

No fallout legacy for Japan's farms

But the most contaminated soils need urgent clean-up.

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Japanese wheat farmers are unlikely to reap a radioactive harvest in future years. B. Weerasinghe/Demotix/Corbis

After the Fukushima nuclear disaster spewed radiation across northern Japan in March, some feared that farming there would be shut down for years. But early studies of how the radiation has accumulated in plants and the soil now suggest that farmers in much of the region can go back to work.

Soon after the meltdown at Fukushima Daiichi, the government evacuated people living within 30 kilometres of the plant, and later imposed restrictions on agricultural products. Those measures are still in place, and the government has not yet announced a clear strategy for dealing with the contaminated areas. "People are panicking because there are no data," says plant radiophysiology expert Tomoko Nakanishi at the University of Tokyo.

Nakanishi is coordinating seven teams to study the impact of the disaster on soil, plants, animals, fisheries and forests for the next decade, measuring contamination levels and assessing the long-term threat. Their first results, to appear in the Japanese journal *Radioisotopes* in August, paint a surprisingly optimistic picture.

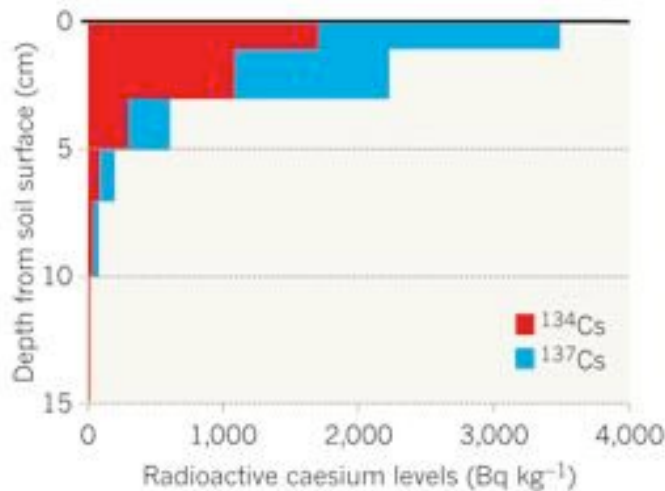
The scientists studied crops at a Tokyo research field, including cabbages and potatoes that were planted a few weeks after rains showered the field with radioisotopes from Fukushima. The crops were harvested on 16 May, and contained low levels of radiation — around 9 becquerels per kilogram (Bq kg^{-1} ; wet weight), much lower than the 500 Bq kg^{-1} safety limit for human consumption. Furthermore, most of the radiation had accumulated on the leaves and could be washed off, suggesting that the plants were not absorbing dangerous levels of radioisotopes directly from the soil.

The more highly exposed fields around Fukushima showed similar results, with most of the radiation in plants accumulated on their surfaces. Wheat leaves that were open at the time of the

greatest fallout were heavily contaminated, with combined levels of caesium-134 and caesium-137 ranging from thousands to about 1 million Bq kg^{-1} . But leaves that unfolded afterwards were largely free of contamination. Wheat ears from these plants contained 300–500 Bq kg^{-1} — within the prescribed radiation limit. "It's harvest time now and farmers are wondering what to do," says Nakanishi. "They can throw the current harvest away. But it is OK to plant again."

SKIN DEEP

Soil contamination is limited to the top few centimetres of fields around Fukushima.



Despite this good news, the team's data also show that the radioisotopes seem to be stuck firmly to the soil, mainly in the top five centimetres (see 'Skin deep'), and are not being washed away by rain. This might prevent the radioisotopes from entering groundwater, but suggests that cleaning up the more radioactive public spaces in Fukushima prefecture will not be easy.

A separate group from Kobe University, led by radiation expert Tomoya Yamauchi, has found that soil radiation levels at four sites in Fukushima city, some 60 kilometres from the reactors, measured up to 47,000 Bq kg^{-1} — surpassing the 10,000 Bq kg^{-1} human exposure safety level set by the government. Yamauchi says that these areas, which are outside the current 30-kilometre evacuation zone, should be evacuated immediately.

In May, the agriculture ministry unveiled a ¥490-million (US\$6-million) initiative to develop clean-up techniques, including removing contaminated soil. But results from the tests won't come for months, and Nakanishi says that, in the meantime, the information gap is dangerous. Without data on the true depth of soil contamination, local schools are using large machines to scoop up the top 50 centimetres of soil — probably much more than is necessary — and leaving it as radioactive mounds in the corners of school playgrounds.

The agriculture ministry is also testing how well plants can clean the soil in highly contaminated areas, and several non-governmental organizations have followed suit with a campaign of sunflower planting. Nakanishi says that the effort is "nonsense", arguing that such phyto-remediation would absorb only small amounts of radioisotopes. Chihiro Inoue, an expert in soil and groundwater remediation at Tohoku University, says that phyto-remediation is worth testing, but warns that even if it works, "you're still left with the problem of how to

dispose of the [radioactive] plants".

Burying the soil is expensive, however. Inoue says that the cost of cleaning up a school playground could be ¥50 million, and there are more than 100 schools in the affected areas, not to mention parks and other public places. Given that caesium-137, with its 30-year half-life, will be around for a while, soil burial sites would have to be monitored to make sure contaminated soil was not exposed by weather, he says.

Whatever happens, it needs to happen soon, Inoue says. People cannot rebuild their lives until the radiation risks are understood and a plan for reducing them is in place. "We can't wait much longer," he says.