BASIS AMA Research Program Request for Proposals

Proposal Full Title:

A Multiple Interventions Approach to Increasing Technology Adoption with a View Towards Scaling-Up: Evidence from Mexico

Proposal Acronym:

MITA

List of Principal Investigators:

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Total Project Budget: $1,232,611

Funds requested from the AMA CRPS: $802,772

Abstract:

Crop yields in much of the developing world remain below potential partly due to low adoption of profitable technological packages (e.g. improved seeds and fertilizer). In Mexico alone, average maize yields among smallholders without access to irrigation are below 2 tons/hectare, similar to those in Africa.[1] We plan to implement an experimental evaluation of the Trust Funds for Rural Development's (FIRA's) Technological Guarantee Program (TGP) targeted a Mexican maize smallholders. The TGP hopes to increase maize yields among smallholders by simultaneously addressing the main barriers to adoption: risk aversion plus lack of formal insurance, credit constraints and lack of information. The program comprises five distinct interventions: a) a personalized soil analysis allowing for optimal input recommendations by agricultural extension workers (AEWs) who will monitor package application, b) credit to purchase recommended inputs, c) the provision of an income guarantee conditional on adoption intended to reduce adoption risk, d) financial incentives for AEWs based on farmer yields and finally e) the project will measure all inputs and non-farm activity in a comprehensive and detailed manner with multiple visits to farmers. We also plan to use the results from the evaluation to inform a similar intervention to be carried out in Africa.

[1] MasAgro CIMMYT, 2011, http://masagro.cimmyt.org/. Average maize yields in Sub-Saharan Africa are still below 2 ton/ha: Foreign Agricultural Service, USDA, 2012, http://www.fas.usda.gov/psdonline/.

<u>Narrative Description:</u>

Project Description:

This project is a joint large-scale experimental intervention of a Technological Guarantee Program (TGP) with the University of California Los Angeles (UCLA), ITAM (Mexico),World Bank economists, the Mexican government's Trust Funds for Rural Development (FIRA) and the International Maize and Wheat Improvement Center (CIMMYT).

The research project's objective is to answer the overarching question of what are the pay-offs from simultaneously relaxing several --mostly financial-- constraints to technology adoption, and what are the complementarities between agricultural extension worker (AEW) incentives and farm output. The relevance of this research lies simultaneously addressing the most prominent barriers to technology adoption for small enterprises: risk aversion plus lack of insurance, lack of credit or liquidity, insufficient information about optimal input use and limited use of complementary inputs. The proposal touches on the Call's Themes 1, 2 and 4, since it addresses financial and risk barriers to agricultural technology adoption, and this has an impact in productivity and helps graduate households from social protection schemes.

The TGP consists of the following interventions:

1. **A personalized soil analysis and recommendation of a technological package consisting of production inputs** (e.g. seeds, fertilizer, pesticide, herbicide, and conservation agriculture procedures) based on this analysis. This intervention directly addresses the concern that yields to using fertilizers and hybrid seeds have been low

because farmers do not have information about the ideal inputs composition for their specific plot of land.

2. **Credit to purchase the recommended inputs**. This intervention relaxes credit constraints by offering farmers credit for the purchase of this input package. This touches on Agricultural Finance (Theme 4), but unlike typical farming loans, we are making the loan conditional on adopting better farming practices and giving complementary expert advice, so making the loan more likely to be repaid.
3. **Frequent plot inspections by AEWs** to verify input use and advice on conservation agriculture methods. This thereby addresses the concern that yields may be low because farmer implementation of the input package is sub-optimal.
4. **A key innovation is the minimum income guarantee conditional on following input recommendations** (i.e. households will receive transfers to guarantee that their post-harvest income is above a minimal amount). This directly addresses the concern that adoption of improved farming techniques is low because of risk-averse behavior by farmers. Risk aversion is particularly important for small farmers because crop failure can be catastrophic and since there are limited formal insurance markets in these poorer regions. We see this intervention mainly as an instrument for risk management and resilience (Theme 1) that also touches on expanding production possibilities and growth (Theme 4): it shares the conditionality component of Conditional Cash Transfer programs, but here the condition is to adopt productive technology**.** Issues of adverse selection and moral hazard are clearly paramount when guaranteeing a minimum income, and we hope to examine these by experimentally varying the income guarantee. The income guarantee was proposed directly by FIRA since policy-makers hypothesize that the prospect of low returns is a leading reason for low-adoption of improved hybrid

seeds and fertilizer. We will vary the minimum income guarantee in two groups, with one group receiving a 25% income guarantee and the other a 100% income guarantee. This arm tests FIRA policy-maker beliefs that reducing the variance of future income will improve take-up. The income guarantee is a key FIRA intervention. Note that since adverse selection as well as moral hazard may be a concern here we will employ a two-stage randomization to separately identify their relative importance.

5. **Financial incentives for AEWs.** This intervention is designed to address the problem of low-performance by AEWs resulting in farmers not receiving high quality information and assistance to achieve the expected increases in yields.

The main operation of the pilot will be done by FIRA, which will use its existing resources to provide the soil analysis to participating farmers. Private lenders in conjunction with FIRA (who will offer a measure of collateral for the private lenders) will provide farmers with credit. FIRA will also provide the income guarantee. The AEW´s will be contracted workers hired by FIRA and CIMMYT staff to assist and monitor farmer proper application of the technological package throughout the entire maize cultivation cycle. FIRA as well as our own research staff will monitor the AEWs.

The Target population:

The Mexican government through FIRA is interested in implementing a pilot version of the TGP targeted at small maize farmers (1-8 hectares of holdings and producing less than 3 tons of maize per hectare), and working in regions with agro-climatic conditions favorable for maize cultivation. The target population comprises approximately 13% of the Mexican population and is characterized by low incomes and living standards. We will work with farmers situated in many agro-ecological regions of the country (most likely in the states of Puebla, Tlaxcala, Hidalgo and Estado de Mexico) to broaden external validity.

We focus only on maize production since it is a staple crop central to the Mexican diet and also a staple worldwide.

The Team:

UCLA:

The team at UCLA will consist of Dr. Aprajit Mahajan who is a Development Economist with a Ph.D. from Princeton University. He is a Jameel Abdul Latif Poverty Action Lab (J-PAL) affiliate, which will be very useful in the dissemination stage, as JPAL has the reputation and resources to communicate results to policy makers effectively worldwide. His primary responsibilities for this project will be model estimation, theory modelling and writing academic papers. His work explores how poor households and firms in developing countries cope with their economic environments and respond to new technologies. He has examined the adoption of health protecting technologies in poor rural contexts as well as the adoption of modern management technologies by large Indian textile firms. His work has been published in *Econometrica*, the *American Economic Review*, The *Quarterly Journal of Economics* and *The Review of Economics and Statistics*. UCLA provides a host of resources to help with the project including prominent experts in agronomy and related fields.

ITAM (Mexico):

Dr. Enrique Seira will head the team from ITAM. Dr. Seira has a Ph.D. in Economics from Stanford University, and is currently a researcher at ITAM. He has specialized in program evaluation and industrial organization and has published in the *Quarterly Journal of Economics* and the *Journal of Public Economics.* He is the only Mexico based J-PAL affiliate. His primary responsibilities for this project will be survey design, field liaison, model estimation and writing academic papers. ITAM has substantial relationships with the Mexican government, which will prove helpful in influencing policy, and is geographically not far from the states where the intervention will happen, thus it will facilitate adequate monitoring of the implementation. Several research assistants and supervisors will come from ITAM.

The World Bank

Dr. Xavier Giné is a Senior Economist at the World Bank's Development Economics Research Group (DECRG). He has a Ph.D. in Economics from the University of Chicago and has focused on researching access to financial services and rural financial markets. He has published in The American Journal of Agricultural Economics, The Journal of Development Economics and The Journal of Applied Econometrics. His primary responsibilities for this project will be survey design, model estimation and writing academic papers.

FIRA:

Established by the Mexican government, FIRA is a development bank that offers credit and guarantees, training, technical assistance and technology-transfer support to the agriculture, livestock, fishing, forestry and agribusiness sector. FIRA's experience and technical expertise in the sector is a strong aspect of the project. In its 57 years of history in Mexico's rural sector, FIRA has strived to create a strong and broad network of experts, from agronomic sciences to business training, with strong participation from national and international organizations and institutions. Experts working with FIRA have more than 20 years of experience in Mexico's maize production. The participation of these experts, in the form of specialized services companies, will drastically improve the program's chances for success.

CIMMYT:

CIMMYT is a non-profit research and training center established in 1966 and headquartered in Mexico. CIMMYT's work has had great impacts throughout the world and it is an ideal partner to scale-up the program in other developing countries as it has seven projects in Africa, one in Asia and one in Latin America. For this project CIMMYT will use its conservation agriculture expertise and its experience with the intervention's target population to help implement the project.

The different partners involved in this research project already have a history of collaboration. In past years, FIRA has collaborated with CIMMYT in designing and implementing strategies to help improve the productivity of smallholder farmers. Moreover, all partners are currently participating in the implementation of a small operational pilot of the TGP in the state of Tlaxcala, with 70 smallholder farmers (we are currently in the process of entering and cleaning the data from the first half of the project).

Intellectual Context

In their recent comprehensive review of the literature, Foster and Rosenzweig (2010) list risk aversion, credit, heterogeneity in returns and information as prominent constraints on technology adoption in developing countries. Their reading of the evidence is that more research is needed particularly for parsing between the different explanations. A consensus view is that poorly developed loan and insurance markets in low-income countries (LICs) interact with high levels of risk aversion among poor households and lack of information (on optimal input use) leading to low technology adoption. However, the literature is divided on the absolute and relative importance of these constraints. For instance, Suri (2011) concludes that there is no under-adoption of seeds once we properly account for heterogeneity in returns. In contrast, Duflo, Kremer and Robinson (2008) and Udry and

Anagol (2006) document high returns to farming inputs (e.g. fertilizer), in the range of 50% and 150%, which suggests that there may be under-adoption.

Moreover, there has been little rigorous evidence on the effect of risk aversion in adoption decisions. Dercon and Christiansen (2011)[2] using non-experimental data find that poor households buy less fertilizer because of their inability to face adverse shocks ex-post. Furthermore, Minten and Barrett (2008)[3] show that farmers with diversified income sources are more likely to adopt new crop varieties because their other income sources allow them to counter the risk of experimenting with new technologies. Anecdotal evidence on the importance of risk as a barrier to the adoption of improved seeds and fertilizer is prevalent, but unfortunately it has not been systematized or proven more directly.

From our pilot is also appears that farmers are not always aware of the optimal input allocations of inputs (e.g. fertilizers and pesticides) for their particular soil and climate type. This further magnifies the perceived risk of technology adoption and dampens the demand. The primary state response historically has been to employ large numbers of agricultural extension workers (AEW) to advise farmers and facilitate technology transfer. According to Anderson and Federer (2007) "The extension operations of the past four decades may well be the largest institutional effort the world has ever known". They calculate that there are about half a million public agricultural extension workers worldwide (more than 90% of them in developing countries), and that in 1988 the budget allocated to these activities in the US for example was over 6 billion USD. "Yet the record of extension impact on farm performance is...rather mixed". Some experts claim that extension services worldwide are

[2] S. Dercon, and L. Christiensen, "Consumption risk, technology adoption and poverty traps: Evidence from Ethiopia", Journal of Development Economics, 2011 (96).
[3] B, Minten, and C.B. Barrett. “Agricultural Technology, Productivity, and Poverty in Madagascar.” World Development 2008 (36).

in a state of "disarray or barely functioning at all"4, others claim to find returns in excess of 50%.5 Part of the disagreement stems from the absence of credible empirical studies. An important concern with agricultural extension (AE) services is the low quality of advice since (1) AEWs have little incentive to perform well since their salaries are low and flat, and (2) there is almost no accountability, leading to corruption and misreporting.[6]

Our study will add to BASIS' research knowledge in the following 5 ways:

1. We are the first to test whether *joint* input provision implies much higher yields.
2. We randomly vary exposure to income risk by varying the income guarantee amount, and therefore can experimentally measure the effect of risk on take-up.
3. We will measure complementary of inputs like labor at a high frequency, which is essential to measure profits accurately. This also allows us to model and estimate moral hazard effects induced by the guarantee.
4. We will measure the effect of AEW pay for performance incentives on farmer yields.[7] This is extremely important in the light of the prevalence of these programs and the current debate on how to improve them.
5. We provide plot specific recommendations based on a soil analysis, which is crucial given how sensitive fertilizer returns are as a function of soil types.

Research Methodology and Treatment/Control Comparisons:

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[4] Rivera, W. Qamar, M. and Crowder, L. (2001) "Agricultural and Rural Extension Worldwide", FAO, Rome.

[5] To find median effect of 58% see Alston, J. Chan-Kang, C. Marra, M, and Pardey, P. (2000) "A Meta Analysis of Rates of Return to Agricultural R&D: Ex Pede Herculem?" Research report 113 IFPRI, Washington DC. To find zero effects see Gautam, M (2000) "Agricultural Extension: The Kenya Experience: An Impact Evaluation." Operations Evaluation Department, World Bank.

[6] For instance, in Mexico the biggest AEW program has about 2,000 such workers (PROMAF). They have no impact evaluations, they self-evaluate themselves and complete surveys on crop yields. These survey report extraordinary and constant growth in yields per hectare since the program began, uncorrelated with weather shocks. Anecdotally they seem to recommend seed and fertilizers for which they get a kickback from providers and not the optimal levels. In our pilot study cited above we found some fields to be actually *over* fertilized.

[7] In the private sector, piece rates have been found to increase production by 44% in Lazear (2000), 20% in Sharer (2004), and 50% in Bandeira et al (2005).

Moral Hazard
Sel
ect
ion

We will implement a randomized control trial (RCT) with 3 arms.: (1) a treatment arm that receives all experimental interventions with an income guarantee of 100%, (2) a second treatment arm that receives all experimental interventions but with an income guarantee of 25%, and (3) finally a control arm that receives none. We will have about 300 farmers per arm. Additionally we will overlay an incentive treatment which pays AEWs for yield performance.

By comparing (1) or (2) vs. the control we can measure the effects of jointly providing credit, advice, and an income guarantee. This is a very powerful treatment, and if there is no increase in yields we can be reasonably confident that any of the individual interventions in isolation will likely not increase yields either. If there is an increase, we could decompose the contribution of each input in a follow-up experiment varying a single input at a time.

By comparing treatments with different guaranteed incomes we will be able to measure adverse selection and moral hazard. Since we are interested in distinguishing the effect of moral hazard versus that of adverse selection of providing the guarantee we will use the Karlan and Zinman (2009) design[8]. We will offer a 25% income guarantee to a set of 400 farmers and a 100% income guarantee to 200 farmers. Subsequently, we will upgrade half of those who accepted the 25% guarantee (i.e. conditional on selection) to an income guarantee of 100% (see Figure below).

	Upgraded to 100%	Left in 25%
Offered 25%	200	200

[8] Karlan, D and Zinman, J. " Observing Unobservables: Identifying Information Asymmetries With a Consumer Credit Field Experiment", Econometrica 2009.

Offered 100%	200	

The AEWs pay for performance incentives are also innovative and scalable. Out of the 60[9] AEWs who will work in the project, we will randomly select 30 who will get incentives based on yields from the farms under their purview. Within each geographical region, we will randomly assign farmers to AEWs. This way we will be able to test experimentally two crucial questions: (a) does AEWs pay-for-performance matter and to what extent?, and (b) how important is the quality of AEWs as a determinant of yields?

We will make 3 further methodological contributions:

- One central concern with randomized interventions in the social sciences is that outcomes are typically a function of the provided treatment as well as effort exerted by the treatment unit. Identifying this function is an important pre-requisite to thinking about generalizability. We plan to **directly measure farmer effort better** than in previous studies by having technicians make frequent field visits to farmer plots and recording information on farmer activity. For instance, we will be able to test whether own-farm labor supply changes depend differentially upon the provision of an income guarantee or whether farmer's off farm activities change as a result of technology adoption on the farm.
- Since we observe farmer actions over the entire season, we can specify and **estimate a dynamic structural model of choice** that will allow us to examine counterfactuals for policies that were not implemented as part of the intervention. For instance, we can examine the effect of the conditional income guarantee at levels not included in the intervention.

[9] Approximately.

- We plan to **implement novel measures of risk and time-preference** in the field.[10] These measures will be of independent interest in it of themselves, as well as helpful in examining variations in outcomes and finally as elements that aid in the identification of structural risk and time-preference parameters in a dynamic discrete choice model.

Power Calculations:

Accurately implementing power calculations is a challenge because there are no statistics at the farm level in Mexico. Here we will rely on calculations using statistics from other developing countries and also sample size comparisons with the published literature. Data from Tanzania´s National Panel Survey (TNPS) reveals that kilograms maize per hectare is 867 when no fertilizers are used and 1,351 when they are used. Yields from a study in Tanzania looking at the impact of an input voucher program offer similar yield numbers: 900 without fertilizer and 1,600 with fertilizer and hybrid seeds. These "effects" on yields are 55% and 78% respectively. Regarding effects on net profits, in Kenya, Duflo, Kremer and Robinson (2011) find average increases per acre of about 64% for using fertilizer. Suri (2011) estimates average yield increases of 60% from using hybrid seeds. Since our intervention involves implementation of fertilizer, hybrid seeds and technical assistance, it is reasonable to expect larger yield increases. Intracluster correlations (ICC) of yields using the 300 enumeration areas of the TNPS yield an ICC of 0.02. For a similar survey in Malawi the ICC is 0.17, with 700 enumeration areas, so presumably they cover a much smaller area. A yield increase from 1 to 1.5 tons per hectare (ton/ha), with a standard deviation of 1 ton/ha -- standard deviations across municipalities of the states of Tlaxcala and Puebla are 0.4 and 0.9 respectively-- 40 clusters and ICCs equal to 0.05 or 0.1 requires

[10] See J. Andreoni and C. Sprenger "Risk Preferences Are Not Time Preferences," NBER working paper 16348 and J. Andreoni and C. Sprenger "Estimating Time Preferences from Convex Budgets," NBER working paper 16347.

85 or 136 farmers per arm, respectively. For 100% increases we only need 30 farmers per arm even with an ICC equal to 0.2. These estimates are conservative since we are not considering the variance reduction when we use controls. Experimental papers such as Duflo et al. (2011) and Conely and Udry (2010) work with just over 200 farmers in total. Hanna, Mullianathan, and Schwartzstein (2012) work with about 500 farmers in total. Overall, ***with 300 farmers per arm, 900 in total we are well powered***. We use a larger sample the sample size in prominent recent experimental papers in the field.

Data and Use of Data:

Our data will be substantially richer than most previous studies because of the variety of interventions and the high-frequency gathering of input and activity information from farmers (about one visit per month). The investigators will use the data to write a series of academic papers based on the comparisons detailed above. In addition, we will make the data available for graduate students for dissertation work. We will also make them publicly available upon study completion. We will collect:

- Baseline survey information to measure context, consumption, assets, risk perception, risk aversion, plot-by-plot characteristics, perceived constraints on adoption and technology use history.
- High frequency information (every 6 weeks) on input use, compliance with recommendations and indications of moral hazard using the technicians.
- Endline survey information to measure harvest, profitability of technology and agricultural technician performance.

Host Country Research Capacity Building

Dr. Enrique Seira from Mexico´s ITAM will be involved in all stages of the project. Approximately four thesis students from ITAM will participate in the implementation of the study and will have access to data for their thesis. The ongoing pilot has already used an ITAM student who has been actively involved in the project.

There is no public information at the farm level in Mexico, thus part of our contribution will be to disseminate our datasets. Dr. Seira has already taught a seminar on impact evaluation for agronomists at CIMMYT. In spite of its experience FIRA has never conducted a large scale randomized impact evaluation. Our evaluation could convince FIRA and other players to evaluate other programs. Furthermore, CIMMYT is an important and very prestigious agricultural institution in Mexico, Asia and Africa. Developing its capacity and appetite for doing impact evaluations will maximize the policy influence of results. For this project Dr. Enrique Seira, will offer an impact evaluation seminar for local FIRA and CIMMYT staff (around 20 participants) before project implementation, focused on the evaluation design of the project.

Relevance to USAID

Our research proposal perfectly complements the objective of USAID Mexico's Competitive Program of improving the design, implementation, and evaluation of government programs that aim to support small rural producers. First, the TGP will be a pilot program of FIRA whose intention is to scale-up if proven effective. Second, the program directly sets out to impact the competitiveness level of small rural producers by increasing take-up of productivity increasing technologies. This also directly contributes to Feed the Future's purpose of unleashing the "proven potential of small-scale agricultural producers to deliver results on a large scale". Furthermore, FIRA has the technical and financial capacity to scale-up this program as it already serves 1.6 million farmers with other programs and works with all 32 Mexican states. FIRA calculates that there are 724,000 maize producing farms with a productivity of 0.6 to 2.5 tons of maize per hectare in Mexico. FIRA plans to reach 75% of them in a span of five years. Third, this program could reach not only the 3.5 million of low-income farmers in Mexico, but could prove valid and easy to implement in Asian and African countries by organizations such as our partner CIMMYT. Moreover, by training participants in Conservation Agriculture the TG program focuses in on USAID's priority of promoting sustainable agriculture. We plan to collaborate with USAID Mexico staff by inviting them to actively participate in all implementing partner meetings during all research project stages and site visits. We will also share progress reports with them.

In addition, we also hope to implement a version of the program in Africa, in countries that are of direct interest to USAID. Our current plan is to use the results from the Mexican project to design a program that can be implemented in Tanzania (or Uganda) with the assistance of a locally based research team. We hope to finalize the details in the next few months and will seek separate funding for this project under the next funding window (other than some funds in this proposal to meet with potential partners and explore the feasibility of a similar design).

Policy Relevance:

The Mexican government, through FIRA requested this project and the associated impact evaluation. The government did this with the aim of determining how to best design its new TGP before scaling it up to the entire small farmer population. FIRA will use the results to decide whether its credit programs and technology assistance programs are effective and whether its income guarantee scheme is effective at increasing adoption and yields without succumbing to moral hazard problems. In addition, after being invited by the government and recognizing the project´s agricultural policy significance, CIMMYT is now an integral part of the project. CIMMYT intends to use the results from this study to inform their policy recommendations world-wide. In particular, they will use the results (if successful) to promote similar programs elsewhere in Africa and Asia so that we can leverage our work internationally.

Anticipated Outputs:

We will have several policy outputs; addressing different audiences:

1. Report of the program design and scale-up lessons for FIRA and CIMMYT. This will be used directly to improve the program with the objective of starting scale-up in 2015. The idea of this entire endeavor is not only to produce academic papers but to learn what works in order to design a scale-up plan of the TGP.
2. Policy Briefs and Recommendations: We will release a J-PAL Type Policy Lesson 3 page brief (two of the project's investigators are J-PAL affiliates). We will release things after obtaining final results of the TGP's impact. In Mexico, the recipient will be the Federal and State governments, and farmer associations (Ejidos). Internationally, we will send these to the World Bank, the Inter-American Development Bank and the United Nations among others. The research team will prepare this with the advice and support of communication teams from FIRA and CIMMYT. We will release policy briefs based on the study through UCLA that also have a wide audience.
3. Datasets: We will share the data with the Ministry of Agriculture in Mexico and with Congress and make it public on the web after the study's completion.
4. Academic conferences: We will produce a series of academic papers focusing on the main results of the program that provide key insights regarding the main

constraints faced by smallholder farmers. We will hold academic seminars in several universities in the U.S., Asia and Latin America. J-PAL will make academic papers available on their web portals. We will publish the data on the web while complying with confidentiality laws.

5. Outreach Workshops: We intend to organize and host various outreach activities to disseminate results in African countries for which perhaps the results from this study are most relevant. At this stage we plan to hold a workshop to bring together researchers working on similar topics in the African continent (ideally in collaboration with USAID and other interested parties) and use the workshop as a site both for research dissemination as well as potential collaboration.

Anticipated Impacts:

Ultimate impact: The TGP will impact the lives of beneficiaries through two main channels: one is the direct effect on income from increase yields. We calculate that net profit will increase 30% (assuming a 1.2 t/ha initial yield, a 275% production increase, a $320/ton maize price, and a $1,102 technological package loan coast). Notice that the intervention is about technology adoption, which will have long-term effects. The second channel is access to credit. Most smallholder farmers have never had a loan and therefore have no credit history. This lowers the probability that they can get a loan. We will break this vicious cycle by giving them their first loan. Since many of the inputs that compose the TGP already exist in many developing countries --but mostly provided separately and forgoing their complementarity-- if successful, the program scales up easily. The lessons will be used to (re)design the Mexican government's technology outreach programs in agriculture and to expand it to other countries.

Benchmarks:

- 1st quarter 2013: enroll 900 farmers in the pilot
- 2nd and 3rd quarters 2013: provide advice and inputs to farmers
- 4th quarter 2013: measure performance.
- 2014 to 2016: expand the program to all Mexican States
- 2016 onwards: disseminate lessons for implementation in Latin America and Africa where Maize production is important and yield per hectare are low due to low technology adoption

Timeline:

The study will last two years, beginning November 1, 2012 and concluding October 31, 2014. In November 2012, we will hire and train specialized services companies working with FIRA and CIMMYT (i.e. financial intermediaries, agricultural technicians and input providers) and will plan program promotion. From November to December 2012, we will implement the program promotion campaign and begin baseline survey planning. From January-February 2013, we will survey 900 eligible and interested program applicants. In March 2013, we will randomly assign the 900 eligible program applicants into treatment and control groups and integrate all program contracts. From April-May 2013, we will train program beneficiaries on proper technology package application. The maize cultivation cycle lasts from May-November so during this time period we will monitor agricultural technicians and their collection of high frequency data (5 times during the 8 month period). Close to the end of the cycle, in October-November 2013 we will begin endline survey planning. In December 2013, we will complete the following: production and sales report, pay-out income guarantees (in cases where income earned is below the expected level). From January-February 2014, we will carry out endline surveying. From

March-May 2014, we will clean survey data and begin preliminary data analysis. From June-October 2014, we will carry out all data analysis, complete a final report of results and carry out dissemination activities.

In addition, we will start work on the African intervention in January 2014 beginning with an initial visit by the PIs to meet potential collaborators in Africa and lay the groundwork for a dissemination conference in Africa in April 2014. Following this, we hope to finalize our funding and launch the second project in early 2015.

Project Implementation Schedule

Activity	2012		2013												2014									
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct
Hire Specialized Service Companies (SSC)	■																							
SSC training	■																							
Promotion planning	■																							
Program promotion	■	■																						
Baseline survey planning	■	■																						
Long application (baseline survey)			■	■																				
Contact producers accepted into the program					■																			
Contract integration					■																			
IPA intervention monitoring						■	■	■	■	■	■	■	■											
Agricultural Technician assistance and high frequency surveying						■	■	■	■	■	■	■	■											
Program beneficiary training						■	■																	
Land preparation and sowing						■	■																	
Crop growth							■	■	■	■	■	■	■											
Harvesting and commercialization												■	■											
Planning and preparation for endline survey												■	■											
Production and sales report													■	■										
Enforcement of guarantees													■	■										
Endline survey															■	■								
Database cleaning																	■	■	■					
Analysis, evaluation report and dissemination planning																			■	■	■	■	■	■
Dissemination seminars and conferences																							■	■