Slate Magazine

On the Front Lines of the Global Food Crisis

Is the damage inflicted on Punjab by the Green Revolution driving India's next big separatist movement?

By Mira Kamdar

Subject: Things That Go Bump in the Night

Posted Monday, Aug. 4, 2008, at 2:42 PM ET

JAITU, FARIDKOT DISTRICT, India—Wrapped in a musky blanket under a fan that was frantically trying to beat the air free of mosquitoes, exhaustion was finally overtaking me when I vaguely felt something nuzzle my left hand. In theory, I was alone, deadbolted away from the family of six, who were sleeping outside on string cots so I could have the only bed in the only room of their home. At the second nudge, definitely mammalian, adrenaline flooded my body, sending me shrieking into an upright position. A rat scurried away.

I had traveled to this remote part of Punjab to try to understand India's agricultural dilemma. Squeezed between the relentless pressure to increase production and an environment stressed to the breaking point, the agricultural miracle brought to Punjab by the Green Revolution back in the 1960s was failing, the terrible costs of its success tearing at the fabric of Punjabi society. If Punjab couldn't find a way out of the current impasse, I didn't see how India, or the world as a whole, was going to feed a growing population in the face of environmental collapse and growing political instability fueled by scarcity.

The next morning, after tea with milk from the cow tethered out front, my host family's son Jitinder gave me a ride into town on the back of his motorcycle so I could attend a workshop on natural farming organized by Umendra Dutt, an agricultural activist who runs an organization called Kheti Virasat Mission. Kheti Virasat Mission's work focuses on raising awareness about the damaging effects of chemical pesticides, synthetic fertilizers, and overwatering, as well as the mass dislocation of people away from their land and communities into an urban-oriented economy that can't absorb them.

I braced myself as lightly as I could against Jitinder's body, conscious of being a woman perched behind an unrelated man in a strongly patriarchal culture, as we wove our way out of the dirt lanes of the village and onto a narrow asphalt road that cut through an endless sea of ripening wheat, passing bullock carts piled high with fodder, tractors clanking toward the fields. I hadn't ridden on the back of a motorcycle in a long time. It was exhilarating to feel the air whipping around my face, the throb and bob of the machine gripped between my legs. I could smell the green scent of the plants and hear the morning bustle of the birds. Farmers and laborers were already wading through the waist-high wheat, spraying pesticide by hand from backpack reservoirs.

When the Green Revolution arrived in Punjab, the "land of five rivers," India faced chronic food shortages. A combination of massive irrigation infrastructure mandated by the Indian state, new hybrid seeds, chemical fertilizers, and pesticides boosted yields to record levels over the following decades, saving India from the specter of mass famine. With just 1.5 percent of India's land area, Punjab produces 20 percent of the country's wheat and 12 percent of its rice. It provides 60 percent of the government's reserve stocks of wheat and 40 percent of its reserves of rice, the country's buffer against starvation.

Punjab's amazing productivity made it possible for India to feed most of a growing population that tripled from 350 million when the country became independent in 1947 to more than 1.2 billion people today. In 2001, India even began to export grain, though critics claim this impressive achievement was gained at the expense of India's poor.

Only two years later, in 2003, India had to reverse the funnel and import grain, something it had not done in decades. Every year since then, India has imported more and more of its food. Panic-buying by India is credited with helping to raise the price of wheat on global markets by more than 100 percent last year, causing prices to spike around the world, from pasta in Italy to bread in Russia.

In an era of global food scarcity, economic growth does not guarantee India the ability to buy as much food as it needs on the world market. And steps India has taken to liberalize its domestic grain market, a move hailed by some as a necessary corrective to a system riddled with inefficiencies and disincentives to production, may have contributed to the current food crisis by allowing agribusiness giants to siphon off huge quantities of grain.

Meanwhile, the tragic social and environmental costs of the Green Revolution are escalating, threatening a return of the political violence that took the lives of more than 25,000 Punjabis during the 1980s and '90s when a violent secessionist movement—fueled by profound social disruption caused by the Green Revolution, which dislocated small farmers—militated for an independent Punjab, which would be called Khalistan. The movement had religious overtones derived from Punjab's majority religion, Sikhism. The Indian state came down on the movement as hard as it could, culminating in June 1984 with an attack by the Indian army on Sikhism's most sacred site, the Golden Temple in Amritsar. Then-Prime Minister Indira Gandhi was subsequently assassinated by her Punjabi Sikh bodyguards, after which thousands of Sikhs were massacred in retribution. The government, at the least, looked the other way.

The nasty side effects of the Green Revolution have gotten only worse in the years since. The irrigation canals are drying up. Water tables are sinking. According to a new report from Punjabi University in Patiala, pesticide levels, among the most elevated in the world, are being blamed for actually altering the DNA of Punjabis exposed to them.

Meanwhile, there aren't enough jobs or slots at the better schools and universities. Unemployment is high. The children of farmers, who've grown up with the tantalizing images of the new urban India paraded before them on television, have no desire to farm but no skills to do much else. Drug addiction, fueled by heroin transited from Afghanistan via Pakistan through Indian Punjab on its way to Europe and North America, is rampant, claiming an astonishing 40 percent of the state's youth and 48 percent of its farmers and laborers, according to one recent report.

Before my encounter with the rat, as I sat with my host family around the bed that would become mine for the night, Jitinder's father, Prem Kumar, proudly showed me a photograph of his father, a Communist rebel who eluded Indian government forces for years. "He was never caught," he exulted. "He fought in the tradition of Bhagat Singh," Prem Kumar added proudly, citing a local boy turned national hero who didn't hesitate to take up arms against the British in the early 20th century.

Prem Kumar explained to me that most of the land around the village was mortgaged to banks or private moneylenders. The water table keeps sinking, and the villagers are having trouble getting enough water to irrigate their fields. Prices for everything have gone up. Many people in the village are sick with cancer.

His 8-year-old granddaughter's playmate came over to visit with her grandmother.

"She lost her mother just two months ago," Prem Kumar explained.

"That's horrible," I replied. "What happened to her?"

"She had brain cancer," he replied. Looking at the girl cradled in her grandmother's lap, he sighed: "Such a beautiful child, like her mother."

It was true, she was a beautiful child. I looked into her big brown eyes and wondered what her future held.

Subject: In the Test Fields of Academe

Posted Wednesday, Aug. 6, 2008, at 7:08 AM ET

LUDHIANA, PUNJAB, India—India has never been able to feed all its people. Even when it has produced plenty of food, an inefficient distribution system that allowed tons of grain to rot in storage barns, coupled with abject poverty, ensured that people went hungry. India shamefully boasts the world's largest population of malnourished children. Still, most people believe that the situation would have been much worse if yields in Punjab had not risen as dramatically as the country's population. If a single institution can take credit for bringing the Green Revolution to Punjab, it is Punjab Agricultural University.

Founded in 1962 on the American land-grant-university model, PAU was inaugurated by Jawaharlal Nehru, the nation's first prime minister, with the mission of finding a way to feed the country's hungry millions. It succeeded spectacularly. Yields increased more than 10-fold, from 2.3 million tons of food grains in 1960-'61 to 25.9 million tons in 2005.

The university maintains close ties to Ohio State and other agricultural universities. It is a research-oriented institution that received a $2 million government grant this year to decode the wheat genome. PAU intends to be at the forefront of the promise by agribusiness corporations that biotechnology and genetic engineering are the way to food security—not to mention a potentially enormous new area of economic activity.

I gained entrée to the pinnacle of the university's administration through a series of introductions that ultimately led me to Dr. N.S. Malhi, director of the university's extension education program. Dr. Malhi graciously gave me a ride in his chauffeur-driven white Ambassador sedan to the building where the vice chancellor, Dr. Manjit Singh Kang, recently returned after years of teaching at Louisiana State University, had his office. I hadn't ridden in an Ambassador, the car used by government officials all over India, in years. The experience was as different from the back of Jitinder's motorcycle as PAU was from the revolutionary fervor of Umendra Dutt's would-be natural farmers.

The meeting was highly decorous, with formal introductions all around and sensitivity to hierarchy, great deference being paid to the vice chancellor, and to me, the honored guest from the United States. I resigned myself to hearing an unquestioned advocacy of technological solutions to Punjab's agricultural woes or maybe to being told that there were no problems. I was wrong.

I launched into my concerns: the fact that the Peter G. Peterson Institute for International Economics has predicted that India will see its current level of agricultural production decline by 38 percent as a result of climate change by the year 2080—the same period in which India's population is expected to grow by 400 million; the soaring cancer rates and the alarming levels of pesticide residues in the nation's water, land, food, and milk, including breast milk; the water crisis, which could only get worse; the use of chemical fertilizers derived from natural gas, which will become more expensive and are causing grave environmental harm; the 80 percent of India's farmers who have such small-scale operations that they have no access to formal credit and can't afford the increased cost of seeds, fertilizer, pesticides, and digging deeper wells, who therefore become indebted to usurious private moneylenders and who, in ever-increasing numbers, commit suicide in despair.

More than 100,000 Indian farmers have killed themselves during the past 10 years, the same decade that has seen India's rapid rise as a global economic power. Thirteen thousand of these suicides were in Punjab, India's most productive agricultural state.

After listening intently, the vice chancellor and the deans voiced their own concerns. Did I know that 25,000 acres of farmland were being gobbled up each year for nonagricultural development, including "green field" industrial parks and posh residential enclaves? Did I know that Punjab had a problem with migration, with 6.7 million migrants from other parts of India moving in to work in the fields, many of them ending up in slums and creating an additional burden on already overtaxed schools and social services? Was I aware of the educational crisis in the state, where only 8 percent of the students at Punjab Agricultural University came from farms and 92 percent came from cities where better schools got them better exam results? That unemployment was a huge problem? That drug addiction was a plague among the state's young people?

They argued passionately that Punjab was caught in a global crisis in which small farmers around the world were being cut off from collective structures that allowed them to leverage economies of scale by sharing big-ticket items like tractors. They complained that governments, including the government of India, had reduced spending on agriculture, gradually abandoning farmers to a private sector that cared only about maximizing production and profits.

"Most of the policies that have come since globalization have not been farmer-friendly," observed one dean.

Incredibly, in a country where 70 percent of the population lives in rural areas and slums are the fastest-expanding part of overloaded cities, India's leaders believe that moving millions of people off the land so that large-scale factory farming can be established with private investment is the way to go. After all, that's what the United States did, and in the process it became a fabulously rich and powerful country, never mind the damage done to its heartland or to the health of a people whose "supersized" diet has afflicted them with epidemic obesity, diabetes, and heart disease.

The Indian government gets a lot of encouragement for this scenario from institutions such as the World Bank that favor export-oriented agriculture; from transnational agribusiness giants clamoring to get into India, a country with the second-largest amount of arable land after the United States; and from India's own big companies eager to get into a new business area some experts predict will eclipse the billions made from outsourcing and information technology. India's minister of finance, Palaniappan Chidambaram, envisions a future where 85 percent of India's population lives in cities and only 15 percent are engaged in agriculture, an India with a heartland as empty as that of the United States with its few remaining farmers completely beholden to the agribusiness giants who sell them their seeds, their fertilizers, and their pesticides, and then buy their harvests.

This is not the vision I found at PAU. One dean lamented: "We've been told you have to push people off the farm, that that is the solution." Clearly, he disagreed.

Still, the dean and his colleagues are research scientists, not social activists. They are skeptical about organic farming. ("Who can wait three years for certification?" asked one academic.) They have great faith in the capacity of agricultural science to deliver solutions to the threats posed by climate change. On this front, PAU is working with the Tata Energy Research Institute, whose director general, Rajendra K. Pachauri, chaired the United Nations Intergovernmental Panel on Climate Change and shared the Nobel Peace Prize with Al Gore, as well as with the M.S. Swaminathan Institute, named after and headed by the father of India's Green Revolution, to create new heat-resistant seeds and engineer new rice varieties that would absorb more carbon from the atmosphere and others that would use less water.

If climate change slams India as hard as it is predicted to do, these efforts could prove life-sustaining.

Subject: The Organic Farmer

Posted Thursday, Aug. 7, 2008, at 6:48 AM ET

SIRSA, HARYANA, India—"Sit right here, sweetheart," croons Ricchpal Singh Grewal. A robust man with silver hair and a neatly trimmed beard, Grewal is one of India's pioneering organic farmers. I can't quite place the smoothness and inflection of his voice. His English is flawless but not in the usual Oxbridge-educated way one hears in Delhi.

"Can I get you something?" he offers. "Some tea?" he asks, gesturing to an armchair. The room is immense and rather dusty, with just a sofa and a couple of chairs in one corner. "Relax, baby," Mr. Grewal smiles, "we have all the time in the world."

It doesn't make sense. How can a farmer with some land off the national highway near the Haryana-Punjab border be talking to me in what is, without doubt, a "Hollywood, baby" style?

On the wall are enlarged vintage black-and-white photos of Sikh farmers in a field of wheat. Grewal returns, followed by a young girl carrying a tray with tea things that she shyly places on a table in front of me.

"The sugar is our own," he says. I usually don't take sugar, but the mound of crumbling caramel tempts me. It is delicious in the tea. "Those are amazing photos," I observe.

"That is my grandfather. He bought 500 acres here with the pension he'd earned as an engineer for the British raj. He and my father knew the earth and how to coax life from it like no one else. I came to it too late," he sighed. He explained how as a youth he ran away from farming, hopped a freighter in Bombay and made his way to Mexico, then to Los Angeles.

"Hollywood, that's where I ended up," he beamed. I'd nailed it! "They loved India, but they didn't know anything about it. I was the first to import tie-dye. I became a huge success, with offices in Milan, and my line in Vogue magazine. But the drug scene was too much. One day, I told my partner in Milan, 'You want this? It's all yours.' I came back here. I knew I had to farm. I needed the soil, the earth. Everything is born of her," he declared, sounding like a California guru.

In the kitchen, I meet his wife, Amrith, a lovely woman who manages the processing aspect of their operation in addition to running their home, which includes cooking three meals a day for the family and their dozen employees. The food is cooked using biogas derived from cow manure. The hot water heater runs on crop waste and paper scraps. Except for electricity and gasoline, the farm is self-sufficient.

Grewal takes me out into the fields. He shows me how he practices inter-cropping, growing nitrogen-fixing legumes between the cotton plants. When we get to the wheat fields, he notes that a lot of weeds have come up. "Got to get some women out here. They'll weed this in a day. The best are from Rajasthan—very respectful and hard-working." And also inexpensive, I think.

Abundant cheap labor is one of the potential advantages India can bring to expanding organic agriculture. Picking off pests by hand, harvesting inter-cropped fields with a mix of plants ready at different times, eliminating weeds by frequent hoeing between tight rows, preparing soil with

organic fertilizers, deploying micro-irrigation lines positioned to release water at the roots of each plant—these are all labor-intensive tasks.

But organic farming in India faces significant disincentives. Most government policies favor industrial agriculture, with heavy subsidies for India's chemical-fertilizer and pesticide industries. The focus, understandable in a developing country, is on maximizing yields and boosting exports. The mindset of the Green Revolution is well-entrenched, despite the widely acknowledged social and environmental damage those practices have wrought and the knowledge that they are simply not sustainable.

"The very rich and the poor eat organic in India," chuckles Grewal. "Seventy percent of the farmers in India are organic farmers. They can't afford to farm any other way. The chemical inputs are too expensive for them. But they don't know they are doing organic farming, and they aren't certified. Unless you're certified, you can't export, you can't get the confidence of the consumer," he explains.

"Another problem is that to export, you need to be able to provide a full shipping container of product. Foreign buyers want scale. They don't want a little from me, a little from the next guy," Grewal complains. His answer is to do his own product processing and packaging. He shows me a sample, a millet grown in the northwest Indian state of Himachal Pradesh where he plans to buy land and expand his operation. The small plastic packet is labeled, "Product of Grewal's Organic Agriculture Farms: Certified Organic." The back of the package is crowded with logos and organic certifications.

India is now the world's biggest exporter of organic cotton, though many people I've talked to claim that by this point most Indian cotton has been contaminated with genetically modified seed. After Monsanto introduced its patented Bollgard cotton, which contains a bacteria toxic to the boll worm, enterprising Indian entrepreneurs concocted a range of legitimate and bootleg genetically modified cotton seeds, which they sold at lower prices. Small fields and the natural tendency of genetically modified material to migrate with the wind have ensured, I'm told, that no one can guarantee Indian cotton to be "GMO-free," an important criteria for certified organic products.

The domestic market for organic food is slowly increasing among India's health-conscious, affluent urbanites, but procurement, distribution, and retail networks are patchy. Organic farming in India is growing at a year-over-year rate of 40 percent, but it still represents a tiny portion of

India's total production. By 2012, there are expected to be more than 5 million acres under organic cultivation out of a total of more than 419 million cultivated acres.

Meanwhile, a host of genetically modified crops are being fast-tracked to market in India. The Indian government is encouraging private companies, including global genetic-engineering giants Monsanto, Syngenta, and Bayer Crop Science, to expand their activities. It sees this as a way to boost growth in the lagging agricultural sector of the economy and to position India as a key site for global research and development of new biotechnologies. The long-term health consequences of eating genetically modified food and the impact on the environment from genetically modified organisms have been dismissed as trivial concerns. Genetically modified eggplants will hit the Indian market this year. They will not be labeled.

The landholdings of small farmers are being aggregated by big players through long-term leasing schemes, with the farmers being hired as contract labor on the new factory farms. In India, as elsewhere in the world, organic and natural farming by small producers is on a collision course with large-scale industrial farming. Whether India can transition to a sustainable agricultural model that can feed its hungry millions while providing a dignified living for the farmers who are the majority of its workforce remains to be seen.

Subject: The Seeds of Violence

Posted Friday, Aug. 8, 2008, at 7:09 AM ET

MUKTSAR, PUNJAB, India—On a numberless district road between Muktsar and Jaitu, my driver slows the car down to a crawl, again. It's another police roadblock. Rows of sandbags reduce traffic to a single lane. Tractors, open-backed trucks loaded with people, camel carts, and cars are backed up in both directions. It's slow going, slow enough for the dozens of khaki-uniformed policemen massed on both sides of the road to get a good look at each vehicle. Lee-Enfield rifles slung over their shoulders, most sport manly mustaches and menacing glares. Their superiors slouch in grimy plastic chairs under a nearby tree. The police seem particularly interested in the trucks loaded with people, but they give our car a penetrating look as well.

It turns out I've chosen to visit Punjab during a period of renewed tension between the Indian state and militant Sikh separatists who want to turn Punjab into an independent nation named Khalistan, a goal unlikely to be realized. The Indian state, which has long struggled against separatist movements in Kashmir and in its northeastern territory, has zero tolerance for any

movement that threatens the integrity of its national boundaries. The government crackdown on the Khalistan movement in the 1980s and '90s was brutal and effective. Most of the leadership was eliminated or forced into exile. The appetite to join the cause was dampened when thousands of young Sikh men were tortured and "disappeared," atrocities for which no one in the Indian government has been held accountable. The militants engaged in their share of violence as well. Among their more headline-grabbing deeds: halting buses, separating the Sikh passengers from the Hindus, and gunning down the latter.

It was a lot of violence to stomach, especially in the state that suffered most during the bloody partition of Pakistan from India back in 1947. Partition sundered the historic region of Punjab in two; one part ended up in India and the other in Pakistan. At least 1 million people lost their lives during Partition, the largest and most violent migration in human history. A large part of the mayhem occurred in Punjab.

Sheer weariness with sickening violence was one factor in the Khalistan movement's decline. Since elections in 1997, the state has enjoyed relative peace. The naming of Sikh Manmohan Singh as India's prime minister, after national elections returned the Congress Party to power, was widely seen as the final healing touch to relations between Punjab and the Indian state.

This symbolic gesture is lost on the new generation of Khalistan militants, who are splintered into a plethora of distinct groups. There is the Khalistan Commando Force (known as KPF), the Babbar Khalsa International, the Khalistan Liberation Force, and the Bhindranwale Tigers Force of Khalistan, named after Jarnail Singh Bhindranwale, who died in 1984 at the hands of the Indian military when it attacked the Golden Temple in Amritsar. In March of 2008, two BKI militants were arrested in Jalandhar, Punjab, on their way, it is alleged, to kill Baba Piara Bhaniarewala, a charismatic religious leader whom they consider to be a heretic as well as a competitor for the hearts and minds of Punjabi Sikhs.

It may well be that the decade of relative peace is about to end. In March, Prime Minister Singh warned the government of Canada, where thousands of Sikhs have emigrated, that it needed to pay closer attention to Khalistan-movement activity there. The Indian government is concerned that members of pro-Khalistan groups in the Sikh diaspora will get their organizations removed from terrorist watch lists.

A large percentage of the Sikh diaspora in Canada and in the United Kingdom is composed of small farmers who were pushed off their land and propelled out of Punjab in search of a better

life by the fallout from the Green Revolution. They have done well. Many retain strong ties to Punjab, with close family members still living at home. Many still hold titles to land from which they could no longer make a living yet that they can't bear to let go. Their sense of rootedness in Punjab often eclipses any sense of India, a more abstract entity, as their homeland. They understand firsthand the damage done to the land and the people of Punjab by Green Revolution agricultural practices, and while the vast majority would never engage in terrorist acts, it is easy to blame the Indian state that reaps a disproportionate share of the Green Revolution's benefits while Punjab's residents live with its negative effects.

India also believes that Pakistan's Inter-Services Intelligence agency is providing cross-border assistance to Khalistan militants and fanning the drug trade. The drug trade has emerged as potentially the most destabilizing factor in Punjab. One morning, I woke up to find the front-page headline of the local English-language newspaper screaming the sensational news that the head of the youth wing of Punjab's ruling party had been arrested on his way to the Amritsar airport with 22 kilos of heroin in his car. That the drug trade has apparently penetrated to this level is worrying.

The heroin in Punjab originates in Afghanistan, a country that for all intents and purposes has turned into a narco-state. It is then funneled through Pakistan. From Punjab, it is transported to Canada or the United Kingdom, where it is distributed by diaspora drug mafias.

Local demand is growing as well. Legions of poor youths, with no job prospects and no desire and little ability to survive by farming, are susceptible to being recruited to work as couriers. Addiction has reached epic proportions, with one recent report putting the portion of addicted Punjabis between the ages of 15 and 25 at 40 percent.

Such epidemic despair bodes ill for Punjab's future. Perhaps the state will be able to keep producing record-breaking harvests of wheat and rice right up until the moment when the last drop of water is used and the last villager drops dead from cancer. Then what?

Punjab is a microcosm of the success and the failure of industrial agriculture in the developing world. There is no doubt that, with enough water and enough chemicals, privileging production above all else can boost yields dramatically. But the damage to the land and the people that make that production possible is profound. It is a model that is not sustainable, as a report published this spring by the International Assessment of Agricultural Knowledge, Science and Technology for Development, a joint effort of the World Bank and various U.N. agencies, so strongly argued.

Ultimately, it will fail. It is failing now, just as the world is desperate to find a way to feed a growing population in a time of climate uncertainty and resource scarcity.

After my trip to Punjab, I came to believe that Umendra Dutt is right: Farmers who switch to natural farming techniques are engaging in a truly revolutionary act. Instead of Bhagat Singh's pistol, they are wielding plowshares, with no less profound consequences for the future of India than the shaking off of British imperialism decades ago. India's new nonviolent revolution, against incredible odds, is in agriculture. It bears watching.

Subject: A Real Green Revolution

Updated Friday, Aug. 8, 2008, at 11:03 AM ET

JAITU, FARIDKOT DISTRICT, India—Jitinder's motorcycle pulled up in front of a concrete arch that had been draped with cloth banners printed with messages about pesticide poisoning and cancer.

"Welcome, welcome to our workshop," a beaming Umendra Dutt called out in English as I alighted. The tangled locks of his long hair gave him a bit of a wild-man look. A cell phone was clutched in the hand he waved. Umendra started to read the Hindi messages on the banners and was delighted when I chimed in. It helped that English words such as cancer were simply rendered phonetically in Devanagari script.

Under a white tent, a buffet table had been laid, a stage erected, and rows of chairs set out. Boys hurried to and fro at Umendra's orders, their rubber thongs slapping against the grimy marble floor. On the table, grease and curry stains randomly bloomed on a fabric that must once have been an elegant cream color. Flies swarmed everywhere, exploring the stains and the platters of food that began to appear.

Farmers in turbans of every hue, many coordinated with the color of their immaculate shirts, milled around helping themselves to tea and breakfast. They had come from all over the state to learn about natural farming. These were educated men who'd clearly prospered from Punjab's Green Revolution. They also had firsthand experience of its dark side. No one made eye contact with me, the only woman and the only foreigner in the room. When I asked Umendra about the

gender exclusivity, he said matter-of-factly: "Farming is mainly men's work." I'd seen too many women out in the fields to believe that, but I supposed that managing a farm, as opposed to spending the day bent over, transplanting seedlings or weeding, was, mainly, men's work.

Umendra pointed with conspiratorial pride to the large poster of Bhagat Singh that beamed over the stage. Dashingly mustached, Bhagat Singh stood boldly behind a half-open door, handgun poised to shoot the first Englishman who got in his way.

"I want the farmers to get the message that what we are doing, what they will be doing when they embrace natural farming, is revolutionary," Umendra explained in a low voice as he restlessly surveyed his public. "This is about taking back our land and our health. It is our new freedom struggle."

I thought about the 2006 hit movie Rang de Basanthi, in which a group of feckless college kids get roles acting in a movie about Bhagat Singh and are transformed into rebels by the experience. Clearly, Umendra envisioned similarly inspiring his audience of Punjabi farmers.

Umendra's comrades in arms included Rajender Singh, Rajasthan's "water man," whose organization Tarun Bharat Sangh has brought water back to villages in that parched state using traditional techniques such as building check dams and refurbishing village ponds. Dr. G.V. Ramanjaneyulu, quickly nicknamed "Ramuji," from the Centre for Sustainable Agriculture in Hyderabad, had come to share techniques of natural yet highly effective pest control. Like Umendra, Singh wore the hand-woven cotton khaddar clothing popular with Indian social activists, a tradition that dates from the early days of India's independence movement and the refusal to wear clothing made from cloth spun in English mills. Ramuji wore trousers and a button-down shirt. He had come equipped with a projector and a laptop loaded with PowerPoint presentations, graphs, photos, and short demonstration films. Between the two of them, Rajender and Ramuji covered the most critical nodes of Punjab's agricultural crisis: water scarcity and pesticide poisoning.

The hybrid seeds introduced during the Green Revolution flourished when a grand scheme of irrigation canals brought plenty of water to the fields. Where the canals didn't reach, farmers sank tube wells and pumped water out of the ground. A naturally dry area, Punjab became one of India's top producers of water-loving rice.

For decades, the water flowed through the new canals and out of the wells as if it would last forever. Then the flow began to ebb. Wells had to be dug deeper to reach water tables that now sink as much as 100 feet a year. Those who couldn't afford to dig deeper placed their faith in seasonal rains, a faith that was all too often dashed. The canals, their symmetrical culverts lined with imported eucalyptus, carried less and less water. Where water was applied with too much abandon, naturally occurring soil salts rose to the surface, making the topsoil too saline for plants to grow properly.

The Green Revolution's miraculous yields depended on boosting efficiencies through mono-cropping. Family farms that placed small plots of vegetables next to fields of wheat or other traditional grains, such as local varieties of sorghum and millet, disappeared in favor of an American agribusiness vision of the farm as a vast outdoor factory. Today, Punjab is practically one continuous lawn of wheat and rice.

Tractors allowed farmers to plow larger fields faster. Everyone wanted one. Very poor farmers with only an acre or two borrowed money to park one of these shining symbols of modernity on their land. Brides brought them to their in-laws' farms as dowry gifts. Double-cropping and even triple-cropping were introduced, one harvest succeeding the last during the same calendar year, like shifts on an assembly line. The amount of food produced soared. India's grain stocks groaned under the sheer weight of Punjab's incredible productivity.

Insect pests also thrived under this new regime. An infestation in one field quickly spread to a whole region across an uninterrupted ocean of grain. At first, chemical pesticides were effective, but the pests became resistant. More pesticides were applied. Farmers, unaware of any danger, sprayed their crops without donning protective clothing. Pesticide and chemical fertilizer runoff permeated the state's soil and water, and Punjab became one of the most poisoned regions of India, a country where pesticide use has generally been heavy. Cancer rates rose so alarmingly that the government of Punjab began a cancer-registry program this year to understand how bad the epidemic has become.

The farmers who'd come to Umendra's workshop realized they were caught in a vicious cycle requiring them to buy more fertilizer and more pesticides, to invest more money in getting water while they watched pests become even more voracious and their soil fertility decline. Seeds were also becoming more expensive. The farmers paid dearly for new hybrids that promised ever-greater yields. They paid even more for the new genetically engineered seeds whose very DNA was copyrighted, making it illegal for farmers to do what farmers have done since the dawn of agriculture: save seeds from one year to plant the next.

These farmers were practical men, not eco-warrior ideologues. What they wanted from the workshop was a way out. They shouted out the names of their various insect enemies. With Ramuji's coaxing, they came up with a few traditional means of control. When Ramuji played a video showing low-cost, effective, nonchemical techniques for pest control, such as digging trenches into which hairy caterpillars fell and were trapped or using neem-based and cow-urine-based sprays, the farmers watched with rapt concentration, scribbling notes in their datebooks.

And when Umendra told them that they were learning how to take back their land, their lives, and their freedom from the agribusiness giants who profited by keeping them hooked on toxic pesticides, chemical fertilizers, and genetically modified seeds, and that they were revolutionaries in the mold of Bhagat Singh, the farmers roared their approval.

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