IDB Invest

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What Works Best to Strengthen Beekeeper Productivity and Climate Resilience?

- Beekeeping is of high economic and social importance in Latin America and the Caribbean and provides livelihoods for low-income people.
- Growing threats to bee colonies, such as climate change and increased pesticide use, make the adoption of improved hive management practices increasingly important.
- After severe flooding in Yucatán in 2020, IDB Invest, and the Mexican food company Naturasol co-financed a pilot program to help small beekeepers recover and increase their resilience to climate change.
- The comprehensive program included a combination of basic inputs, new queen bees, and training in sustainable hive management and queen bee breeding.
- An evaluation of the program shows that producers who received the "full package" of support increased their number of hives, honey production, yields, and adoption of best practices compared to producers who only received basic inputs.

SUSTAINABLE DEVELOPMENT GOALS

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BEEKEEPING IN A CHANGING CLIMATE

Beekeeping is of high economic and social importance in Latin America and the Caribbean. The region accounts for 14% of global honey production and 8% of global bee livestock.[1] Argentina, Mexico, and Brazil are among the top honey exporters in the world. Honey production also provides an important livelihood opportunity for low-income populations. For example, in Mexico, honey production is concentrated in the South, which lags behind other regions of the country in terms of development and job opportunities.

To date, countries in the region have succeeded in honey production despite poor colony management. However, beekeepers need to improve their hive management practices in the face of growing threats such as climate change and increased pesticide use.[2]

In June 2020, tropical storm Cristobal led to severe flooding in the state of Yucatán, where most of Mexico's honey is produced, causing production to plummet (Figure 1). This was not the first climate shock to hit the area; in 2017 severe droughts gravely affected honey production. The flooding weakened the state's entire honey supply chain. Small beekeepers were hit the hardest, faced with devastating economic damage and scarce resources to rebuild their hives.

THE PILOT PROGRAM

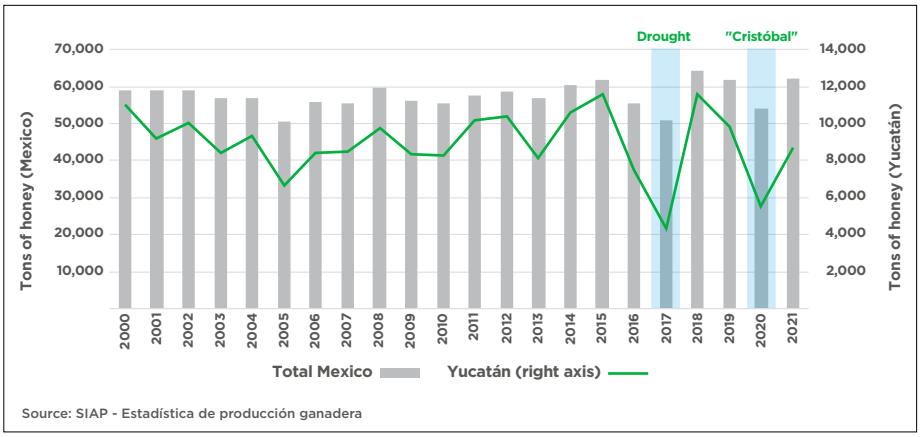
To help the producers recover, improve productivity, and build resilience to future climate events, IDB Invest and Mexican food company Naturasol[3] co-financed a pilot program with small-scale beekeepers in Yucatán who sell their honey to Mielmex,

Naturasol's sister company. At the time, Naturasol had over 16,000 honey suppliers, 95% of which were small-scale producers. The implementation of the pilot program was carried out by Agroeco, a consulting firm specialized in beehive management.

The free, one-year program was provided to beekeepers in 17 locations in Yucatán from July 2021 to July 2022. It included four main components: 1) basic inputs for feeding, pest control, and equipment; 2) general training on sustainable hive management practices; 3) new queen bees with improved genetics; and 4) training focused on queen bee breeding. However, due to pandemic-related logistical difficulties at that time, beekeepers in 3 locations only received basic inputs, while those in the other 14 locations received the full program.

Training was offered in the local Mayan language and included group workshops and individual follow-up visits. The content was defined based on the needs identified by the producers, and training was delivered by local beekeepers who were trained as technicians. Ensuring the full and equal participation of women beekeepers—who had often been left out of past interventions—was also a priority.

Figure 1: Honey Production and Climate Shocks in Mexico



Source: SIAP - Estadística de producción ganadera

The timing of the training topics and provision of inputs was planned to coincide with beekeepers' needs during an entire agricultural year.

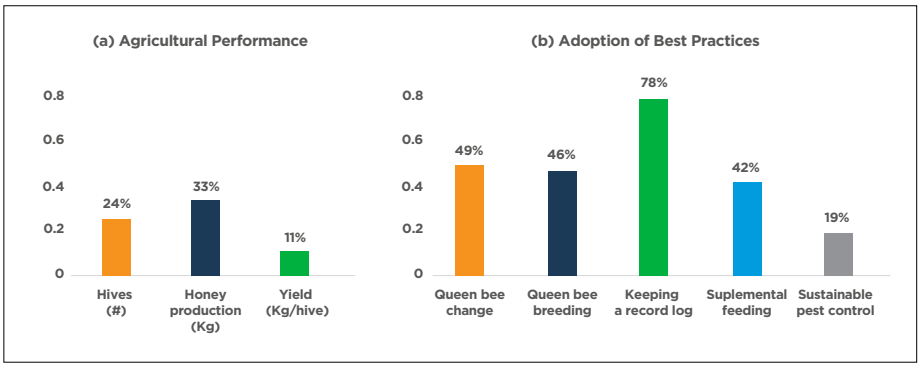
THE IMPACT STUDY

To assess the effects of the pilot program on the productive performance and adoption of best practices among beekeepers, IDB Invest carried out an impact study using data from baseline and follow-up surveys conducted with the 356 participants.

To quantify these impacts, the study compares the change observed in key outcomes – number of hives, honey produced, yield, and adoption of best practices – for beekeepers who received the "full package" including all four components of the program versus beekeepers who only received basic inputs. The latter served as the "control group", allowing us to measure what would have happened in the absence of the full program.[4]

To make this comparison more reliable, the study uses a statistical method called entropy balancing[5] to ensure that the two groups are comparable in terms of their observed characteristics before the program was implemented (e.g., educational attainment, initial production levels, share of female beekeepers).

Figure 2: Impact of the "Full Package" (% change in performance and likelihood to adopt best practices relative to control group)



IMPROVED PRODUCTIVITY, ADOPTION OF BEST PRACTICES & RESILIENCE

The results show that the program was highly effective at improving beekeepers' productive performance. Beekeepers who received the "full package" increased the number of hives in their colonies by 24%, honey production by 33%, and most importantly, yields by 11%, compared to the control group (Figure 2a). This led to higher monthly income from honey sales, increasing from US$100 in 2020 to US$163 in 2022. The full approach was also cost-effective, generating US$1.2 in additional honey sales per US$1 invested in the program.

"With the project, I have learned to care for more hives, this has motivated me to grow as a beekeeper. I learned to breed queens, giving me courage to invest the money my husband sends from the U.S. in more equipment. With the inputs from the project now I have 40 hives, before I only had 20."

— Karina from the Yotholín community, one of the many beekeepers who benefited from the program as evidenced by the statistical analysis.

Beekeepers receiving the "full package" were also more likely to adopt best practices in hive management, which bodes well for longer-term climate resilience. As shown in Figure 2b, they were nearly 50% more likely to change their queen bees annually, 46% more likely to breed queens themselves, and 78% more likely to keep a log of their beekeeping activities, relative to the control group.[6] Receiving the full program also increased their use of supplemental feeding by 42% and pest control practices by 19%.

DRIVERS OF POSITIVE RESULTS

The addition of new queen bees seems to be the main driver behind the positive results in terms of increasing honey production and yields. This is not surprising as having high quality queen bees is generally considered one of the most crucial factors for productive beekeeping. Likewise, the hive management training was a decisive factor in the adoption of best practices among the beekeepers.

In terms of impacts by gender, we initially expected that women would benefit more than men since they had typically been excluded from past interventions. Instead, the results show that women benefited from the program just as much as men. We may not be able to detect meaningful differences across gender due to the relatively small number of women participants (71 out of the 356 producers). Nonetheless, interviews with female beekeepers during and after the program suggest a high degree of participation and motivation among women who felt they had equally benefitted from the training.

CONCLUSION

This experience in Mexico shows that a comprehensive package of support combining basic inputs, training, and key assets (in our case, queen bees) can help improve beekeeper performance and resilience in the face of climate change in a cost-effective way. It also demonstrates how investing in building climate resilience across the supply chain can be a win-win for both private sector companies and their small suppliers. Anecdotal evidence suggests that the program resulted in increased supplier loyalty to Naturasol and Mielmex. Even when offered higher prices elsewhere, beekeepers preferred to sell their honey to Mielmex due to the technical support provided. ■

1. Food and Agriculture Organization of the United Nations (2023). FAOSTAT statistical database.
2. Galetto et al. (2022). Risks and opportunities associated with pollinators' conservation and management of pollination services in Latin America.
3. Naturasol is a family-owned business engaged in the development, production, and sale of foodstuffs including honey, nuts, grains, and spreads.
4. A completely "clean" control group is not available for the study because all producers included in the surveys received at least one program component.
5. Hainmueller (2012). Entropy Balancing for Causal Effects: A Multivariate Reweighting Method to Produce Balanced Samples in Observational Studies.
6. These are among the most important practices for good beehive management. Dini & Bedascarrasbure (2011). Manual de Apicultura para ambientes subtropicales; Gobierno de México (2019). Manual de Buenas Prácticas Pecuarias en la Producción de Miel; Blog Apicultura y Miel (2022). Cambiar la reina de las colmenas: Cuándo y cómo debe hacerse.
7. The resilience index is based on a GIZ methodology, and the variables were selected by the consulting firm that implemented the project.

Additional Information
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This brief summarizes the preliminary findings of a forthcoming study that will be part of IDB Invest's *Development through the Private Sector* Series.

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