Hybrid Gains and Tasty Grains: The Role of Agronomic and Consumption Traits in Technology Adoption

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Abstract

The dual role of farm households as both producers and consumers implies that adoption decisions for improved crop technologies are shaped not only by agronomic performance but also by consumption attributes. We study how emphasizing different traits of an improved maize variety affects adoption behavior. In a randomized controlled trial in eastern Uganda, we implemented two interventions: one highlighted production traits via seed trial packs, the other emphasized consumption traits through cooking demonstrations. Both interventions improved farmers' knowledge and perceptions of the variety, but only the consumption-focused approach led to a modest increase in the adoption of the promoted variety in the subsequent season. In contrast, trial pack recipients often reused harvested grain from the trial pack as seed, lowering demand for improved seed varieties. Although the promoted hybrid is not intended for recycling as seed, farmers' behavior appears to be a rational response to informational, economic and structural barriers.

Keywords: technology adoption, consumption and production traits, trial packs, cooking demonstration and blind tasting, maize, Uganda.

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1 Introduction

To sustainably feed a growing population while addressing climate change and preserving biodiversity, it is essential to produce more food using less land (Tilman et al., 2011). Green Revolution technologies, particularly improved crop technologies, have been key to achieving higher yields and enhancing resilience to environmental challenges, such as drought, and emerging biotic stresses, such as pests and diseases (Evenson and Gollin, 2003). Traditionally, crop improvement efforts in breeding programs which serve smallholder farmers have focused on improving production-related agronomic traits, such as yield, drought tolerance, disease resistance, and pest resistance. However, as farmers in sub-Saharan Africa often produce for self-consumption (Carletto, Corral, and Guelfi, 2017; Bellon et al., 2020), the adoption of new crop varieties is also influenced by consumption-related traits, such as taste, color, texture, and ease of cooking (Timu et al., 2014; Thiele et al., 2021; Otieno et al., 2011). Integrating improvements in such traits alongside agronomic traits may be crucial for driving demand for improved crop varieties.

Because the production and consumption attributes of new varieties are not directly observable to farmers upon seed purchase, widespread adoption also may require raising farmers' awareness of their beneficial attributes. A common strategy to encourage farmers to learn about a new variety is through the distribution of seed sample packs (often referred to as "trial packs", "starter packs", or "mini-kits") (Blackie and Mann, 2005; Cromwell, 1990). These seed trial packs typically contain small quantities of seed (e.g., 1 kg) and are provided for free, allowing farmers to test them on a small portion of their plot.[1] The primary aim is to reduce the cost and risk associated with learning about the production attributes of the variety, such that farmers will purchase the seed in subsequent seasons if they find doing so beneficial.

Strategies that explicitly seek to raise farmers' awareness of the consumption-related attributes of improved varieties are less common. This is perhaps surprising given the theoretical and empirical literature showing that in smallholder agriculture settings consumption and production decisions are intricately related (Singh, Squire, and Strauss, 1986; LaFave and Thomas, 2016). Moreover, interventions that familiarize farmers with consumption traits, such as cooking demonstrations and tasting events, are often primarily concerned with nutrition-related outcomes and rarely consider actual adoption of the crop (Reicks, Kocher, and Reeder, 2018).[2]

This paper examines how highlighting agronomic and consumption-related attributes of improved maize varieties affects their adoption by smallholder farmers, recognizing their dual role as both producers and end-users. To achieve

[1]Some trials may also include small quantities of other relevant inputs such as fertilizer, pesticide, and/or herbicide. For instance, Malawi's starter pack program provided both seeds and fertilizer (Blackie and Mann, 2005).

[2]While seed trial packs may also enable farmers to discover consumption traits after they harvest the grain obtained from the seed trial pack, such learning is often not the primary focus of trial packs and may occur only if farmers taste the harvest from the trial pack before mixing it with other varieties and/or selling it.

this, we conduct a field experiment to test the relative effectiveness of two interventions using a cluster-randomized control trial. The first intervention targets production traits by providing farmers with 1 kg trial packs of seed of an improved variety.[3] A second intervention involves cooking demonstrations and blind tasting tests. This intervention allows farmers to familiarize themselves with consumption attributes of maize flour derived from the grain grown using the promoted improved variety. Additionally, farmers in this treatment arm are provided with maize flour samples derived from the grain grown using the promoted improved variety to further explore consumption traits at home and potentially convince other household members of consumption related benefits.

The field experiment was conducted in four districts in eastern Uganda among a representative sample of about 1,500 farmers. The area, commonly known as the Busoga Kingdom, is predominantly populated by smallholder farmers who cultivate maize for both home consumption and sale. The study ran over two consecutive agricultural seasons in 2023, with endline data collected in early 2024 after the harvest of the second season. The variety we promoted in this study is a hybrid marketed as *Bazooka* (UH 5354), which is widely available from agro-dealers but has yet to see broad adoption among farmers. *Bazooka*'s primary notable production trait is its yield potential, which is over double that of popular open-pollinated varieties (OPVs) such as Longe 5 (Semalulu et al., 2022), but in terms of consumption attributes, *Bazooka* also combines a high starch content with mild sweetness.

We find that farmers who received a trial pack are actually *less likely* to plant (fresh) seed of an improved variety in the next season because they instead use recycled seed obtained from the trial pack's harvest. Hybrid seeds are not intended to be recycled given the associated yield penalty for doing so, as recycled seeds from improved hybrid varieties are not genetically the same as their parent seeds. However, we find suggestive evidence that the cooking demonstration and tasting session increased the adoption of fresh *Bazooka* specifically, and there is some indication that this treatment led to modest yield gains.[4] We find no evidence that either intervention influenced how the harvested maize in the next season was used—whether for own consumption, market sales, or saved to be used in the next season.

We see little evidence that receiving both treatments had additional impacts beyond those of the main treatment—this may have been the case if, for instance, some household members are more sensitive to production traits and others are more sensitive to consumption traits, and the trial pack facilitated coordination—though the estimates are fairly noisy. Contrary to our expecta-

[3]We use the term "improved variety" throughout this paper to refer to both fresh maize hybrids and open-pollinated varieties (OPVs) that are either newly purchased or have been appropriately recycled (up to four seasons). This excludes farmer-saved seed or seed from informal exchanges, which, in the specific context of maize, may be less effective due to cross pollination and genetic drift over multiple generations, or due to poor seed storage and handling between seasons (Pixley and Banziger, 2004; Roos, 1980).

[4]We deem this evidence as suggestive because, while false discovery rate–adjusted q-values point to significant effects, our prespecified analysis, which aggregates outcomes into indices across related measures, does not show significant effects.

tions, highlighting consumption traits did not increase women's involvement in seed-related decision-making. Finally, we observe no downstream impacts of either intervention on household food security or overall welfare.

Exploring some of the impact pathways, we do find that the cooking demonstration and blind tasting increased the share of farmers who rank improved varieties higher on a range of consumption attributes such as taste, portion size, appearance, and ease of cooking. Furthermore, we find that farmers who received the seed trial pack rank improved varieties higher in terms of production-related attributes such as yield, abiotic and biotic stress resistance, time to maturity, and germination rate, although the evidence is less convincing. Interestingly, the seed trial pack also positively affects how farmers think about consumption traits of improved varieties, suggesting farmers separately consume the harvest from the seed trial pack and pay close attention to consumption attributes.

A key finding from our study is that the majority of farmers who received the seed trial pack continued using the distributed hybrid maize variety by recycling the harvest from the trial pack rather than purchasing fresh seed. This behavior does not seem to be merely the result of a lack of knowledge about the drawbacks of recycling hybrid seeds; rather, it may represent a rational response to the conditions farmers face: Even when farmers are aware of potential yield penalties associated with reusing hybrid seed, they may still find recycling preferable in light of high cost of seed, liquidity constraints, market risk, and distrust in agro-dealer networks. These findings suggest that exposure alone is not enough to ensure continued use of fresh improved seed, and that addressing the informational, economic, and structural barriers that shape farmers' decision environments is essential for promoting sustained adoption.

Our work contributes to several strands of the literature on agricultural technology adoption. First, we add to the literature examining whether short-term input subsidies—whether provided in cash or in-kind—can stimulate longer-term uptake of improved technologies (Carter, Laajaj, and Yang, 2021; Balew, Bulte, and Kassie, 2025; Gignoux et al., 2023; Fishman et al., 2022). Specifically, despite the prevalent use of temporary subsidies as a policy instrument to spur agricultural technology adoption (Phiri et al., 2000; Dorward and Kydd, 2005; Christinck, Diarra, and Horneber, 2014), we add to a relatively limited set of experimental impact evaluations testing the effectiveness of trial packs in accelerating technology adoption, which finds mixed results.[5] For instance, Emerick et al. (2016) distribute starter kits for seed of a new rice variety in India and find that seventy-six percent of treatment farmers cultivated the technology in the second season following distribution. On the other hand, Biedny et al. (2020) find that, in Tanzania, adding trial packs to demonstration plots run by

[5]While other studies with interventions featuring a trial pack exist, the aim of many is not to evaluate its impacts on future technology adoption. For instance, Boucher et al. (2024) provide a trial pack of drought tolerant varieties to farmers before offering households the opportunity to purchase the variety bundled with index insurance in the subsequent season. Other studies similarly look at the effect of trial pack provision on other outcomes, such as willingness-to-pay for seeds (Morgan, Mason, and Maredia, 2020) or beliefs about the yields of improved varieties (Tjernstrom and Gars, 2019) .

village-based agricultural advisors had no significant impacts on sales, orders received, or learning outcomes, and Maredia et al. (2025) further show no increases in adoption at the 1 or 4 year marks as a result of trial pack provision. Similarly, Jones et al. (2022) find provision of a horticulture mini-kit to farmers in Rwanda has no significant impact on the adoption of horticulture. Ragasa, Oyinbo, and Ma (2025) present results from Nigeria showing that seed trial packs substantially increase adoption of improved maize and cowpea OPVs. We contribute to this literature by assessing the effect of seed trial packs on subsequent adoption, instead of limiting observation to a single season and primarily investigating the immediate use of the seed trial pack. Moreover, we measure subsequent adoption using observed (revealed preference) choices, as opposed to only asking farmers about their intention to use the seed in the next season, which can be prone to social desirability bias.

We also contribute to the literature on consumer acceptance of improved varieties, by introducing an intervention that exposes farmers to a variety's consumption traits. While many studies use consumer tasting of new varieties as part of their research, in order to either assess consumer preferences for the varieties or sensitize consumers to varietal traits before eliciting willingness to pay (Birol et al., 2015; De Groote et al., 2014; Okello et al., 2021), these studies do not treat the tasting experience as an intervention designed to induce take-up of new varieties. As such, the opportunity to try new variety is not randomized between participants. Existing interventions that expose farmers to consumption attributes of new varieties also tend to promote nutritional (credence) traits, rather than experience traits such as taste or cooking quality, and rarely measure subsequent adoption in the following season (Olney et al., 2015; Kramer, 2017; Schreinemachers, Patalagsa, and Uddin, 2016; Osei et al., 2017; Murty, Rao, and Bamji, 2016). One exception is De Brauw et al. (2018), who study the impact of the HarvestPlus' Reaching End Users project (which includes a demand creation component that focuses on consumption attributes) on the adoption of bio-fortified sweet potato in Mozambique and Uganda. They find that the combination of the demand creation treatment and production-focused extension activities increases adoption of vitamin A fortified orange-fleshed sweet potatoes in the subsequent season by over 60 percent in both Mozambique and Uganda. We contribute to this literature by developing and testing an intervention that highlights non-nutrition-related consumption traits as well as offering this both apart from and in combination with other interventions highlighting production attributes.

The remainder of the paper is organized as follows. Section 2 outlines the research methodology, including the experimental design and empirical strategy. Section 3 describes the study context and data sources. Section 4 presents the main findings, focusing on the primary outcome of improved seed variety use and production outcomes as well as secondary outcomes related to use of harvest output, intra-household decision-making, food security, and overall well-being. Section 5 investigates potential mechanisms underlying the observed effects. Section 6 discusses possible explanations for why farmers who received a seed trial pack chose to recycle seed rather than purchase fresh seeds. Section 7 concludes.

2 Methods

2.1 Experimental Design

We use a cluster randomized control trial (RCT) to evaluate the effectiveness of two interventions, using a 2x2 factorial design, with treatments assigned at the village level to mitigate potential concerns about spillover effects. The first factor in the factorial design is the seed trial pack treatment; sampled farmers in the treatment villages received a complimentary sample of a hybrid maize variety (*Bazooka*), whereas those in the control villages did not. The second factor involved a cooking demonstration and tasting session; in treatment villages, sampled farmers were invited to a session where they observed the preparation of maize flour made from the *Bazooka* hybrid variety, participated in a tasting session, and received a free sample of *Bazooka*-derived maize flour to try at home. No such activities were conducted in control villages.[6]

2.2 Treatments

The first intervention involves providing a seed trial pack to the household member responsible for most maize cultivation decisions. This trial pack contains *Bazooka* maize, which was released by the National Agricultural Research Organization (NARO) in Uganda in 2013 and is currently available in the market but not yet widely adopted by farmers.[7] Some of *Bazooka*'s key features include high yield, resistance to drought, and resistance to diseases like maize lethal necrosis (Akwango-Aliau et al., 2022).[8] Specifically, we provided 1 kg bags of *Bazooka* seed, which is enough to plant about one-eighth of an acre. Given that the average farmer in our sample cultivates 1.24 acres of maize, this seed covers approximately 10 percent of their total cultivated area.

The second intervention consists of a cooking demonstration and tasting event. Here, both male and female co-heads of sampled households in the treatment villages were invited to a central place for a facilitated meeting. The facilitator started by asking the group to mention the most commonly grown maize varieties by farmers in their village. These varieties are grouped into "improved varieties" and "local varieties" on a flip chart.[9] Farmers were then asked to rank the two categories based on ratings of various consumption attributes by a show of hands. To facilitate the discussion, flip charts were pre-filled with

[6]Farmers in pure control villages under both factors received a "token of appreciation" of similar value to the seed trial pack/maize flour bag to account for potential income effects.

[7]At baseline, only about 7 percent of sampled farmers reported growing *Bazooka* on a randomly chosen plot—See Table 1 in Section 3.3 below.

[8]The primary production trait of *Bazooka* is its high yield, underscored by the package slogan, "yield explosion."

[9]The terms for the seed types in the local language were "Dhuuma Omulongosemu" for "seed of an improved variety" and "Dhuuma Omusoga" for local seed. The latter is derived from the name of the region, Busoga.

the five consumption traits most commonly mentioned during focus group discussions held during the design phase of the study: taste, texture, color, aroma, and the degree to which the flour expands during cooking. Farmers could add as many additional traits as they saw fit.

After the rating exercise, sessions proceeded with the cooking demonstration and blind taste testing. The facilitator asked a volunteer participant to prepare *posho*, a thick, dense staple porridge made by mixing maize flour with boiling water until it reaches a dough-like consistency. The volunteer cook then prepared two meals: one using flour obtained from a local variety and one using flour derived from *Bazooka*. Neither the cook nor the other participants were aware of which flour corresponded to which maize type. The research team provided all necessary utensils for the session, including a gas stove, pots, aprons, and even a chef's hat. We ensured that the two dishes differed only in terms of the flour used by employing the same cook and starting with identical amounts of flour, measured on a weighing scale. The resulting dishes were displayed on a table, and participants were invited to taste the two varieties, simply labeled by their position as the variety on the "left" and the variety on the "right." The participants then rated the two varieties on the various consumption attributes again, voting on which of the two samples is superior for each attribute by a show of hands.

Finally, the rating results were discussed within the group and participants were informed that one sample was made from flour obtained from local maize while the other was made from an improved maize variety called *Bazooka*. After being asked to guess which was which, the facilitator gathered the guesses and revealed the correct answers. As the results in Section 5.2.1 will show, improved seed varieties are generally perceived favorably with respect to consumption traits, yet these positive perceptions are far from universal, leaving scope for further improvement.

2.3 Estimation and Inference

We use analysis of covariance (ANCOVA) models to estimate the intent-to-treat (ITT) effects of the interventions. Given that randomization was conducted at the village level, we will estimate ITTs using the following equation:

$$Y_{ij} = \alpha + \beta_S T_j^S + \beta_D T_j^D + \beta_I T_j^S T_j^D + \delta Y_{ij}^B + \varepsilon_{ij} \tag{1}$$

where T_j^S is an indicator variable that equals one if village j was randomly assigned to the seed trial pack intervention (and zero otherwise), and T_j^D is an indicator variable that equals one if village j was randomly assigned to the cooking demonstration and blind tasting intervention (and zero otherwise). Outcomes are measured at the individual level (Y_{ij}). We allow for an interaction effect between the two interventions, and we control for baseline outcomes $\left(Y_{ij}^B\right)$ to improve precision. We apply a cluster-robust variance estimator with the bias-reduced linearization (CR2) small-sample correction (Imbens and Kolesar, 2016), with standard errors clustered at the level of randomization (village level).

Factorial designs are commonly employed to evaluate multiple treatments within a single experiment. While our main specification is the fully interacted model in equation 1, our pre-analysis plan also states that we may wish to enhance statistical power by pooling observations across the orthogonal treatments if we find that a treatment effect is smaller than the minimal detectable effect size assumed during power calculations (Colen et al., 2024). For conciseness, we include results from these pooled specifications, which are qualitatively similar to the results from the fully interacted model, in Online Appendix A1 rather than the main text.

While our main outcome of interest is whether individuals adopt improved varieties the subsequent season, we also look at additional outcomes related to productivity, use of harvest output, intrahousehold decision-making, and household welfare. Since we evaluate treatment effects across a range of outcomes, it is necessary to address the multiple comparisons problem. As prespecified, we address the issue following Anderson (2008) and aggregate various outcome measures within a given family into summary indices. Each index is calculated as a weighted average of the standardized (z-score) values of the individual outcomes. The weights are derived from the inverse of the covariance matrix of the outcomes within the family, such that outcomes that are more highly correlated with others receive less weight. This efficient generalized least squares (EGLS) estimator maximizes the statistical power of the index by down-weighting redundant information and emphasizing variation that is orthogonal across outcomes. However, because it may also be useful to understand changes in specific outcomes within a given family rather than just changes in index values, we also present the coefficients on each outcome, controlling the false discovery rate (FDR) by using sharpened two-stage q-values proposed by Benjamini, Krieger, and Yekutieli (2006).

2.4 Timeline

Our experiment runs over two consecutive agricultural seasons. This is because the main outcome of interest for the trial pack treatment is not whether farmers plant the trial pack, but whether the experimentation facilitated by the trial pack in one season leads to the variety's continued use in the subsequent season. As such, outcomes must be measured after the second season. Conversely, the cooking demonstration and tasting session intervention does not require an entire planting season to implement. Hence, this intervention is administered at the beginning of the second experimental season so as to measure the outcomes of both interventions at the same time.

The study area experiences two maize growing seasons each calendar year. The first season, locally known as *Entoigo*, runs from March/April to June/July, while the second season, referred to as *Nsambya*, extends from August/September to November/December. *Bazooka* can be grown in either season. As the study timeline in Figure 1 shows, we distributed the seed trial packs along with baseline data collection a few months before planting commenced for

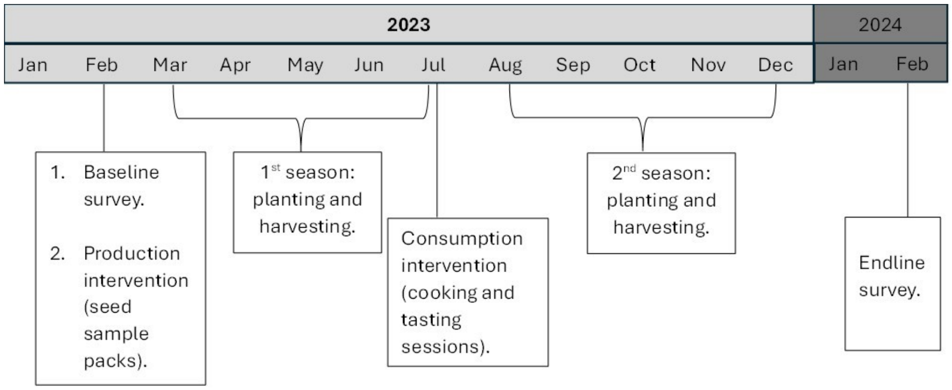

Figure 1: Timeline

Entoigo 2023, such that farmers could plant their trial packs during this season. After *Entoigo* and before the start of *Nsambya*, the cooking demonstrations and tasting sessions were held. Endline data was collected in February 2024, after the conclusion of *Nsambya*.

3 Study Sample and Data

3.1 Sample Size Calculation

Sample size was determined through a series of power simulations detailed in the pre-registered pre-analysis plan (Colen et al., 2024). The primary outcome used in these simulations is a binary indicator for the type of seed used by the farmer (1 if the farmer used fresh seed of an improved variety, 0 otherwise). Data from a previous project, which included 3,450 smallholder maize farmers across 345 villages, were used to estimate the intra-cluster (within-village) correlation for this outcome (Miehe et al., 2023). We assumed a 13.5–percentage point increase (over a baseline adoption percentage of 30 percent) for both the seed sample treatment and the cooking demonstration treatment, and a 23.5–percentage point increase for the interaction effect as minimal detectable effect size.

The simulations resulted in a sample design of 148 villages, with 10 households in each village. In this setup, 74 villages (740 households) would receive a free trial pack, and 74 villages (740 households) would be exposed to the cooking demonstration and blind tasting treatment. Approximately half of the villages in each treatment group (or around 37 villages comprising 370 households) would receive both treatments. To counteract potential attrition which would decrease power, we increased the sample size by adding 2 additional villages in each treatment cell. This leads to a total sample size of 1,560 households located in 156 villages.

3.2 Sampling Strategy

The study was conducted in Eastern Uganda in an area that is also known as the Busoga Kingdom. The main income-generating activity in this area is smallholder maize production. We selected our sample from four districts—Bugiri, Iganga, Kamuli, and Mayuge—chosen for their relatively low adoption rates of *Bazooka,* the improved maize variety we use in this study, despite a well-established network of agro-input dealers, which helps mitigate access issues.

To obtain a representative random sample of farmers in the Busoga Kingdom, villages were selected with probability proportional to the number of households within each village, and then randomly assigned to one of the four study arms (control, trial pack only, consumption demonstration only, both trial pack and consumption demonstration). Within each sampled village, 10 households were randomly chosen to participate in the study from the list of farm households maintained by the village council.

3.3 Descriptive Statistics and Baseline Balance

We pre-registered 10 variables to assess balance in our design during baseline data collection. These variables were selected to offer a comprehensive description of a representative farmer in our sample. Five of the variables are characteristics that are unlikely to be influenced by the intervention, while the other five are drawn from the pre-registered primary and secondary endline outcomes.

Table 1 shows control means in the first column (and standard deviations below). We see that the average household head in the control group was about 50 years old at the time of the baseline survey. About half of the household heads had finished primary education, and in 16 percent of the households, the household head was a woman. Households in the area are large, with on average 8 to 9 members. The average distance to the nearest agro-input shop where maize seed of an improved variety can be bought is about 4 kilometers.

In terms of variables that will be used to assess impact at endline, we first inquired whether farmers had used "quality maize seed, such as an OPV or hybrid seed, on any of their plots during the previous season (*Nsambya* of 2022)." Approximately 42 percent of control group households answered affirmatively to this question at baseline. Subsequently, we posed a more specific question regarding the exact type of seed used on a randomly selected plot. The reason we asked about both overall usage and usage on a specific plot is as follows. Asking about whether improved varieties were used at the farm level makes sure that we captures any improved seeds planted. However, thinking in aggregate about behavior over one's entire farm might lead to reporting errors. Ideally, we would resolve this by asking about the improved varieties used on each plot. But capturing plot level input use data is highly time consuming. So instead of capturing all the plots, we asked respondents to list all of their plots and then just asked about a randomly chosen one. The seed type of interest was *Bazooka*, the hybrid seed variety that is also utilized in our experiment. At baseline, only about 7 percent of farmers in the control group reported having used *Bazooka* seed on the randomly selected plot in the previous season. We also asked where the seed used on the randomly selected plot was obtained from. Results indicate that approximately 29 percent of control farmers sourced their seed from formal channels, such as agro-input dealers, non-governmental organizations, or the government extension system. Conversely, 52 percent of control group farmers reported reusing seed from previous seasons, with some having used it for more than four seasons despite recommendations against using hybrid varieties more than once and against using OPVs more than four times, at the risk of losing any yield advantage. Finally, the average farmer in the control group harvested about 380 kilograms per acre on the randomly selected plot at baseline.

The table reports baseline mean differences between the trial pack group and the control group (column 2, β_S), between the cooking demo group and the control group (column 3, β_D), and the interaction term capturing the additional effect of receiving both treatments beyond the sum of individual effects (column 4, β_I). These estimates are obtained from the fully interacted specification in Equation 1. Overall, the results suggest good baseline balance, as none of the treatment–control differences are statistically significant.

3.4 Attrition and Treatment Recall

Attrition was minimal: during endline, we successfully located all but four of the 1,560 households interviewed at baseline. Moreover, only 18 of the remaining 1,556 households could not be interviewed due to circumstances such as burial or illness, or they refused participation, reducing the effective sample size at endline to 1,538, or 98.6% of the baseline sample. Attrition was balance across treatment arms.

One of the first questions we asked was whether farmers recalled receiving the interventions, regardless of their assigned group. This serves as a useful proxy for treatment fidelity and salience. For the trial pack treatment, 98 percent of farmers in the treatment group indicated that they received a seed trial pack from us in March 2023. Furthermore, 91.4 percent of farmers in the control group indicated that they had not received a seed pack from us. For the cooking demonstration treatment, 92 percent of farmers in the treatment group recalled being invited to a cooking and tasting demonstration. Meanwhile, 96 percent of farmers in the control group did not recall a cooking and tasting demonstration. These figures indicate high recall accuracy and intervention fidelity, supporting our choice to estimate intent-to-treat effects.

4 Results

We now turn to the main results, with subsections of adoption of improved seed varieties, use of harvest, women's empowerment, and welfare and food security.

Table 1: Baseline balance

	control mean	ITT trial pack	ITT cooking demo	ITT interaction
Age of household head (in years)	49.71	-1.53	-1.87	2.45
	(13.29)	(1.31)	(1.22)	(1.69)
Household head has finished primary education (1=yes)	0.51	0.00	-0.02	0.04
	(0.50)	(0.05)	(0.04)	(0.06)
Gender of household head (1=male)	0.84	-0.03	-0.04	0.00
	(0.37)	(0.03)	(0.03)	(0.05)
Household size	8.36	-0.05	-0.03	0.05
	(3.71)	(0.04)	(0.04)	(0.06)
Distance of homestead to nearest agro-input shop (km)	4.10	0.01	0.06	-0.05
	(3.84)	(0.14)	(0.15)	(0.19)
Has used quality maize seed on any plot in last season (1=yes)	0.42	-0.03	-0.01	-0.02
	(0.49)	(0.05)	(0.04)	(0.07)
Has used the promoted seed (*Bazooka*) on a randomly chosen plot in the last season (1=yes)	0.07	0.02	0.02	-0.06
	(0.25)	(0.02)	(0.03)	(0.04)
Seed on random plot was obtained from formal seed source (1=yes)	0.29	-0.01	0.05	-0.06
	(0.45)	(0.04)	(0.04)	(0.06)
Used seed that is recycled more than 3 seasons on randomly selected plot (1=yes)	0.52	0.00	0.02	0.04
	(0.50)	(0.05)	(0.05)	(0.07)
Maize yields on a randomly chosen plot in last season (kg/acres)	384.37	-0.04	0.02	-0.04
	(286.19)	(0.07)	(0.07)	(0.11)

Note: Column (1) reports control group means at baseline (and standard deviations below); column (2) reports the estimate of the intent-to-treat effect of the seed trial packs; column (3) reports the estimate of the intent-to-treat effect of the cooking and tasting demonstrations; column (4) is the interaction effect. Standard errors are below the estimates and are clustered at the level of randomization; **, *, and + denote significance at the 1, 5, and 10% levels. Household size, distance to nearest agro-input shop, and productivity is transformed using the inverse hyperbolic sine transformation (means and standard deviations are in levels).

4.1 Adoption

The use of seed of improved varieties by farmers is the primary outcome of interest in this study. Therefore, Table 2 investigates if farmers use seed of improved varieties in general, while Table 3 reports on more detailed outcomes on seed use and practices on one (randomly selected) maize plot within the farm household. As mentioned in Section 2.3, outcomes are combined in summary indices following Anderson (2008). The structure of the results tables is similar to the one used in Table 1. Each table reports control group means (this time at endline; column 1) as well as intent-to-treat effects from the fully interacted model in Equation 1 (columns 2 to 4).

Before discussing the main results, we note that at endline only about 30 percent of control farm households used maize seed of an improved variety on at least one plot in the second season of 2023 (see Table 2), which is significantly lower than the 42 percent reported during baseline (see Table 1). This difference is most likely due to a change in the way the question on seed use was asked; at baseline, we asked the farmer whether they had used "quality seed" on any plot (whereby it was left up to farmers' interpretation of what was meant by quality seed), while at endline we asked which specific varieties were used on each individual plot, and categorize quality seed of an improved variety as fresh seed of a hybrid variety or an OPV recycled a maximum of three times, obtained from a trusted source (that is, bought from an agro-input shop, seed company or local seed business, or obtained from a public extension system or an NGO that supports agriculture). In other words, the question at baseline may not have fully captured some of the nuances in our definition of improved seed adoption that our endline outcome indicator does. The question was asked in the exact same way across all treatment arms, though, meaning that the change in how the question was asked will not affect treatment effects.

Looking at the adoption index values in Table 2, we see an overall negative effect of the trial pack treatment and little systematic impact of the tasting session treatment on adoption. We also do not see strong evidence that there is an additional interaction effect of both treatments. Turning to specific outcome variables in Table 2, we start by looking at adoption of improved seed varieties on at least one plot in the season preceding endline data collection. Improved seed use is defined as fresh seed of a hybrid variety, or an OPV recycled a maximum of three times, and obtained from a trusted source. We find that the seed trial pack intervention reduced the likelihood of adoption of improved varieties. This reduction is substantial, amounting to approximately half of the mean adoption rate in the control group. Conversely, we do not observe any change in the use of improved varieties as a result of the cooking demonstration and tasting session.

We also examine adoption of *Bazooka* specifically, where adoption is defined more narrowly as having planted fresh *Bazooka* seed from a trusted source. This measure is thus a subset of the previous adoption outcome: if a farmer is counted as adopting *Bazooka* under this definition, they are necessarily adopting an improved variety, though not all adopters of improved varieties fall into this

Table 2: Adoption

	control mean	ITT trial pack	ITT cooking demo	ITT interaction	nobs
Adoption Index	0.00	-0.21**	0.06	0.05	1494
	(0.86)	(0.06)	(0.06)	(0.11)	
Has used seed of an improved variety on any plot in last season?† (1=yes)	0.30	-0.14**	0.03	0.02	1488
	(0.46)	(0.03)	(0.03)	(0.05)	
Has used fresh *Bazooka* on any plot in last season?† (1=yes)	0.05	0.02	0.05*	-0.01	1495
	(0.22)	(0.02)	(0.02)	(0.03)	
Number of plots planted with improved varieties	0.39	-0.18**	0.03	0.05	1495
	(0.70)	(0.05)	(0.05)	(0.08)	
Number of plots with improved varieties as share of total number of plots	0.28	-0.13**	0.03	0.01	1494
	(0.44)	(0.03)	(0.03)	(0.05)	
Area planted with improved varieties (acres)	0.43	-0.22**	-0.02	0.12	1495
	(0.85)	(0.06)	(0.06)	(0.10)	
Area planted with improved varieties as a share of total maize cultivation area	0.28	-0.14**	0.03	0.01	1495
	(0.44)	(0.03)	(0.03)	(0.05)	
Has used *Bazooka* (fresh or recycled) on any plot in last season?† (1=yes)	0.10	0.67**	0.07+	-0.08	1495
	(0.31)	(0.04)	(0.04)	(0.06)	

Note: Column (1) reports control group means at baseline (and standard deviations below); column (2) reports the estimate of the intent-to-treat effect of the seed trial packs; column (3) reports the estimate of the intent-to-treat effect of the cooking and tasting demonstrations; column (4) is the interaction effect. Standard errors are below the estimates and are clustered at the level of randomization; **, *, and + denote significance at the 1, 5, and 10% levels based on sharpened q-values (Benjamini, Krieger, and Yekutieli, 2006). † indicates that baseline outcome was controlled for in the regression.

category. In the control group, about 5 percent of farmers use fresh *Bazooka* seed on at least one plot. We do not see a negative effect of the seed trial pack on this outcome. We do find that farm households exposed to the cooking demonstration intervention are more likely to use fresh *Bazooka* seed in the season following the intervention.

Next, defining maize seed of an improved variety in the same way as how we defined the first outcome (fresh seed of a hybrid variety or an OPV recycled a maximum of three times, and obtained from a trusted source), we consider some intensive margin adoption indicators, including number of plots, share of plots, total area, and share of maize cultivation area that planted using improved varieties. We find that seed of an improved variety was planted on one out of 2.5 maize plots in the control group. The seed trial pack reduced the number of plots on which seed of an improved variety was planted by 0.16 and the share of plots on which improved varieties were planted by 13 percentage points. In terms of area planted, we find that, on average, control households planted about 0.43 acres with seed of an improved variety. However, in households that received a seed trial pack, the area planted with an improved seed variety was 0.16 acres less compared to control group households. We also observe a reduction in the proportion of the total area planted with seed of an improved variety, suggesting that the intervention led farmers to shift from planting fresh seed of an improved variety to planting local or recycled seed.

Turning to Table 3 on outcomes related to adoption on a randomly selected plot, we see similar results. At the plot level, there are negative effects on the adoption of seed of an improved variety for the seed trial pack treatment, but a positive effect on the use of fresh *Bazooka* seed from the cooking demonstration. To look at intensive margin adoption at the plot level, we consider the total quantity of seeds of an improved variety planted, as well as quantity per acre. The seed trial packs lead to reductions in both measures, while the tasting session treatment has no detectable impact. Interestingly, the reduced use of fresh seed of improved varieties in the seed trial pack group did not lead to detectable reductions in plot-level maize production or productivity (yield). There is, however, a positive effect of the cooking demonstration and tasting sessions on maize yields, but the sample seems too small to pick this up in the fully interacted model (the effect becomes statistically significant if we pool across the orthogonal treatment—see Appendix table A3). This is consistent with the fact that the cooking demonstration group was more likely to plant fresh seed of the high-yielding *Bazooka* variety.

At first glance, the results of the seed trial pack intervention may seem counterintuitive; the intervention aimed to increase the use of quality seed of improved varieties in future planting seasons, yet we observe a decline. This can be explained by the fact that many farmers who received the *Bazooka* seed trial packs chose to recycle seeds from the harvested grain rather than purchasing fresh *Bazooka* seeds from agro-input suppliers, NGOs, or government programs. According to our definition of seed of improved varieties, only fresh *Bazooka* seed obtained from a credible source qualifies as an improved variety, while recycled *Bazooka* is classified as local/recycled seed. However, if we were to redefine

Table 3: Adoption on random plot

	control mean	ITT trial pack	ITT cooking demo	ITT interaction	nobs
Adoption Index	-0.02	-0.16*	-0.05	0.13	1331
	(0.71)	(0.05)	(0.05)	(0.07)	
Has used improved variety on randomly selected plot in last season (yes=1)	0.27	-0.13**	0.02	0.02	1495
	(0.45)	(0.03)	(0.03)	(0.05)	
Has used fresh *Bazooka* on randomly selected plot in last season (yes=1)	0.04	0.02	0.05*	-0.02	1495
	(0.20)	(0.02)	(0.02)	(0.03)	
Quantity of improved variety used on randomly selected plot (kg)	2.01	-1.27**	-0.51	0.77+	1438
	(3.84)	(0.25)	(0.28)	(0.35)	
Quantity of improved variety used on randomly selected plot (kg/acre)	1.85	-1.12**	-0.39	0.67	1411
	(3.37)	(0.23)	(0.24)	(0.34)	
Maize production (log)	5.39	-0.09	0.09	0.04	1410
	(1.02)	(0.08)	(0.09)	(0.12)	
Maize productivity (log)	5.61	-0.01	0.11	0.04	1375
	(0.91)	(0.08)	(0.07)	(0.11)	
Has used *Bazooka* (fresh or recycled) on randomly selected plot in last season (yes=1)	0.10	0.64**	0.07+	-0.08	1495
	(0.29)	(0.04)	(0.03)	(0.06)	

Note: Column (1) reports control group means at baseline (and standard deviations below); column (2) reports the estimate of the intent-to-treat effect of the seed trial packs; column (3) reports the estimate of the intent-to-treat effect of the cooking and tasting demonstrations; column (4) is the interaction effect. Standard errors are below the estimates and are clustered at the level of randomization; **, *, and + denote significance at the 1, 5, and 10% levels based on sharpened q-values (Benjamini, Krieger, and Yekutieli, 2006). All regressions include baseline outcome as control.

adoption to include reused *Bazooka* seeds, the last row of Table 2 shows that almost 70 percent of farmers who received the trial pack continued growing *Bazooka* in the next season, and the intent-to-treat effect of the seed trial pack in only slightly lower if we consider use of (potentially recycled) *Bazooka* on a the randomly selected plot (bottom row in Table 3).

Moreover, the fact that we observe a decline in the use of seed of improved varieties—along with the insignificant effect of the trial pack on fresh *Bazooka* purchases—indicates that (appropriately recycled) OPVs and other (fresh, non-*Bazooka*) hybrid varieties were likely crowded out. This is probably because farmers, encouraged by the high yields from the trial pack, opted to continue using recycled *Bazooka* rather than investing in fresh hybrids or fresh or recent OPVs. Meanwhile, farmers in the control group, potentially dissatisfied with their local seeds, were more likely to seek out fresh hybrids or use OPVs that are recycled a maximum of three times. However, they tended to opt for cheaper alternatives rather than purchasing fresh *Bazooka* seed, which is more expensive than OPVs, which are more popular but lower yielding compared to hybrid varieties. We come back to this in Section 6.

4.2 Use of Harvest

We also asked what farmers did with the maize that was harvested. To do so, we again focus on the randomly selected plot and ask how much was sold (or still planned to be sold), how much will be kept for seed and how much would be used for own consumption.[10] Table 4 summarizes treatment effects on these three outcomes (shares of maize consumed, sold, or held for seed) and an index thereof.

On average, households consumed the bulk of their maize harvest—about 75 percent—underscoring its central role in food security. Roughly 21 percent of maize was sold. Finally, a small portion of maize—just under 5 percent—was held for seed. We might expect systematic shifts in the way harvest is used if, for instance, the trial pack induces households to use some of their harvest for recycling (of which we see some evidence between our two experimental seasons) or the consumption demonstration causes them to substitute between home-grown and market purchased maize given their new understanding of consumption attributes of improved varieties. However, the results show no meaningful shifts in post-harvest behavior attributable to the interventions.

4.3 Women's Empowerment

In addition to our main hypotheses about the effects of the interventions on the adoption of improved varieties, we also hypothesized that highlighting the consumption traits of improved seed varieties may increase women's influence in decisions concerning seed selection and the use of harvested maize, as it is more

[10] Note that the endline survey was implemented immediately after the harvest and so in many cases farmers did not sell yet.

Table 4: Use of harvest

	control mean	ITT trial pack	ITT cooking demo	ITT interaction	nobs
Use Index	-0.01	0.02	-0.01	0.08	1302
	(0.71)	(0.08)	(0.08)	(0.11)	
Share of maize consumed (%)	75.19	-1.21	-2.56	3.69	1449
	(29.97)	(3.00)	(2.80)	(4.21)	
Share of maize sold (%)	21.42	-1.50	-1.07	1.53	1495
	(29.98)	(2.93)	(2.67)	(4.16)	
Share maize kept for seed (%)	4.74	-0.24	0.11	-1.19	1321
	(7.93)	(0.86)	(0.86)	(1.21)	

Note: Column (1) reports control group means at baseline (and standard deviations below); column (2) reports the estimate of the intent-to-treat effect of the seed trial packs; column (3) reports the estimate of the intent-to-treat effect of the cooking and tasting demonstrations; column (4) is the interaction effect. Standard errors are below the estimates and are clustered at the level of randomization; **, *, and + denote significance at the 1, 5, and 10% levels based on sharpened q-values (Benjamini, Krieger, and Yekutieli, 2006).

culturally acceptable for women to make decisions in the household food preparation and consumption domains (Kramer and Trachtman, 2024). In Uganda, as in many agriculture-based economies with norms around gendered division of labor, men typically handle production and marketing decisions, while women are more often involved in domestic responsibilities such as cooking. The cooking demonstration and tasting session might increase men's awareness that factors beyond yield, such as consumption attributes, may be important in choosing which variates to produce, potentially creating opportunities for women, who often make decisions in the consumption/cooking domain, to participate more in decision-making processes.

To explore this, we asked about who participates in household decision-making processes. Specifically, we inquired about who decided which maize variety to use on the randomly selected plot, as well as who decided what to do with the harvest from that plot. We consider a woman to be involved in a decision if the decision was made solely by the woman, jointly by the woman and her husband, or if her husband made the decision after consulting the woman (as opposed to her husband deciding unilaterally).[11]

Table 5 indicates that women are already highly engaged in decision-making regarding seed use and harvest management. Contrary to our expectations, the consumption intervention does not increase women's involvement in agricultural decisions.

4.4 Well-being and Food Security

Increasing the adoption of improved seed varieties is a means to an end; farmers ultimately aim to improve their households' food security and overall well-being. While it's unlikely that the small changes in improved seed adoption and yield that we observe would lead to meaningful changes in short-term welfare, we still evaluate the interventions' effects on key welfare indicators, including subjective well-being assessments, food security indicators, and a consumption expenditure aggregate. Results, reported in Online Appendix A2 show no impact.

5 Mechanisms

In this section, we explore various secondary and intermediary outcomes to investigate potential impact pathways. We start by looking at changes in awareness about, and general attitudes toward, improved varieties. We then focus on changes in perceptions related specifically to the consumption and production traits of improved varieties.

[11] We also tested stricter definitions of women's involvement in decision-making, such as requiring that the decision was made solely by the woman or jointly with her husband, or even only unilaterally by the woman. These alternative definitions yielded similar (null) results.

Table 5: Impact on women co-head involvement

	control mean	ITT trial pack	ITT cooking demo	ITT interaction	nobs
Women's Empowerment Index	0.00	0.05	-0.18	0.15	1098
	(0.95)	(0.10)	(0.11)	(0.14)	
Woman involved in decision what to plant (1=yes)	0.85	0.01	-0.06	0.05	1098
	(0.36)	(0.04)	(0.04)	(0.05)	
Women involved in what to do with harvest (1=yes)	0.87	0.02	-0.07	0.05	1098
	(0.34)	(0.04)	(0.04)	(0.05)	

Note: Column (1) reports control group means at baseline (and standard deviations below); column (2) reports the estimate of the intent-to-treat effect of the seed trial packs; column (3) reports the estimate of the intent-to-treat effect of the cooking and tasting demonstrations; column (4) is the interaction effect. Standard errors are below the estimates and are clustered at the level of randomization; **, *, and + denote significance at the 1, 5, and 10% levels based on sharpened q-values (Benjamini, Krieger, and Yekutieli, 2006). All regressions include baseline outcome as control.

5.1 Awareness About and General Attitudes Toward Improved Varieties

One reason that farmers may have changed their behavior around the decision to plant improved varieties, and *Bazooka* in particular, is if the intervention affected farmers awareness of, and general sentiment towards, improved varieties. We explore this hypothesis using the family of outcomes presented in Table 6, which includes measures of varietal awareness, perception of riskiness, and general positive sentiment toward improved varieties. When summarizing these outcomes into an index in the top row of this table, we observe a significant positive impact of the seed trial pack on this set of outcomes. In contrast, the effect of the cooking demonstration and tasting session, while positive, is much smaller and statistically insignificant.

Looking at specific outcomes, we start by testing whether the interventions increased awareness of improved maize seed varieties, specifically *Bazooka*. We asked farmers to list as many improved maize seed varieties as they could name, and enumerators recorded the number of varieties mentioned. Second, we directly inquired whether the farmer was familiar with a maize variety called "*Bazooka*." The top two rows of Table 6 suggest an impact on varietal knowledge resulting from both interventions. On average, control group farmers are aware of approximately 2 to 3 different maize varieties. Both interventions lead farmers to name around 0.5 additional varieties. Overall, 65 percent of farmers in the control group report being familiar with the *Bazooka* variety. The seed trial pack intervention increases the probability that farmers report knowing about *Bazooka* by about 30 percentage points compared to non-trial pack group farmers, likely because seed trial packs prominently displayed the variety's name on the packaging. In contrast, the cooking and tasting demonstration shows a much smaller and insignificant 8 percentage point effect, likely because this intervention had a more general focus on the consumption traits of improved varieties rather than promoting *Bazooka* specifically.[12]

In terms of other more general attitudes toward improved varieties, we assessed farmers' perceptions of the risks related to using improved varieties, by asking them to rate how likely they believe using improved varieties would result in lower yields compared to local varieties. This is a policy relevant question because one of the reasons why seed trial packs are distributed for free is to mitigate the perceived risk associated with trying out new varieties. Responses were recorded on a 4-point Likert scale, ranging from "very likely" (improved varieties will yield less than local) to "very unlikely" (improved varieties will yield more than local). We repeated this question specifically for *Bazooka* as well, but only for farmers who reported familiarity with the variety. We con-

[12]The more general focus was deliberate as we aimed to more generally correct any misconceptions about the taste of improved varieties and did not want to be seen as promoting a particular commercial variety. However, we did mention that the maize flour we used (and also provided a take home sample of) came from *Bazooka*. This is likely why the result for the cooking demonstration is small (but significant in the pooled model reported in Appendix Table A6), and why we do see that farmers in demo group also adopted more fresh *Bazooka* (see Tables 2 and 3)

structed an indicator for downside risk, which is set to 1 if the farmer responded with a 1 or 2 on the Likert scale (indicating "very likely" or "somewhat likely" that improved variety will yield less). Our findings reveal that perceived downside risk is generally limited, and neither intervention significantly affected risk perceptions related to improved varieties in general, nor the specific variety used in the study.

One indicator of positive sentiment towards a variety is whether farmers recommend it to their peers. This is also a policy relevant question because an additional rationale for subsidizing or providing seed at no cost is to harness potential spillover effects to enhance adoption, as it is well known that farmers learn from others about new technologies (Conley and Udry, 2010; Van Campenhout, 2021). To examine whether our interventions influenced peer learning, we asked whether farmers recommended any improved varieties to others, and among those familiar with *Bazooka*, whether they recommended *Bazooka* specifically. Our findings indicate that a substantial proportion of farmers (43 percent of the control group) recommended improved varieties to their peers. Notably, the likelihood of recommending improved varieties is 29 percentage points higher among those who received the seed trial pack. When focusing specifically on *Bazooka*, the difference becomes even more pronounced: receiving a seed trial pack increased the probability of recommending *Bazooka* by 44 percentage points.

Finally, we examine farmers' intentions regarding future use of improved varieties as another assessment of their general attitudes toward these varieties. Although in practice we observe relatively low rates of adoption of improved varieties and of fresh *Bazooka*, 80 percent of control group farmers report an intention to use improved varieties in the future and 25 percent report an intention to use *Bazooka*. While there is no impact of either treatment on the reported intention to use improved varieties, we see that in the group having received a seed trial pack, the percentage reporting an intention to plant *Bazooka* is 20 percentage points higher than in the group that did not receive a seed trial pack. This does not necessarily mean that they intend to purchase new *Bazooka*; it could mean that farmers intend to recycle their *Bazooka* from the trial pack harvest yet again.

5.2 Trait Perceptions

5.2.1 Perceptions of Consumption Traits

Farmers may be of the opinion that crops grown from local varieties are tastier than crops grown from improved varieties (Pícha, Navrátil, and Švec, 2018; Timu et al., 2014). The cooking demonstrations and tasting sessions were designed to alter these potentially biased perceptions about the consumption qualities of maize grain obtained from improved varieties. Additionally, if after farmers plant the seed trial pack, they process the resulting harvest separately and use it for home consumption, they may revise their beliefs about the consumption traits of these improved varieties as well.

Table 6: Knowledge, risk, social learning, and intentions

	control mean	ITT trial pack	ITT cooking demo	ITT interaction	nobs
Awareness and Attitudes Index	0.26	0.16**	0.07	-0.03	1156
	(0.37)	(0.05)	(0.05)	(0.06)	
Knows *Bazooka* (yes=1)†	0.65	0.29**	0.08	0.17**	1538
	(0.48)	(0.04)	(0.05)	(0.02)	
Number of improved varieties farmer knows	2.21	0.48**	0.50**	-0.16	1532
	(1.43)	(0.16)	(0.16)	(0.24)	
Thinks improved varieties are risky (1=yes)	0.08	0.00	0.01	-0.01	1447
	(0.28)	(0.03)	(0.03)	(0.04)	
Thinks *Bazooka* is risky (1=yes)	0.13	0.03	0.01	-0.05	1207
	(0.33)	(0.05)	(0.06)	(0.08)	
Recommended improved varieties to others (1=yes)	0.43	0.29**	0.02	0.01	1538
	(0.50)	(0.06)	(0.05)	(0.07)	
Recommended *Bazooka* to others (1=yes)	0.34	0.44**	0.11	-0.11	1260
	(0.48)	(0.06)	(0.07)	(0.08)	
Will use improved varieties in the future (1=yes)	0.80	0.05	0.01	0.00	1461
	(0.40)	(0.05)	(0.05)	(0.07)	
Will use *Bazooka* in the future (1=yes)	0.25	0.20**	0.05	-0.07	1503
	(0.43)	(0.06)	(0.05)	(0.09)	

Note: Column (1) reports control group means at baseline (and standard deviations below); column (2) reports the estimate of the intent-to-treat effect of the seed trial packs; column (3) reports the estimate of the intent-to-treat effect of the cooking and tasting demonstrations; column (4) is the interaction effect. Standard errors are below the estimates and are clustered at the level of randomization; **, *, and + denote significance at the 1, 5, and 10% levels based on sharpened q-values (Benjamini, Krieger, and Yekutieli, 2006). † indicates that baseline outcome was used as control in regression.

To assess whether our interventions influence farmers' perceptions of the consumption traits of maize from improved seed varieties, we included a dedicated module in the questionnaire that asked farmers to compare maize from local varieties to maize from improved varieties (such as *Longe5*, a popular OPV, or *Bazooka*) across four traits: taste, portion size, appearance, and ease of cooking. For each trait, farmers rated their preference on a 5-point Likert scale, ranging from "local varieties are much better" to "local varieties are much worse." For the purpose of our analysis, we consider improved varieties to be preferred when farmers indicate that local varieties are "somewhat worse" or "much worse" for a given trait.

Results are summarized in Table 7. The overall satisfaction with the consumption traits of improved varieties is already fairly high among control households. Both the seed trial pack intervention and the cooking demonstration and blind tasting sessions significantly increased the proportion of farmers who perceive improved varieties as superior to local varieties according to the summary index, as well as across all four consumption attributes. Interestingly, the results show that the seed trial pack is equally, if not more, effective in changing perceptions in favor of improved seed varieties. This suggests that trial pack interventions may, in some cases, be sufficient to encourage farmers to learn about the consumption traits of new varieties.

5.2.2 Perceptions of Production Traits

The seed trial pack is primarily designed to address preconceived notions farmers may have about the production-related traits of improved varieties. For example, qualitative fieldwork conducted during the study's preparation revealed that some farmers believe that improved maize varieties might offer higher yields but were less resistant to fall armyworm (*Spodoptera frugiperda*) infestations. Others, having been disappointed in the past, might no longer believe in the yield advantages of improved varieties (Miehe et al., 2025). Providing free seed trial packs can be an effective way to alter these perceptions, as it allows farmers to directly experience the production traits of the new technology on their own fields (Foster and Rosenzweig, 1995).

To test if our interventions alter perceptions of improved maize varieties' production traits, we also include a module in the questionnaire where we ask farmers to compare seed of an improved variety to local seed on five agronomic traits—yield, abiotic stress resistance such as drought or heat resistance, biotic stress resistance such as pests and weed resistance, time to maturity, and seed germination rates.

Results are summarized in Table 7. When farmers compare improved varieties directly to local varieties, the summary index indicates a significant positive impact from the seed trial pack, albeit only at the 10 percent significance level. No significant impact was observed from the cooking demonstration and tasting session, which aligns with expectations as farmers can not observe production traits from that treatment.

Table 7: Impact on perceptions of consumption traits of maize grain obtained from improved seed varieties versus maize grain obtained from local seed varieties

	control mean	ITT trial pack	ITT cooking demo	ITT interaction	nobs
Consumption Trait Perceptions Index	0.06	0.29**	0.26**	-0.12	1248
	(0.71)	(0.09)	(0.09)	(0.11)	
Improved variety grain tastes better (1=yes)	0.51	0.27**	0.15*	-0.11+	1424
	(0.50)	(0.06)	(0.06)	(0.08)	
Portions obtained from improved variety grain are larger (1=yes)	0.67	0.14**	0.15**	-0.08+	1360
	(0.47)	(0.04)	(0.05)	(0.06)	
Improved variety grain had better appearance (1=yes)	0.77	0.06	0.10*	-0.02	1421
	(0.42)	(0.05)	(0.04)	(0.05)	
Improved variety grain is easier to cook (1=yes)	0.54	0.19**	0.18*	-0.10	1316
	(0.50)	(0.06)	(0.06)	(0.08)	

Note: Column (1) reports control group means at baseline (and standard deviations below); column (2) reports the estimate of the intent-to-treat effect of the seed trial packs; column (3) reports the estimate of the intent-to-treat effect of the cooking and tasting demonstrations; column (4) is the interaction effect. Standard errors are below the estimates and are clustered at the level of randomization; **, *, and + denote significance at the 1, 5, and 10% levels based on sharpened q-values (Benjamini, Krieger, and Yekutieli, 2006).

Table 8: Impact on perceptions of production traits of improved seed varieties versus local seed

	control mean	ITT trial pack	ITT cooking demo	ITT interaction	nobs
Production Trait Perceptions Index	0.02	0.13^{+}	0.05	-0.04	1273
	(0.60)	(0.08)	(0.07)	(0.10)	
Improved seed yields more (1=yes)	0.90	0.03	0.01	-0.02	1464
	(0.29)	(0.03)	(0.03)	(0.04)	
Improved seed is more restistant to abiotic stresses (1=yes)	0.69	0.10	0.00	-0.06	1336
	(0.47)	(0.05)	(0.06)	(0.08)	
Improved seed is more restistant to biotic stresses (1=yes)	0.52	0.12	0.02	-0.05	1391
	(0.50)	(0.06)	(0.06)	(0.09)	
Improve seed matures faster (1=yes)	0.94	-0.01	-0.02	0.05	1446
	(0.24)	(0.03)	(0.02)	(0.04)	
Improved seed has higher germination rates (1=yes)	0.77	0.09	0.06	-0.02	1439
	(0.42)	(0.05)	(0.04)	(0.06)	

Note: Column (1) reports control group means at baseline (and standard deviations below); column (2) reports the estimate of the intent-to-treat effect of the seed trial packs; column (3) reports the estimate of the intent-to-treat effect of the cooking and tasting demonstrations; column (4) is the interaction effect. Standard errors are below the estimates and are clustered at the level of randomization; **, *, and + denote significance at the 1, 5, and 10% levels based on sharpened q-values (Benjamini, Krieger, and Yekutieli, 2006).

6 Explanations for Seed Recycling

A key finding from our study is that farmers who received the seed trial pack were more likely to continue using the distributed variety (*Bazooka*), but mostly did so by reusing seed rather than purchasing fresh seed as recommended. In fact, the intervention appears to have partially crowded out the use improved seed varieties (defined as fresh hybrids or appropriately recycled OPVs): some farmers who might have otherwise used improved seed opted to recycle the seed obtained through the trial pack. In this section, we explore possible explanations for this behavior, including limited knowledge about hybrid seed degeneration, perceived profitability of recycling and aversion to market price risks, trust and quality perceptions, and liquidity constraints.

6.1 Limited Knowledge

A first plausible explanation is that farmers may be unaware that hybrid seed, such as *Bazooka*, is not intended for recycling.[13] While baseline knowledge regarding hybrid seed recycling is likely balanced across treatment and control groups due to randomization, the decision to purchase new seed is also influenced by farmers' experience with the yield of the seed they currently have access to and can reuse. Treated farmers observe high yields from the trial pack and may, in the absence of adequate knowledge about hybrid seed degeneration, mistakenly infer that the seed can be reused without penalty. Control farmers, by contrast, are more likely using lower-vigor local varieties, making them more inclined to purchase fresh seed when aiming to improve yields. This mechanism implies that the crowding-out effect of the intervention is likely stronger in contexts where baseline knowledge about hybrid seed non-recyclability is low.

We did not formally assess farmers' knowledge of hybrid seed recyclability at baseline. However, during respondent validation sessions held in the form of focus group discussions, farmers generally indicated awareness that hybrid seed is not intended for reuse. They also noted that the yield penalty associated with recycling hybrid seed is gradual, becoming more pronounced with each successive cycle of reuse. This perspective is consistent with our data: farmers who planted fresh *Bazooka* seed achieved an average yield of approximately 535 kilograms of maize per acre. In comparison, farmers using local varieties (excluding recycled *Bazooka*), which have likely gone through successive cycles of reuse, averaged 323 kilograms per acre, while those who recycled *Bazooka* seed just once from the seed trial pack obtained intermediate yields of around 375 kilograms per acre.

[13] We deliberately chose not to inform farmers about the non-recyclability of the seed in order to preserve the integrity of the experimental design, as including such information would have effectively bundled the trial pack with an informational intervention, thereby complicating causal attribution. From an external validity perspective, this decision also reflects typical market conditions: seed dealers rarely convey this information, and warnings about seed degeneration are often absent from packaging.

6.2 Profitability and Aversion to Market Price Risk

Farmers typically seek to maximize profits rather than yields. As such, recycling *Bazooka* seed may represent a dominant strategy, depending on the relative costs and expected returns. Figure 2 illustrates estimated profits per acre of maize as a function of the sales price per 100 kg bag, for three seed types: fresh *Bazooka* hybrid (yielding 535 kg/acre), recycled *Bazooka* (375 kg/acre), and local seed (323 kg/acre). The calculation assumes that planting one acre with *Bazooka* requires approximately 8 kilograms of seed. At the time of the study, the retail price of *Bazooka* seed was UGX 12,000 per kilogram, resulting in a total seed cost of UGX 96,000 per acre. In contrast, we assume that both local seed and recycled *Bazooka* seed are acquired at negligible cost, given that only 1.5% of total *Bazooka* output would need to be recycled to plant the same plot again.

The figure reveals that, across most selling price points, recycling *Bazooka* once yields higher profits than both purchasing fresh *Bazooka* or using local seed. Purchasing fresh *Bazooka* only becomes more profitable than recycling when prices at which maize can be sold exceed approximately UGX 62,000 per 100 kg bag. Given that the median reported sales price at endline in our sample is UGX 60,000 per bag, recycling the harvest from the trial pack for a single season appears to be a profit-maximizing response for the majority of farmers. With its low upfront investment, recycling would also maximize expected utility for a risk averse farmer concerned about any production or price risk that may exist.

Over time, as farmers continue to recycle *Bazooka* seed across multiple seasons, the associated yield—and thus the profit (long-dash blue) line in Figure 2—can be expected to converge toward that of local seed (the short-dash green line). As the yield advantage diminishes, the profitability of recycling declines, making the purchase of fresh hybrid seed increasingly attractive.

It is also important to recognize that the observed high rates of recycling may be season-specific. For example, during the baseline period, maize prices ranged from UGX 100,000 to UGX 120,000 per 100 kg bag—well above the threshold at which purchasing fresh *Bazooka* becomes the dominant strategy. However, since farmers must make input decisions before prices are known, risk-averse farmers may prefer to avoid the upfront investment cost of fresh seed and opt to recycle instead. This also implies that risk aversion is an important cross-cutting factor that amplifies the attractiveness of recycling.

6.3 Quality Issues

Another possible explanation for the observed differences in recycling rates across treatment groups is that farmers may place greater trust in seed provided by a research organization compared to seed sourced from local agro-dealers. This interpretation is consistent with existing evidence documenting low levels of trust in Uganda's agricultural input market (Bold et al., 2017; Barriga and Fiala, 2020; Miehe et al., 2023). To explore this hypothesis, we compare farmer ratings of *Bazooka* seed across different sourcing channels. In addition to elicit-

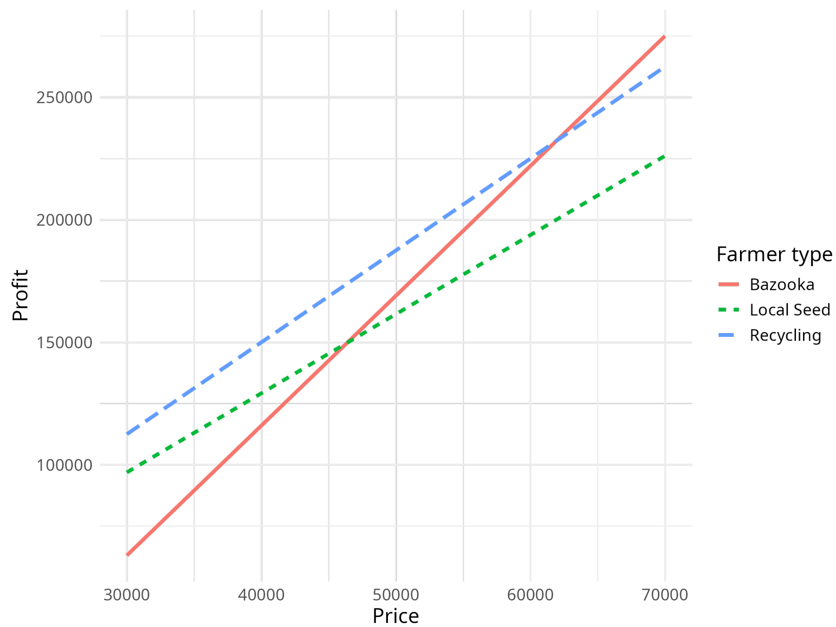

Figure 2: Profits as a function of sales price

ing comparative assessments of improved versus local seed varieties on a range of production traits (see Section 5.2.2), we asked farmers to rate the actual seed used on their plots with respect to specific traits, as well as to provide an overall satisfaction score.

The results, summarized in Figure 3, support the hypothesis that seed quality uncertainty also plays a role. On most production traits, *Bazooka* seed obtained through the seed trial pack receives the highest ratings. For instance, nearly 50 percent of farmers assign it the top score for yield performance, and it is also highly rated for its germination rate. These positive assessments are reflected in high overall satisfaction: approximately 80 percent of farmers report being very satisfied with the seed received through the trial pack. Satisfaction declines somewhat among farmers who recycled *Bazooka* from the trial pack, but even recycled seed is generally rated more favorably than fresh *Bazooka* seed purchased from agro-dealers.

6.4 Liquidity Constraints

Cash or credit constraints may also induce recycling. If a farmer wants to plant *Bazooka*, treatment farmers can fall back on recycling as a cost-minimizing strategy, while control farmers likely must purchase seeds. As a result, liquidity constraints may increase the likelihood of recycling among treatment farmers, while selection into *Bazooka* use among control farmers means that only those

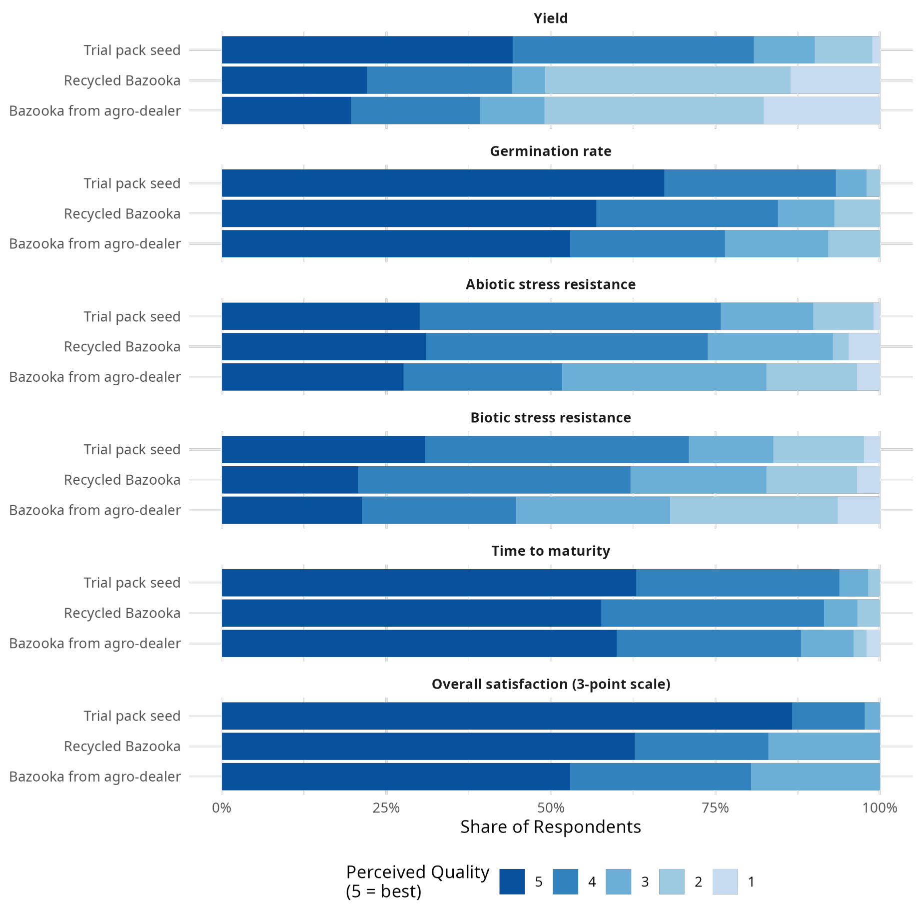

Figure 3: Perceptions of quality of *Bazooka* from agro-dealer vs seed trial pack

able to afford fresh seed will use *Bazooka*, resulting in a higher observed rate of fresh seed use among control farmers.

We explore this by looking at the correlation between wealth (proxied by consumption expenditure per capita at baseline) and the likelihood that farmers recycle seed from the seed trial pack (as opposed to buying fresh *Bazooka* seed) in the group that received a seed trial pack. Recycling of *Bazooka* seed is common across all wealth groups. In the lowest quintile, more than 90 percent of farmers recycled, compared to roughly 84–86 percent in the middle quintiles and 77 percent in the fourth quintile. Overall, the data suggest only modest variation in recycling behavior by wealth, with slightly lower recycling rates observed among relatively wealthier farmers.

6.5 Summary

Taken together, these (non-exhaustive) explanations underscore the complexity of farmer decision-making in input markets. Recycling behavior reflects not only knowledge and profitability considerations, but also constraints related to access, trust, and liquidity. The fact that many treatment farmers chose to recycle a high-yielding hybrid variety—even when aware of potential degeneration—highlights the importance of addressing both informational and structural barriers when promoting sustained adoption of improved technologies.

7 Conclusion

In this study, we conducted a field experiment to evaluate the effectiveness of two interventions aimed at increasing the adoption of an improved maize variety (a hybrid called *Bazooka*) among smallholder farmers in eastern Uganda. The first intervention involved the distribution of seed trial packs, enabling farmers to observe production-related attributes such as germination rates, pest tolerance, and yield potential. The second intervention consisted of cooking demonstrations and blind tasting sessions, designed to emphasize consumption-related traits, including taste, texture, and color. The interventions were evaluated through a cluster-randomized controlled trial involving 1,560 maize farmers across villages randomly assigned to treatments under a 2x2 factorial design.

Our results revealed an unintended consequence of the seed trial pack intervention: rather than increasing the use of fresh, quality-assured seed of improved varieties, it reduced the likelihood that farmers planted such seed in the subsequent season. This outcome was driven by a tendency among treated farmers to recycle seed from the trial pack; seed which, due to hybrid seed degeneration, was not classified as "improved" in our analysis. The cooking demonstration had limited effects overall, although it did lead to a modest increase in the probability of farmers planting fresh *Bazooka*.

Despite this unexpected behavioral response, intermediate outcomes were consistent with the interventions' objectives. The seed trial pack improved farmers' perceptions of production traits, and the cooking demonstration enhanced perceptions of consumption-related traits. Interestingly, the trial pack also positively influenced perceptions of consumption traits, suggesting that farmers formed opinions based on their own consumption experience with the harvested grain.

These findings suggest that consumption traits do matter in farmers' varietal choices, but explicit demonstrations may not be necessary as farmers appear to learn about such traits through direct use from their own harvest. A simple seed trial pack may therefore be the most cost-effective way to expose farmers to both production and consumption qualities. At the same time, the observed recycling behavior underscores the complexity of adoption decisions. Farmers do not merely respond to improved traits; they also weigh economic trade-offs, including the perceived costs and benefits of purchasing fresh seed versus recycling. For the average farmer in our sample, recycling appeared to be a rational response, possibly due to modest yield penalties and limited market incentives to invest in new seed (high cost of seed and low price of grain).

These results point to the need for complementary measures that extend beyond seed trial packs or the experiential learning farmers gain from trying new varieties. Policies that improve access to affordable, high-quality seed (such as through credit or targeted subsidies) and those that enhance market linkages and price incentives for quality output may be necessary to shift the adoption calculus.

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References

Abate, G., S. D. Aredo, S. Kannan, A. Krahn, B. Kramer, N. Ma, C. Mulwa, L. Nabwire, J. J. Okello, V. Patil, C. Ragasa, C. Trachtman, B. Van Campenhout, P. C. Veettil, and C. Waweru. 2024. "Accelerating Varietal Turnover: Appealing to Smallholders as Both Producers and Consumers." Social Science Registry, Trial ID: 12728.

Akwango-Aliau, D., G. Lukwago, R. M. Ariong, I. Kiyingi, I. Obongo, S. Adur, S. Angundubo, J. Ndhokero, H. Luzinda, T. Akongo, D. Magala, S. Mutonyi, G. Bwanika, A. Bua, Y. Baguma, and A. Agona. 2022. "Impact of NARO Bean and Maize Technologies on Farmer Livelihoods Contribution to Uganda's Economy." *National Agricultural Research Organisation* .

Anderson, M. L. 2008. "Multiple Inference and Gender Differences in the Effects of Early Intervention: A Reevaluation of the Abecedarian, Perry Preschool, and Early Training Projects." *Journal of the American Statistical Association* 103 (484): 1481–1495.

Balew, S., E. Bulte, and M. Kassie. 2025. "Short-run subsidies and long-run willingness to pay: Learning and anchoring in an agricultural experiment in Ethiopia." *American Journal of Agricultural Economics* 107 (2): 655–669.

Barriga, A. and N. Fiala. 2020. "The supply chain for seed in Uganda: Where does it go wrong?" *World Development* 130: 104928.

Bellon, M. R., B. H. Kotu, C. Azzarri, and F. Caracciolo. 2020. "To diversify or not to diversify, that is the question. Pursuing agricultural development for smallholder farmers in marginal areas of Ghana." *World Development* 125: 104682.

Benjamini, Y., A. M. Krieger, and D. Yekutieli. 2006. "Adaptive linear step-up procedures that control the false discovery rate." *Biometrika* 93 (3): 491–507.

Biedny, C., N. M. Mason, S. S. Snapp, A. Nord, J.-C. Rubyogo, and J. Lwehabura. 2020. "Demonstration plots, seed trial packs, bidirectional learning, and modern input sales: Evidence from a field experiment in Tanzania." .

Birol, E., J. Meenakshi, A. Oparinde, S. Perez, and K. Tomlins. 2015. "Developing country consumers' acceptance of biofortified foods: A synthesis." *Food Security* 7: 555–568.

Blackie, M. and C. K. Mann. 2005. "The origin and concept of the Starter Pack." In "Starter packs: a strategy to fight hunger in developing countries? Lessons from the Malawi experience 1998-2003," 15–27. CABI Publishing Wallingford UK.

Bold, T., K. C. Kaizzi, J. Svensson, and D. Yanagizawa-Drott. 2017. "Lemon technologies and adoption: measurement, theory and evidence from agricultural markets in Uganda." *The Quarterly Journal of Economics* 132 (3): 1055–1100.

Boucher, S. R., M. R. Carter, J. E. Flatnes, T. J. Lybbert, J. G. Malacarne, P. P. Marenya, and L. A. Paul. 2024. "Bundling Genetic and Financial Technologies for More Resilient and Productive Small-Scale Farmers in Africa." *The Economic Journal* 134 (662): 2321–2350.

Carletto, C., P. Corral, and A. Guelfi. 2017. "Agricultural commercialization and nutrition revisited: Empirical evidence from three African countries." *Food Policy* 67: 106–118.

Carter, M., R. Laajaj, and D. Yang. 2021. "Subsidies and the African Green Revolution: direct effects and social network spillovers of randomized input subsidies in Mozambique." *American Economic Journal: Applied Economics* 13 (2): 206–229.

Christinck, A., M. Diarra, and G. Horneber. 2014. "Innovations in seed systems." *Lessons from the CCRP-funded project" Sustaining farmer-managed seed initiatives in Mali, Niger, and Burkina Faso* 75.

Coates, J., A. Swindale, and P. Bilinsky. 2007. "Household Food Insecurity Access Scale (HFIAS) for measurement of food access: indicator guide: version 3." .

Colen, L., B. Van Campenhout, L. Nabwire, C. Trachtman, B. Kramer, and G. T. Abate. 2024. "Increasing Adoption and Varietal Turnover of Seed: The Role of Consumer and Producer Side Interventions." RCT ID: AEARCTR-0010666.

Conley, T. G. and C. R. Udry. 2010. "Learning about a New Technology: Pineapple in Ghana." *American Economic Review* 100 (1): 35–69.

Cromwell, E. 1990. "Seed diffusion mechanisms in small farmer communities: Lessons from Asia, Africa and Latin America." .

De Brauw, A., P. Eozenou, D. O. Gilligan, C. Hotz, N. Kumar, and J. Meenakshi. 2018. "Biofortification, crop adoption and health information: impact pathways in Mozambique and Uganda." *American Journal of Agricultural Economics* 100 (3): 906–930.

De Groote, H., C. K. Chege, K. Tomlins, and N. S. Gunaratna. 2014. "Combining experimental auctions with a modified home-use test to assess rural consumers' acceptance of quality protein maize, a biofortified crop." *Food Quality and Preference* 38: 1–13.

Dorward, A. and J. Kydd. 2005. "Starter Pack in rural development strategies." In "Starter packs: a strategy to fight hunger in developing countries? Lessons from the Malawi experience 1998-2003," 261–278. CABI Publishing Wallingford UK.

Emerick, K., A. de Janvry, E. Sadoulet, and M. H. Dar. 2016. "Technological Innovations, Downside Risk, and the Modernization of Agriculture." *American Economic Review* 106 (6): 1537–61.

Evenson, R. E. and D. Gollin. 2003. "Assessing the impact of the Green Revolution, 1960 to 2000." *Science* 300 (5620): 758–762.

Fishman, R., S. C. Smith, V. Bobić, and M. Sulaiman. 2022. "Can Agricultural Extension and Input Support Be Discontinued? Evidence from a Randomized Phaseout in Uganda." *Review of Economics and Statistics* 104 (6): 1273–1288.

Foster, A. D. and M. R. Rosenzweig. 1995. "Learning by Doing and Learning from Others: Human Capital and Technical Change in Agriculture." *Journal of Political Economy* 103 (6): 1176–1209.

Gignoux, J., K. Macours, D. Stein, and K. Wright. 2023. "Input subsidies, credit constraints, and expectations of future transfers: Evidence from Haiti." *American Journal of Agricultural Economics* 105 (3): 809–835.

Imbens, G. W. and M. Kolesar. 2016. "Robust standard errors in small samples: Some practical advice." *Review of Economics and Statistics* 98 (4): 701–712.

Jones, M., F. Kondylis, J. Loeser, and J. Magruder. 2022. "Factor market failures and the adoption of irrigation in Rwanda." *American Economic Review* 112 (7): 2316–2352.

Kramer, B. 2017. "Cooking contests for healthier recipes: Impacts on nutrition knowledge and behaviors in Bangladesh." .

Kramer, B. and C. Trachtman. 2024. "Gender dynamics in seed systems: An integrative review of seed promotion interventions in Africa." *Food Security* 16 (1): 19–45.

LaFave, D. and D. Thomas. 2016. "Farms, families, and markets: New evidence on completeness of markets in agricultural settings." *Econometrica* 84 (5): 1917–1960.

Lin, W. 2013. "Agnostic notes on regression adjustments to experimental data: Reexamining Freedman's critique." *The Annals of Applied Statistics* 7 (1): 295 – 318.

Maredia, M. K., J. Farris, N. M. Mason, and S. Morgan. 2025. "Does Providing Free Trial Packs With Demonstration Plots Increase the Adoption of Agricultural Technologies? Cost Effectiveness Evidence From Tanzania." *Agricultural Economics* .

Miehe, C., R. Sparrow, D. Spielman, and B. Van Campenhout. 2023. *The (perceived) quality of agricultural technology and its adoption: Experimental evidence from Uganda*. Intl Food Policy Res Inst.

Miehe, C., L. Nabwire, R. Sparrow, D. Spielman, and B. Van Campenhout. 2025. "Miracle seeds: Biased expectations, complementary input use, and the dynamics of smallholder technology adoption." *Economic Development and Cultural Change* 0 (ja): null.

Morgan, S. N., N. M. Mason, and M. K. Maredia. 2020. "Lead-farmer extension and smallholder valuation of new agricultural technologies in Tanzania." *Food Policy* 97: 101955.

Muralidharan, K., M. Romero, and K. Wüthrich. 2023. "Factorial Designs, Model Selection, and (Incorrect) Inference in Randomized Experiments." *The Review of Economics and Statistics* 1–44.

Murty, P., M. V. Rao, and M. S. Bamji. 2016. "Impact of enriching the diet of women and children through health and nutrition education, introduction of homestead gardens and backyard poultry in rural India." *Agricultural Research* 5: 210–217.

Okello, J. J., F. M. Shiundu, J. Mwende, C. J. Lagerkvist, R. A. Nyikal, P. Muoki, J. Mburu, J. Low, G. Hareau, and S. Heck. 2021. "Quality and psychosocial factors influencing purchase of orange-fleshed sweetpotato bread." *International Journal of Food Science & Technology* 56 (3): 1432–1446.

Olney, D. K., A. Pedehombga, M. T. Ruel, and A. Dillon. 2015. "A 2-year integrated agriculture and nutrition and health behavior change communication program targeted to women in Burkina Faso reduces anemia, wasting, and diarrhea in children 3–12.9 months of age at baseline: a cluster-randomized controlled trial." *The Journal of Nutrition* 145 (6): 1317–1324.

Osei, A., P. Pandey, J. Nielsen, A. Pries, D. Spiro, D. Davis, V. Quinn, and N. Haselow. 2017. "Combining home garden, poultry, and nutrition education program targeted to families with young children improved anemia among children and anemia and underweight among nonpregnant women in Nepal." *Food and Nutrition Bulletin* 38 (1): 49–64.

Otieno, Z., J. J. Okello, R. Nyikal, A. Mwang'ombe, and D. Clavel. 2011. "The role of varietal traits in the adoption of improved dryland crop varieties: The case of pigeon pea in Kenya." *African Journal of Agricultural and Resource Economics* 6 (2).

Phiri, M., R. Chirwa, S. Kandoole, and R. Tripp. 2000. *Introducing new bean varieties with small seed packs: Experience from Malawi.* Overseas Development Institute.

Pícha, K., J. Navrátil, and R. Švec. 2018. "Preference to local food vs. Preference to "national" and regional food." *Journal of Food Products Marketing* 24 (2): 125–145.

Pixley, K. and M. Banziger. 2004. "Open-pollinated maize varieties: A backward step or valuable option for farmers." In "Seventh Eastern and Southern Africa Regional Maize Conference; CIMMYT: Mexico City, Mexico," 22–28.

Ragasa, C., O. Oyinbo, and N. Ma. 2025. "Impact of Production-and Consumption-Oriented Interventions on Crop Varietal Adoption: Cluster-Randomized Controlled Trial Evidence From Northern Nigeria." *Agricultural Economics* .

Reicks, M., M. Kocher, and J. Reeder. 2018. "Impact of Cooking and Home Food Preparation Interventions Among Adults: A Systematic Review (2011–2016)." *Journal of Nutrition Education and Behavior* 50 (2): 148–172.e1.

Roos, E. E. 1980. "Physiological, biochemical and genetic changes in seed quality during storage." *HortScience* 15 (6): 781–784.

Schreinemachers, P., M. A. Patalagsa, and N. Uddin. 2016. "Impact and cost-effectiveness of women's training in home gardening and nutrition in Bangladesh." *Journal of Development Effectiveness* 8 (4): 473–488.

Semalulu, O., P. Kibaya, S. Kyebogola, E. Mworozi, N. Sewankambo, and B. Gebru. 2022. "Profitability and Farmer Acceptability of Selected Climate Smart Technologies and Practices for Maize-Beans Production in Drought-Prone Areas, Uganda." *Agricultural Sciences* 13 (11): 1259–1284.

Singh, I., L. Squire, and J. Strauss. 1986. "A survey of agricultural household models: Recent findings and policy implications." *The World Bank Economic Review* 1 (1): 149–179.

Thiele, G., D. Dufour, P. Vernier, R. O. Mwanga, M. L. Parker, E. Schulte Geldermann, B. Teeken, T. Wossen, E. Gotor, E. Kikulwe et al. 2021. "A review of varietal change in roots, tubers and bananas: consumer preferences and other drivers of adoption and implications for breeding." *International Journal of Food Science and Technology* 56 (3): 1076–1092.

Tilman, D., C. Balzer, J. Hill, and B. L. Befort. 2011. "Global food demand and the sustainable intensification of agriculture." *Proceedings of the national academy of sciences* 108 (50): 20260–20264.

Timu, A. G., R. Mulwa, J. Okello, and M. Kamau. 2014. "The role of varietal attributes on adoption of improved seed varieties: the case of sorghum in Kenya." *Agriculture & Food Security* 3: 1–7.

Tjernstrom, E. and J. Gars. 2019. *Seeds of Uncertainty: Information, Subjective Expectations, and Technology Adoption*. Tech. rep., Working paper.

Van Campenhout, B. 2021. "The role of information in agricultural technology adoption: Experimental evidence from rice farmers in Uganda." *Economic Development and Cultural Change* 69 (3): 1239–1272.

Online Appendix

A1 Pooled models

In this Online Appendix, we provide results for the same set of outcomes and in similar table as in the main manuscript, but now estimated using an alternative empirical specification. Factorial designs are commonly employed to evaluate multiple treatments within a single experiment. While our design is powered for a complete set of interactions (as in equation 1), our pre-analysis plan also states that we may wish to increase statistical power by pooling observations across the orthogonal treatments if we find that a treatment effect is smaller than the minimal detectable effect size assumed during power calculations. However, pooling treatment cells to enhance statistical power can lead to biased estimates of the main treatment effects if there is an interaction between the treatments (Muralidharan, Romero, and Wüthrich, 2023). To mitigate this, we will treat the orthogonal treatment as a covariate we want to adjust for and interact the treatment variable with the demeaned orthogonal treatment (Lin, 2013):

$$Y_{ij} = \alpha + \beta_M T_i^M + \beta_O \left(T_i^O - \bar{T^O}\right) + \beta_I T_i^M \left(T_i^O - \bar{T^O}\right) + \delta Y_{0ij}^B + \varepsilon_{ij} \qquad (2)$$

where now T_i^M is a dummy for the main treatment (the seed trial pack or the cooking demonstration respectively) and T_i^O is a dummy for the orthogonal treatment (which enters in deviations from its means).

It is important to note that the estimand of the respective treatments in Equation 2 changes. For instance, while the estimand for the seed trial pack treatment in Equation 1 is the effect of the treatment in and of itself, the estimand in Equation 2 is a weighted average of the estimand of the seed trial pack treatment of Equation 1 and the effect of the seed trial pack in the presence of the cooking demonstration and testing treatment.

Tables A1 through A8 report results for the pooled models (Equation 2) and correspond to the fully interacted models presented in Tables 1 through 8. In these tables, the second column corresponds to β_M in Equation 2 for the seed trial pack treatment (in which case the cooking demonstration and tasting treatment is considered the orthogonal treatment and controlled for). In the fourth column, this is reversed, showing β_M in Equation 2 for the cooking demonstration and tasting treatment (with the seed trial pack treatment now considered the orthogonal treatment and controlled for). The first and the third columns are control group means for the respective treatments.

Table A1: Baseline balance (pooled)

	control mean	ITT trial pack	control mean	ITT cooking demo
Age of household head (in years)	48.78	-0.31	48.94	-0.65
	(13.79)	(0.85)	(13.57)	(0.85)
Household head has finished primary education (1-yes)	0.50	0.02	0.51	0.00
	(0.50)	(0.03)	(0.50)	(0.03)
Gender of household head (1=male)	0.82	-0.03	0.82	-0.04^{+}
	(0.39)	(0.03)	(0.38)	(0.03)
Household size	8.24	-0.02	8.14	-0.01
	(3.70)	(0.03)	(3.57)	(0.03)
Distance of homestead to nearest agro-input shop (km)	4.18	-0.01	4.04	0.04
	(3.74)	(0.10)	(3.61)	(0.10)
Has used quality maize seed on any plot in last season (1=yes)	0.42	-0.04	0.41	-0.02
	(0.49)	(0.03)	(0.49)	(0.03)
Has used the promoted seed (*Bazooka*) on a randomly chosen plot in the last season (1=yes)	0.08	-0.01	0.08	-0.01
	(0.27)	(0.02)	(0.27)	(0.02)
Seed on random plot was obtained from formal seed source (1=yes)	0.32	-0.04	0.28	0.02
	(0.47)	(0.03)	(0.45)	(0.03)
Used seed that is recycled more than 3 seasons on randomly selected plot (1=yes)	0.53	0.02	0.53	0.03
	(0.50)	(0.04)	(0.50)	(0.04)
Maize yields on a randomly chosen plot in last season (kg/acres)	394.85	-0.06	379.59	0.00
	(301.60)	(0.06)	(287.58)	(0.06)

Note: Column (1) reports control group means at baseline (and standard deviations below); column (2) reports the estimate of the intent-to-treat effect of the seed trial packs; column (3) reports the estimate of the intent-to-treat effect of the cooking and tasting demonstrations; column (4) is the interaction effect. Standard errors are below the estimates and are clustered at the level of randomization; **, *, and + denote significance at the 1, 5, and 10% levels. Household size, distance to nearest agro-input shop, and productivity is transformed using the inverse hyperbolic sine transformation (means and standard deviations are in levels).

Table A2: Adoption (pooled)

	control mean	ITT trial pack	control mean	ITT cooking demo	nobs
Adoption Index	0.03	-0.18**	-0.11	0.08	1494
	(0.86)	(0.05)	(0.81)	(0.05)	
Has used seed of an improved variety on any plot in last season† (1=yes)	0.31	-0.13**	0.23	0.04+	1488
	(0.46)	(0.03)	(0.42)	(0.02)	
Has used fresh *Bazooka* on any plot in last season in last season† (1=yes)	0.08	0.02	0.06	0.05**	1495
	(0.27)	(0.02)	(0.25)	(0.02)	
Number of plots planted with improved varieties	0.41	-0.16**	0.30	0.05	1495
	(0.68)	(0.04)	(0.63)	(0.04)	
Number of plots with improved varieties as share of total number of plots	0.29	-0.13**	0.21	0.03	1494
	(0.45)	(0.03)	(0.40)	(0.03)	
Area planted with improved varieties (acres)	0.42	-0.16**	0.32	0.04	1495
	(0.80)	(0.05)	(0.76)	(0.05)	
Area planted with improved varieties as a share of total maize cultivation area	0.30	-0.13**	0.21	0.03	1495
	(0.45)	(0.03)	(0.40)	(0.03)	
Has used *Bazooka* (fresh or recycled) on any plot in last season in last season† (1=yes)	0.14	0.63**	0.44	0.03	1495
	(0.35)	(0.03)	(0.50)	(0.03)	

Note: Column (1) reports control group means at baseline (and standard deviations below); column (2) reports the estimate of the intent-to-treat effect of the seed trial packs; column (3) reports the estimate of the intent-to-treat effect of the cooking and tasting demonstrations; column (4) is the interaction effect. Standard errors are below the estimates and are clustered at the level of randomization; **, *, and + denote significance at the 1, 5, and 10% levels based on sharpened q-values (Benjamini, Krieger, and Yekutieli, 2006). † indicates that baseline outcome was controlled for in the regression.

Table A3: Adoption on random plot (pooled)

	control mean	ITT trial pack	control mean	ITT cooking demo	nobs
Adoption Index	-0.02	-0.09*	-0.09	0.02	1331
	(0.67)	(0.04)	(0.64)	(0.04)	
Has used improved variety on randomly selected plot in last season (yes=1)	0.29	-0.12**	0.21	0.03	1495
	(0.45)	(0.02)	(0.41)	(0.02)	
Has used fresh *Bazooka* on randomly selected plot in last season (yes=1)	0.07	0.01	0.06	0.04*	1495
	(0.25)	(0.01)	(0.23)	(0.01)	
Quantity of improved variety used on randomly selected plot (kg)	1.82	-0.89**	1.36	-0.13	1438
	(3.61)	(0.18)	(3.22)	(0.17)	
Quantity of improved variety used on randomly selected plot (kg/acre)	1.75	-0.78**	1.31	-0.05	1411
	(3.18)	(0.17)	(2.89)	(0.17)	
Maize production (log)	5.43	-0.07	5.33	0.11+	1410
	(1.01)	(0.06)	(0.98)	(0.06)	
Maize productivity (log)	5.66	0.01	5.59	0.13*	1375
	(0.87)	(0.05)	(0.88)	(0.05)	
Has used *Bazooka* (fresh or recycled) on randomly selected plot in last season (yes=1)	0.13	0.60**	0.42	0.03	1495
	(0.34)	(0.03)	(0.49)	(0.03)	

Note: Column (1) reports control group means at baseline (and standard deviations below); column (2) reports the estimate of the intent-to-treat effect of the seed trial packs; column (3) reports the estimate of the intent-to-treat effect of the cooking and tasting demonstrations; column (4) is the interaction effect. Standard errors are below the estimates and are clustered at the level of randomization; **, *, and + denote significance at the 1, 5, and 10% levels based on sharpened q-values (Benjamini, Krieger, and Yekutieli, 2006). All regressions include baseline outcome as control.

Table A4: Use of harvest (pooled)

	control mean	ITT trial pack	control mean	ITT cooking demo	nobs
Use Index	-0.01	0.06	-0.01	0.03	1302
	(0.71)	(0.05)	(0.74)	(0.05)	
Share of maize consumed (%)	75.19	0.63	75.19	-0.72	1449
	(29.93)	(2.11)	(30.32)	(2.10)	
Share of maize sold (%)	21.42	-0.74	21.42	-0.31	1495
	(29.11)	(2.08)	(30.05)	(2.08)	
Share of maize kept for seed (%)	4.74	-0.83	4.74	-0.48	1321
	(8.02)	(0.61)	(8.36)	(0.61)	

Note: Column (1) reports control group means at baseline (and standard deviations below); column (2) reports the estimate of the intent-to-treat effect of the seed trial packs; column (3) reports the estimate of the intent-to-treat effect of the cooking and tasting demonstrations; column (4) is the interaction effect. Standard errors are below the estimates and are clustered at the level of randomization; **, *, and + denote significance at the 1, 5, and 10% levels based on sharpened q-values (Benjamini, Krieger, and Yekutieli, 2006).

Table A5: Impact on women co-head involvement (pooled)

	control mean	ITT trial pack	control mean	ITT cooking demo	nobs
Women's Empowerment Index	-0.09	0.12^{+}	0.03	-0.11	1098
	(1.03)	(0.07)	(0.90)	(0.07)	
Woman involved in decision what to plant (1=yes)	0.82	0.04	0.86	-0.03	1098
	(0.38)	(0.03)	(0.35)	(0.03)	
Women involved in what to do with harvest (1=yes)	0.83	0.05	0.88	-0.04	1098
	(0.37)	(0.03)	(0.33)	(0.03)	

Note: Column (1) reports control group means at baseline (and standard deviations below); column (2) reports the estimate of the intent-to-treat effect of the seed trial packs; column (3) reports the estimate of the intent-to-treat effect of the cooking and tasting demonstrations; column (4) is the interaction effect. Standard errors are below the estimates and are clustered at the level of randomization; **, *, and + denote significance at the 1, 5, and 10% levels based on sharpened q-values (Benjamini, Krieger, and Yekutieli, 2006). All regressions include baseline outcome as control.

Table A6: Knowledge, risk, social learning, and intentions (pooled)

	control mean	ITT trial pack	control mean	ITT cooking demo	nobs
Awareness and Attitudes Index	0.30	0.14**	0.36	0.05+	1156
	(0.36)	(0.03)	(0.38)	(0.03)	
Knows *Bazooka* (yes=1)†	0.69	0.26**	0.79	0.06+	1538
	(0.46)	(0.03)	(0.41)	(0.03)	
Number of improved varieties farmer knows	2.46	0.40**	2.45	0.42**	1532
	(1.48)	(0.12)	(1.46)	(0.12)	
Thinks improved varieties are risky (1=yes)	0.09	0.00	0.08	0.00	1447
	(0.28)	(0.02)	(0.28)	(0.02)	
Thinks *Bazooka* is risky (1=yes)	0.13	0.01	0.14	-0.02	1207
	(0.34)	(0.04)	(0.35)	(0.04)	
Recommended improved varieties to others (1=yes)	0.44	0.29**	0.58	0.02	1538
	(0.50)	(0.04)	(0.49)	(0.04)	
Recommended *Bazooka* to others (1=yes)	0.40	0.38**	0.60	0.06	1260
	(0.49)	(0.04)	(0.49)	(0.04)	
Will use improved varieties in the future (1=yes)	0.80	0.05	0.82	0.01	1461
	(0.40)	(0.03)	(0.38)	(0.03)	
Will use *Bazooka* in the future (1=yes)	0.28	0.16**	0.35	0.02	1503
	(0.45)	(0.04)	(0.48)	(0.04)	

Note: Column (1) reports control group means at baseline (and standard deviations below); column (2) reports the estimate of the intent-to-treat effect of the seed trial packs; column (3) reports the estimate of the intent-to-treat effect of the cooking and tasting demonstrations; column (4) is the interaction effect. Standard errors are below the estimates and are clustered at the level of randomization; **, *, and + denote significance at the 1, 5, and 10% levels based on sharpened q-values (Benjamini, Krieger, and Yekutieli, 2006). † indicates that baseline outcome was used as control in regression.

Table A7: Impact on perceptions of consumption traits of maize grain obtained from improved seed varieties versus maize grain obtained from local seed varieties (pooled)

	control mean	ITT trial pack	control mean	ITT cooking demo	nobs
Consumption Trait Perception Index	0.20	0.23**	0.23	0.20**	1248
	(0.65)	(0.05)	(0.66)	(0.05)	
Improved variety grain tastes better (1=yes)	0.59	0.21**	0.65	0.09**	1424
	(0.49)	(0.04)	(0.48)	(0.04)	
Portions obtained from improved variety grain are larger (1=yes)	0.75	0.10**	0.75	0.10**	1360
	(0.43)	(0.03)	(0.43)	(0.03)	
Improved variety grain had better appearance (1=yes)	0.83	0.05*	0.80	0.09**	1421
	(0.38)	(0.03)	(0.40)	(0.03)	
Improved variety grain is easier to cook (1=yes)	0.64	0.14**	0.65	0.13**	1316
	(0.48)	(0.04)	(0.48)	(0.04)	

Note: Column (1) reports control group means at baseline (and standard deviations below); column (2) reports the estimate of the intent-to-treat effect of the seed trial packs; column (3) reports the estimate of the intent-to-treat effect of the cooking and tasting demonstrations; column (4) is the interaction effect. Standard errors are below the estimates and are clustered at the level of randomization; **, *, and + denote significance at the 1, 5, and 10% levels based on sharpened q-values (Benjamini, Krieger, and Yekutieli, 2006).

Table A8: Impact on perceptions of production traits of improved seed varieties versus local seed (pooled)

	control mean	ITT trial pack	control mean	ITT cooking demo	nobs
Production Trait Perceptions Index	0.04	0.11*	0.09	0.03	1273
	(0.60)	(0.05)	(0.58)	(0.05)	
Improved seed yields more (1=yes)	0.91	0.03	0.92	0.00	1464
	(0.29)	(0.02)	(0.27)	(0.02)	
Improved seed is more restistant to abiotic stresses (1=yes)	0.69	0.06	0.73	-0.03	1336
	(0.46)	(0.04)	(0.44)	(0.04)	
Improved seed is more restistant to biotic stresses (1=yes)	0.53	0.09	0.59	-0.01	1391
	(0.50)	(0.04)	(0.49)	(0.04)	
Improve seed matures faster (1=yes)	0.93	0.01	0.93	0.00	1446
	(0.26)	(0.02)	(0.25)	(0.02)	
Improved seed has higher germination rates (1=yes)	0.80	0.08+	0.82	0.05	1439
	(0.40)	(0.03)	(0.39)	(0.03)	

Note: Column (1) reports control group means at baseline (and standard deviations below); column (2) reports the estimate of the intent-to-treat effect of the seed trial packs; column (3) reports the estimate of the intent-to-treat effect of the cooking and tasting demonstrations; column (4) is the interaction effect. Standard errors are below the estimates and are clustered at the level of randomization; **, *, and + denote significance at the 1, 5, and 10% levels based on sharpened q-values (Benjamini, Krieger, and Yekutieli, 2006).

A2 Well-being and Food Security

This section provides more details on the impact of seed trial packs and the cooking and tasting session on food security and welfare indicators. Results for the fully interacted models are in Table A9, while results for the pooled models are in Table A10.

Judging by the index values, we indeed find no effects from the treatments on overall welfare and food security. The effects on individual indicators broadly tell the same story, showing little in the way of welfare gains. The first two indicators assess subjective measures of relative well-being, both within the village and over time. In particular, we asked if the respondent felt that their household was better off, about the same, or worse off in terms of income and consumption than the average households in the community and create an indicator variable which is equal to one if the respondent answered that they were better off and zero otherwise. Similarly, we asked if the respondent felt that their household was better off, about the same, or worse off in terms of income and consumption than six months earlier and construct an analogous indicator. Approximately 35 percent of farm households report that they perceive themselves as better off compared to the average within their village. There is no significant change in this perception following either the seed trial pack nor the cooking demonstration and tasting session. Additionally, 38 percent of households believe they are better off than they were six months ago—approximately one agricultural season prior. Notably, there is some indication that farmers in the seed trial pack group are more likely to feel that their well-being improved over time compared to those who did not receive a seed trial pack (though the effect does not survive p-value adjustments for multiple hypothesis testing). This may be due to the perceived benefits from planting the seed trial pack, either through real or perceived harvest increases (despite yields not showing a significant increase on average, as detailed in Table 3).

Next, we use two questions from the The Household Food Insecurity Access Scale (HFIAS), including one that aligns with the "food preference" dimension, which assesses whether people had to compromise on their preferred diet due to financial or food constraints, and one that captures "reductions in food quantity", a more severe form of food insecurity where people eat smaller portions or skip meals due to lack of resources (Coates, Swindale, and Bilinsky, 2007).[14] Table A9 shows that 52 percent of households in the control group indicate that in the past month they were always able to eat what they wanted, whereas 61 percent of control households indicate that in the past month they always had the desired quantities of food they wanted. We do not find any impact of the interventions on these outcomes.

Finally, we approximate consumption expenditure by asking farmers to report how much money was spent in the week prior to the survey on 14 of the most consumed items in the area (maize, sorghum, millet, rice, cassava, sweet potatoes, beans, groundnuts, fruits, vegetables, sugar, cooking oil, soap, and

[14] In our analysis, as we want to focus on positive outcomes, we take the inverse and measure food security instead of insecurity.

airtime) and dividing this by the household size. On average, a household in the control group spent about 12234 per capita, which at the time of the survey corresponds to about US$3. We also do not find that our treatments affected per capita consumption expenditure.

Table A9: Welfare and food security

	control mean	ITT trial pack	ITT cooking demo	ITT interaction	nobs
Welfare and Food Security Index	0.01	0.00	-0.08	0.13	1471
	(0.58)	(0.06)	(0.06)	(0.09)	
HH is better off than average of village? (1=yes)	0.35	0.00	-0.02	0.05	1504
	(0.48)	(0.05)	(0.05)	(0.07)	
HH is better off than 6 months ago? (1=yes)	0.38	0.10	-0.05	0.06	1531
	(0.49)	(0.05)	(0.05)	(0.07)	
HH always eat what they want (1=yes)	0.52	-0.07	-0.07	0.21	1538
	(0.50)	(0.07)	(0.07)	(0.10)	
HH can always eat quantity needed (1=yes)	0.61	0.01	-0.10	0.13	1538
	(0.49)	(0.05)	(0.06)	(0.08)	
Consumption expenditure (*1000 UGX/week/capita)	12234	169	-59	-525	1507
	(8603)	(792)	(908)	(1176)	

Note: Column (1) reports control group means at baseline (and standard deviations below); column (2) reports the estimate of the intent-to-treat effect of the seed trial packs; column (3) reports the estimate of the intent-to-treat effect of the cooking and tasting demonstrations; column (4) is the interaction effect. Standard errors are below the estimates and are clustered at the level of randomization; **, *, and + denote significance at the 1, 5, and 10% levels based on sharpened q-values (Benjamini, Krieger, and Yekutieli, 2006).

Table A10: Welfare and food security (pooled)

	control mean	ITT trial pack	control mean	ITT cooking demo	nobs
Welfare and Food Security Index	0.01	0.06	0.01	-0.01	1471
	(0.59)	(0.04)	(0.57)	(0.04)	
HH is better off than average of village (1=yes)	0.35	0.02	0.35	0.00	1504
	(0.47)	(0.03)	(0.48)	(0.03)	
HH is better off than 6 months ago (1=yes)	0.38	0.12**	0.38	-0.02	1531
	(0.48)	(0.03)	(0.50)	(0.03)	
HH can always eat what they want (1=yes)	0.52	0.03	0.52	0.03	1538
	(0.50)	(0.05)	(0.50)	(0.05)	
HH can always eat quantity needed (1=yes)	0.61	0.08	0.61	-0.04	1538
	(0.50)	(0.04)	(0.49)	(0.04)	
Consumption expenditure (*1000 UGX/week)	12233.87	-93.00	12233.87	-320.31	1507
	(8494.61)	(588.00)	(8066.98)	(585.79)	

Note: Column (1) reports control group means at baseline (and standard deviations below); column (2) reports the estimate of the intent-to-treat effect of the seed trial packs; column (3) reports the estimate of the intent-to-treat effect of the cooking and tasting demonstrations; column (4) is the interaction effect. Standard errors are below the estimates and are clustered at the level of randomization; **, *, and + denote significance at the 1, 5, and 10% levels based on sharpened q-values (Benjamini, Krieger, and Yekutieli, 2006).