on reported purchase of the bundle, the use of complementary inputs is higher among farmers who received a 75% discount than among farmers who received a 50% discount.

Table 1: Incomplete Adoption of Bundle Components and Recommended Practices

	T2: Info + 50% Discount	T3: Info + 75% Discount
Farmers who planted 2kg Iron Pearl Millets	0.73	0.84
Farmers who planted 6Kg Iron Cowpea	0.69	0.86
Farmers who planted 5Kg Vit A Maize	0.71	0.86
Farmers who used 50kg NPK	0.81	0.96
Farmers who used 50kg Urea	0.81	0.95
Farmers who used Cypermethrin	0.76	0.92
Farmers who used Pendamethalin	0.75	0.90
Use of cypermethrin for cowpea at flowering	0.36	0.38
Used pendimethalin within a week after planting	0.47	0.57
1st use of NPK & urea between 10-14 days after planting	0.51	0.61
Used microdosing for fertilizer	0.73	0.87
2nd use of Urea between 3-4 weeks of planting	0.06	0.10
Observations	582	586

Note: Each cell reports the mean of the given variable conditional on bundle purchase.

However, many farmers who report purchasing the bundle do not report using the recommended agronomic practices for optimal crop performance. For farmers receiving a 75% discount who reported purchasing the bundle, while 87 report using the microdosing fertilizer application technique, 38 percent report using cypermethrin at the recommended timing, 57 percent report using pendimethalin within a week after planting, 61 percent applied NPK and urea fertilizer 1-2 weeks after planting, and only 10 percent report applying a second dose of urea fertilizer one month

after planting. This suggests that more specifically targeted farmer extension efforts may be necessary to help farmers implement recommended agronomic practices.

Next, comparisons of crop yields by treatment assigned shows no evidence of yield gains due to the intervention. These results are likely driven by high variability in self-reported harvest values by farmers, the relatively small scale of the bundle itself, and the incomplete adoption of recommended agronomic practices. However, despite the limited effects on crop yield, the intervention seems to increase indicators of household consumption of biofortified crops. Households receiving discounts reported being more likely to consume biofortified varieties of maize, millet, and cowpea included in the bundle. This latter finding demonstrates that interventions focused on agricultural production can effectively enhance dietary quality and micronutrient consumption, even when productivity gains are modest.

Finally, we find no evidence of differences in bundle adoption or downstream outcomes between displaced and host households. This suggests that policy interventions promoting improved agricultural technologies can be effective among both displaced and host populations within fragile settings in Nigeria.

Conclusion

Our study is unique in that it takes place in a fragile setting characterized by both climate and conflict shocks with high levels of internal displacement. Given the lack of studies in fragile contexts, knowledge about how to effectively promote the adoption of improved agricultural technologies in such settings is limited. This knowledge gap is increasingly important to address because poverty and hunger are increasingly concentrated in fragile and conflict-affected areas (Abay et al. 2025).

We find that both displaced households and host population households are very price sensitive as they respond to price discounts with near-universal rates of adoption. Additionally, despite the finding that combining inputs together in a bundle can successfully promote the use of complementary inputs necessary for agricultural intensification, the adoption of recommended agronomic practices necessary for optimal crop performance was limited and likely requires more detailed and targeted agricultural extension efforts. Despite limited returns in terms of crop productivity, our study provides evidence that a production-side intervention can shift the consumption patterns of agricultural households who tend to consume a high fraction of the agricultural produce that they cultivate.

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