



Do Tailored Input Recommendations and Flexible Subsidies Increase Uptake and Yields among Maize Farmers in Mexico?



Independent
Science and
Partnership
Council

Standing Panel on Impact Assessment (SPIA)

January 2019

Brief Number 75

BACKGROUND AND CONTEXT

Agricultural productivity remains low among small-scale farmers in developing economies. At the same time, adoption of productivity-improving technologies is often low. A plausible reason is that the technologies do not deliver expected benefits under heterogeneous farming conditions. Maize crops are of particular concern because yields vary widely across the globe—from 1.1 tons per hectare (ha) in Sub-Saharan Africa to more than nine tons per ha in the United States. In Mexico, despite the growth in yields in recent decades, yields are still around three tons per ha and lower still among smallholders. Maize is the most important food crop in Sub-Saharan Africa and Latin America, so increasing productivity could have widespread knock-on effects on food security and livelihoods. Better understanding of the drivers of productivity hence remains a first-order question for policy makers, because different drivers suggest different interventions to improve yields.

A randomized controlled trial (RCT)—by researchers from [J-PAL](#), [Qué Funciona para el Desarrollo \(QFD\)](#), [UC Berkeley](#), and [World Bank](#)—examined whether providing small-scale maize farmers with input recommendations tailored to their local conditions, other complementary inputs (precision sowing drill, herbicide) as well as extension services (e.g., on dosage and timing of fertilizer application) can improve yields relative to more generic recommendations. It drew on [International Maize and Wheat Improvement Center \(CIMMYT\)](#) research, in Mexico, on conservation agriculture extension services and the use of inputs based on plot specific soil analysis.

TAILORING TECHNOLOGIES TO FARMERS' NEEDS

Technology adoption is one important mechanism for increasing productivity, but take-up of technologies, such as chemical fertilizer, has been sporadic and uneven among smallholder farmers. In many countries, including Mexico, fertilizer recommendations are typically generic—not tailored to local agro-climatic conditions. Because soil quality can vary substantially even within a small area, optimal input combinations to maximize yield might vary, and this might explain the low and unstable take-up of inputs.

DATA AND METHODOLOGY

This RCT was designed to measure and compare the effects of three types of interventions: (a) providing individual plot-level fertilizer recommendations compared with more aggregated village-level recommendations; (b) providing inflexible in-kind subsidies compared with flexible in-kind subsidies; and (c) providing subsidies relative to not providing subsidies.

The program was widely advertised in 13 municipalities of the state of Tlaxcala, Mexico, during 34 promotional meetings conducted in January 2015. Of the 1,299 smallholder farmers (<15 hectares) who attended the promotional meetings, 981 farmers were randomized into the five arms of the experiment. Of these farmers, 914 actually followed through on their intent to sow maize in 2015 and were included in the study.

Budget considerations precluded a full factorial design, so the study focused on the following treatment arms:

- T1: Individualized plot-level soil analysis and recommendations, inflexible in-kind subsidies to purchase recommendations, and extension services
- T2: Average village-level soil analysis and recommendations, inflexible in-kind subsidies to purchase recommendations, and extension services
- T3: Average village-level soil analysis and recommendations, flexible in-kind subsidies to purchase recommendations, and extension services
- T4: Average village-level soil analysis and recommendations, no subsidy for purchases, and extension services
- No treatment (control group)

The in-kind grants provided 2,000 pesos (US\$ 150) worth of inputs, which was roughly half the average per-hectare cost of the recommended inputs. For farmers who received the inflexible in-kind subsidy, the grant was applied sequentially, starting with a precision sowing drill for fertilizing during sowing (800 pesos). The remainder was applied to the recommended fertilizer package. If the input recommendations cost more than 2,000 pesos, farmers were responsible for paying the difference. Farmers who were offered the flexible in-kind subsidy could purchase any input at the agro-dealer and were not required to rent the drill. Three plot visits by extension workers along with three group-training sessions (at sowing, 40 days after sowing, and before harvest) were also done.

SUBSIDIES, NOT TAILORED RECOMMENDATIONS, DRIVE PERSISTENT TAKE-UP AND HIGHER YIELDS

Tailoring recommendations to villages rather than individual plots did not reduce yields. Results showed that providing recommendations based on soil analyses can improve yields in the short term for smallholder farmers and that agro-dealers can feasibly provide such tailored inputs. It also showed that tailoring at an aggregate level (that is, at the more cost-efficient village level) did not lead to significant yield losses relative to tailoring at an individual plot level. Providing recommendations (aggregate or local) also improved farmers' confidence in their own assessment of soil fertility.

Subsidies are essential to achieving high rates of uptake of the fertilizer recommendations. In treatment groups

T1, T2 and T3—all of which included subsidies to purchase recommended fertilizers—take-up was more than 75 percent. This result suggests that neither the level of localization (of recommendations) nor the restrictions on the use of the subsidy mattered for uptake. Among farmers in T4, who did not receive a subsidy for fertilizer purchases, take-up of the recommendations was only seven percent.

Farmers' plot characteristics varied considerably, and only standardized fertilizer packages were previously available in local markets. Detailed soil analyses carried out on smallholder plots showed considerable variation in plot characteristics, and the resulting tailored fertilizer recommendations were markedly different from farmers' usual practices. For instance, the analysis recommended 235 kg of fertilizer per hectare, whereas study farmers were using 340 kg on average (previous year). That is, farmers were applying large quantities of urea and to an extent, di-ammonium phosphate (DAP)—much more than recommended by the analysis—but under applying potassium chloride (KCl) and micronutrients such as boron. Preliminary data collected in the first year of experiment suggested that fertilizers in blends recommended by soil analysis—based on either average village-level or plot-level characteristics—were also unavailable in local markets, limiting the ability of farmers to follow recommendations. Hence, the researchers worked with agricultural dealers to provide a more diverse set of fertilizer packages.

Farmers across treatment arms continued to use the practices learned in 2015 during the following year. This was especially true among farmers in T3, who received flexible in-kind subsidies that gave them discretion over purchases. The use of fertilizer with machinery at sowing increased by 67 percentage points (p.p.). Compared to the control group, farmers in T3 were more likely to use fertilizer at sowing (20 p.p.), and herbicide one week after sowing (20 p.p.), and they were also more likely to cover the fertilizer right after topdressing (82 p.p.) to reduce the loss of nutrients. This learning process, however, did not translate into higher yields in 2016.

SOURCE

Mahajan, A., Seira, E., Gine, X., and Corral, C. (2017). *A Multiple Intervention Approach to Increasing Technology Adoption with a View Towards Scaling-up: Evidence from Mexico*. Unpublished report submitted to the Standing Panel on Impact Assessment (SPIA) of the ISPC.

