

Temporal and Spatial Change of Soil Organic Matter and pH in Cultivated Land of the Songliao Plain in Northeast China during the Past 35 Years



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Soil organic matter (SOM) and pH are not only an important part of soil fertility, but also a source of nutrients for plants and an energy source for the life activities of soil microorganisms (Huang, 2000). Moreover, soil organic matter (SOM) has a great impact on soil properties and can improve soil fertility and buffering performance. Therefore, the contents of soil organic matter and pH are important indicator to measure soil fertility (Yu, 2003; Wang et al., 2015), and a main source of various nutrients (such as N and P) for plants and an important part of soil fertility. Therefore, this study is of great significance in finding out the real situation of black soil, protecting the northeast granary and realizing the sustainable development of grain production.

Using the collected second national soil census data (1982, referred to as “two pu”) and the latest obtained the surface soil data of Songliao Plain in 2017, the changes of surface soil organic matter and pH in Songliao Plain were summarized and compared. The results showed that the average content of organic matter in the surface soil of Songliao Plain was 2.661%

in 2017, and it was 2.928% in 1982. After nearly 35 years, the average content of organic matter decreased by 9.12%, and the content is significantly degraded; and the average content of pH in the surface soil of Songliao Plain was 7.313, and it was 7.304 in 1982, showing weak alkalinity.

In order to comprehensively understand the changes of soil organic matter and pH content in the cultivated land of Songliao Plain during the past 35 years, the soil organic matter content was divided into 11 levels using the two periods geochemical survey data of the surface soil of Songliao Plain, respectively >3% (3.5, 4, 6, 10), 2 to 3% (2, 2.5, 3), <2% (1.5, 1, 0.5), and using ArcGIS software, to compile the distribution of organic matter in the surface soil of Songliao Plain (Fig. 1). The grading method for the surface soil of Songliao Plain is classified into five levels (<5.0, 5.0–<6.5, 6.5–<7.5, 7.5–<8.5, ≥8.5) using the grading standard in the Land Quality Geochemical Evaluation Specification (DZ/T0295-2016) (Fig. 2).

It can be seen from Figure 1:

1. The content of organic matter in the surface soil of Songliao

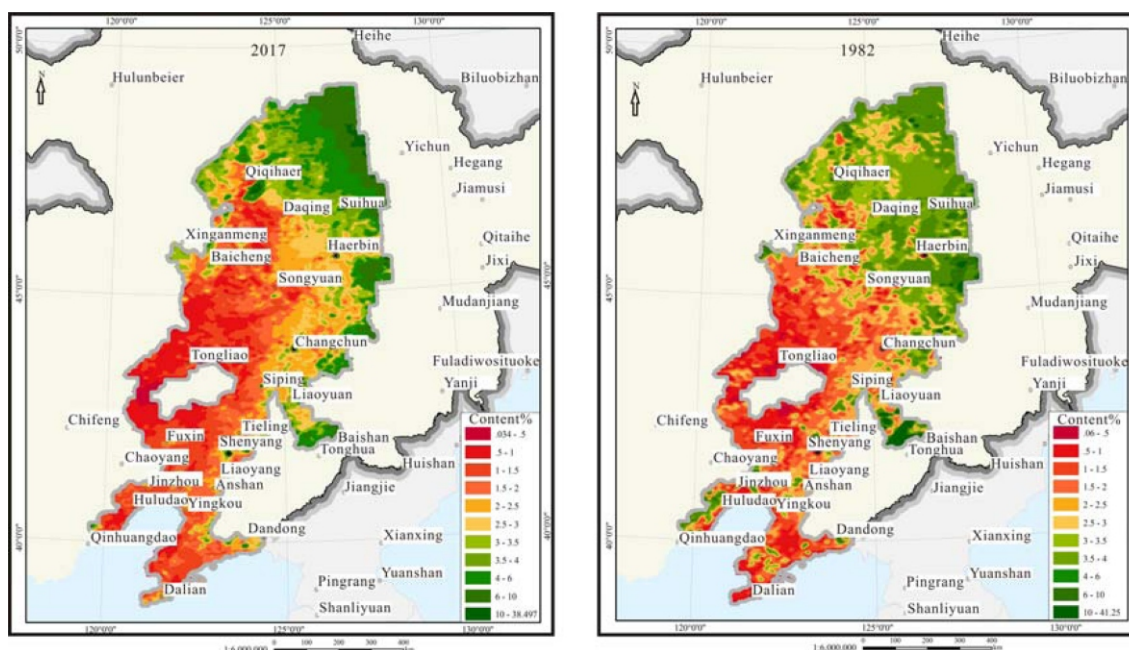


Fig. 1. Distribution of soil organic matter during the two periods in cultivated land of Songliao Plain.

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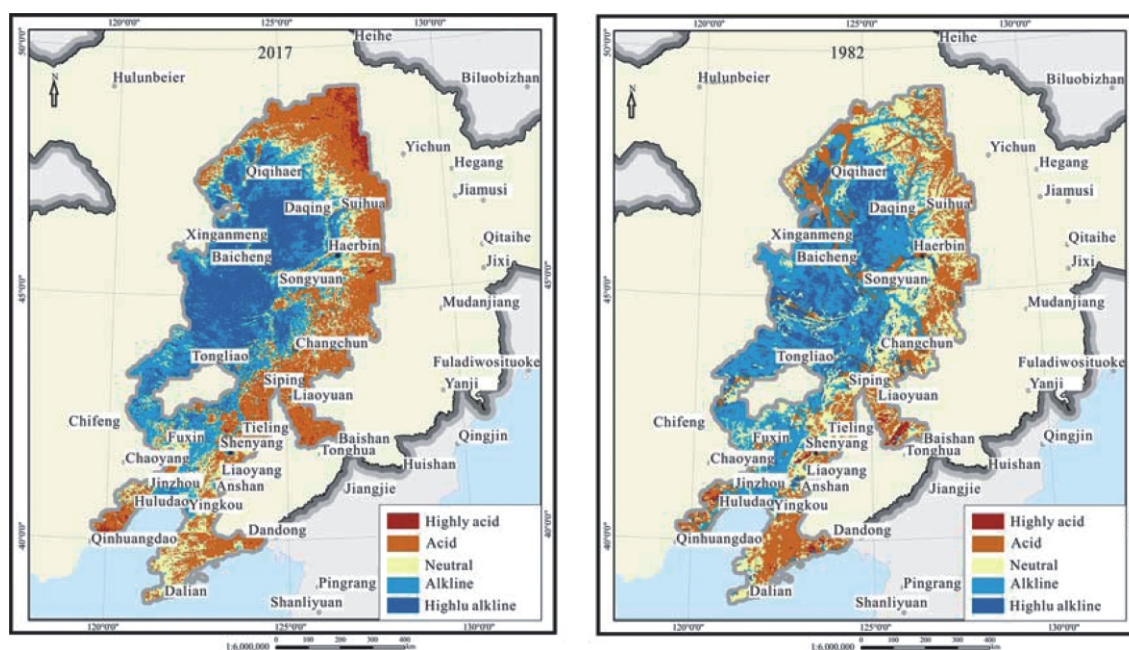


Fig. 2. Distribution of soil pH during the two periods in cultivated land of Songliao Plain.

Plain has obvious zonal distribution characteristics: it gradually decreases from north to south. The spatial distribution of soil organic matter content in cultivated land in Songliao Plain has been generally consistent over the past 35 years. The overall performance is moderate. The average soil organic matter decreased from 2.928% to 2.661%. The organic rich areas are mainly distributed in Jilin Province and eastern Heilongjiang Province. The soil in Liaoning Province is generally lacking in characteristics, and only local areas have changed. In 1982, the area of soil organic matter content >3% (rich and rich) was 67.998 million mu and 98.88 million mu, and the area of the organic matter content was 2 to 3% (medium) was 93.864 million mu, and the total area of the three accounts for 59.7%. In 2017, the organic matter content was mainly 2 to 3% (medium) and <2% (lack), and the total area of the two accounts for 60.89%. The content of organic matter showed a trend of increasing from west to east and from south to north, indicating a close correlation with the degree of colonization.

2. Among different soil types, the content of organic matter increased in cinnamon soil (37% of the area increased between 0–5%) and brown soil (36% of the area increased range ≥5%). The content of organic matter decreased significantly in meadow soil (35% of the area reduction by more than 10%), black soil, chernozem, saline-alkali soil and aeolian sandy soil. While the changes in dark brown soil, albic soil, fluvo-aquic soil, chestnut soil, paddy soil and boggy soil are not obvious.

It can be seen from Figure 2:

1. The average pH value of cultivated soil in Songliao Plain was 7.313 in the past 35 years, which was weakly alkaline. The main characteristics of alkali and strong alkalinity in desertification and salinization areas in the central and western regions. Acidic soil was distributed in the northeast direction in Liaoning Province, Jilin Province and eastern Heilongjiang Province. In 1982, the area of alkaline and strong alkaline soil was 230.7 million mu, accounting for 45.3%, and the area of acidic soil was 130.05 million mu, accounting for 25.6%. In

2017, the area of alkaline and strong alkaline soil was 233.3 million mu, accounting for 44.8%, and the area of acidic soil was 185 million mu, accounting for 35.6%.

2. Among different soil types, the pH value of saline-alkali soil, chestnut soil and aeolian sandy soil decreased most obviously, and acidification was significant; while the pH value of albic soil increased significantly.

Key words: black soil in northeast China, soil fertility, Songliao Plain, soil organic matter (SOM), pH

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