



FEED THE FUTURE

The U.S. Government's Global Hunger & Food Security Initiative



FEED THE FUTURE INNOVATION LAB FOR THE REDUCTION OF POST-HARVEST LOSS SEMI-ANNUAL REPORT

October 1, 2018-March 31, 2019



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KANSAS STATE
UNIVERSITY



EXECUTIVE SUMMARY

The first half of the 2019 fiscal year saw the transition from “Phase I,” our initial five years of programming, to “Phase II,” which will run from Jan. 1, 2019, to December 31, 2021. This transition is marked by a strategic shift in focus on barriers to adoption and targeted scale up of technologies and practices developed in Phase I. It also includes continued biophysical research in areas of need, taking Phase I findings to the next stage of the research for development inquiry process. With this combination of critical biophysical research questions, essential social science research, and scaling activities toward key end users, the next three years of the Post-Harvest Loss Innovation Lab seeks to substantially contribute to global efforts to reduce post-harvest loss, promote agriculture-led growth and strengthen resilience of people and systems.

In the report that follows, you will find progress to date in those efforts, characterized by the conclusion of Phase I activities (which officially ended on December 31, 2018), and preparation for Phase II activities, which will ramp up significantly in the second half of FY2019. Activities and outcomes are described for each program country, followed by a summary of the total Phase II objectives for that country and planned aligned FY2019 activities. The report goes on to outline our peer-reviewed publications, challenges at hand, short and long term trainings and technology scaling efforts for the period from October 1, 2018 to March 31, 2019, and ends with a preview of our future work beyond this reporting period.

Cover caption: *A woman works on the chatal, or drying floor, at the Moti Auto Rice Mill in Netrokona, Bangladesh, March 2019.*

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RESEARCH AND SCALING PROGRESS SUMMARY

Research Progress: October 1, 2018-March 31, 2019

Bangladesh

On October 24, 2018, BAU hosted the Regional Symposium on Sustainable Agricultural Mechanization and Post-Harvest Practices, which was jointly organized by PHLIL and the Appropriate Scale Mechanization Consortium. The symposium included stakeholders from universities, government, private sector and civil society and hosted representatives from India and Cambodia.

The beginning of Phase II of the Post-Harvest Loss Innovation Lab's work in Bangladesh has concentrated heavily on leveraging partnerships created in Phase I, fully integrating gender, agricultural economics, and youth into the program, and reviewing all compliance and management processes. In March 2019, the BAU and Agricultural Economics team visited farmers in three districts (Nokla, Sherpur; Norail Sadar, Norail and Bhagarpara, Jessore) to garner a better understanding of seed storage practices in Bangladesh in preparation for a Randomized Control Trial (RCT) study on use and adoption of hermetic bags for seed storage. This activity provided information crucial to the RCT design. In the same period in March, the PHLIL Bangladesh team hosted PHLIL's USAID AOR, representatives from the USAID Mission to BAU and the Moti Auto Rice Mill, and had information sharing meetings with the USAID Mission in Dhaka. The team also met with the Department of Agricultural Extension (DAE) to discuss their plans by to scale up the BAU-STR dryer to farmer field schools throughout Bangladesh.

Phase II includes research on drying technologies in two critical areas. The first is further modifying the BAU-STR dryer to use Liquid Petroleum Gas as a fuel source alternative to rice husk briquettes. The second is developing a rice dryer appropriate for medium scale semi-automatic rice mills, which are widespread in Bangladesh and serve many small scale farmers. The team at Bangladesh Agricultural University (BAU) is currently conducting literature reviews in preparation for this research. Additionally, BAU is expanding their understanding of current paddy seed storage practices, particularly for large scale seed distributors, in preparation for research on hermetic storage in bulk seed storage, an activity that will happen in partnership with the Bangladesh Agricultural Development Corporation.

While youth and gender activities, which will be led by the AgReach team at the University of Illinois, will get fully underway later in FY2019, PHLIL leveraged a training at BAU by the AgReach team for the ASMC project to provide training to BAU PHLIL team members on conducting gender technology assessments.

Additionally, one of three remaining graduate students from Phase I research activities submitted their thesis in December 2018, with the other two students to submit their theses in June 2019.

A summary of PHLIL Bangladesh Phase II Objectives and corresponding FY2019 Activities is below:

Bangladesh Objectives and Activities	
Phase II Objectives	FY2019 Activities
To build a coalition among research, public institutions and private entrepreneurs for creating entrepreneurial advances to reduce post-harvest losses of paddy leading to reduction in poverty and hunger	<ul style="list-style-type: none"> • Promote the BAU-STR dryer via collaboration with the Department of Agricultural Extension • Gender technology assessment with information from manufacturers, producers and BAU to understand how to increase adoption of PHL technologies by women stakeholders in the smallholder farming sector
To research and evaluate on-the-shelf and in-the-field elsewhere drying and storage technologies to extend economic benefits to smallholder farmers, public institutions and private entrepreneurs, thus enhancing their resilience	<ul style="list-style-type: none"> • Modify BAU-STR dryer further to use liquid petroleum gas (LPG) as a fuel source, as rice husk briquettes are not available in all regions • Develop an appropriate scale dryer for use on parboiled paddy rice in small-medium sized semi-automatic rice mills
Identify and solve foundational, country-relevant barriers (e.g. effective delivery of information to different stakeholder categories and agricultural economic aspects) to education and adoption of post-harvest interventions in Bangladesh	<ul style="list-style-type: none"> • Ag Economics randomized control trial on liquidity and risk for hermetic bags • Create awareness, enhance demand, and establish of efficient distribution channels for these hermetic bags by women and youth-focused stakeholders in the agriculture sector

Ethiopia

To finalize critical research findings from Phase I, four Ethiopian PhD students came to Kansas State University for a month of publication and dissertation writing with KSU faculty. This period provided the students with an opportunity to jump start their academic career with multiple peer-reviewed publications. These students are the next generation of post-harvest experts, now equipped to conduct cutting edge research on drying, mycotoxins and storage.

With a strong foundation of post-harvest technical research outputs from Phase I, the PHLIL Ethiopia team's Phase II strategy will shift to an approach with increased focus on barriers to adoption and improved information transfer. To launch this strategy for Phase II, Kick-off meetings were held at Mekelle University and Bahir Dar University in February 2019. This was the first of a series of kick-off meetings across PHLIL countries where the Management Entity visited and reviewed key policy and management guidance, discussed Phase II objectives, and started the program off on a positive note.. The Ministry of Agriculture continues to be a critical partner in Phase II for getting accurate information out to Ethiopian farmers. Additionally, the Ethiopia Value Chain project managed by Fintrac was identified as a potential partner for scaling post-harvest loss reducing technologies.

Since the kick-off meeting, graduate student researchers have been working to update extension manuals to include more accurate information on how to mitigate post-harvest losses. The PHLIL Ethiopia team has also provided information and presented (virtually) at the Livestock Systems Innovation Lab's feed mycotoxin workshops in Addis Ababa and Kigali, in addition to organizing a national mycotoxin workshop to be held in May 2019, hosted by Mekelle University.

A summary of PHLIL Ethiopia Phase II Objectives and corresponding FY2019 Activities is below:

Ethiopia Objectives and Activities	
Phase II Objectives	FY2019 Activity (full execution contingent on receipt of funds)
Develop a National PHL Advisory Committee for the inclusion of PHL in Extension programs & enhance the national food/grain safety agenda through this engagement	<ul style="list-style-type: none"> • Revision of various extension materials, enhanced with further evidence-based information on PHL drivers and interventions, and translation for availability in Amharic, Oromo, and English • Host forums and events related to PHL to share the knowledge gained through our research, including a national mycotoxin workshop hosted/led by Mekelle University and involving PHLIL • Provide supporting information and participate in Livestock Systems II stakeholder aflatoxin risks in feed meetings (risk communication presentation) • Participate in planning meetings with members of the nascent National PHL Advisory Committee
Establish a distribution system for PHL technologies & determine feasibility of PHL technologies in cooperatives	<ul style="list-style-type: none"> • Research the government registration process for filter cake and/or triplex and sign an MOU with a factory that produces one or both of these two inert dusts
Enhance the inclusion of women and youth in PHL decision-making	<ul style="list-style-type: none"> • Work with recent female graduates from Mekelle University to support them as entrepreneurs for scaling PHL technologies
Determine the prevalence of pesticides in economically important grains	<ul style="list-style-type: none"> • This research will be conducted by an MSc student in partnership with the EIAR Debre Zeit research station.
Assess the adoption of post-harvest technologies by training participants, the presence of spill-over adoption & determine the motivation for participation in training experiences	<ul style="list-style-type: none"> • Engagement surveys will determine the adoption rates of former trainees
Determine the impact of previously researched PHL technologies as components of integrated mitigation strategies	<ul style="list-style-type: none"> • This research will be conducted by an MSc student, who will be identified through a competitive process.

Ghana

Several members of the PHLIL Ghana team held the Kick-off meeting for Phase II in Sunyani, Ghana in March 2019. The meeting included strategic discussions around research objectives and program plans and a review of key policy guidance for the team. The team also spent time on with poultry producers to gain insights into effective strategies to improve training capacity and engage women and youth in distribution channels for scaling up hermetic storage bags and other post-harvest technologies.

Ghana's Phase II objectives include continuing to work with Sesi Technologies, poultry producers, and Kwame Nkrumah University of Science and Technology (KNUST) to scale up the GrainMate moisture meter and the PICS and ZeroFly® hermetic bags. The PHLIL Ghana team shifted their focus to the Dormaa region, a hub for poultry production in Ghana, and to a deeper focus on engagement, youth and gender, and agricultural economics. The team is also currently designing research to determine if the use of a low-cost locally built elevated platform will mitigate mycotoxin levels associated with heaping maize on the ground. A prospective master's student to conduct this research has been identified and is currently in the process of applying to KNUST to enroll in August 2019. Additionally, Dr. Paul Armstrong continues to provide technical backstopping and advisement to Sesi Technologies for more efficient assembly of the GrainMate moisture meters.

A summary of PHLIL Ghana Phase II Objectives and corresponding FY2019 Activities is below:

Ghana Objectives and Activities	
Phase II Objectives	FY2019 Activities
Work with Sesi Technologies, poultry producers, Kwame Nkrumah University of Science and Technology (KNUST), Vestergaard and PICS to increase adoption of GrainMate moisture meters and hermetic technologies by stakeholders in the agriculture sector	<ul style="list-style-type: none"> Identify MPhil student for research at KNUST, provide backstopping for Sesi Technologies, and support the distribution channels for storage technologies
Facilitate creation of awareness, enhanced demand and establishment of efficient distribution channels for hermetic bags, particularly (on the distribution side) for ZeroFly Hermetic (ZFH) bags	<ul style="list-style-type: none"> Establishment of activities for research around awareness, demand, and distribution of hermetic bags in preparation of research activities beginning in FY2020
Evaluate impact of use of GrainMate moisture meters and hermetic technologies by stakeholders in the agriculture sector, including awareness and adoption by women and youth-focused stakeholders in the agriculture sector	<ul style="list-style-type: none"> Design research experiments for Year 7 that assess the impact of the GrainMate moisture meter and hermetic technologies by stakeholders in the ag sector
Assess the use of low-cost, locally built elevated platforms to mitigate high mycotoxin levels that are usually associated with heaping maize on the ground in the field	<ul style="list-style-type: none"> Design research experiments for Year 7 that assess the efficacy of the platforms
Contribute to increased success (in sales and efficiency) of Sesi Technologies, serving in an advisory role to increase assembly efficiency, continue to make upgrades to the GrainMate, etc.	<ul style="list-style-type: none"> Paul Armstrong, USDA ARS, will continue backstopping Sesi Technologies to improve efficiency and advance supply and distribution capabilities
Conduct research into effective training methods	<ul style="list-style-type: none"> The engagement team will conduct surveys of new and previous participants about technology adoption of PHL technologies

Guatemala

In November 2018, PHLIL Guatemala conducted an initial assessment of the maize value chain in three lowland regions of Guatemala. For Phase II we intend to transition the main focus of our work from the Western Highlands to a selected lowland region as the lowlands are larger producers of maize who may be better equipped to adopt post-harvest loss-reducing technologies. In addition, farmers in the Western Highlands still purchase as much as 60 percent of their maize for consumption, and much of it is sourced from lowland production areas, which are likely to be more prone to aflatoxin contamination due to climatic conditions. Thus, an improvement in post-harvest practices in the lowlands promises dual benefits, locally and into Western Highland communities.

The assessment results guided the team in making an informed decision on which region the project will be implemented in the next three years. Playa Grande Ixcán, a Zone of Influence district in the department of El Quiché was selected. The process involved initial discussions with the Mission, followed by our local Field Work Technical Director, Mr. Walfer Martinez, interviewing twenty actors across the different regions, representing academia, private sector and local nonprofits. From this initial assessment a priority list with the three most impactful zones for the project was identified, which was consistent with the three most impactful zones identified in the literature for this area of the country. Playa Grande, Municipality of Ixcán, Department of El Quiché, Guatemala was identified as the best place for future activities.

Additionally, the PHLIL Guatemala team conducted a desk exercise on the drying, storage and shelling technologies that have been researched by PHLIL and other Feed the Future Innovation Labs in Feed the Future countries. This exercise prepared the necessary information for the USAID innovation marketplace, which will serve as the information hub for technical details on all types of equipment, assisting implementers and researchers working in the area of post-harvest management, and it covered all of PHLIL's countries, as well as innovations from the Food Processing and Horticulture Innovation Labs.

Additionally, our in country partner, SHARE, has been engaged in continuing conversations with potential local collaborators including private sector actors, NGOs, government organizations, and academic institutions.

A summary of PHLIL Guatemala Phase II Objectives and corresponding FY2019 Activities is below:

Guatemala Objectives and Activities	
Phase II Objectives	FY2019 Activities (full execution contingent on receipt of funds)
Further investigate regionally-relevant post-harvest interventions and management practices and socio-economic and educational barriers that prevent the adoption of post-harvest loss reducing technologies in the lowlands of Guatemala	<ul style="list-style-type: none"> • Desk exercise to catalogue and prospect best off-shelf drying and storage technologies from across all of PHLIL • Propose research on technologies, management practices, and socio-economic factors to make the adaptations of post-harvest kits and the training materials from Phase I to be deployed in this region
Test small-scale kernel sorting as an avenue to remove mycotoxin-contaminated maize from the food supply	<ul style="list-style-type: none"> • Assessment of the corn value chain in the lowlands, along with agricultural practices that would inform • Design and execute, small-scale kernel sorting as an avenue
Ensure gender inclusion and youth engagement components are defined and incorporated while evaluating post-harvest loss technology and their potential adoption	<ul style="list-style-type: none"> • Support gender inclusion and youth engagement messaging via desk research exercise for those promising post-harvest technologies and the educational materials created for information dissemination
Strengthening and expanding networks for information dissemination, mycotoxin and grain quality assessment, and connection of farmers to the maize processor value chain in Guatemala, through partnerships with industry, NGOs, academia and government institutions	<ul style="list-style-type: none"> • Our partnership with SHARE will remain the central partnership for our work in Guatemala • New partnerships including PepsiCo are currently being developed as Phase I begins.

Publications

During the reporting period of October 1, 2018 – March 30, 2019, five peer reviewed publications were published by PHLIL researchers on our Ghana and Ethiopia teams. Three of these publications were published in the Journal of Stored Products Research, one was in the African Journal of Science and Technology, and one was in the American Journal of Entomology. The citations are listed below.

Ethiopia

Kalsa, K. K.; Subramanyam, B.; Demissie, G.; Mahroof, R.; Worku, A.; Gabbiye N. (2019) Evaluation of postharvest preservation strategies for stored wheat seed in Ethiopia. *Journal of Stored Products Research* 81: 53-61.

Kalsa, K. K. (2019) Farmers' attitudes and practices towards variety and certified seed use, seed replacement and seed storage in wheat growing areas of Ethiopia. *African Journal of Science, Technology, Innovation and Development* 11: 107-120.

Tadesse, T. M.; Bhadriraju, S. (2019) Efficacy of Filter Cake and Triplex Powders Against Three Internally Developing Stored-product Insect Species. *American Journal of Entomology* 3: 15-23.

Ghana

Manu, N.; Opit, G. P.; Osekre, E. A.; Arthur, F. H.; Mbata, G.; Armstrong, P.; Danso, J. K.; McNeill, S. G.; Campbell, J. F. (2019) Moisture content, insect pest infestation and mycotoxin levels of maize in markets in the northern region of Ghana. *Journal of Stored Products Research* 80: 10-20.

Danso, J. K.; Osekre, E. A.; Opit, G. P.; Arthur, F. H.; Campbell, J. F.; Mbata, G.; Manu, N.; Armstrong, P.; McNeill, S. G. (2019) Impact of storage structures on moisture content, insect pests and mycotoxin levels of maize in Ghana. *Journal of Stored Products Research* 81: 114-120.

Additional post-harvest loss publications from the Management Entity:

Benigni Temba, Mary Fletcher, Glen Fox, Jagger Harvey, Sheila Okoth and Yasmina Sultanbawa (2019) Photoinactivation of conidia and hyphae of *Aspergillus flavus* using curcumin and its effect on aflatoxin B1 formation in maize kernels. *Food Microbiology* 82: 82-88.

Ross Darnell, Jagger Harvey, Glen Fox, Mary Fletcher, James Wainaina (2018) NIR calibration of aflatoxin in maize flour. *Australian Journal of Chemistry* 71(11): 868-873.

Marguerite Niyibituronsa, Arnold Onyango, S.Gaidashova, S. M. Imathiu, M. Uwizerwa, Immaculate Wanjuki, F. Nganga, J. C. Muhutu, Josephine Birungi, Sita Ghimire, K. Raes, Marthe De Boevre, Sarah De Saeger and Jagger Harvey (2018) Evaluation of mycotoxin content in soybean (*Glycine max* L.) grown in Rwanda. *African Journal of Food, Agriculture, Nutrition and Development* 18(3): 13808-13824.

Presentations

Opit, G. P. 2018. The Innovation Lab for the Reduction of Post-Harvest Loss: Accomplishments from 5 years of maize postharvest loss mitigation work in Ghana. Talk: The 66th Annual Meeting of the Entomological Society of America. Vancouver, Canada. November 11–14, 2018.

Bosomtwe, A., E. A. Osekre, G. P. Opit, G. Mbata, P. Armstrong, F. H. Arthur, J. F. Campbell, and E. P. Nsiah. 2018. Evaluation of Plastic and Steel Bins for Protection of Stored Maize against Insect Infestation in Ghana. The 12th International Working Conference on Stored Product Protection (IWCSPP). Berlin, Germany, from 7–11 October 2018.

Danso, J. K., N. Manu, E. A. Osekre, G. P. Opit, P. Armstrong, F. H. Arthur, J. F. Campbell, G. Mbata, and S. G. McNeill. 2018. On-Farm Maize Insect Pest and Mycotoxin Levels in Ghana. The 12th International Working Conference on Stored Product Protection (IWCSPP). Berlin, Germany, from 7–11 October 2018.

Danso, J. K., E. A. Osekre, G. P. Opit, N. Manu, P. R. Armstrong, F. H. Arthur, J. F. Campbell, G. Mbata, and S. G. McNeill. 2018. Insect Pests and Fungal Pathogens in Maize Stored in Ghana. The 12th International Working Conference on Stored Product Protection (IWCSPP). Berlin, Germany, from 7–11 October 2018.

Opit, G. O., A. Ocran, and K. Shakya. 2018. Population growth and development of *Liposcelis obscurus* Broadhead (Psocodea: Liposcelididae) at constant temperatures and relative humidities. The 12th International Working Conference on Stored Product Protection (IWCSPP). Berlin, Germany, from 7–11 October 2018.

Bingham, G. V., E. A. Osekre, G. Otitodun, and G. Opit. 2018. Field Studies with Insecticide Treated Packaging for the Control of Stored Product Insects. The 12th International Working Conference on Stored

Product Protection (IWCSP). Berlin, Germany, from 7-11 October 2018. The 12th International Working Conference on Stored Product Protection (IWCSP). Berlin, Germany, from 7–11 October 2018.

Armstrong, P. R., S. McNeil, Bh. Subramanyam, J. Akowuha, J. K. Danso, N. Manu, E. Osekere, G. Opit, F. Arthur and J. Campbell. 2018. Low-Cost Instrument to Measure Equilibrium Moisture Content of Bagged and Bulked Grain. The 12th International Working Conference on Stored Product Protection (IWCSP). Berlin, Germany, from 7–11 October 2018.

Jagger Harvey, Dena Bunnell, Jeff Morris and John Leslie. Mycotoxin risk communication strategies: empowering national systems to be proactive and responsive. Livestock Systems Innovation Lab meeting on Mycotoxins in Feed, Ethiopia, March 26, 2019 (Virtual)

Jagger Harvey, Dena Bunnell, Jeff Morris and John Leslie. Mycotoxin risk communication strategies: empowering national systems to be proactive and responsive. Livestock Systems Innovation Lab meeting on Mycotoxins in Feed, Rwanda, April 3, 2019 (Virtual)

Jagger Harvey, Organized and led a session at the Partnership for Aflatoxin Control in Africa (PACA) Partnership Platform meeting, on “Integrated Post-Harvest Mitigation Strategies.” Presented “Integrated Post-Harvest Mitigation Strategies: PHLIL.” King Fadh Hotel conference center, Dakar, Senegal October 2, 2018.

Issues or Concerns Encountered

The three year timeline for Phase II activities creates some challenges that will take a combination of careful planning and leveraging of partner resources. This includes the enrollment of graduate students for program research and capacity building, where a three-year timeframe is not always sufficient for completion of a PhD program. Delays and uncertainty of funding also pose a more acute challenge, with less time to compensate for associated delays and challenges in activities and budgets.

Bangladesh: Continuing research and technology scale up are occurring simultaneously, which can cause challenges for unbiased research. To address this for the planned hermetic storage RCT, the Ag Economics team plans to implement the RCT in districts not previously targeted. The team is also assessing the feasibility of partnering with the DAE on their BAU-STR dryer scaling project to possibly obtain additional information on use and barriers to adoption; however, as the distribution design is held by DAE, rather than PHLIL, care must be taken to ensure good research outcomes.

Ethiopia: PHLIL is striving to meet an aggressive timeline for delivery on the revision of extension manuals in multiple languages has proved challenging; the team must remain particularly dedicated and focused to achieve its goals. Continued delay in receipt of Year 6 funds exacerbates this problem and threatens the success of program activities.

Ghana: The master's student at KNUST will be needed for a variety of PHLIL-related work with multiple people/universities for data collection, research and related support during Phase II. Careful planning will be needed to ensure good outcomes and a successful graduate experience for the student. The USDA-funded AMPLIFIES project has been a key partner to leverage both funds and program reach. The project is currently scheduled to wind down later this year. If not extended, it will be necessary to find other field-based projects to partner with to ensure scaling and sustainability.

Guatemala: With US Government commitments to development programs in Central America wavering, it may prove difficult to accomplish our goals if we are unable to travel to Guatemala. At the time of this report's preparation, it was unclear what work will be able to be accomplished in Guatemala. Additionally, it is an election year in Guatemala, so commitments from central and local government are limited and volatile, which should be considered in our interactions and reliance upon them.

Human and Institutional Capacity Development

Short-term training

Country of Training	Brief Purpose of Training	Who was Trained	Number Trained		
			M	F	Total
Bangladesh	No Trainings to Report		0	0	0
Bangladesh Subtotals			0	0	0
Ghana	Poultry Farmers and Feed Millers Training at KA Unity Farms (March 8, 2019) Dormaa Ahenkro, Dormaa Central, Bono Region	Producers	1	0	1
Ghana	Poultry Farmers and Feed Millers Training at Evans Jones Farms (March 8, 2019) Masu, Dormaa Central, Bono Region	Producers	0	1	1
Ghana	Poultry Farmers and Feed Millers Training at I.M Unity Farms (March 8, 2019) Kofiasua, Dormaa Central, Bono Region	Producers	1	0	1
Ghana	Poultry Farmers and Feed Millers Training at ADF Farms (March 11, 2019) Nsesereso, Dormaa East, Bono Region	Producers	1	0	1
Ghana	Poultry Farmers and Feed Millers Training at Doughi Royal Farms Atesikrom, Dormaa Central, Bono Region (March 11, 2019)	Producers	1	0	1
Ghana	Poultry Farmers and Feed Millers Training at God is Good Farms Ltd. (March 12, 2019) Benekrom, Dormaa West, Bono Region	Producers	1	0	1
Ghana	Poultry Farmers and Feed Millers Training at Royal Golden Eggs Ent. Ltd. (March 12, 2019) Kyeremasu, Dormaa East, Bono Region	Producers	1	0	1
Ghana	Poultry Farmers and Feed Millers Training at Apple Egg Farms (March 13, 2019) Kyeremasu, Dormaa East, Bono Region	Producers	1	0	1

Ghana	Poultry Farmers and Feed Millers Training at MM Unity Farms (March 13, 2019) Adomasi, Dormaa West, Bono Region	Producers	1	0	1
Ghana	Poultry Farmers and Feed Millers Training at Sromani Farms (March 13, 2019) Kofi Badu Kromm, Dormaa Central, Bono Region	Producers	1	0	1
Ghana	Poultry Farmers and Feed Millers Training (March 13, 2019) Dormaa Ahenkro, Dormaa Central, Bono Region	Producers, Private Sector Actors,	12	0	12
Ghana Subtotals			21	1	22
Guatemala	No Trainings To Report				
Guatemala Subtotals			0	0	0
Ethiopia	No trainings to report				
Ethiopia Subtotals			0	0	0

Long-term training

Support for graduate education is an important part of PHLIL's mission to build capacity for the next generation of post-harvest experts. Graduate students are also essential in performing PHLIL's activities, including lab and on-farm research and assisting in PHLIL trainings. In FY2019 in Bangladesh, PHLIL directly funded three graduate students at Bangladesh Agricultural University. The students are working on doctoral degrees in our three key areas of drying, storage or mycotoxin analysis. In addition, one PhD student in agricultural and applied economics at the University of Illinois at Urbana-Champaign is working on PHLIL research, but direct funding for his academic program is from other sources. In Ethiopia in FY2019, there were seven graduate students directly funded by USAID through PHLIL – three at Mekelle University, three at Bahir Dar University and one at Kansas State University. Two additional master's students are engaged in PHLIL-related research at Bahir Dar University. Three additional students at KNUST, two PhD and one bachelor's, are engaged in PHLIL research, but are not receiving USAID funds. An additional PhD student at UNL added to the Guatemala team, but were externally funded.

PHLIL has 5 additional graduate students who are engaged in PHLIL-affiliated research activities but who are not funded by USAID. These students are enrolled and funded wholly separately from PHLIL funds; however, they are assisting in research activities, often due to their being advised by faculty on our team. Thus we still seek to capture their significant contribution to our program:

Innovation Transfer and Scaling Partnerships

Bangladesh: *BAU-STR Dryer*

As outlined earlier, the BAU team is continuing to work with small scale, regional manufacturers for commercialization of the BAU-STR dryer. A local electronic company has produced a lighter and less expensive blower, which is a significant achievement; this has previously been a challenge to produce locally. This now achieves full local production of the dryer.

Ethiopia: *Solar Bubble Dryer*

The Feed the Future Value Chain project has expressed interested in scaling these dryers in the appropriate settings at markets and in cooperatives.

Ghana: *PHL Moisture Meter*

The PHL Ghana team has worked to engage the private sector by facilitating the development of Sesi Technologies, which will allow the PHLIL moisture meter to be locally produced in Ghana. In Phase II, PHLIL will continue to support Sesi Technologies via backstopping from Paul Armstrong, an Agricultural Engineer with the United States Department of Agriculture (USDA) Agricultural Research Services (ARS).

ZeroFly® Hermetic Bags

Sesi Technologies is now serving as a distributor of the ZeroFly® bags to improve its availability in the market.

Future Work

Bangladesh

The Agricultural Economics team will initiate a scoping study prior to a full baseline survey to assess current practices around rice seed storage in households. In conjunction with BAU faculty, the AgReach team will conduct an assessment of gender dimensions and a gender based technology assessment and develop an entrepreneurship strategy centered on youth for the BAU-STR dryer. The BAU team will pilot a limited number of BAU-STR dryers at the field level and demonstrate the technologies for training purposes and to develop business interest for youth entrepreneurs as potential for scaling the dryer. In FY2020 targeted research will begin on the development of an appropriate scale dryer for meso-level mills in Bangladesh and on a modified BAU-STR dryer that used LPG as a fuel source. The engagement team will also review all training materials and give feedback for improvement. The research in FY2019 will inform the next two years of the program to ensure the information gained will help reduce post-harvest losses, poverty, and hunger.

Ethiopia

The PHLIL Ethiopia team will continue revising extension manuals to address deficiencies in post-harvest loss prevention content, strengthening the nationally distributed materials on post-harvest practices. The May 2019 Mycotoxin workshop will honor the late Dr. Dereje who served as an advisor to PHLIL students and will discuss solutions to mycotoxin challenges facing Ethiopian farmers. The engagement team will enhance materials for trainings with extension personnel and will identify and train local enumerators to carry out the adoption surveys, which will provide insight into the barriers to adoption for short term training participants. Finally, MSc students will be identified through a competitive process in which researchers from US and Ethiopian institutions will review student research proposals and select the best candidates. These updated manuals, improved trainings, and survey will build capacity in the national extension system, provide high quality trainings to stake holders along the maize, chickpea, sesame, wheat and sorghum value chains, and provide useful information on the barriers to adoption for post-harvest loss reducing practices and technologies. Ultimately, this research will help steer Ethiopian agriculture to the adoption of techniques that prevent post-harvest losses, thus increasing food security across the country.

Ghana

PHLIL Ghana will continue designing research experiments for Year 7 on assessing the use of low-cost locally built elevated platforms to mitigate high mycotoxin levels that are usually associated with heaping maize on the ground in the field and the impact of use of GrainMate moisture meters and hermetic storage technologies on maize storage in poultry farms. The engagement team will conduct a follow up survey of 2017 and 2018 short term training participants to identify barriers to adoption and conduct comparative research on the impacts of training an individual on drying and storage technologies one-on-one versus in a large workshop setting. This will serve as a comparison to the large engagement workshops done in Phase I in Ghana and Ethiopia. The first seven of the individual trainings took place on March 8, 11, and 12, 2019. Additionally, the engagement team will survey training participants from Phase I trainings to determine incentives and barriers to adoption of post-harvest technologies.

The AgReach team will prepare for research activities through literature reviews and working remotely with the MPhil student once he is enrolled at KNUST. Additionally, the Ag Economic team will assess the feasibility of a randomized control trial on post-harvest technologies and seasonal arbitrage for possible implementation in Year 7. The research outcomes from the use of these platforms, the GrainMate, and hermetic storage techniques to prevent post-harvest losses, especially for actors in the poultry value chain, will help identify and solve foundational, country-relevant barriers to post-harvest losses.

Guatemala

Starting later in FY2019, PHLIL Guatemala plans to carry out an assessment of grain quality in Playa Grande Ixcán, including mycotoxin levels of the maize produced in the region during harvest, handling, and local storage before sale to traders and consumers. This assessment will identify the different potential causes of quality loss and contamination, allowing PHLIL Guatemala to tailor our research to the problems facing farmers, aggregators, traders, and consumers in order to reduce post-harvest losses. The team will also execute a single season trial/demo of a selected grain dryer in consultation the with stakeholders so they can provide input and assess the efficacy first-hand. Conversations are continuing with other local stakeholders, including private companies and NGOs, who are operating in the maize value chain in the lowlands.