

HOLIDAYCOVER

Soil: Up to 400 years to form humus layer

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The thickness of the soil dropped from 60 to 70 centimeters in the 1950s to 20 to 30 cm at present.

"The soil is black because its surface is covered with a layer of soil rich in black humus," said Zhang Xingyi, a researcher on agriculture with the Northeast Institute of Geography and Agroecology of the Chinese Academy of Sciences, adding that "it takes 200 to 400 years to form a 1-cm-thick humus layer in black soil."

"Soil productivity decreased by an average of 12.7 percent for every 1 percentage point decrease in soil organic matter content," he said.

The practice of returning maize straw to the farmland for mulching purposes not only increased the amount of organic matter in the soil but also helped prevent wind and water-driven soil erosion and preserve soil moisture, Xi said, adding that the so-called Lishu model was worth promoting.

With a cultivated area of over 260,000 hectares, Lishu, a major grain-growing area in Jilin, had an annual grain output of more than 2.5 billion kilograms for many years, ranking steadily among the top five grain-producing counties in China.

Revolutionary practices

However, around 1980, farmers in the county found that the nutrient-rich black soil was becoming increasingly eroded and using more fertilizer didn't result in greater yields from the farmland.

In 2009, Li Baoguo, dean of the College of Land Science and Technology at China Agricultural University, led his students to establish China's first academic black soil protection workstation in Lishu.

After years of joint research and cooperation with the Northeast Institute of Geography and Agroecology of the Chinese Academy of Sciences and the county's agricultural technology station, the model was created, revitalizing the thinner layers of black soil.

"The model is a revolution in traditional farming practices," said Wang Guiman, head of the station. "The key to conservational tillage is to plow less soil through the no-tillage and stalk-covering technology."

"In the past, farmers had to plow the land at least four times when they planted maize, which may destroy the structure of the black soil layers," he said. "Now with the technology of mechanized planting, the processes of cleaning straw, ditching, fertilizing, sowing and covering soil can be completed in a single operation."

"The reduction of rolling compaction in the field by agricultural machines can help improve the water percolating capacity of the soil and the maize straw can provide potassium and nitrogen to the farmland," he said.

"After five years of the no-tillage and stalk-covering operation in the experimental area, the soil organic matter increased by about 0.1 percent per year, six times that of conventional farming."



An aerial view of harvesters reaping rice across a paddy field in Northeast China's Heilongjiang province. This region boasts high grain yields because of its fertile black soil. WANG JIANWEI / XINHUA

Distribution of black soil



"In the traditional planting model, it may cost around 2,200 yuan (\$339) per hectare from planting to harvesting while the new model can save at least 800 yuan," he said. "Furthermore, the new model can help increase the output by over 500 kg per hectare."

He added that farmers who performed conservational tillage on their farmland could receive a government subsidy of 750 yuan per hectare.

The total area of conservational tillage is expected to increase to more than 2.6 million hectares by 2025, according to Jilin Department of Agriculture and Rural Affairs.

Soil thickness increased

The neighboring province of Heilongjiang also saw remarkable effects after years of effort in black soil protection.

Monitoring data showed that the average thickness of cultivated land increased from 19.8 cm in 2014 to 23.3 cm in 2019, according to the provincial department of agriculture and rural affairs.

The department also said that the farmland cultivated by farms and large agricultural machinery cooperatives saw a recovery in growth.

Faced with the eroded black soil, Heilongjiang has taken different measures according to local conditions, including returning straw to the farmland, as well as increasing the amount of organic fertilizer and crop rotation.

Since 2015, the province has established 20 pilot projects on the protection and utilization of black soil, covering an area of 348,400 hectares.

In 2018, Hailun, a major grain production area in the province, was identified as a pilot county to promote the integrated system of black soil protection and utilization by the Ministry of Agriculture and Rural Affairs.

Over 33,300 hectares of farmland in the county became experimental fields managed by local governments to carry out conservational tillage, including promoting rotation farming of corn and soybeans, returning straw to the farmland and increasing the amount of organic fertilizers.

"All of the 133 hectares of farmland of our cooperative has been classified as experimental fields," said Liu Chunsheng, head of Dongxing Cooperative. "Thanks to integrated planning and management by the government, the yields from the farmland have increased significantly."

"Over the past years, farmers in the cooperative have seen their incomes increase by 14,000 yuan," he said. "More importantly, their awareness of protecting the black soil is growing stronger as they benefit from the improved quality of the land."

According to the Guideline on Protecting Black Soil in Northeast China (2017-30), by 2030, Northeast China's 16.67 million hectares

of black soil will be better protected and see improvements to its fertility, ecology and farming facilities which will yield higher crop yields.

"To realize the sustainable use of black soil, it is necessary to focus on scientific research of black soil conservation, nutrient balance and conservational tillage," Han Xiaozeng, a researcher with the Northeast Institute of Geography and Agroecology of the Chinese Academy of Sciences, said during a recent online seminar. "These research results can provide important support for maintaining the fertility of black soil and improving the overall grain yield."

Researcher Liu Xiaobing from the same institute suggested improving laws and regulations on arable land to urge land users to protect the black soil.

"Agriculture and soil and water conservation staff in the northeast region have explored some effective technical measures, but they didn't receive wide acceptance as some operators only seek to maximize economic benefits and lack an awareness of protection," he said.

"Therefore, special regulations on the protection of black soil should be introduced to solve these problems," Liu added.

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Big data helps build smarter agriculture

By LIU MINGTAI in Changchun and ZHOU HUIYING in Harbin

Modern agriculture development in Northeast China's Jilin province has tremendously changed local people's production methods and lifestyles as the province encouraged enterprises to carry out research and development in agricultural science and technology in recent years.

In Jilin city, staff members from Jilin Yungeng Agriculture Co Ltd are busy developing a scientific and reasonable planting scheme for farmers who use their agricultural big data service platform.

"With the help of big data processing, including precise images taken by satellites, measurement of fields and chemical fertilizer, our staff members can make more accurate output forecasts and help bring more profits for farmers," said Wang Liying, the founder and president of the company. "According to the structure and quality of the black soil, we can provide suggestions on what and how to plant."

Wang, 50, started the company in 2015 and began to develop the platform with the help of a 12-member team after around three years of nationwide investigations on agricultural big data.

"In fact, agricultural big data hasn't aroused much attention around 2010," she said. "With years of experience of big data work in an industrial company, I hoped to do something for my hometown."

After three years of research and development, her platform was put into use in September 2018, providing big data that can be used to manage crop growth and enhance brand value.

"The platform is suitable for the integration of regional agriculture," she said. "Based on big data, we can master the planting structure of a township, a province or even the whole world, and then we can provide good suggestions on what to plant and how much to plant according to market demand."

The platform can provide data to help farmers decide how to protect farmland, improve seed quality, and prevent and control disease and insects.

As of the end of 2020, Yungeng has established the platform via cooperation with local governments in five regions in Jilin, Sichuan and Hunan provinces and the Xinjiang Uygur autonomous region.

"It is expected to establish another 45 platforms this year as more agricultural departments begin to realize the advantage of big data," she said. "We will continue to improve our technology and try our best to promote the sustainable development of digital villages."

Farmers make good use of crushed maize straw

By LIU MINGTAI in Changchun and ZHOU HUIYING in Harbin

With spring temperatures on the rise, farmers in Northeast China are welcoming the busiest spring plowing season.

However, in Sangang, a town in Nongan county of Changchun, the capital city of Jilin province, many no-tillage planters can be seen busily planting on the maize-straw-covered fields, instead of lots of farmers sowing by hand.

In recent years, after the harvest, farmers in Sangang chose to leave the crushed maize straw covering the fields instead of burning it.

Maize straw has become the "superstar" in Sangang after the practice of returning straw stalks to the field boosted the incomes of villagers and helped to improve the quality of the farmland.

"Nongan, an agricultural county where most farmers plant maize on the fields, is often hit by spring droughts that have a great effect on spring plowing," said Chang Yabin, head of Yabin Specialized Agricultural Machinery Cooperative. "The practice of returning straw stalks to

the fields can well retain soil moisture and ensure the success ratio of seedlings."

"Furthermore, the practice can protect the black soil and reduce the environmental pollution caused by burning straw stalks," he added.

Chang, 55, a local farmer who established the cooperative in Sangang in 2013, is the pioneer who promoted the innovative no-tillage and stalk-covering methods in the county.

"I have planted maize for more than 35 years," he said. "In Sangang, there are a total of 15,000 hectares of cultivated land, most of which is saline-alkali and low-lying. The soil on the land is hardened, high in salinity and alkalinity, and poor in terms of permeability."

"Before 2013, in spite of an increasing reliance on chemical fertilizers, we could only see an output of 5,000 kilograms per hectare," according to Chang.

"However, thanks to the practice of returning straw stalks to the field, output has now doubled. The practice also helped to reduce chemical fertilizer usage from 1,000 kg per hectare to around 750 kg," he said. "I

believe we can see a sustained decline as the quality of the black soil continues to improve."

Almost all of the 9,000 hectares of maize farmland at the 14 villages of Sangang will be planted using no-tillage and stalk-covering methods this year.

However, it took Chang several years to persuade the villagers to change their traditional tillage methods.

New knowledge

"Around 2012, technical staff from the county's and the town's agricultural departments began to introduce conservational tillage to farmers across the county," Chang said. "It got known that it was a major measure to protect black soil, and a major strategic measure to maintain the green and sustainable development of agriculture."

"These methods can reduce the loss of soil moisture and increase the content of organic matter in the soil," he said. "Therefore, I began to use no-tillage planters under the guidance of the technical staff when my cooperative was founded in the spring of 2013."

At the same time, Chang visited farmers in nearby villages to introduce his experience in order to help them benefit from it too.

"Farmers are reluctant to change, especially older ones who have been deeply influenced by traditional farming methods with a history of thousands of years," he said. "They insisted that the fields must be clean and tidy after harvesting while fields with maize straw left on them would make them look really lazy."

In 2018, a heavy spring drought hit Nongan, and had a serious impact on the success ratio of seedlings, except for those at Chang's cooperative.

"We had a high ratio of seedlings on the fields that used the method of conservational tillage while other farmers had to reseed their fields," he said. "Then I found more nearby farmers began to accept these new methods."

Since 2011, Changchun has arranged 10 million yuan (\$1.54 million) of special funds to support conservational tillage in the city.

A total of 100 demonstration areas have been set up across the city.



Machines leave a lower section of maize straw behind to cover the fields. The remanent straw can retain soil moisture and help seedling growth. PROVIDED TO CHINA DAILY

The areas, each of which has an area of more than 100 hectares, can provide a platform for local farmers to visit, study and exchange experiences.

In December 2020, a national demonstration area for black soil protection and utilization was set up at Chang's cooperative, which made him firmly determined to protect the black soil.

This year, the cooperative will

manage more than 700 hectares of maize farmland for 600 families.

"Farmers can pay 1,750 yuan per hectare for the service, which includes plowing, planting and harvesting," he said, adding that planting work was expected to be finished before May 20.

"With great support from the government and trust from the farmers, I believe we will see a good harvest in the autumn," he said.