# With CRISPR and machine learning, startups fast-track crops to consume less, produce more

Small players take on big seed conglomerates with next-generation non-GMO crops.

Agbiotech newcomer Inari has raised $89 million to pursue an ambitious goal: to challenge the status quo in agriculture. Inari, based in Cambridge, Massachusetts, plans to use the total $144 million it has raised so far to develop crops that are more productive and consume less water and fertilizer than those currently produced by seed conglomerates. The company will focus on major crops such as corn, soybean, wheat and tomato. "All the genetics [for these crops] are owned by just a couple of multinational companies, and we want to challenge that," says Ponsi Trivisvavet, CEO of Inari. "We want to bring back genetic diversity to make seeds that are better for the environment and the farmer," she says.

Inari is one of a several small companies with similarly lofty goals who are capitalizing on new editing technologies, such as CRISPR, and computational methods for predictive modeling. Such tools make crop development faster and less expensive, and potentially could give startups a shot at competing with the big players by sidestepping onerous and expensive regulatory oversight.

Just a few years ago, a seed developer could plan on spending a decade and up to $100 million on bringing one new crop trait to market (*Nat. Biotechnol.* **35**, 396–398, 2017). That's not only because the old tools for altering the genetics of these crops, such as *Agrobacterium*-mediated transformation, were slower, more expensive and more unpredictable than CRISPR, but also because of regulations, both in the United States and especially in Europe. Companies had to present years of field data to regulators before they could sell the seeds. And the final food products were often marked "GMO," a label distasteful to the public, presenting marketing challenges.

These barriers kept many would-be small players out of the industry. Trivisvavet says that with new tools, her company can develop crops for a fraction of the cost and time previously required. And so far, it appears that CRISPR-edited plants won't trigger US regulatory oversight or a GMO label (*Nat. Biotechnol.* **36**, 6–7, 2018).

Of course, scientists working for multinational seed companies like Corteva Agriscience, Bayer, Syngenta and BASF almost certainly have at their fingertips similar computational and genome editing tools. "So the foot race is on between the newcomers and the established players," says Ron Meeusen, managing director at Chicago-based Cultivian Sandbox, a venture capital firm focused on food and agriculture technologies that has not invested in Inari. "But startups are nimble, and if they can get there first on a given trait—say a one- or two-year lead—that can be a significant advantage in market share," he says.

Plants edited with the new genome editing tools will incorporate useful traits and will not be classed as GMOs. Credit: reHAWKEYE / Alamy Stock Photo

Trivisvavet says Inari's exclusive access to two particular technologies gives the company an edge. From the University of California, Los Angeles the company has licensed patents that describe key epigenetic pathways in plants and methods based on CRISPR for altering DNA methylation and gene regulation (*Nat. Commun.* **10**, 729, 2019). And through an exclusive deal with Cold Spring Harbor Laboratory, Inari has licensed a CRISPR-based tool for editing promoters, which are the genetic components that influence the way genes are expressed (*Cell* **171**, 470–480, 2017).

Meanwhile, other startups capitalizing on CRISPR–Cas9 and similar editing tools, as well as computational science, are making their own plays. Benson Hill, in St. Louis, offers a platform called CropOS that speeds the development of crops using a combination of machine learning, big data, genome editing and plant biology. Pairwise, based in Durham, North Carolina, uses genome editing to leverage natural diversity in major crops such as corn, soybeans, wheat, cotton and canola, and in March 2018 announced a $100 million collaboration with Monsanto (now Bayer).

And Indigo, in Boston, announced in September 2018 a $250 million series E financing, bringing its total to a whopping $650 million. The company develops cocktails of microbes using predictive machine learning algorithms, sells seeds coated with the proprietary microbial mix directly to farmers (*Nat. Biotechnol.* **35**,

1120–1122, 2017), and has launched an online marketplace to connect growers and buyers.

Inari, for its part, is shaking up the status quo in other ways. About 50% of its scientists are women, Trivisvavet says. The company was founded in 2016 by Flagship Pioneering, which contributed to the latest funding round, along with the Investment Corporation of Dubai in the United Arab Emirates, EDBI in Singapore, and other investors. ❐

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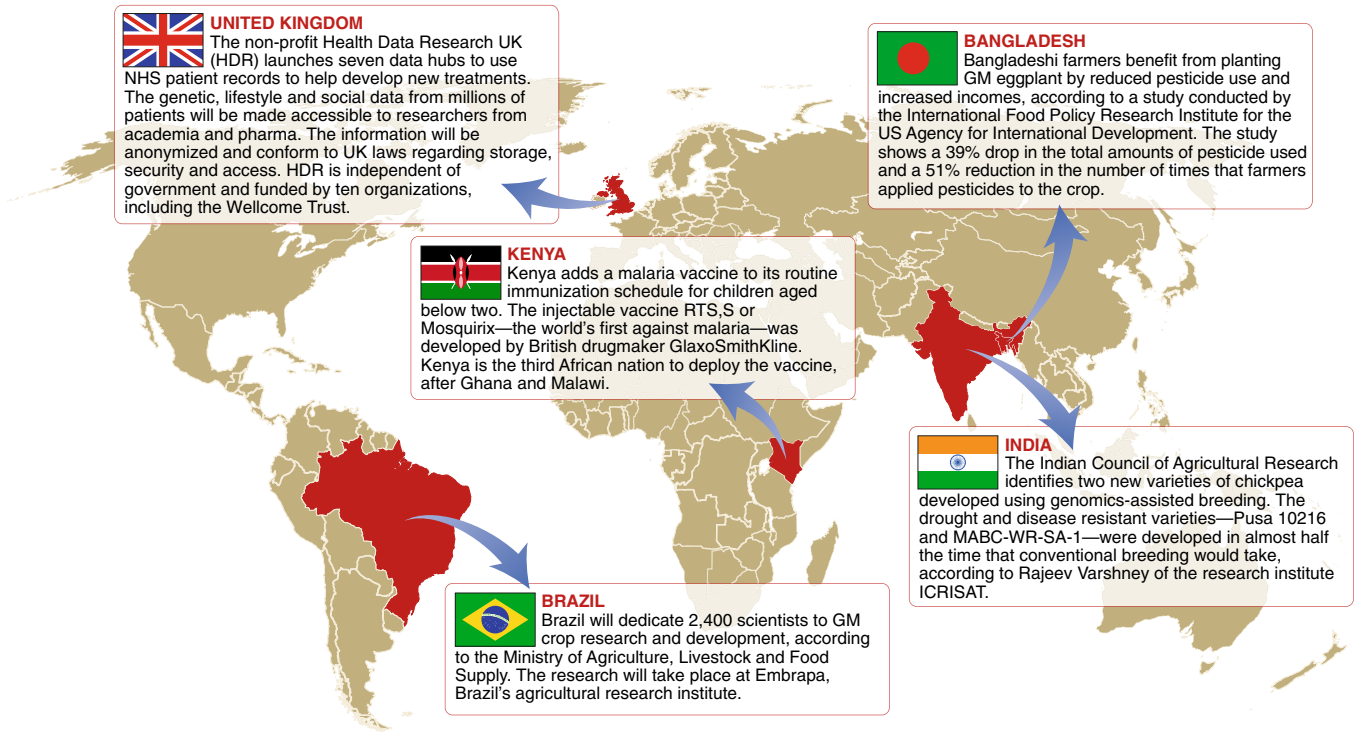
# Around the world in a month

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PODCAST

# First Rounders: Samantha Du

Samantha Du is founder, CEO and chairman of Zai Lab. In her conversation with *Nature Biotechnology* she discusses her thoughts on the US–China trade war, what makes Zai Lab a success, and her family's experience during the Cultural Revolution in China. https://www.nature.com/nbt/podcast

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