

## Doubts surround link between *Bt* cotton failure and farmer suicide

Results from a new investigation into the tragic phenomenon of Indian farmers' suicides and the alleged link with genetically modified (GM) cotton have been published. The International Food Policy Research Institute's (IFPRI) analysis released in October provides the most robust evidence yet that suicide among farmers in India has several causes, but *Bt* cotton is not a major factor. Indeed, the authors of the report, *Bt Cotton and Farmer Suicides in India: Reviewing the Evidence*, argue that insect-resistant cotton encoding the *cry1Ac* toxin gene from *Bacillus thuringiensis* (*Bt*) has been very effective in India overall, notwithstanding the significant levels of variation that individual farmers have experienced with the technology. The study is unlikely to be the last word on what remains a highly emotive question, given both the chaotic conditions under which adoption of transgenic hybrid varieties in India proceeded at the start of this decade and the lack of solid data underpinning the very real and complex tragedy of farmer suicide in the country.

Official statistics on the problem vary widely. The study authors, Guillaume Gruère and Debdata Sengupta, both of IFPRI, an agriculture policy think tank based in Washington DC, and former IFPRI researcher Purvi Mehta-Bhatt, opted to use figures from the National Crime Records Bureau, whose data indicate that about 17,000 farmers take their lives in India every year. "I'm not sure if it's the perfect data, and I'm not sure if it's well measured," says Gruère.

However, other sources may underestimate the problem, he and his co-authors argue.

The report (<http://www.ifpri.org/pubs/dp/IFPRIDP00808.pdf>) attempts to bridge an information gap between official farmer suicide data on one hand, which offers scant detail on individual cases, and the adoption of GM bollworm-resistant cotton on the other. It draws on a wide variety of sources, including peer-reviewed farm-level studies, official data, reports from nongovernmental organizations and media reports issued during the 2002–2007 period. It argues that farmer suicide in India predates the official commercial introduction of *Bt* cotton by Dawalwadi-based Monsanto Mahyco in 2002—and its unofficial introduction by Ahmedabad-based Navbharat Seeds a year earlier—and that farmer suicide has accounted for a fairly constant portion of the overall national suicide rate since 1997 (the point at which the IFPRI analysis begins). The authors' analysis indicates there is no evidence, either at the national or state level, to suggest a causal connection between the two, although the situation in Andhra Pradesh is more



The daughter of a cotton farmer who committed suicide after failing to keep up loan repayments. His death and that of other Indian farmers is unlikely to be linked to *Bt* cotton as previously alleged.

ambiguous, they note, because the farmer suicide data do not follow a linear pattern in that region.

"To be brutally honest there was nothing in there which was significant, given the scatter [of data] you had," says Stephen Morse, professor of sustainable development at the University of Reading in the UK, whose farm extension studies were cited in the IFPRI report. "If they had done a proper [statistical] analysis they might have picked up something." But he too is highly sceptical of a causal link between *Bt* cotton failure and suicide. "There is no evidence of any kind of a jump or any kind of surge."

Seeking to draw any firm conclusions on *Bt* cotton adoption from the official data is a fraught undertaking, given the hugely confusing seed market that developed after its introduction. The number of approved transgenic hybrid varieties has risen rapidly, from just three in 2002 to 135 in 2007 and an estimated 150 in 2008. In Gujarat, in particular, a thriving cottage industry has emerged in parallel, in which farmers develop their own unapproved transgenic hybrids by backcrossing officially approved varieties with locally adapted conventional varieties. "If you compare the legal and illegal varieties, there has been no significant difference between the two," says Lalitha Narayanan, associate

professor at the Gujarat Institute of Development Research, in Ahmedabad.

The picture is further clouded by the selling of mislabelled, counterfeit seed packets, which often contain more than one variety. One Indian official was quoted in SciDev.net defining four distinct categories of *Bt* cotton: "legal, illegal, fake legal and fake illegal."

Despite this confusion, at a macro level it is clear that the productivity of India's cotton growers has risen substantially since the introduction of *Bt* cotton and that the rate of increase in productivity has also jumped. Overall, national cotton production, including transgenic and conventional varieties, climbed from 15.8 million bales in 2001–2002 to 24.4 million bales in 2005–2006, according to the IFPRI report. Average yields rose from around 300 kilograms per hectare (kg/ha) in 2002/03 to around 500 kg/ha in 2007–2008, whereas it took fifteen years, from 1982 to 1997, to take average yields from 200 kg/ha to 300 kg/ha. "One of the major factors is *Bt* cotton," says Purvi Mehta-Bhatt, who is now director of The Science Ashram, an agriculture capacity-building nongovernmental organization based in Verodara, in Gujarat, although other improvements have also contributed. "Agricultural management is improving day by day," she adds.

Even so, it is also clear that not everyone profited from the headlong rush—one academic observer called it a stampede—to embrace transgenic cotton production, particularly in the Vidharba District in northeast Maharashtra, in northwest Andhra Pradesh and in northern Karnataka. "Many things went wrong in the early phase, that's true," says Matin Qaim, professor of international food economics and rural development at Georg August University of Goettingen, in Germany.

IFPRI's Sengupta concurs. "A lot of varieties that were introduced were not suitable for dry land agriculture," he says. Moreover, sound information on how to cultivate the new *Bt* cotton varieties was poorly disseminated, with the result that some farmers sprayed pesticides excessively, adding significantly to their input costs. (Cotton accounts for only 5% of land under cultivation in India, but it accounts for around 45% of total pesticide usage). The expense of transgenic seeds—approved varieties initially cost about five times as much as conventional hybrids although recently introduced price caps have slashed the differential—created additional burdens. So too did the high cost of credit in some regions, particularly in Andhra Pradesh, where private moneylenders rather than financial institutions are the main source of

## IN brief

## EU tightens animal rules

The European Commission has published plans to reform its current animal-welfare directive. The draft proposal has drawn criticism from industry groups who say the new rules will merely lead to increased bureaucracy without commensurate benefits for animal welfare. The revised directive is aimed at strengthening protection for animals used in research and would address the differing standards across member states. Besides banning the use of great apes, the new provisions would require increased cage sizes and rigorous ethical evaluations to be carried out before projects using animals are authorized. There are concerns, however, that implementing such changes will disproportionately burden small and medium-sized companies, and may push animal research out to countries with lower standards, such as China and India. Simon Festing, executive director of the Research Defence Society, a London-based organization that represents scientists using animals for medical research, says the directive is exceptionally disappointing. He thinks it is unlikely to achieve the goal of improved animal welfare and could threaten burgeoning biotech in the EU. "Countries that are not paying sufficient attention to these changes risk strangling a potential biotechnology sector in the future," says Festing. "It seems to us extremely shortsighted of countries like Poland and the Czech Republic to say that they're not too bothered because they don't have that much biotechnology." The new provisions will be debated for at least a year before they become law.

—Hayley Birch

## Public life cut short

Bioheart, the single biotech to go public this year in North America, faces delisting eight months after going public. The Sunrise, Florida-based company is expected to appeal the NASDAQ staff determination notice received on November 17, threatening to suspend trading and remove the company's securities. "There has been a sharp increase in delistings as most companies fail to find a healthy financing window," says Cowen and Company senior research analyst Phil Nadeau. Bioheart's troubles surfaced in October, when the company received a delisting notice for falling below NASDAQ's \$35 million market capitalization minimum. The company filed for IPO last February and expected to raise \$35–47 million, but instead brought in \$5.8 million at \$5.25 per share after lowering its initial public offering price range from the original \$14–16. The company, which is burning through about \$4 million per quarter and has \$3 million in total assets, is in need of cash. Like other public biotech firms in this economic downturn, it might be forced to look outside the public markets. "In the current risk-averse environment, non-profitable small and micro-cap biotechs will be adopting alternative financing vehicles more common in other sectors, such as venture debt or selling royalty streams," says Nadeau. Bioheart's product portfolio includes Myocell, the autologous stem cell therapy for heart failure patients in phase 2/3.

—Victor Bethencourt

## Pfizer's \$100 million stem cell stake

Pfizer has launched Pfizer Regenerative Medicine, an independent research unit focused exclusively on using stem cells to develop new medicines. The New York-based company will spend more than \$100 million over the next 3–5 years on the new initiative, which will employ 70 researchers based at two facilities, in Cambridge, Massachusetts, and Cambridge, UK. The UK group will focus on neural and sensory disorders, whereas the US team will concentrate on endocrine and cardiac research. In-house researchers will work with both embryonic and adult stem cells, but significant collaborations are also planned. Chief Scientific Officer Ruth McKernan, who will head the UK site, says: "We are keen to take advantage of successful work done by other companies and academic labs. We will be working with several collaborators and these will be announced in the new year." In the past, big pharma has shied away from investing in stem cell research, but Pfizer's move confirms that attitudes are changing. London's GlaxoSmithKline recently signed a \$25 million four-year deal with Harvard University, and the venture funds of Basel-based Novartis and Roche helped bankroll Cellerix, a Madrid company testing stem cells from fat to treat rare skin conditions. Stanford University, California, also recently announced the construction of the world's largest stem cell research building to house over 600 scientists by 2010.

—Nayanah Siva

## IN their words



**"The agency is hanging on by its fingertips in protecting us."**

William K. Hubbard, a 27-year veteran of the Food and Drug Administration, comments on the need to boost agency funding so that it

can keep pace with its responsibilities.

**"An opportunity to sell new versions of snake oil."**

Theodore Friedmann, director of the University of California-San Diego Medical Center's interdepartmental gene therapy program, describes Atlas Sports Genetics' ACTN3 genetic testing kit touted for predicting "speed, power and endurance" (*NY Times*, November 30, 2008).

loans for farmers. All of these vulnerabilities were exacerbated by the unscrupulous selling of counterfeit seeds, which often contained a mix of transgenic and conventional hybrids.

Crop failures were seized on by activist groups in India, such as Gene Campaign, which had previously campaigned against—and indeed successfully delayed—the commercial rollout of *Bt* cotton. "The statements they made weren't completely wrong, but they weren't completely representative," says Qaim, who says his own work in India is in agreement with the IFPRI findings. The evidence for the scale of *Bt* crop failures is anecdotal, as is any causal connection with farmer suicide. Where such failures did occur, the IFPRI report blames the conditions in which the technology "was introduced, sold, and used" rather than the technology itself.

Vandana Shiva, the country's most prominent anti-biotech activist, rejects this line of reasoning. "You cannot separate the technology from the context. That doesn't work at all," she says. Any seed that is sold to a farmer, she says, is sold on the basis that it will work for them within their specific ecological and socioeconomic contexts. She is critical of the overall report, moreover, including its failure to deal with what she sees as the real underlying problem. "Nothing in that paper is addressing the issue of debt, which is the prime cause of suicide," she says.

Morse, who is a geographer (some of whose work in India has been funded by St. Louis-based Monsanto), says the experience with *Bt* cotton in that country is broadly similar to the introduction of *Bt* cotton in the Makhathini Flats, in KwaZulu Natal Province in South Africa, where he has also performed field research (*Nat. Biotechnol.* 22, 379–380, 2004). He also sees parallels between the introduction of *Bt* cotton in India and an unsuccessful attempt to introduce conventional hybrid varieties of maize in Nigeria during the mid-1980s. "The same issues frankly have always been there," he says. Farmers take time to adapt to new varieties and conduct small-scale experimental plantings as part of their learning process. "Farmers have done this for centuries," he says. "The GM varieties are no different, I think, in terms of that basic dynamic."

The clash between an ecological approach to agriculture and one based on biotech remains, of course, at the heart of the exhaustive and circular debate on transgenic crops. Matin Qaim says it is a "pity" that no one has found a constructive way of adopting the two. "In my eyes both are important approaches. They're not actually mutually exclusive."

Cormac Sheridan Dublin