



WHITE TERROR: Wang Furong sorts used plastic mulch for recycling at his workshop in Mingrong Village in Xiji County, Ningxia Hui Autonomous Region

Spoiled Soil

Plastic pollution of farmland worsens as the use of polyethylene film becomes more popular

By Yin Pumin

Each new harvest brings Xiao Fulin, a farmer in Manas County in northwest China's Xinjiang Uygur Autonomous Region, less joy and more frustration. This is on account of the land that Xiao is using becoming increasingly polluted by the plastics used to increase the yield of crops.

Xiao first started using plastic film as "mulch" for his 2.7 hectares of cotton farm 30 years ago, and it led to a substantial increase in yield. "Mulch" is a broad term referring to a wide range of substances often used in farming to cover the soil. It prevents soil moisture from evaporating, restricts the growth of weeds and regulates soil temperature. Although straw, peat moss and leaves can all be used, most of the time purpose-made sheets of polyethylene film

are utilized in modern agriculture, enabling crop yield increases between 20 and 50 percent.

In spite of the advantages, the residual pollution left in the soil by 30 years worth of plastic mulch has come back to haunt Xiao.

"This headache is common to farmers all around. We don't know how to deal with it," Xiao said anxiously.

The extensive use of plastic mulch in farming across the northwest and southwest China has brought on severe pollution, posing challenges to local agricultural production, said Yan Changrong, a researcher with the Institute of Environment and Sustainable Development in Agriculture at the Chinese Academy of Agricultural Sciences (CAAS).

"Plastic remnants left over from mulch

use prevents crop seeds from absorbing water from the soil, leading to lower yields," Yan said, warning that the problem has affected the sustainability of China's farming. "It's an urgent issue requiring the attention of relevant authorities."

Careless contamination

Chinese farmers first began using plastic mulch in 1979, mainly for the growing of vegetables. In 1982, it was promoted in the farming of nearly all kinds of crops across the whole country.

"The use of plastic mulch was a revolution in the history of Chinese agriculture. It helped farmers make massive strides toward increasing grain production," said Xu Zhiguo, a professor at the Institute of Plastic Processing and Application of Light Industry at Beijing Technology and Business University.

For the past 30 years, China has been the number one consumer of plastic mulch in farming. CAAS statistics show that more than 1.2 million tons of the product are used in farming each year in the country, covering more than 40 kinds of crops across 133 million hectares of farmland.

"It's through using plastic mulch that the output of corn has increased by at least 30 percent in China's northwestern areas," Yan said, adding that Xinjiang's rise to become the country's primary producer of cotton should also be

attributed to the introduction of the technology. He explained that in the past, many high-yield strains of cotton could not survive in Xinjiang because of the region's lower temperatures, but the use of plastic mulch means that is no longer a problem.

However, with more plastic mulch being used in farming, an unexpected side effect has gradually emerged.

According to Xu, problems arise from the fact that plastic mulch is made from polyethylene. "Plastics like polyethylene can remain in the soil for more than 100 years without degrading," Xu said. "With more and more plastic lying stagnant in farmland, the original 'white revolution' has turned out to be a 'white terror'."

According to Jiang Gaoming, a researcher with the Institute of Botany under the Chinese Academy of Sciences (CAS), currently about half a million tons of plastic mulch are left in China's farmland every year, almost 40 percent of the total annual consumption. "This forms a layer in the soil that is less permeable to water and air, making it harder to grow crops," Jiang said.

Over the past two years, the Xinjiang Department of Agriculture conducted an investigation in 20 counties, taking samples of the soil of each. The results show that there are currently 255 kg of plastic waste lying in each hectare of local farmland, which is five times the average level nationwide.

In some townships in south Xinjiang, the amount of residual plastic has surpassed 600 kg per hectare. "If we consider the average use of 60 kg per hectare each year, this means that local farmland has been effectively covered by the equivalent of 10 layers of plastic mulch," said Qin Xiaohui, an agricultural official in Xinjiang.

"What's even more worrying is that China's consumption of plastic mulch is still increasing and the trend will not change in the near future," Yan said, adding that the country's annual consumption of plastic mulch is expected to exceed 2 million tons in 10 years.

Yan has surveyed the yield of crops grown in farmland affected by plastic waste. He found that when the amount of the plastic residue in the soil reached 52.5 kg per hectare, the yield of wheat grown in it would reduce by 2-3 percent, corn by about 10 percent and cotton by 10-23 percent.

"The large amounts of plastic residue in our farmland will seriously reduce the sustainability of China's agriculture," Yan warned.

On top of the worries about decreasing yields, there are also environmental concerns. Plastic residue is light and usually mixed with

earth, so it is difficult to collect and filter out to be recycled. "When there is a big enough pile of plastic waste, farmers generally burn it, polluting the environment even further," Jiang said.

Organic compounds that do not biodegrade are known as persistent organic pollutants (POPs), and 12 of the most harmful of these chemicals have been restricted or banned internationally by the 2004 Stockholm Convention on POPs. These compounds linger in the environment for a long time and can enter the human body through food or respiration, causing poisoning, cancer and even death.

"Burning plastic mulch results in the release of at least five of the 12 POPs listed by the Stockholm Convention," Jiang said.

Yan admitted that there are also many other consequences caused by residual plastic mulch that need to be evaluated. For example, it remains unclear whether such residues will affect underground water. He calls for a thorough investigation led by the central authorities so as to understand the general situation of plastic mulch pollution around the country.

"Otherwise, we cannot work out an effective plan to treat and prevent the problem," Yan said.

Seeking a solution

In recent years, some farmers in Xinjiang have started using specific machines to collect residual plastic mulch from their farmland, but their efforts have not received positive feedback from experts. They say it cannot solve the problem because many other farmers are reluctant to follow suit.

"A major problem is that the economic returns of collecting and recycling residual plastic mulch are too low. Both farmers and enterprises have no incentive to do so," Yan said.

Sun Wenchuan is a farmer in Xinjiang's Yuli County. According to him, it will take a person 20 days to clean up his 2.7 hectares of farmland. "According to current labor costs, I would have to pay 3,000 yuan (\$500) for the work," Sun said. In contrast, the price for recovered plastic residue is only 1.2 yuan (\$0.19) per kg.

Li Zhong, Director of the Agricultural Bureau of Yuli County, admitted that the lack of efficient recycling mechanisms has become a major hindrance for further promoting the treatment of plastic residues in the county.

In response, Yan suggested the government give subsidies to enterprises concerned, encouraging them to expand their networks for the purchasing of used plastic mulch.

Aside from the costs, another factor hindering proper recycling is that the amount of plastic mulch that does not meet standards is far too high.

In the 1990s, a national standard was established to regulate the quality of plastic mulch. It stipulates that the thickness of mulch should be around 0.008 mm, but a discrepancy either way of 0.003 mm is allowed. In order to save costs, many mulch manufacturers take advantage of the permitted discrepancy and have chosen to produce mulch only 0.005 mm thick. Farmers also prefer thinner mulch due to cost concerns. According to Xiao, he needs 47.5-60 kg of 0.008 mm mulch to cover 1 hectare of farmland, but only 30-37.5 kg of 0.005 mm mulch.

However, due to its lower density, thinner mulch breaks apart much more easily, creating difficulties for recycling.

"Stricter rules are needed to regulate the production and recycling of plastic mulch, or else the problem of plastic pollution in our farmland cannot be solved," said He Wenqing, another researcher with the CAAS' Institute of Environment and Sustainable Development in Agriculture.

A more effective method for alleviating plastic pollution in farmland is to use biodegradable alternatives, say experts.

Biodegradable mulch has been around for some time, but higher prices make it unpopular with farmers. "Generally, the prices for biodegradable mulch are 3-5 times that of non-biodegradable ones," said Chen Xuesi, a researcher with the CAS' Changchun Institute of Applied Chemistry in Jilin Province.

Chen is leading a research project on biodegradable mulch. He said that his team hopes to develop a kind of biodegradable mulch that can be manufactured cheaply in two years. "The price of the new product will be twice that of non-biodegradable mulch. We hope this lower price-point will help open the market for biodegradable mulch," Chen said.

Wang Xinyong, Director of the Institute of Soil and Fertilizer at the Xinjiang Academy of Agricultural Sciences, called for increased input to speed up the development of biodegradable mulch. "The government should also consider giving subsidies to manufacturers and farmers to encourage them to produce and use pollution-free products," Wang said. ■