



2015 Nuru Kenya Agriculture Program Impact Assessment

Results of the Annual Agriculture Harvest Yield Survey

September 2016

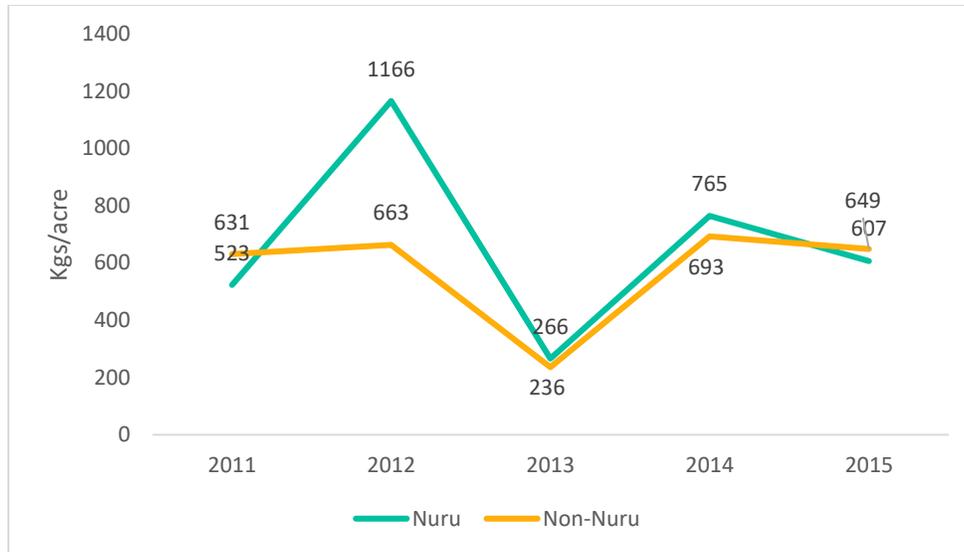
Executive Summary

Nuru Kenya (NK) Agriculture aims to improve crop yield, agriculture profits and household food security by disbursing quality agriculture inputs on loan and providing extension services. Nuru Monitoring and Evaluation (M&E) supports this work by conducting annual evaluations to address the question: ***What is the impact of Nuru Kenya Agriculture on Nuru farmers?***

Overall, 2015 was year with less than optimal impact for NK Agriculture due to poor field staff supervision, poor weather and non-ideal farmer compliance with best agronomic practices. Yield performance was well below the ideal performance benchmark, and similarly results on income generation and food security were below average. This report quantifies and identifies these shortcomings as well as generates recommendations for taking steps to improve programming in coming years.

NK Agriculture slightly increased crop yields in 2015 compared to a non-intervention group and since baseline. However, results were below the ideal target of yield increase and decreased from the previous year. Nuru farmer crop yields increased on average by 15 percent since baseline, from 523 kilograms per acre in 2011 to 607 kilograms per acre in 2015; however, yields per acre for Nuru farmers have dropped by 21 percent since 2014. In comparison to the non-Nuru cohort, Nuru farmer revenues showed a net difference in crop yield of 12 percent. Impact on agricultural income was mixed. With regards to agriculture revenue, Nuru farmers show a 3 percent advantage versus their baseline in 2011. However, 83 percent of sampled Nuru farmers did not repay their Nuru agriculture loan and agriculture profits have decreased by 27 percent since baseline. In terms of food security, Nuru farmers experienced an 11 percent increase in food security over the previous year, although this increase was less than the non-intervention group.

Harvest Yields for Nuru and Non-Nuru Farmers in Kenya



Similar to 2014, NK Agriculture offered a diversified crop package equivalent to one acre of inputs in order to mitigate the risks inherent in mono-cropping strategies. In the 2015 package, Nuru farmers could take out three-fourths of an acre of maize and a quarter acre of either sorghum or millet. All Nuru farmers planted maize and could choose whether they wanted to plant sorghum or millet. For comparability across years, NK M&E uses a crop equivalent yield (CEY) approach to track progress over time — essentially converting the season’s production of sorghum and millet into maize equivalent units.

The reasons behind the decrease in Nuru farmer yields and profits relative to 2014 are complex. A severe El Niño brought delayed rains, unexpected flooding and a late season drought. Additionally, inconsistent quality of training and support from NK Agriculture staff for Nuru farmers magnified the repercussions of these weather challenges. In the end, while a diversified crop package was recommended, most farmers chose to plant only maize during the long rains growing season.

Findings from 2015 indicate that, on average, Nuru farmers have experienced a slight increase in crop yields versus baseline. In contrast with 2014 yields, however, Nuru farmers saw a decrease in yields. Discussions with program staff indicate that this could be related to the weather challenges experienced by Nuru farmers as well as the field supervision challenges on behalf of NK Agriculture staff. Results show that most of the sampled Nuru farmers made enough profit to cover the costs of the input loan, but loan repayment rates were unexpectedly low. Given the current results, however, recommendations for NK M&E and Agriculture to consider are as follows:

1. **Host group discussions with Nuru farmers.** NK Agriculture should seek to isolate the causes behind the lack of adherence to the diversified crop strategy by utilizing group discussion techniques with Nuru farmers about crop preferences and barriers to adopting crop diversification before and during the crop season.
2. **Increase farmer supervision and crop monitoring.** In light of the results, NK Agriculture should also consider increasing supervision and monitoring of farmers throughout the growing season to ensure farmers can maximize their yields at harvest time.
3. **Adopt robust risk management strategies.** Ultimately, farmers are vulnerable to environmental fluctuations; thus, increased staff supervision and support of farmers may not be sufficient in the face of a severe climate incidences. NK Agriculture should explore more robust risk management strategies for Nuru farmers moving forward.
4. **Coordinate scaling plans with study design.** Since measuring attributable impact of NK Agriculture relative to an isolated comparison group has been made an organizational priority, NK Agriculture and M&E should coordinate scaling plans with study design, as it influences the ability to report on such outcomes.
5. **Enhance sustainability.** A low seasonal loan repayment of 44 percent indicates compromised sustainability of the program. Restructuring how farmers interact with Nuru's lending efforts at a fundamental level is a necessary step to address this.

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Introduction

Nuru Monitoring and Evaluation (M&E) produces useful and relevant information that can contribute to key decision-making about Nuru's programs (e.g., whether to continue, replicate and/or scale an intervention). With this focus on utilization at the center of its strategy, the M&E team works to objectively monitor and evaluate the performance and impact of Nuru's four impact programs — Agriculture, Financial Inclusion, Healthcare and Education.

In service to this approach, NK M&E administered a household-level survey in September 2015 that built on a similar data collection in 2011 through 2014 and aimed to answer the question: ***What is the impact of Nuru Kenya Agriculture on Nuru farmers?*** This paper addresses this question, reviews NK M&E's approach in assessing the impact of the program and highlights the findings for crop yields, agriculture profits and food security.

The Integrated Nuru Model

Nuru International is on a mission to end extreme poverty in remote, rural areas. Communities facing extreme poverty deal with fundamental challenges around hunger; an inability to cope with economic shocks; averting preventable disease and death; and illiteracy. Nuru has proven its ability to deliver lasting impact in these four areas in Kenya and is currently positioning its model for global scale.

As a catalyst for sustainable development, Nuru's role is to identify nationals to raise up as servant leaders and nation builders; remove barriers preventing them from realizing their full potential; equip them with skills, resources and attitudes to end extreme poverty in their region; and build social enterprises to provide a reliable, market-based source of capital.

By establishing community development organizations that are locally-led and also launching social enterprises to fund the work, Nuru enables nationals to lift communities out of extreme poverty within seven years.

Nuru Kenya Agriculture

NK Agriculture provides farmers with a complete agricultural package: an in-kind agriculture loan, technical training, extension services and group support structures. Throughout the growing season specifically, farmers receive technical assistance from experienced NK Agriculture field officers as well as periodic farm visits to ensure they are able to follow the most appropriate agronomic practices. Moreover, Nuru farmers can leverage both the knowledge and labor of their peers via a farming support group. At harvest time, farmers finish repaying their loans and commercialize their surplus produce with the assistance of Nuru Kenya. Additionally, in relation to the integrated Nuru

model, farmers who participate in NK Financial Inclusion are also encouraged to deposit savings from crop sales into group savings accounts.

Due to low yields in 2013 resulting from drought, NK Agriculture shifted from a mono-cropping strategy to a diversified crop strategy in 2014 and decided to continue with this strategy in 2015. During the 2015 long rains (LR) season, NK Agriculture offered a diversified loan package for the production of 0.75 acres of maize and 0.25 acres of either brown sorghum or finger millet. The inputs included improved hybrid seed for each of these crops as well as planting fertilizer (DAP) and top-dressing fertilizer (CAN).

Planting a variety of crops insulates farmers from climate, pest and disease related risks. In Kenya, where periodic drought is commonplace and Maize Lethal Necrosis Disease (MLND) has threatened maize cultivation nationwide since 2011, crop diversification is an indispensable part of a prudent agricultural investment for NK and smallholder farmers alike. However, the crop diversification strategy is not without its drawbacks and challenges, foremost of which is changing behavior of smallholder farmers to invest in crops besides maize and to adopt other resilience-building strategies.

Methodology

The following section outlines the 2015 methodology for selecting the sample population to assess the three core indicators of NK Agriculture related to crop yield, agriculture profits and food security.

Sampling Frame

In 2015, NK Agriculture worked with approximately 6,738 Nuru farmers in Kuria West and Migori districts. See Figure 1 (below) for the location of Nuru farmers.

Figure 1: Map of Kuria West, Kuria East¹ and Migori in Migori County, Nyanza Province, Kenya



Firstly, for data collected on household food security in May and June of 2015, NK M&E stratified the population by new and returning Nuru farmers and by sublocation: 563 new Nuru farmers and 425 returning Nuru farmers were selected for a total of 988 Nuru farmers (Table 1). However, during survey implementation, NK M&E ran into significant challenges with locating farmers. It then discovered that residency records in Salesforce, NK's cloud database, were incorrect. Therefore, in order to correct for systematic biases, NK M&E later reselected a new random sample equivalent to 90 percent of each cohort. During analysis, data from 507 new Nuru farmers and 382 returning Nuru farmers were utilized to report results on household food security. These sample sizes are still above the minimum threshold needed for a representative random sample.

Based on the challenges with data collection in May and June of 2015, NK M&E did not stratify by sublocation for the collection of harvest yield and agriculture profits. Rather, new and returning Nuru farmers were randomly and proportionally selected from separate lists of new and returning Nuru farmers who took out an agriculture loan in 2015 (Table 1). In contrast with previous years, NK M&E

¹ Kuria East is the new administrative scaling district for 2016.

cannot disaggregate data by sub-locations in Kuria West and Migori districts because of this sampling strategy. In total, NK M&E administered the harvest yield survey to 893 Nuru farmers and 364 farmers in the comparison group. One Nuru farmer observation was excluded due to data error.

Data Collection

NK M&E conducted two separate surveys on Nuru farmers in 2015. Data on food security were collected during the hunger season (May to June) and data on crop yields and agriculture profits were gathered during the LR harvest. A third survey was conducted in 2016 on a comparison group of non-Nuru farmers. Details surrounding the specific dates and number of enumerators employed for data collection can be found below in Tables 1 and 2.

Table 1: Harvest Yield Survey Timeline and Sample Sizes

Survey group	Training dates	Number of enumerators	Survey collection dates	Data entry and quality control	Final Sample Size
Nuru farmers	Aug 8- Sep 9, 2015	22	Sep 7-16, 2015	--	892
Non-Nuru farmers	Feb 15-18, 2016	15	Feb 22- Mar 11, 2016	Feb 23- Mar 12, 2016	364

Table 2: Household Hunger Survey Timeline and Sample Sizes

Survey group	Training dates	Number of enumerators	Survey collection dates	Data entry and quality control	Final Sample Size
New and returning Nuru farmers	May 5-15, 2015	41	May 18- Jun 6, 2015	May 19- Jun 25, 2015	New: 507 Returning: 382

As implemented in 2014, NK M&E again implemented a system of tight data quality controls. First, each individual survey was reviewed three separate times before final entry in a process of checking, coding and scoring. Throughout this process, data entry clerks highlighted systematic data collection errors so that supervisors could correct any field mistakes in real time. Second, surveys were randomly selected for a question-by-question comparison versus the data entry. As a final measure, NK M&E randomly called survey respondents from the list of households visited by each enumerator. Conversations with farmers helped NK M&E to understand if enumerators had accurately recorded the farmers' responses. Consistently poor data collection or data entry resulted in employee

termination. Given the system employed by NK M&E, the 2015 season resulted in a limited number of firings as well as minimal outliers.

Methodologies

The sections below describe the various methodologies utilized to measure increase in crop yields and agriculture profits over time as well as farmers' perception of household food security.

Approach to Calculating Crop Equivalent Yield

Since NK Agriculture switched from a maize only loan package to a diversified loan package in 2014, NK M&E began calculating crop equivalent yields. Under the previous mono-cropping strategy, the evaluation methodology compared maize yields between Nuru and non-Nuru farmers, making comparisons straightforward. However, the diversified crop strategy introduces two additional crops to evaluate (brown sorghum and finger millet) and thus complicates the methodology. For purposes of comparability across Nuru and non-Nuru farmers and versus baseline, NK Agriculture and M&E developed one composite picture of crop performance: Crop Equivalent Yield (CEY).

The CEY calculation utilized by NK M&E converts the performance of select crops into one standard unit of maize kilograms per acre. This is done using the farm gate prices per kilogram of brown sorghum, finger millet and maize. Finally, NK M&E transforms all crops into maize via the price ratios of sorghum or millet versus maize. One way to interpret this calculation is to ask: ***If farmers only grew maize this season, how much maize would they have produced?*** While on average, absolute yields per acre of sorghum and millet are lower than maize, the farm gate value per kilogram of these crops tends to be higher. Ultimately, if Nuru farmers successfully plant maize and either sorghum or millet, the overall value of their production after the LR harvest should be *higher* than if they relied on a mono-cropping strategy. Thus, the CEY formula is optimal for demonstrating the value add of a diversified crop approach.

Approach to Calculating Agricultural Profits

In 2012, M&E adopted a methodology known as gross marginal analysis to determine the overall agricultural profits generated by Nuru farmers.² In gross marginal analysis, costs for Nuru farmers are represented by the total amount of Kenyan Shillings spent on the NK Agriculture loan.³ NK M&E then calculates revenue via multiplying average crop equivalent yield per acre by the farm gate price of the particular crop. Finally, to calculate agriculture profits, loan costs are subtracted from

² This methodology is used by other organizations including One Acre Fund.

³ Gross Marginal Analysis Tools. Retrieved from <http://dpiwwe.tas.gov.au/agriculture/investing-in-irrigation/farm-business-planning-tools> on 18 November 2014.

revenue.⁴ For comparison group farmers, NK M&E collects cost-related farming data equivalent to an NK Agriculture loan. Calculations for revenue and profits are generated for the non-intervention group and then agriculture profits are compared between the two groups.

Approach to Calculating Food Security (Household Hunger Scale)

The Household Hunger Scale (HHS) is an evaluative tool designed by Food and Nutrition Technical Assistance Project (FANTA) and USAID in 2011. Its main purpose is to provide an assessment of hunger that can be utilized and compared across cultures. The HHS authors recommend applying the tool during or directly after the worst of the lean (hunger) season in order to measure the prevalence of food deprivation. For comparison purposes, the survey is then implemented at the same time each year to measure household food insecurity between years. As mentioned in previous sections, NK M&E implements the HHS tool during May and June, when Nuru farmers suffer from food insecurity. Essentially, farmers harvest in September and January and sometimes, depending on the size of their surplus yields and other sources of profits, a food gap may occur in the following months. NK M&E implements the tool during the hunger season to understand how the previous harvest affects farmers' perceptions of food security. In order to analyze the relationship between food security and crop yields, food security data is collected the year after the yields data.

In relation to the varying domains of household food access, the HHS focuses on the quantity of food available to a family. Specifically, the tool includes a series of six questions geared toward understanding household food supply, food consumption and the physical repercussions of a lack of food.⁵ Depending on the household's perception of the occurrence and frequency of insufficient food supply, NK M&E classifies households into two categories: food secure or experiencing low to severe hunger.

Results

Overall results in terms of crop yield, income and food insecurity were below benchmarks for program performance, indicating corrective actions need to be taken. At continuation, the results demonstrate how Nuru farmers stacked up against comparison non-intervention farmers.

2015 Crop Equivalent Yield (CEY) Results

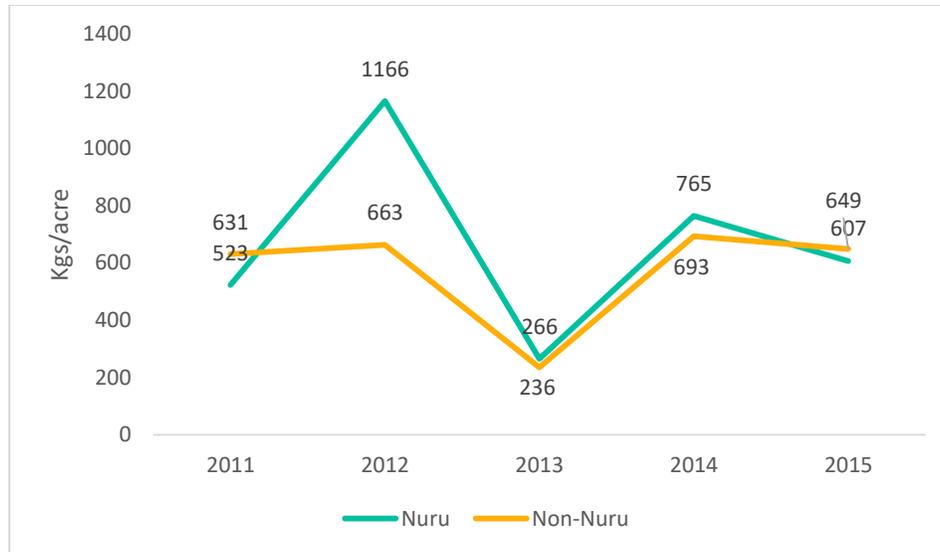
The 2015 findings do not demonstrate a significant difference in CEY kilograms per acre yields between Nuru farmers and those in the comparison cohort. Relative to baseline data, however, Nuru farmers increased yields by 15 percent, from 523 maize kilograms per acre to 607 CEY kilograms per

⁴ Gross marginal analysis excludes opportunity and labor costs.

⁵ FANTA 2. "Introducing a Simple Measure of Household Hunger for Cross-Cultural Use." Technical Note No. 12, February 2011.

acre. Relative to 2014 yields, however, Nuru farmer harvests dropped by 21 percent, from 765 CEY kilograms per acre in 2014 to 607 CEY kilograms per acre in 2015.

Figure 2: Harvest Yields for Nuru and Non-Nuru Farmers



In terms of the diversified crop package, most farmers did not plant millet or sorghum during the 2015 LR season. The low percentage of crop diversification could have resulted in similar CEY and maize only yields.

These results, however cannot be interpreted without contextualizing the 2015 LR season, which brought several environmental aberrations. Firstly, the LR season began with a shortened planting window for Nuru farmers in Kuria West and Migori districts. If farmers missed the first but brief planting period (which is especially important for sorghum and millet), they could no longer be guaranteed a successful sorghum or millet harvest at the end of the LR 2015 season. Secondly, toward the end of the 2015 LR season, drought plagued farmers' fields; in particular, this drought would have been most harmful to farmers who missed the first (but brief) planting window for maize during the LR season. Finally, farmers in certain areas also suffered from floods which may have further impeded their chances of a productive 2015 LR harvest. Despite environmental challenges, one cannot discount the important NK Agriculture staff play in helping farmers mitigate mild shocks. Through extension services, field staff can improve the way they work to encourage farmers to plant at the first signs of rainy season onset and/or advise those farmers prone to flooding to plant elsewhere.

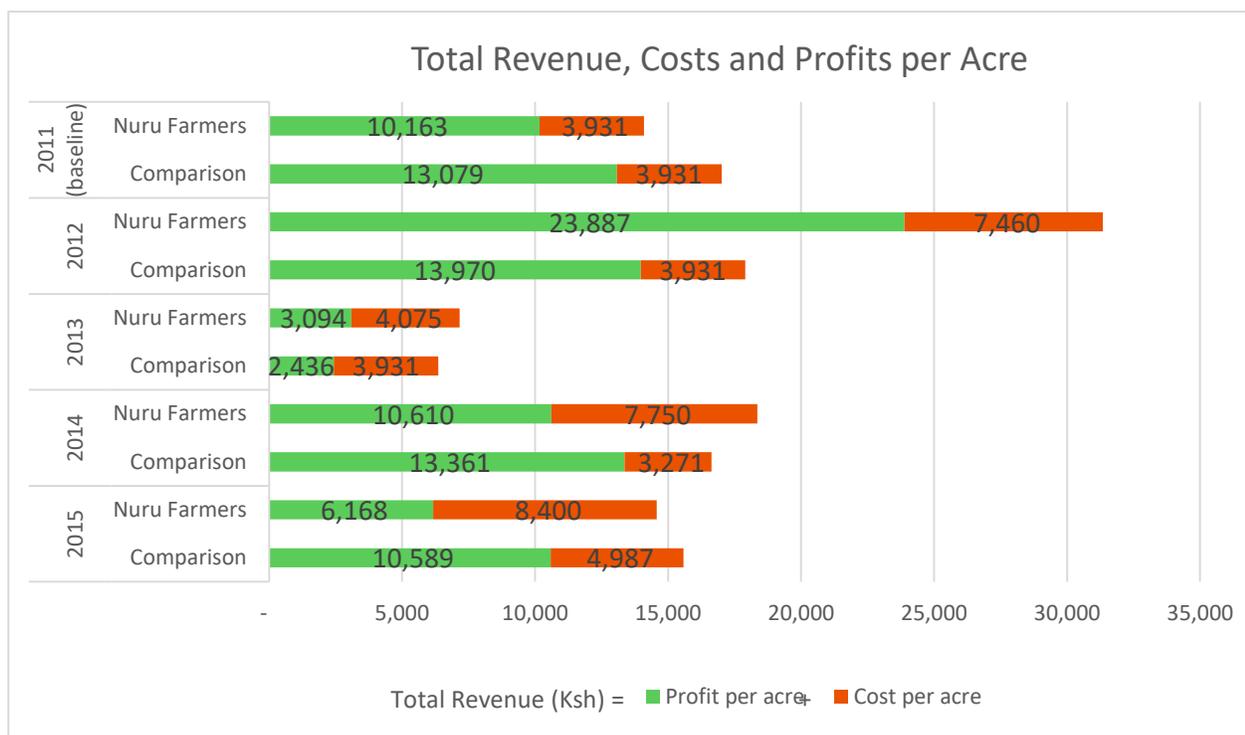
In addition, most farmers planted only maize during the LR season. Only 31 percent of sampled farmers diversified their crops. This adoption is similar to the 2014 season in which the uptake for crop diversification was 30 percent. Furthermore, other factors may have influenced farmers' 2015 yields. At the end of Q4 2015, NK Agriculture loan repayment rate reached 44 percent — a historical low for NK Agriculture. Notably, however, Nuru farmers on average were able to generate enough

revenue to repay their loans. The low repayment rate suggests a need to further examine the behavior and circumstances of Nuru farmers in relation to Nuru programming. Trends in the 2015 harvest yield data collected by NK M&E also show farmers who repaid at least 75 percent of their loan in Q4 had higher CEY per acre than those who paid less than this amount. While NK M&E did not design a study to test for statistical differences in yields according to loan repayment, Nuru farmers who repaid most of their loan harvested 285 more kilograms per acre than Nuru farmers who did not repay a majority of their loan.

Results of Agricultural Profits Calculation

Due to low yields during the 2015 season, preliminary agriculture revenue and profits have not shown significant shifts since baseline. Nuru farmers on average make 3 percent more in revenue versus baseline whereas profits dropped 27 percent during the same time period. In other words, despite low repayment rates, Nuru farmers made enough to repay their loans. On average, farmers earned 14,568 KSh in revenue. Loans for one acre of production cost 8,400 KSh. As the data show, however, Nuru farmers did not make as much profit in comparison with baseline. Currently, Nuru farmers spend 82 percent more on the quality inputs NK Agriculture offers versus the amount spent prior to engaging with Nuru. Ultimately, the difference in input prices should be offset by higher yields that normally accompany improved agricultural inputs and techniques, but results show this was not the case in 2015. Table 3 outlines the revenues, costs and profits for Nuru and non-Nuru farmers during the baseline year (2011) and most recent harvest year (2015).

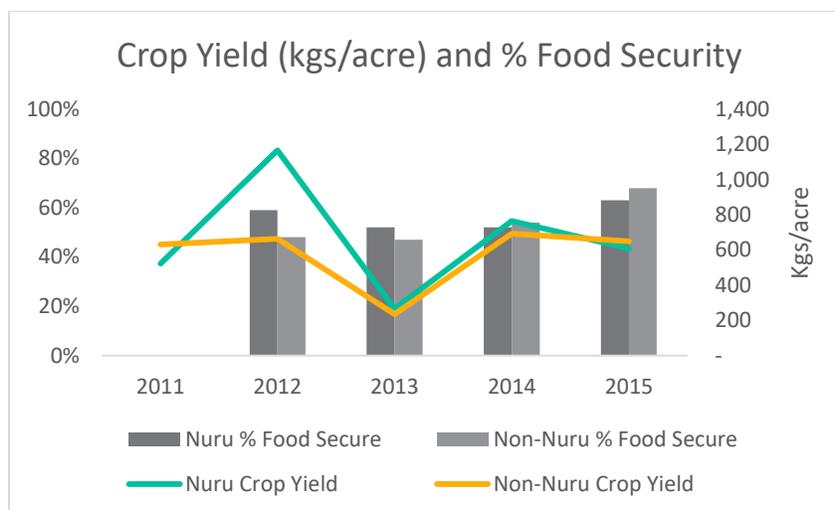
Table 3: Net Profit of Nuru and Non-Nuru Farmers for 2015 Compared to Baseline Calculations



Household Food Security

Based on data collected from the Household Hunger Scale (Figure 3) during the 2015 lean season, both Nuru and non-Nuru farmers show increased levels of food security with 63 percent of Nuru and 68 percent of non-Nuru farmers reporting being food secure. Since these data were collected in May and June of 2015, they represent the impact of the 2014 LR harvests. Figure 3 shows that despite decreased crop yields in 2015, both Nuru and non-Nuru farmers' food security improved. Nuru farmers experienced a 21 percent decrease in yield since 2014, but saw an 11 percent increase in food security. Non-Nuru farmers saw a 6 percent decrease in yield, but a 14 percent increase in food security.

Figure 3: Household Food Security and Harvest Yields 2011-2015



Limitations

Several limitations must be considered when reflecting on the analyses presented above. First, the method of collecting the 2011 baseline yields may have introduced bias into the dataset, as farmers were asked to recall their 2011 harvest yields one year later in 2012. Comparison group data were collected in January 2016 which is longer than the recommended recall time of four weeks for accuracy.⁶ Anything beyond this window may be subject to recall bias.

Secondly, incorrect cloud database records of Nuru farmers limited the sample design and the conclusions NK M&E could make about crop yields and hunger data in the various Nuru farmer communities for 2015. In 2014, NK M&E was able to isolate differences between different administrative divisions as well as connect lower yields in certain areas to higher prevalence of Maize Lethal Necrosis Disease. In contrast, conclusions cannot be made about the subsets of farmers within the Nuru farmer population for 2015.

Additionally, during the first week of the harvest yield survey, reports came back from the field of Nuru farmers misrepresenting their crop yields. While these claims cannot be objectively verified, it is possible that farmers might have misrepresented their yields to NK M&E in hopes of benefiting from potential NK Agriculture loan discounting. To correct for this potential problem, NK M&E invited NK Agriculture field staff to be present during the portion of the survey when farmers report yields. Since concerns were only raised during the first several days of survey implementation, NK

⁶ Verma, V., T. Marchant, C. Scott. 1988 Evaluation of Crop Cut Methods and Farmer Reports for Estimating Crop Production: Results of a Methodological Study in Five African Countries, London: Longacre Agricultural Development Centre Ltd. <http://www.ifpri.org/sites/default/files/publications/ifpridp01097.pdf>.

M&E believes that no overarching systematic biases are present in the dataset. Moving forward, NK M&E will always invite NK Agriculture staff to be present for the yield recall portion of the agriculture survey.

Conclusions and Recommendations

Overall, 2015 was year with less than optimal impact for NK Agriculture due to poor field staff supervision, poor weather and non-ideal farmer compliance with best agronomic practices. Yield performance was well below the ideal performance benchmark, and similarly results on income generation and food security were below average. This report quantifies and identifies these shortcomings as well as generates recommendations for taking steps to improve programming in coming years.

In conclusion, Nuru farmers have shown slight improvements in crop yields since baseline in 2011, although many challenges exist with the diversified crop strategy as most farmers opted to plant only maize in 2015 for reasons both beyond and within the control of NK Agriculture. While loan repayment remains at less than 50 percent for Nuru farmers, the farmers who repaid most of their loans demonstrate higher crop yields per acre in comparison with Nuru farmers who repaid less than 75 percent of their loan. Moreover, while Nuru farmers generated enough revenue to repay their loans theoretically, agriculture profits since baseline has dropped by 27 percent. In terms of household food security, however, no differences between new and returning farmers have been detected across years since baseline.

Recommendations for NK M&E and Agriculture to consider as a result of these findings are as follows:

1. **Host group discussions with Nuru farmers.** NK Agriculture should seek to isolate the causes behind the lack of adherence to the diversified crop strategy by utilizing group discussion techniques with Nuru farmers about crop preferences and barriers to adopting crop diversification before and during the crop season.
2. **Increase farmer supervision and crop monitoring.** In light of the results, NK Agriculture should also consider increasing supervision and monitoring of farmers throughout the growing season to ensure farmers can maximize their yields at harvest time.
3. **Adopt robust risk management strategies.** Ultimately, farmers are vulnerable to environmental fluctuations; thus, increased staff supervision and support of farmers may not be sufficient in the face of a severe climate incidences. NK Agriculture should explore more robust risk management strategies for Nuru farmers moving forward.
4. **Coordinate scaling plans with study design.** Since measuring attributable impact of NK Agriculture relative to an isolated comparison group has been made an organizational

priority, NK Agriculture and M&E should coordinate scaling plans with study design, as it influences the ability to report on such outcomes.

5. **Enhance sustainability.** A low seasonal loan repayment of 44 percent indicates compromised sustainability of the program. Restructuring how farmers interact with Nuru's lending efforts at a fundamental level is a necessary step to address this.