POST-HARVEST DIALOGUES ENGAGE FARMERS PARTICIPATING WITHIN THE ON-FARM EXPERIMENTATION PROCESS
#9687

Ivan S. Adolwa[1], Simon Cook[2], Thomas Oberthür[3], Steve Phillips[3], Thérèse Agneroh[4], Kokou A. Amouzou[4], and Gavin Sulewski[3]
[1]APNI, Nairobi, Kenya; [2]Curtin and Murdoch Universities, Perth Australia; [3]APNI, Benguérir, Morocco; [4]APNI, Yamoussoukro, Côte d'Ivoire
e-mail: i.adolwa@ apni.net; tel: 254 205143614

ABSTRACT

Initiated in 2021, APNI's on-farm experimentation project called NUTCAT, or the NUTtrient CATalyzed Agricultural Transformation project is uniquely poised to implement a change process anchored on scalable behavioral change that is supported by agronomic insights and validated by data. The experimental design adopted divided smallholder fields into an Optimized treatment (OT) initially defined by local cropping system experts and a Farmer practice (FP) treatment. A total of 268 sites were established in seven African countries. By design, a continuous cycle of open engagement with farmers is key component of this farmer-centric research due to its ability to generate a variety of co-leaning opportunities while encouraging participation amongst farmers and other stakeholders. The post-harvest dialogue settings adopted within NUTCAT prove to be an effective mechanism to ensure the viewpoint of participating farmers is fully considered as nutrient management strategies evolve and become co-generated amongst stakeholders to be locally appropriate.

INTRODUCTION

The NUTCAT project is APNI's flagship project for co-design, co-development, and delivery of relevant precision nutrient management (PNM) innovations for cereal-based cropping systems in Africa. The project's objectives include: 1) improvement of cereal system production using precision nutrient management (PNM), 2) evaluation of grain yield potential and spatial variation in smallholder agriculture using remote sensing, and 3) promotion of farmer-centric innovation and co-learning through **On-Farm Experimentation (OFE)**.

The OFE process for the NUTCAT project follows several steps or activities (**Fig. 1**). It starts with engagement, whereby cooperating farmers and experimental sites are identified. Acquisition of agronomic (yield, biomass), spectral (Sentinel 2 data) and socio-economic data are all important parts of this step.

To acquire agronomic data the project uses a simple experimental design wherein smallholder farm-scale plots (2 ha or less) are divided into an Optimized treatment (OT) and a Farmer practice (FP) treatment. The OT is defined by a team of local cropping system experts [i.e., the Cereal Improvement Team (CIT)], as the combination of practices and inputs required to produce an attainable yield target specific to the agro-ecological zone (AEZ) within the country. The FP treatment mirrors the practices and inputs the farmer was planning to apply that season. To date, about 268 trial sites have been established in seven countries across Africa (**Fig. 2**).

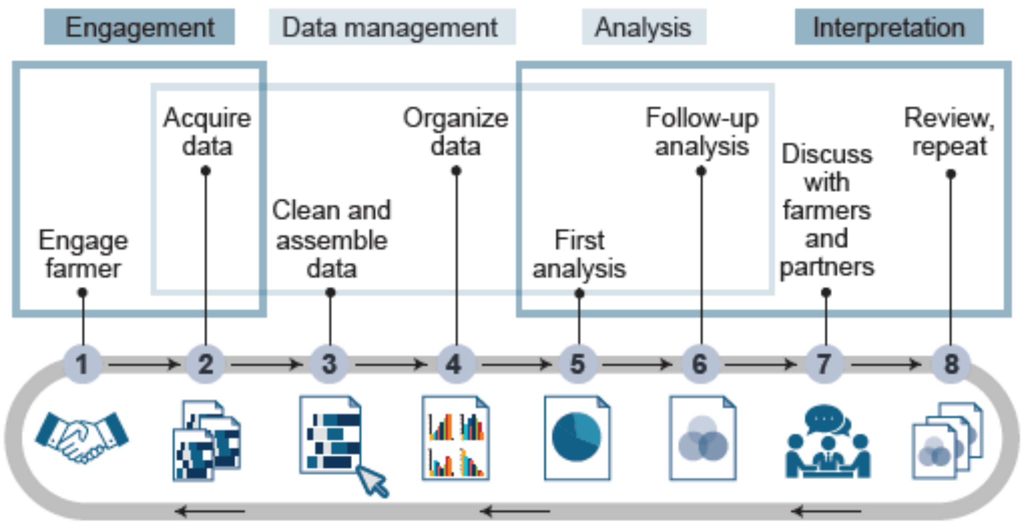


Fig. 1. The OFE process for NUTCAT (adapted from Lacoste et al., 2021).

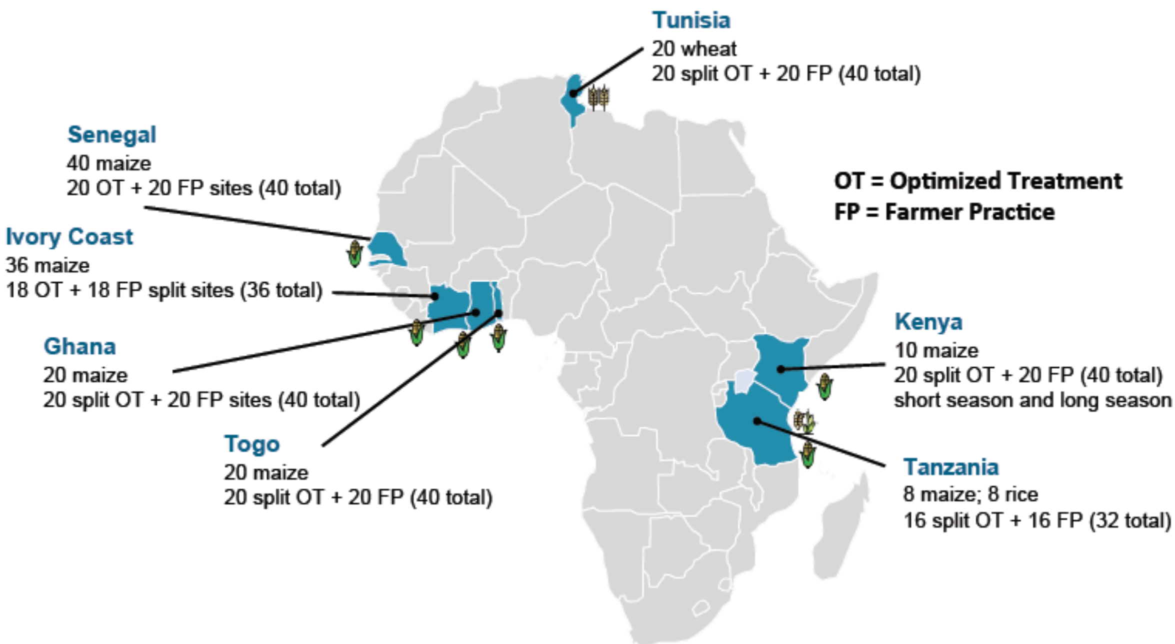


Fig. 2. NUTCAT field site locations (268) during the 2021/2022 experimental season.

Co-learning via post-harvest dialogue

Open engagement with farmers is, by design, a key plank of the OFE platform. It seeks a co-learning environment that encourages farmer participation in landscape-scale research while providing a means to better understand the learning, decision-making and management change processes of farmers themselves. Such engagement is the goal of the **post-harvest dialogue (PHD) workshop**, which after the steps of data collection and analysis, provides a setting to share inferences made from the results achieved. The open discussion sheds light on what worked best in farmers' fields. Supporting technical and scientific advice is also sought from other project stakeholders including regional extension staff, agronomists, and APNI scientists. NUTCAT trial sites in northern Côte d'Ivoire and Kenya provide examples from contrasting biophysical, cropping, and socio-cultural patterns. For instance, northern Côte d'Ivoire has a uni-modal rainfall pattern (one cropping season) representative of the cereal-root crop mixed farming system of West and Central

Africa. Kenya's bimodal pattern (two cropping seasons per year) is typical of the maize mixed farming systems found in East, Central and Southern Africa. However, maize is the main cereal crop for both regions, and it is grown in association with legumes, root crops and cotton in intercrop, rotation, or relay sequences.

PHD workshops for these regions gathered participating farmers as well as neighboring farmers who gained interest in the activities they observed throughout the season. Focus group discussions and in-depth interview approaches were supported by evidence drawn from agronomic and remote sensing data. Farmer engagement with extension specialists, agronomists and other agricultural stakeholders provided an opportunity to share observations and lessons learned, initiate plans for next season's plantings, and fine-tune the optimized treatment (OT) packages.

Innovation awareness and learning

The workshops uncovered a good level of awareness amongst NUTCAT farmers about cropping systems innovations such as planting in rows, recommended spacing, weed control, pest control, and fertilizer use according to the 4R Nutrient Stewardship framework.

Each workshop made it apparent that much peer-to-peer (social) learning is already taking place within the study areas. Non-NUTCAT farmers learned about good agronomic practices (GAP) from NUTCAT farmers and attained better yields after applying the acquired knowledge. There is also clear evidence of didactic learning through NUTCAT and other projects where APNI has been an original source of GAP and 4R Nutrient Stewardship practices. Tracking how these two types of learning (social vs. didactic) are evolving is important. The PHDs provided a participatory platform to explore the role of data (digital and spatial) in accelerating such learning and making it scalable.

Management change

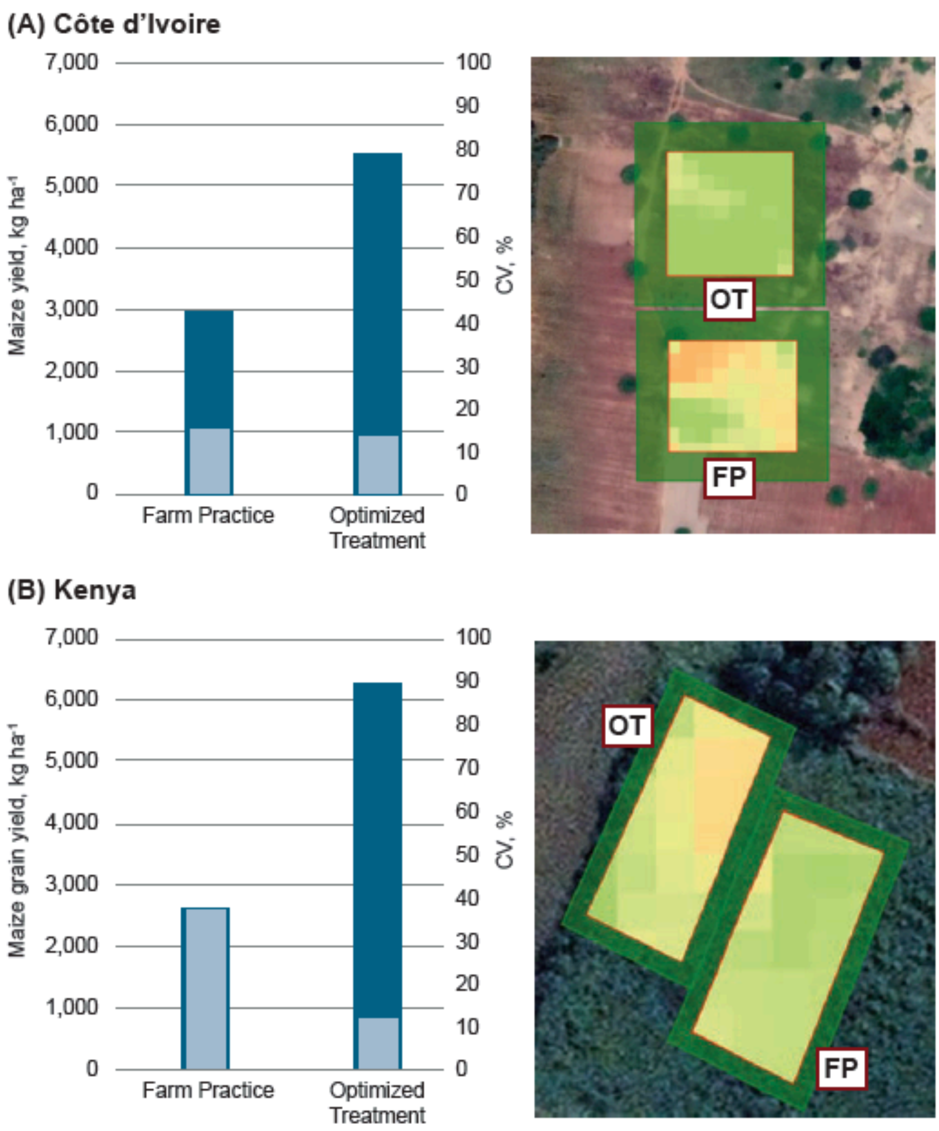
Dialogues helped unravel the different perspectives farmers have about variability within their fields (FP) and between fields (OT vs FP). They were also critical in deciphering some of the confounding issues arising from the data analysis including:

Why in some cases were yields so similar for the FP and OT?

As an example, Mr. Ouattara Adama, a farmer in Côte d'Ivoire, harvested three-fold the amount he usually gets on larger farm sizes from his 1 ha FP field after applying the full technological package he had observed in the adjacent OT field. This points to a move towards gradual agricultural intensification, which apart from being an effective risk-reduction strategy is highly relevant in the context of rising input costs (Bonilla-Cedrez et al. 2021; Hassen and El Bilali 2022).

Why did OT yields fail to meet the set targets?

Two cases were apparent in eastern Kenya where OT and FP yields were similar, most probably due to the combined use of inorganic and organic fertilizer in the FPs. Under the conditions of an erratic rainfall regime during the short-rain season of 2021/2022, poor grain yield performance was avoided through the synergistic effects of combining mineral fertilizers and organic manures rather than reliance on mineral fertilizers alone (Mucheru-Muna et al. 2014; Mugwe et al. 2009). Given that the yield target of 7.5 t ha^{-1} was not met for the Kenyan OT treatments this was an important insight for the Kenyan CIT, which now proposes the additional application of manure at 5 t ha^{-1} in all OT plots.



Agronomic and remotely sensed results from one site in Côte d'Ivoire (A) and Kenya (B).

Why was there very little divergence between FP and OT spectral data for the entire season?

Strong spectral signatures (NDVI, NIR, SWIR) were observed from both OT and FP fields, but there was little correlation between these signatures and yield. The confoundingly strong NDVI signatures of FP plots could have been due to weed pressure as the signatures do not distinguish between different plant species. Based on remotely-sensed imageries and their own observation, farmers recognized within-field variability of their fields, which according to them is driven by several factors. In Kenya, intercropping or mixed cropping, weed infestation (Striga), shading effects of trees, and type of germplasm used were mentioned as drivers of variability. For both countries, management aspects (e.g., manure application, herbicide use) and edaphic factors were critical.

All NUTCAT farmers expressed an intention to change their current practices in the coming season. This shift in attitude was based on the learning received from different channels and better yield performance of the OT. Most aim to adopt key elements of the 4Rs such as improved fertilizer placement and split application. Increased emphasis on recommended plant spacings, herbicide use, armyworm control, use of hybrid maize seed was noted. In Kenya, some farmers will employ practices that were not previously part of the OT package such as manure or compost application.

The next steps

Going forward, a critical step involves monitoring of how farmers implement change within their fields. In addition, a pattern of both peer-to-peer and didactic learning is emerging, which suggests the potential for enhanced social learning among farmers or farmer associations through the agency of the CIT. Therefore, the project has developed a management change and learning tracking tool, which is modelled on the Social Behavior Approach (SBA) adopted by the Catholic Relief Services (CRS, 2021). This tool is further fine-tuned using a Competency Model Approach to help us unravel learning through a skills competence assessment (CRS, 2021). Hence, the tool instils skills competency within a continuous learning and innovation cycle. This tool will be deployed to farmers at three to four key stages in the next cropping season. Similarly, a scouting protocol is in place to monitor weed and pest pressure, crop establishment, and other observations as a complement to existing data to help in explaining confounding issues.

The next steps in the OFE process entail the tracking and documentation of farmer learning and experimentation as they engage in the change process. This will be a basis for further interactions with relevant partners to capitalize the OFE process through identification of value, development of scalable business models that show how partners can invest, measuring outcomes (expected and unanticipated) and the sustained building of the process.

REFERENCES

Bonilla-Cedrez, C., Chamberlin, J., Hijmans, R.J. 2021. Fertilizer and grain prices constrain food production in sub-Saharan Africa. Nat. Food 2, 766-772

Hassen, T.B., El Bilali, H. 2022. Impacts of the Russia-Ukraine war on global food security: Towards more sustainable and resilient food systems? Foods 11, 2301. 38.

Catholic Relief Services (CRS). 2021. SMART Skills Competency Model. Baltimore: CRS. https://asa.crs.org/recursos/smart-skills-competency-model

Lacoste, M., et al. 2021. On-Farm Experimentation to transform global agriculture. Nature Food 3, 11-18.

Mucheru-Muna, M, et al. 2014. Enhancing maize productivity and profitability using organic inputs and mineral fertilizer in central Kenya small-hold farms. Exp. Agric. 50(2), 250-269.

Mugwe, J., et al. 2009. Maize yields response to application of organic and inorganic input under on-station and on-farm experiments in central Kenya. Exp. Agric. 45(1), 47-59.