

Towards a ceasefire: "Measures have ranged from persuasion to threats, incentives and entreaties, all aimed at dissuading farmers from continuing with the practice." Smoke envelops a field at a village on the outskirts of Mohali. • AKHILESH KUMAR

The highway to Bibipur, a hamlet about 50 km from Patiala town, cuts through acres of paddy. Some of the rice stalk are still a couple of feet high and green but many fields have taken on the distinctive yellow of straw that is ready to be harvested. About 200 km northwest of Patiala, in Amritsar from where the monsoon winds recede earlier - the fields have already been harvested and readied for the winter crop. In Patiala, this step is still some time away, as the fires attest. Flaming carpets belch white smoke into the clear blue sky along this stretch of

Until October 14, 321 cases of fires were recorded in Amritsar. In contrast, there were only 81 in Patiala, according to the Punjab Remote Sensing Centre, Ludhiana, which tracks such fires via satellites and reports them to the government. Punjab alone generates about 20 million tonnes of straw, three-quarters of which are burnt. Behind the generation of such a huge volume of chaff is the increasing popularity of combine harvesters. Farmers prefer these machines as it helps them save on the high labour costs of manual harvesting. But one advantage of manual harvesting is that the stalk which remains is extremely small and does not impede the sowing of fresh seed. But the machines leave stubble shavings that are 6-8 inches high, which if not cleared make fresh sowing impossible.

There are just two things needed for the quickest and the cheapest way to get rid of this stubble: diesel and a match box. Not surprisingly, setting the stubble on fire to prepare the fields for wheat has become a common practice in Punjab. Until a few decades ago, the straw generated by the machines was manageable. They could be sold to the packaging industry and also turned into mulch within the field through the natural, slow process of organic decomposition. Now, however, with about 20 million tonnes of straw generated in the State, and barely two to three weeks to dispose them of and prepare the fields for the next crop, cost-conscious farmers are left with few options other than burning the whole lot.

For about a decade now, the Delhi administration has been complaining about this practice, holding it responsible for the abysmal air quality in the capital in winter. In 2013, the National Green Tribunal issued a directive to Punjab, Haryana and Uttar Pradesh asking them to ban such stubble burning. The environment ministers of these States as well as top officials at the Centre declared a "zero tolerance" policy on the burning of stubble, which has been estimated to contribute anywhere from 7% to 78% of the particulate matter-emission load in Delhi during

Since then, farmers in these States, particularly in Punjab, have been at the receiving end of an arsenal of measures which have ranged from persuasion to threats, incentives and entreaties, aimed at dissuading them from the practice.

## Are machines the answer?

In Bibipur, on an early October evening, a group of farmers have gathered at the village council office, a single-storey structure with a corrugated metal roof. In the building's porch are what the State (and Central) government consider to be the instruments of emancipa-



tion: a 'Happy Seeder' machine, a paddy straw chopper and a super straw management system.

Broadly, they are a family of hulking, mechanical attachments hitched to tractors. Between them, they can cut the rice straw, chop it finely, and strew it in the field so that over time it decomposes into mulch and becomes organic manure. The 'Happy Seeder', in particular, allows the rice straw to be cut, new seed (wheat, in the case of Punjab) to be sown, and the residual chaff to be

Seeders and choppers have a long history in India. Inspired by the design and make of similar implements in fields in the U.S. and Australia, they cost ₹1-2 lakh a piece.

Until 2016, Gurubans Singh, who is Bibipur's biggest farmer with 70 acres of land, was not convinced about the benefits of mechanised harvesting. Singh, who worked as a senior official in the State excise department, returned to farming post-retirement, leasing out portions of his land to tenants. "We have been hearing about the harmful effects of stubble burning for some years now. But there were few practical alternatives," he says.

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This year, Singh says, he was convinced by an environmental engineer at the Punjab Pollution Control Board (PPCB) to try out the machines. Further, there was a new scheme, funded by both the State and Central governments, to defray the expense of buying

Earlier this year, the Union Agriculture Ministry earmarked ₹591 crore for disbursal to Punjab, Haryana and Uttar Pradesh, the idea being to help farmers access these machines. Individual farmers could buy them at half their retail price; if bought through self-help groups, they got an 80% discount. In Bibipur, Singh and nine other farmers got together and formed such a group. The cost price of the equipment in the Bibipur council office yard is ₹10 lakh, but thanks to the government scheme, Singh and his associates bought it for ₹2

According to Hardeep Singh, a local farmer, there are about 800 households in Bibipur, and nearly 1,200 acres of paddy fields that are ripe for harvesting. 'These machines, at best, can harvest 10 acres a day. There are just three to four machines available [for a variety of tasks such as cutting the straw, planting wheat, baling the straw] for all of us,"

says Hardeep. That works out to 120 days for managing the fields. But farmers have barely two months - from mid-September to mid-November - to clear out the field. This year, delayed rains have shrunk that window further, and different regions in Punjab have different harvesting times in keeping with subtle weather differences. "In many cases there is no option but to burn because it's quick and cheap," says Har-Given the narrow harvesting window,

farmers who require the machines have to line up at the village office to rent them, at ₹150 per hour. These machines, now gleaming as they are fresh from the factories, will last about seven to eight years, during which they would lie idle for 11 months in a year. There are servicing costs as well. Sub-optimal machines could backfire and even reduce the yield of the wheat. Servicing and maintenance costs, however, are not included in the government subsidy.

Even Singh, who is optimistic that farmers in his village would, "like him, whole-heartedly eschew stubble-burn ing" doesn't expect it to happen this year. There also remains to be addressed the matter of inadequacies in the harvesters. For instance, the implements that Bibipur has procured are suitable for large tractors, whereas many farmers here only have smaller ones. This problem is prevalent in other vil-

In Rolu Majra, a village in Rupnagar, Ajaib Singh, 58, who has three acres of paddy, points out that to derive optimum results from the 'Happy Seeder' machine, a tractor with a capacity of 45-55 hp is required. "I have a tractor of only 35 hp. Tell me how can I use this machine in my field? The government is pushing these machines without realising that they are not viable for small and marginal farmers, and that they will only increase their straw management costs," he says, adding that given the speed at which the 'Happy Seeder' machine operates, it would take several days to sow wheat as farmers in the village would have to use the machine turn by turn. This would mean that the farmers either have to lease bigger tractors to use these implements or procure customised implements that may cost them more. "Just one self-help group in a village is not adequate. What we hope is that by next year (the subsidised-implements scheme is expected to continue) there will be greater supply," Ajaib says.

According to government figures, there are around 1.85 million farming families in Punjab, of whom 65% are small and marginal farmers. Of the 5.03 million hectares of land in Punjab, around 4.23 million hectares are under cultivation. Patiala has about 270,000 hectares under cultivation, and in line with the rest of the State, follows a rice-wheat cropping pattern, with rice sown in July and harvested in October-November, while wheat is the winter crop harvested in March-April.

## A routine practice

About 100 km from Bibipur, in Ludhiana's Rola village, a paddy field that is barely an acre, is on fire. Upendra, a daily wage labourer from Bihar, is navigating the periphery of the field with a thresher, pushing in stray clumps of straw into the flames to ensure they burn better. He says he is merely following instructions from his paymaster (a farmer whose name he does not know)

Sarabjit Singh, another farmer from Rola, says that for him, burning the paddy field after harvest is a "routine, annual practice". He adds that in his village and for 50 others in the region, no machines have been made available nor have there been any awareness programmes on the harmful effects of

State government officials, however, claim that Punjab had disbursed about 8,000 farm implements to individual farmers and set up 4,795 custom hiring centres, from where such machinery could be leased. The cost of hiring these machines, according to Sarabjit, was ₹5,000 an acre, and setting the field alight only cost him a few litres of diesel. The per-acre costs also vary depending on the size of the landholding and the cost of fuel on a given day.

This narrative, of many farmers being too poor to afford the machinery, is one that State pollution control board officials routinely encounter through the year.

Until mid-October, the PPCB had levied ₹8,92,500 as fines – or 'environmental compensation cess' as it is officially called - on farmers burning paddy stubble. However, they have managed to collect only ₹3,05,000, according to PPCB figures.

"The fines are collected over time. Often the farmers do not have the money to immediately pay these fines," says Gulshan Rai, chief environmental engineer, PPCB. Another PPCB official, on condition of anonymity, says that they often do not enforce the fines as these work out to about ₹2,500 per acre. Officials say that satellite images alert them to fields set afire by farmers but actually confronting a guilty farmer is a complicated affair. "We get in touch with the patwari (who keeps land-ownership records) to identify the farmer concerned. Sometimes the farmers protest, sometimes they plead innocence, and sometimes poverty," says the officer, who is tasked with following up on stubble burning incidents in Punjab.

There is also the danger of violence. The cropping and harvesting seasons are highly stressful times for the farmers who have their hands full coping with uncertainties on the procurement and weather fronts. "There have been instances when our officials were gheraoed, or asked 'why am I being punished, when you've let my neighbour get away', and then there are the farmer unions backed by different political

groups. These are complications that we face every year. This year is no different," says another PPCB official.

Jaspal Singh, another farmer from Ludhiana, says that rising diesel prices are another factor that farmers bear in mind when choosing between mechanised stubble harvesting and merely burning the field. "The machines consume about five litres of diesel per acre. If we grow potato, then about 20 litres. The cost for potato is higher because it is not possible to deploy a 'Happy Seeder', which is only equipped to thresh rice-straw and sow wheat. In other words, other instruments, such as the mulcher plough, are needed to prepare the field for potato, which would add to

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KRUNESH GARG Member Secretary, Puniab Pollution Control Board

In Punjab and Haryana, there are restrictions in place on how much groundwater could be drawn, as farmers in these States like to flood their fields to sow the rice crop. This, according to Jaspal, has further narrowed the window to a mere two-three weeks for clearing out the rice stubble, forcing farmers like him to burn away the stubble.

## The government line

But officials from the PPCB insist that enforcement of the stubble-burning ban has been stepped up, and so far, there have been fewer fires this year when compared to the same time frame last year. From September 21 to October 21 this year, there were 2,589 cases of stubble fire in the State compared to 7,613 such cases during the corresponding period last year.

There has also been independent confirmation (though relying on the same satellites) of this decline from Hiren Jethva, a U.S.-based researcher at the National Aeronautics and Space Administration (NASA)-affiliated Universities Space Research Association. Jethva's analysis of crop fires in Punjab and Haryana between October 1 and October 22 suggests that there were 12,194 instances of fires in 2017 and only 5,893 this year. There had been 16,275 of these in 2016.

For Krunesh Garg, Member Secretary, PPCB, this is a sign that government intervention is working. "We have scaled up several measures this year. Now the crop residue is also being used for seven biomass-based power projects with a combined capacity of 62.5 MW," he said at a recent media briefing. "We are educating farmers that burning the soil also destroys the soil nutrients and increases their fertilizer requirement. We have run advertisements. Using farm equipment is only slightly costlier, just ₹300 more per acre, than burning the field, and it helps preserve the environment as well as their health."

Apart from efforts to motivate farmers to sell their field residue to power generation companies, the administration is also trying to build a narrative on +how stubble-burning damages the soil.

According to Punjab's Additional Chief Secretary (development), Viswajeet Khanna, burning a tonne of paddy straw leads to the soil losing about 5.5 kg of nitrogen, 2.3 kg of phosphorus, 25 kg of potassium, 1.2 kg sulphur, and 400 kg of organic matter, besides causing the death of useful microbial population. Currently, about 4.30 million tonnes of paddy (21.82% of the total paddy straw generated) is being consumed by various stakeholders, as opposed to being burnt in the fields.

Pointing out that mechanisation is not the sole answer to the problem of stubble burning, Umendra Dutt of Kheti Virasat Mission, an organisation promoting organic farming, says that "mechanisation is only a partial solution, since most of these machines would be used for just a month and lie idle for the rest of the year. Instead, farmers should be motivated to diversify their crops, focussing on domestic diversification and not just commercial diversification."

Yet, even the most optimistic of pollution board authorities, be it in Punjab or Delhi, is not expecting instances of stubble-burning to drop down to zero. In his briefing a fortnight ago, Garg said that 80,879 fire incidents were detected during the season in 2016, and 43,660 in 2017. "This year, we expect a 50% reduction," he said. This is roughly in line with the reduction last year. Garg also contends - and this is a widely prevalent view among farmers in Punjab as well as among other PPCB officials that the pollution from stubble-burning in Punjab contributes minimally to Delhi's pollution. "We frequently see that air pollution remains low in Punjab but becomes very high in Delhi. Surely, if stubble-burning is a major factor, would not that be reflected here too?" he asks.

While studies over the years have established that pollutants can travel great distances and survive in the atmosphere for a long time, the contribution of Punjab's stubble-burning to Delhi's winter smog has not been precisely determined. A Harvard University study published in March 2018 said that "7-78%" of PM2.5 pollution in Delhi is due to "agricultural fires".

Sachchida Nand Tripathi, a professor at the Indian Institute of Technology Kanpur and an expert on air pollution, says that the relative contribution of crop burning to Delhi's pollution episodes is "over-emphasised" and gives a "simplistic explanation" for severe pollution episodes. "Stubble burning does play a role, but our recent studies show that 60% of Delhi's pollution is due to a wide range of sources within Delhi NCR, such as industries, coal burning, and vehicular emissions. Efforts should be made to address them too."



Turning to technology: A farmer in Mohali ploughs his field with a paddy straw chopper. • AKHILESH KUMAR