Our latest note tests how different ways of providing best agricultural practices to maize farmers in Mexico affects adoption during and after the intervention.

**Empowering Farmers to Adopt Agricultural Recommendations**

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A quick glance at agricultural input use data from developing countries reveals a large dispersion in take up of improved inputs and practices across farms. One explanation is that this is a problem resulting from limited information, credit constraints, risk, poor input quality, and/or behavioral biases. An alternative view is that farmers are in fact making optimal adoption decisions, and differences among farmers instead reflect heterogeneity in a fixed factor such as soil quality.

We test whether rainfed farmers in Tlaxcala, Mexico adopt tailored recommendations based on soil analyses and whether productivity improves as a result. We vary the level of information specificity (whether recommendations are based on the farmer's own plot or on a larger geographical area) because individually tailored information may be more effective but is also more expensive. We also vary whether farmers can choose what inputs to purchase by offering an inflexible grant that subsidizes only the recommended inputs or a flexible one that gives farmers the choice of which inputs to purchase.

### 1. Experiment

The experiment consists of 678 farmers divided into a control group and four treatment arms that combine soil analysis and recommendations (either at the plot or cluster level) with flexible or inflexible in-kind grants. Farmers in all treatment arms were offered a soil analysis report, a set of input recommendations and a package of agricultural extension services designed to help them implement the recommendations. In addition, three of the four treatment arms were offered an in-kind grant of 2,000 pesos (roughly 150 US$ at the time of the intervention):

- **T1** received *individualized or plot level* soil analyses with input recommendations and an *inflexible* in-kind grant.
- **T2** was the same as *T1* except that the soil analysis and recommendations were *averaged* in the cluster. Comparing *T1* with *T2* allows us to estimate the effect of varying the level of the specificity of the soil analysis and recommendations.
- **T3** differed from *T2* in that the in-kind grant was *flexible*. A comparison between *T2* and *T3* thus measures the effect of autonomy, i.e. the ability to choose the inputs purchased.
- **T4** provides the same recommendations as *T2* and *T3*, except that no grant was provided. Comparisons between *T4* and *T2* (or *T3*) measure the effect of providing the in-kind grant.
- A *control group C* did not receive any interventions during the experiment, but instead received soil analyses and recommendations (without extension services) the year after the intervention ended. Comparisons between *C* and *T4* estimate the effect of providing localized
soil analyses, recommendations and extension services.

2. Results
We document substantial heterogeneity in soil quality, mostly within (rather than between) clusters. This heterogeneity implies a corresponding variation in the optimal mix of fertilizers.

We then examine adoption using a standardized index of new agricultural practices introduced by the intervention. By this metric, farmers in T4 adopted 0.33 s.d. more practices relative to control farmers. Farmers that received the in-kind grant adopted considerably more practices (ranging from 1.68 to 1.96 s.d. depending on the arm) underscoring the importance of the in-kind grant. Since the value of the grant was designed to be roughly equal to the amount spent on fertilizer by control farmers, we view the grant as primarily encouraging experimentation rather than relaxing liquidity constraints. Surprisingly, T3 farmers, who could ignore the recommendations at no cost, adopted these new practices at the same rate as T2 farmers. Finally, we find no evidence for specificity since T1 farmers did not increase adoption of new practices relative to farmers in T2.

We also examine the impact of the treatments on productivity and find results similar to those on adoption. Average yields and profits for farmers in T4 are not statistically different from those in the control group but despite a drought, yields for farmers that received a grant were 0.2-0.4 tons/hectare higher relative to those for control farmers, corresponding to an increase of approximately 12-17%. The increase in profits is more muted and not statistically significant at conventional levels. Since neither specificity nor autonomy affected yields or profits, during the intervention there appears to be no significant downside to providing farmers with autonomy. Finally, we examine the persistence of the recommended practices in 2017, two seasons after the intervention ended. Farmers in T4 adopted 0.39 s.d. more practices in 2017 relative to control farmers. Since control farmers received recommendations in 2016, this suggests complementarities between extension services and recommendations, consistent with work in other contexts.

More interestingly, farmers who had received the flexible grant, were substantially more likely to persist with the new practices in 2017 relative to farmers with the inflexible grant (an increase of 0.55 s.d.) and to farmers in the control group (an increase of 1.08 s.d.). The fact that some farmers continued to use the new practices two years after the intervention suggests that they were perceived as valuable.

3. Policy Recommendations
These results have the following relevant implications:
1) Cluster recommendations are as effective as the more expensive plot-level ones, even in a context with substantial heterogeneity.
2) Recommendations should be paired with extension services to help implement them.
3) Program beneficiaries should be given autonomy, particularly if the program is top-down and involves expert advice.

