AgResults Learning Brief #2:
Results and Initial Observations from the Vietnam Pilot's First Cropping Season

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Background

The Vietnam Greenhouse Gas (GHG) Emissions Reduction Pilot tests the assumption that AgResults can incentivize private sector enterprises to overcome a market failure in the way that most smallholder producers grow rice. Specifically, we are assessing whether we can incentivize rice producers, fertilizer producers, input suppliers, and other actors in the paddy rice value chain, to test and scale improved rice growing technologies and practices that increase yields and decrease GHG emissions. In 2017, we held an open request for applications from interested private sector enterprises and accepted 11 into the contest.

The pilot runs over two phases. Phase I, which began in the summer of 2017, will occur over two rice cropping seasons, during which accepted organizations are testing their technologies. Phase II, which begins in the spring of 2019, consists of four consecutive cropping seasons during which organizations who have proven their technology in Phase I, will attempt to scale that technology to the greatest number of smallholder farmers. Both phases include interim prizes, awarded proportionally based on the results after each growing season, and grand prizes based on aggregate results over all seasons of that phase.

The first rice-cropping season of the AgResults Vietnam GHG Emissions Reduction Pilot is over, and the results are encouraging: out of 11 implementers accepted into the contest, nine received a proportion of the first interim prize, which totaled $55,000.

Figure 2: Taking Yield Measurements

Figure 1: Implementer Field at Harvest

During the season, which ran from June through November 2017, our pilot verifier Applied GeoSolutions (AGS), along with its local partner Institute for Agricultural Environment (IAE), collected rice crop growth and GHG emission data for all 11 implementer and control sites in the Thai Binh province. During the harvest period in October and November, IAE collected and analyzed yields for all 22 fields. IAE also analyzed all GHG emissions data to determine total methane (CH_4) and nitrous oxide (N_20) emissions. Using that data, AGS ran analyses to determine the mean yield for each site as well as carbon dioxide equivalent (CO2e) emissions during the entire growing period from sowing to harvest.

Calculating Crop 1 Results: Yields

To derive yields, IAE, observed by the pilot manager SNV, took five 4m² samples from each field, choosing areas that best represented the condition of the field at harvest. IAE carefully weighed fresh yield and then, after appropriate drying to achieve ideal moisture content, weighed it again to determine average dry yield for each field. Using this process, we determined that while nine implementers increased yields against the baseline, two implementers did not improve on their baseline and thus were ineligible for a proportion of the prize. This data supports agronomic observations of these two fields during the course of the harvest period.

The yield metric for the final scores is based on percentage increase above the baseline yield. However, during the season there was some slight but significant variability in control plot management. In some cases, irregular rains and inability to drain impeded timely fertilizer application or drainage. To adjust for this variability, we applied a formula of

$$\%yieldchange = 0.2\left(\frac{I}{C_v}\right) + 0.8\left(\frac{I}{C_s}\right)$$

where I is the mean site-specific yield of the implementer field, C_v is the mean variety-specific yield for control fields of all solvers using the same rice variety, and C_s is the mean site-specific yield of the control field.

In other words, for the crop yield metric, we used the percent increase above baseline for each implementer as 80% of their score, with the final 20% using an average percent change above all control plots that used the same variety for that implementer's control plot. This slight adjustment helped alleviate the inconsistencies that may have driven some yields to be slightly higher or lower than expected for certain control plots, and thus unfairly influence certain implementer's final yield scores. We will consult with the pilot's advisory council to ascertain the need for this adjustment in crop 2.

Calculating Crop 1 Results: GHG

AGS led the process of GHG data quality assurance and control. Each field contained three static chambers through which we obtained samples for measurement. For any day's measurements that failed rigorous quality checks, that chamber's measurement was discarded. For example, if two out of the three chamber measurements failed on any given day, that day's measurements were discarded. In addition, for any abnormal readings that were not in line with other chambers or previous/ subsequent readings, they were carefully analyzed against observed crop and water measurements. This allowed us to identify data inconsistencies due to human or unexplained error that are not possible given what we know about the nature of GHG emissions.

Figure 3: Preparing a Gas Sample for GHG Analysis

Pilot Background

Current rice farming practices in South and Southeast Asia produce significant amounts of greenhouse gas (GHG), particularly non-carbon dioxide (CO2) emissions including methane (CH4) and nitrous oxide (N2O). These compounds are potent contributors to global GHG emissions that drive climate change-related extreme weather events including droughts and floods. Smallholder rice farmers contributing to these emissions, including those in Vietnam, are particularly vulnerable to climate-related shocks.

The AgResults Vietnam GHG Emissions Reduction Pilot is a four-year, US $8 million pull mechanism that aims to develop, test, and scale up innovative technologies, tools, and approaches to reduce GHG emissions in the land cultivation and production stages for rice in order to ultimately reduce poverty, protect the environment, and reduce GHG emissions. Focusing on the Thai Binh province in the Red River Delta, the pilot will provide results-based monetary incentives to a diverse pool of actors who successfully test and scale technologies that increase yields and reduce GHG emissions in rice production. The pilot will be conducted in two phases. Phase I, beginning in the Summer of 2017, consists of two growing seasons during which accepted organizations will test their technologies. Phase II, which begins in Spring 2019, consists of four consecutive growing seasons during which organizations who have proven the viability of their Phase I technology will demonstrate their ability to scale that technology to the greatest number of smallholder farmers.

GHG measurement in agriculture has a high level of associated uncertainty due to the complexity of emissions processes and the sampling process. To account for this uncertainty, AGS applied Bayesian modeling to the analyzed data to estimate the percentage decreases in emissions. While most implementers showed an overall mean reduction in GHG, we used statistical modeling that accounted for uncertainty in measurements to arrive at a final estimate. After the analysis, AGS found there was insufficient evidence (a 90% confidence) to say that any of the sites showed an increase in GHG emissions on average relative to the controls. This meant that all implementers who increased yields also met the GHG requirement and thus qualified for a prize. The proportion of the interim prize each qualifying implementer received was based on quantification of the yield results and GHG results, adjusted to account for relative uncertainty. In other words, for those implementers for which we had a higher degree of confidence in their ability to reduce emissions by a larger amount, they received a higher proportion of the interim prize.

Initial Observations and Next Steps for Crop 2

We can take away a number of initial observations that we can immediately apply to Crop 2, while others indicate potentially deeper learning that we will further validate after the end of Phase I:

- This season was a difficult one in which many implementers faced disease (black streaked dwarf virus, a relatively new disease to Vietnam) and extreme rainfall/ hail that hampered their ability to implement their proposed technology on schedule. Despite challenges, the results indicate that the technology packages are quite good overall in maintaining adequate yields in the face of challenges, and somewhat good at achieving GHG reductions.
- Complicated alternate wetting-and-drying (AWD) water management schemes are difficult to follow in summer in the Red River Delta due to variable and sometimes extreme rainfall. AWD, especially when requiring multiple drain events, may not be a fully appropriate technology to push across the entire Thai Binh province until water management committees understand and manipulate irrigation systems accordingly. Regardless, rains will affect AWD results from year to year. The spring crop should be much more successful in terms of each implementer's ability to manage water according to their plan.
- Implementers may need to better choose their sites and/ or better understand the potential of their rice chosen varieties. Some varieties did not perform as expected against the selected control varieties, which may lead to changes for crop 2. Additionally, some learned that it matters which farmer one chooses to manage the field.
- Agronomic development data has been important to monitor in cases of data issues that we needed to validate by what we expect given crop growth.
- We may make slight adjustments to GHG measurement protocols and analysis especially in light of the fact that N_2O potential is much higher in the spring due to the lower presence of water. The sampling technicians will also undergo additional training to avoid any potential human error in measurement (for example, technicians must carefully check the needle just before sampling the chamber to make sure the needle is not compromised. Additionally, technicians must avoid damaging rice when placing chambers and disturbing the soil, which could cause gas bubbling that could distort a sample).

Figure 4: Control Field Severely Affected by Black Streaked Dwarf Virus

- Implementers expressed grand plans to begin upscaling their technologies before the start of Phase II. Any progress made (or lack thereof) could indicate the scale that implementers may eventually achieve in Phase II, when their results will be in part based on the number of farmers who apply the technologies.

About AgResults

AgResults is a $122 million collaborative initiative between the governments of Australia, Canada, the United Kingdom, the United States, and the Bill & Melinda Gates Foundation to incentivize the private sector to overcome market barriers and develop solutions to food security and agricultural challenges that disproportionately affect people living in poverty. The initiative designs and implements prize competitions, also referred to as pay-for-success or pull mechanisms, which are innovative development finance mechanisms that incentivize the private sector to work towards a defined goal.

About AgResults Lessons Learned Series

One of the primary objectives of AgResults is to better understand how well pull mechanisms work to solve market failures in agricultural development. The lessons learned series explores AgResults' experiences in designing and implementing pull mechanisms, with the goal of providing key lessons and recommendations that development practitioners should consider before designing agricultural-focused pull mechanisms.

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