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Research on the Strategy for Improving Cultivated Land Quality in China

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Abstract: Based on a systematic analysis of changes in quantity and quality of cultivated land in China, this paper put forward an overall strategic thinking of realizing three strategic transformations in the cultivated land management from the aspects of the quantity, quality, and ecology of the cultivated land. Five important measures, including enhancing the cultivated land quantity in China, curbing undisciplined growth of construction land, improving the fertility of cultivated soil, preventing and controlling heavy metal pollution in soil, and preventing and controlling agricultural film pollution, were proposed. It was also recommended that four major projects, namely “middle- and low-yield farmland reforms”, “comprehensive improvement of rural land”, “comprehensive reparation of heavy metal pollution of soil”, “soil and water conservation, sand prevention, and saline soil improvement”, should be implemented as soon as possible.
Keywords: cultivated land quality; temporal and spatial change; strategy; major projects

1 Arable land in China

1.1 Arable land per capita is low, with the arable land reserves almost depleted

According to data provided by the Ministry of Land and Resources (MLR), the amount of arable land in China has decreased from 2.031×10^9 mu (1 mu ≈ 666.667 m^2) in 2009 to 2.025×10^9 mu in 2015. The arable land per capita of China is 1.47 mu, which is only 40% of the global average. According to the most recent data released by the MLR, the total arable land reserves of China is 8.029×10^7 mu, with the area of contiguous arable lands a mere 2.832×10^7 mu. Most of these reserves are located in ecologically fragile regions, like Northwestern and Northeastern China, which are currently facing water shortages and severe ecological problems owing to excessive agricultural land reclamation. Consequently, China’s reserve of arable lands for future cultivation is nearing depletion. The shortage of arable land resources is the primary obstacle preventing the development of China’s agricultural sector.

1.2 Arable lands tend to be of low quality, with high-quality lands being replaced by low-quality lands on large scales

According to 1:1 million scale maps of China’s land resources, unrestricted high-quality arable lands only account for 28.9% of the arable lands. The remaining lands are restricted by slopes, erosion, water availability, or salinity.

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Furthermore, the MLR has found that excellent- and high-grade arable lands only account for 32.6% of China's total arable land area, whereas medium- and low-grade arable lands account for the other 67.4%. Therefore, the arable lands of China tend to be low in quality.

The rapid urbanization of China has also resulted in large swathes of high-quality arable land being occupied by non-agricultural uses. Notably, 3×10^6 hm^2 of high-quality farmland was converted to non-agricultural land uses between 1996 and 2009 alone, with approximately 80% of these conversions occurring in Central and Eastern China. Furthermore, rural settlements are growing rapidly despite the declining rural population. The growth of construction land in rural and urban areas have exacerbated the loss of high-quality arable lands. To maintain the total amount of arable land in China, large amounts of low-productivity land in ecologically fragile regions, like Northwestern and Northeastern China, have been converted into farmland. Therefore, the replacement of high-quality arable lands with low-quality arable lands is a serious problem.

Based on our calculations, the farmland that was converted into construction land during the 1990 – 2010 period had an average food yield per unit area of 8.82 t/hm^2. However, the newly added farmlands only have an average food yield per unit area of 6.49 t/hm^2. To maintain the overall agricultural production levels of China, each mu of farmland occupied by construction land must be replaced by 1.54 mu, 2 mu, or 3.54 mu of farmland in Xinjiang, Northeastern China, or Inner Mongolia, respectively. The replacement of high-quality arable lands with low-quality equivalents over the past 20 years has reduced the total agricultural productivity of China's arable lands by approximately 2%.

1.3 Relatively low soil fertility and severe land degradation

1.3.1 Arable lands are lacking in soil fertility

According to data provided by the Food and Agriculture Organization (FAO) of the United Nations, the average soil organic matter content of China's arable lands is only 1.86%, which is much lower than that of the Americas, Europe, and many other countries/regions. Therefore, the soils of China are relatively lacking in fertility (Fig. 1). Although the overall soil organic matter content of China's arable lands has increased slightly in recent years [1], the soil organic matter contents of some regions, like Northeastern, Southwestern, and Southern China, are still decreasing over time. In particular, the soil organic matter content of Northeastern China has decreased by two soil nutrient grades.

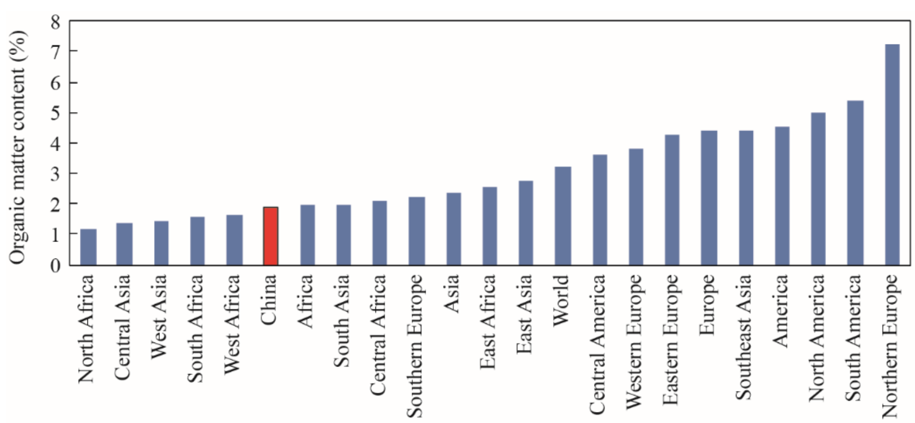

Fig. 1. Comparison between arable lands in China and other global regions, in terms of the soil organic matter content.

1.3.2 Increasingly severe soil acidification

Over the past 30 years, the soil pH of arable lands in China has decreased by 0.13–0.80, with especially severe soil acidification in the arable lands of Southern China [2]. For example, the soil pH of Hunan province has fallen from 6.4 to 5.9 and the coverage of strongly acidified farmland soils (pH: 4.5–5.5) has increased from 4.9×10^5 hm^2 to 1.46×10^6 hm^2. Furthermore, the proportion of strongly acidified soils in the farmlands of Poyang Lake in Jiangxi province has increased from 58.2% to 78.4%. Therefore, soil acidification is becoming increasingly severe across China [3].

1.3.3 Worsening of heavy metal soil contamination in primary food production regions

A study was conducted on the current state and trends of heavy metal soil contamination in the major food production

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regions of China, including the Yangtze River Middle Plain and Jianghuai Plain, Huang–Huai–Hai Plain, Sichuan Basin, Songnen Plain, and Sanjiang Plain. The results indicate that 21.49% of the monitoring sites in the five major food production regions had excessive heavy metal levels (i.e., failed to meet national soil quality standards), which is higher than the national average (19.4%). The proportion of samples that were lightly, moderately, and heavily contaminated were 13.97%, 2.50%, and 5.02%, respectively. The most important contaminants were Cd (17.39%), Ni (8.41%), Cu (4.04%), Zn (2.84%), and Hg (2.56%). The remaining metals accounted for 0.14% – 0.18% (see Table 1, Figs. 2 and 3).

Table 1. The state of heavy metal contamination in the five major food production regions of China.

Region	Number of monitoring sites	Number of monitoring sites with excessive heavy metal contamination	Rate of exceedance (%)	Light contamination (%)	Moderate contamination (%)	Severe contamination (%)
Sanjiang Plain	60	1	1.67	0.00	1.67	0.00
Songnen Plain	353	33	9.35	1.98	3.97	3.40
Middle Yangtze-Jianghuai region	731	224	30.64	21.61	1.92	7. 11
North China Plain	1 350	165	12.22	5.78	1.33	5.11
Sichuan Basin	512	223	43.55	34.57	5.47	3.52
Sum	3 006	646	21.49	13.97	2.50	5.02

Note: The data in this table was derived from various publications about heavy metal soil contamination in arable lands

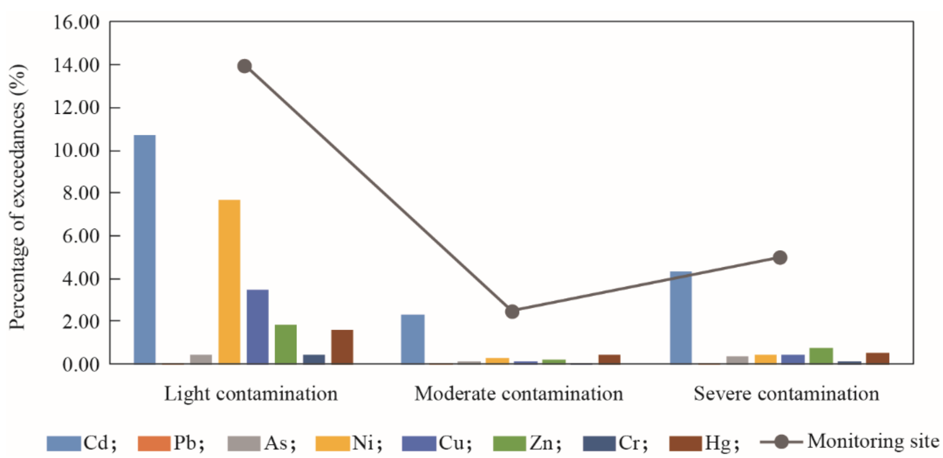

Fig. 2. Analysis of heavy metal contamination levels in the major food production regions of China.

Heavy metal contamination was more severe in the southern regions than in the northern regions (Fig. 3). In the Sichuan Basin and Yangtze River Middle Plain and Jianghuai Plain, 43.55% and 30.64% of the monitoring sites, respectively, had excessive heavy metal levels, as opposed to 12.22%, 9.35%, and 1.67% of the monitoring sites in the Huang–Huai–Hai Plain, Songnen Plain, and Sanjiang Plain, respectively. The contaminated sites were mainly located in non-ferrous metal mines, industrial zones, wastewater irrigation areas, and the surroundings of large/medium-sized cities.

In the last 30 years, the number of soil monitoring sites in the five major grain producing regions increased from 7.16% to 21.49%. In particular, the contributions of Cd, Ni, Cu, Zn, and Hg towards heavy metal contamination have increased by 16.07%, 4.56%, 3.68%, 2.24%, and 1.96%, respectively. Other than the Sanjiang Plain, the proportion of monitoring sites increased more significantly in the northern regions than in the southern regions.

1.3.4 Ongoing and considerable pollution of arable lands caused by residual plastic films

At present, the average quantity of residual plastic films in China's farmlands ranges between 60 kg/hm^2 and 90 kg/hm^2. However, areas with severe plastic film pollution, like Xinjiang province, contain 255 kg/hm^2 on average, which is five times the national average. In southern Xinjiang, the highest recorded level of plastic mu film pollution was greater than 600 kg/hm^2. Furthermore, plastic film pollution in China is worsening year by year.

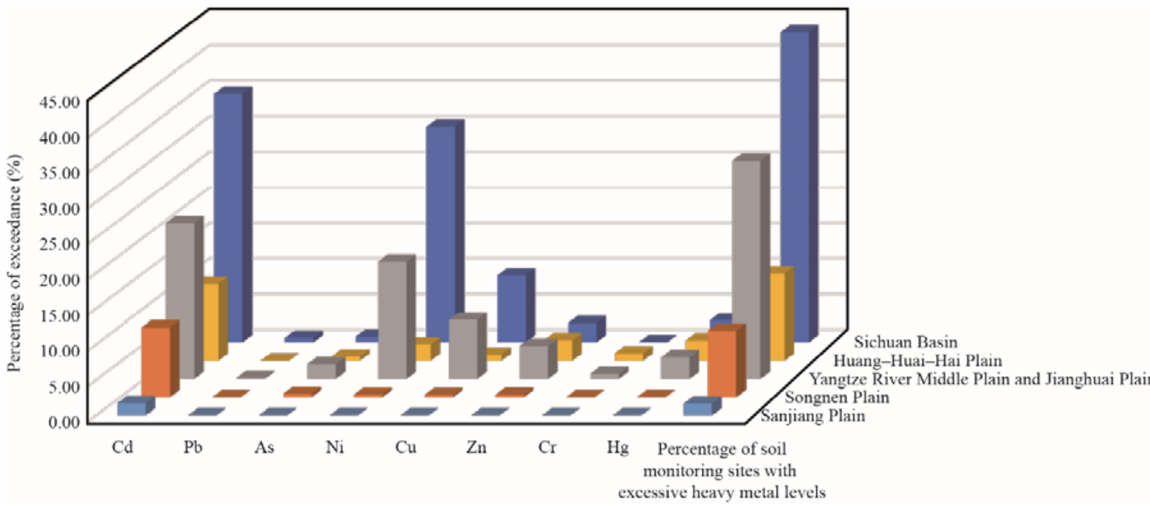

Fig. 3. Contaminant percentages of eight heavy metals in the five major food production regions of China.

1.4 Continued severity of topsoil thinning, farmland desertification, soil salinization, and soil erosion

Physical soil problems, such as topsoil thinning, decreasing plow pan depth, increases in the soil compaction, and decreases in the porosity and permeability of the soil, are still being faced by the primary agricultural production areas of China. For example, the thickness of the topsoil in the North China Plain has decreased from 20–30 cm to 10–15 cm.

In the last five years, desertified farmland increased by 3.91×10^5 hm^2. From 2006 to 2014, the proportion of salinized farmland in the irrigated areas of Xinjiang increased from 31.7% to 37.7%. The proportion of salinized farmlands is also large in the Hexi Corridor, Hetao Plain, and western Songnen Plain [4]. Furthermore, over 20% of China's arable lands are sloped, especially in the Upper Yangtze River, Loess Plateau, and the Southwestern karst area of China, where land degradation is a serious issue.

In summary, the quality of China's arable lands has been decreasing over the past few decades. The recent increases in agricultural production have been driven by enormous amounts of investments and sacrifices in soil quality, which are unsustainable in the long term.

2 Strategic measures and pathways for improving the quality of China's arable lands

The overall strategic thinking consists of three strategic transformations in the cultivated land management from the aspects of quantity, quality, and ecology of the cultivated land. The three transformations are as follows. (1) The number of arable lands will no longer be the sole consideration of arable land management, as the new mode of management will also account for the number, quality, and ecological protection of arable lands. (2) Farmland use will be transformed from "heavy use with minimal maintenance" to "integrated use and maintenance." (3) Arable land management will come under the purview of the law, as opposed to ordinary administrative units. The measurements undertaken in this strategy are described below.

2.1 Enhancing the cultivated land quantity in China

According to surveys conducted by multiple national agencies, the total arable land of China has been greater than 2×10^9 mu since the 1980s, with the yearly average being 2.035×10^9 mu (Table 2). In other words, the large-scale production of food crops and other agricultural products, over the past 30 years, has been supported by 2×10^9 mu of arable land.

Although food crop production in China has increased in recent years, China's food imports are still rising. In 2015, food imports already accounted for more than 20% of China's total food supply. As living standards continue to improve, the food demands of China will also continue to increase, especially during the population peak in 2030. However, against the backdrop of the aforementioned decrease in arable lands, declining agricultural productivity, and increases in food demand, the MLR plans to convert the following categories of low-quality arable lands into grasslands or forests: all sloped farmlands with a gradient greater than 25°, arable lands in the forest and grassland zones of Northeastern China,

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and farmlands within the flood control level. The total area of these low-quality arable lands is 1.5×10^8 mu. Furthermore, the MLR also intends for there to be 1.825×10^9 mu of arable land in 2030. These changes will significantly decrease the expanse of arable land and, therefore, endanger the food security and agricultural productivity of China in the future.

Table 2. Total arable land in China, according to the surveys of several national institutes (in units of 10^9 mu).

Year	National Agricultural Zoning Commission	Commission for Integrated Survey of Natural Resources (CISNAR)	Institute of Remote Sensing and Digital Earth (RADI)	Former State Land Administration	Soil Fertility Station of the Ministry of Agriculture	Chinese Academy of Sciences and the Ministry of Agriculture	First National Land Survey	Second National Land Survey
1980s	2.095	2.086	2.059	1.987	1.988	/	/	/
1993	/	/	/	/	/	2.060	/	/
1996	/	/	/	/	/	/	1.951	/
2009	/	/	/	/	/	/	/	2.069
2015	/	/	/	/	/	/	/	2.025

Note: Prior to the abolishment of the national agricultural tax, reports about the arable land surveys of China often contained deliberate omissions or misreported numbers

By the end of 2016, the first and second stages of the Grain for Green program had already caused the cumulative conversion of 1.7×10^8 mu of low-quality arable land into forests and grasslands. The amount of arable land that urgently needs to be converted is already very limited. Moderately sloped farmlands account for 6.5×10^7 mu of the 1.5×10^8 mu of arable land earmarked for the Grain for Green program, and the majority of arable lands with slopes greater than 25° have already been converted. Therefore, the proportion of steep-sloped farmlands that actually need to be converted is quite small. Currently, existing sloped farmlands in mountainous regions could be converted into terraced farmlands instead, to safeguard the basic food supplies of local farmers. The amount of arable land in forest zones and areas covered by flood control levels is approximately 8.5×10^7 mu. As arable lands in forest zones are not very steep and are of acceptable levels of quality, it may be wise to retain these farmlands. The inflows of China's rivers and lakes have also decreased significantly in recent years. Consequently, most of the arable lands within flood control levels have already been designated as basic farmlands. Therefore, it would be unwise to completely retire these farmlands. According to rough estimates, a minimum of 50% of the farmland designated for the Grain for Green program could be permanently retained as farmland instead.

Based on the quantity and trends of arable lands that are currently in use and in reserve across China, it is predicted that China will lose a minimum of 2×10^6 mu of arable land (net) each year. If the 1.5×10^8 mu of arable land that earmarked for conversion into grassland/forest is reduced by 50%, the total arable land of China could reach 1.926×10^9 mu during the population peak in 2030. Consequently, it would then be possible to strive to retain 2×10^9 mu of arable land by 2030.

2.2 Curbing undisciplined growth of construction land, and increasing the efficiency of land utilization in urban areas

Approximately 82.5% of China's arable land losses are caused by the occupation of farmland for building construction. The proportion of arable land occupation is 10% – 15% higher in medium and small cities compared to large cities. Therefore, the loss of high-quality arable land in China is mainly caused by the uncontrolled expansion of construction land.

At present, the per capita urban industrial and mining construction land area of China is 149 m^2, which is higher than the level specified in the national standard (110 m^2). Hence, a large amount of land could potentially be gained by economizing and intensifying land use. In 2014, the urban construction lands of China amounted to 8.9×10^4 km^2. Given a per capita requirement of 110 m^2, the needs of China's urban population in 2030 can be met by approximately 1×10^5 km^2 of construction land. However, as urban lands have expanded at an average of 3.6% per annum over the past 10 years, the total urban land area of China will reach 1.57×10^5 km^2 by 2030, which is 57% more than the required amount.

Therefore, the uncontrolled expansion of urban lands must be restricted. The total urban land area of China should be regulated to 1×10^5 km^2 – 1.1×10^5 km^2. The key to future urban developments is the maximization of currently existing land resources inside urban areas.

It is suggested that high-quality arable lands around cities or highways should be designated as permanent basic farmland to delimit urban developments, thus forcing cities to look inwards for land resources. The non-agricultural use of arable lands must continue to be stringently restricted, to control the excessive expansion of small/medium-sized cities and prevent development zones, such as cities, districts, and counties, from occupying arable lands. Local governments should be guided using policy innovations to revitalize their stock of construction lands. Additionally, new construction lands should be obtained from urban land stocks and the reorganization of rural lands. The cross-province balancing of arable land occupation and supplementation must be stringently restricted in core agricultural areas. The areas of overlap between rapidly developing city clusters (e.g., Wuhan, Changzhutan, Zhongyuan, and Chengyu) and China's primary agricultural production areas will become key areas for arable land protection in the future.

Construction land should be optimized to promote economic and intensive land use. The intensification of land use should be prioritized in mining and industrial areas, to facilitate economical and intensive land use and the prevention/treatment of arable land pollution. The rate and efficiency of land utilization can be increased by increasing the level of development and investment per unit area of land.

2.3 Improving the fertility of cultivated soil

2.3.1 Increase the application of organic fertilizers and combine the use of organic and inorganic fertilizers

Currently, organic fertilizer use in fruit and vegetable farms accounts for 80% of all organic fertilizer use in China. Very little organic fertilizer is used in large fields. Therefore, the simultaneous use of organic and chemical fertilizers should be encouraged for large fields. The amount of organic fertilizer recommended in each unit area is 500 kg/mu – 1000 kg/mu (composted livestock and poultry manure) or 80 kg/mu – 100 kg/mu (commercial organic fertilizer), which will reduce the use of chemical fertilizers by 20% – 40%. Organic fertilizer use in large fields should be piloted in the primary food production areas of China, such as the Huang–Huai–Hai region, Middle Yangtze–Jianghuai region, Sanjiang Plain, Songnen Plain, and Sichuan Basin.

A strong level of support should be provided to enterprises that produce organic fertilizers. In addition, cooperation between large/medium-sized organic fertilizer enterprises and livestock farms should be encouraged, so that waste products, like livestock manure, can be used to produce organic fertilizers. Preferential policies should be formulated for enterprises that are committed to refined and efficient organic fertilizer production, including preferential energy use rates, transportation costs, and taxation rates.

2.3.2 Promotion of straw return to fields

Straw return takes up 40% of the total straw production of China, which is 20% lower than that of developed countries. The mechanization and automation of straw return should be accelerated. Research and development efforts should focus on high-horsepower tilling machines, bundling machines, and grinders for the northern regions of China, as well as machines that are suitable for the smaller farms in the southern regions of China.

According to surveys, each mu of straw return costs 20 – 30 CNY in mechanical grinding costs and burial costs. The farmers who are unwilling to accept this cost will simply burn or dispose of their straw instead. Therefore, it is suggested that the national or local governments should fully subsidize these costs.

2.3.3 Promotion of grass planting and grass-crop rotations to re-fertilize farms

Forage and green manure should be cultivated in farming-pastoral ecotones, the arid areas of Northwestern, Northeastern, and Northern China, and the winter fallow fields of Southern China. This will help to improve the fertility of arable soils and solve the animal feed problem of the animal husbandry industry.

The forage crops that should be grown in the northern regions of China are mainly medick and rapeseed, with the supplementation of other forage legumes and green manure. Rapeseed, Chinese milk vetch, and perennial ryegrass are the main forage crops that should be grown in the winter fallow fields of Southern China.

The propagation of grass–crop rotations must be tailored to the characteristics of each region. In the grassland/pastoral areas of the northern regions of China, forage grass cultivation, integrated animal husbandry–crop farming, and ordinary crop farming should occupy approximately 50%, 20% – 40%, and 10% – 20% of all crop-growing areas, respectively.

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Based on rough estimates, the coverage of grass–crop rotation in the northern regions could reach 7×10^7 mu by 2030 (4.5×10^7 mu in farming–pastoral ecotones and the arid regions of Northwestern China; and 2.5×10^7 mu in Northeastern and Northern China). The coverage of grass–crop rotations based on legume, green manuring, and fodder rapeseed cultivation in the winter fallow fields of the south will reach 1×10^8 mu by 2030.

Automated agricultural equipment for the harvesting, silage, and tilling of forage grass, rapeseed, and green manure should be developed and propagated with vigor. In addition, the sustainability of grass–crop rotation should be enhanced by actively developing the animal husbandry and grass production industries, as well as by extending the relevant industry chains. The use of chemical fertilizer could be reduced by 20% – 30% in farms that use grass–crop rotations.

2.4 Preventing and controlling heavy metal pollution of soil

2.4.1 Establish a "prevention-first" approach to pollution management

The construction of industries that cause heavy metal pollution, such as non-ferrous metal smelting, in agricultural areas must be strictly restricted. The use of clean production techniques must be enforced in relevant industries and enterprises. The water quality of wastewater irrigation sources should be monitored periodically. Additionally, the release of wastewater, waste residues, and waste gas, caused by mining operations near farmlands, must be strictly restricted. The use of irrigation water sources that fail to meet requirements must be prohibited.

In heavily polluted farming areas, agricultural production activities should be ceased and the farmlands should either be converted into forest/grasslands or fallowed.

2.4.2 Reduction of the bioavailability of heavy metals in soil

According to China's soil environment quality standards, the soil cadmium exceedance of developed nations, such as the U.K. and Japan, can range between 20% and 40%, but the heavy metal exceedance of their agricultural production is significantly lower than that of China. At present, 16.5% and 12.2% of the rice produced by the Middle Yangtze and Sichuan Basins, respectively, contains excessively high levels of heavy metal contamination, which indicates that the bioavailability of heavy metals in the soils of these areas is relatively high. Therefore, it is imperative that the sources of heavy metal pollution are eliminated. In severely acidified soils, lime should be applied once every three to four years. Farmers should be guided to flood their fields during the grain-filling period of rice, so as to reduce the chromium content of the rice. A strict quality control system, based on spot checks, should be implemented for agricultural products, to force producers to take the initiative to reduce the contaminant levels. Active efforts should be made to selectively cultivate low-accumulation cultivars and reduce the cultivation of indica rice, which tends to accumulate a large amount of cadmium.

2.4.3 Formulation of robust laws and supporting standards

As there are no laws in China that specifically deal with the prevention and remediation of arable land pollution, the *Soil Pollution Prevention and Control Law* should be issued as soon as possible. In addition, a supporting system of technical standards should also be formulated.

2.5 Further research on degradable plastic films and improvements to the mechanical retrieval of agricultural plastic films

The development, piloting, and propagation of effective and degradable plastic films should be intensified. Retrieving machines that collect residual plastic films, up to a depth of 20 cm, should be developed with haste, especially multi-function retrieving machines. In addition, the government should increase subsidies for the purchasing and operational costs of plastic film retrievers. The enforcement of mandatory national standards on plastic film thickness should be improved and the sale of plastic films thinner than 0.01 mm prohibited.

3 Major projects for improving the quality of China's arable lands

3.1 Reconstructing low- and middle-yield arable lands

Low- and middle-yield arable lands account for approximately 70% of China's total arable land. The low yields of these arable lands are caused by a lack of water conservancy facilities and the co-occurrence of native and secondary soil constraints. Various soil constraints affect 5×10^5 km^2 and 2×10^5 km^2 of China's medium- and low-yield farmlands, respectively. Therefore, the reconstruction of low- and middle-yield farmlands should be performed according to the features of their soil constraints and localities.

The reconstruction of low- and middle-yield farmlands should be combined with the establishment of high-standard farmlands. Moreover, the improvement of soil fertility should be based on the construction of agricultural water conservancy facilities. Crop rotation systems should be established to increase the area of fodder crops and green manure cultivation, alongside the promotion of straw return to increase the organic matter content of the soil. These measures will promote the formation of high-standard farmlands.

By 2020, it is estimated that 4×10^8 mu of low- and middle-yield farmlands will be reconstructed (1.5×10^8 mu and 2.5×10^8 mu, respectively). Additionally, 6×10^8 mu of high-standard farmland will also have been established. Low- and middle-yield farmland reconstruction should be prioritized in cotton-growing and edible oil production areas, such as the Sanjiang Plain, Songnen Plain, North China Plain, Jianghan Plain, Jianghuai region, Dongting Lake Plain, Poyang Lake Plain, Sichuan Basin, and Tarim Basin.

3.2 Comprehensive improvement of rural lands

In 2015, the per capita construction land use of rural settlements in China was 300 m^2, which is two-times the national standard (150 m^2). According to some researchers, the comprehensive rehabilitation of rural lands across China could potentially increase the arable land by 1.14×10^8 mu [5].

Under the provision that the wishes and land rights of farmers are respected, rural settlement revitalization projects should first be conducted in economically developed regions, based on an urbanization-led mode of "hollow village" rehabilitation. In regions with moderate levels of economic development, remediation works should focus on the aggregation of scattered villages and the restoration of unoccupied/abandoned settlements. In regions where economic development is slow, the development of hollow villages should be contained by guiding the congregation of farmer settlements. Following these actions, the rehabilitated lands should then be converted into farmlands to help establish large-scale agricultural operations.

These projects should be implemented in the North China Plain, Middle-Lower Yangtze Plain, Northeast China Plain, Jianghan Plain, Hanzhong Basin, and Sichuan Basin. By 2030, the rehabilitation of rural lands is expected to have increased China's arable lands by 2×10^7 mu.

3.3 Demonstration project of comprehensive reparation of heavy metal pollution of soil

In the Yangtze River Middle Plain and Jianghuai Plain as well as the Huang–Huai–Hai Plain, 30.64% and 12.20% of the soil monitoring sites, respectively, have been shown to contain excessive heavy metal levels. In addition, it has been shown that heavy metal contamination is spreading across China's arable lands.

It is suggested that demonstration project of comprehensive reparation of heavy metal pollution of soil should be conducted in the two abovementioned regions, in farmlands with different soil contaminants. In these projects, the first step is to strengthen the elimination of heavy metal pollution sources. The second step is to implement remediation measures according to the type and degree of soil contamination. For example, fallowing trials can be conducted in severely contaminated areas, and the soils may be remediated by planting non-edible plants or by converting farmland into grasslands/forests. In lightly contaminated areas, remediation could be performed by removing contaminated soils, introducing foreign soils, using chemicals, or by adjusting agricultural processes.

China must endeavor to develop mature and safe pollution remediation methods by the end of the 13th Five Year Plan. Soil remediation projects in the Yangtze River Middle Plain and Jianghuai Plain as well as the Huang-Huai-Hai Plain should be expanded up to 5×10^6 mu over the course of the 14th Five Year Plan.

3.4 Continued implementation of soil and water conservation, sand prevention, and saline soil improvement projects

Projects for soil and water conservation, sand prevention, and saline soil improvement should be continued in the Loess Plateau, Upper Yangtze region, Southwestern lava mountains, Northwest wind-blown saline-alkali area, western part of the Northeastern China, and coastal secondary salinization area.

The priorities of water and soil loss remediation works will differ from one region to another. In the Loess Plateau, remediation efforts should be based on the conversion of farmland into forests/grasslands and the development of fruit farms and distinctive industries, with small catchments being treated as unit elements. Check dams should be constructed

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and slopes should be converted into terraces. In addition, steep slopes and mountain tops should be covered by trees or grass. Water and soil loss remediation projects in this region should focus on the sediment-laden and coarse-sand areas of the Yellow River. In the karst rock regions of Southern China and the upper Yangtze, sloped arable lands with inclines greater than 25° should be converted into forests and grasslands, alongside terracing projects. Basic farmlands should also be constructed. In addition, distinctive crops (e.g., forest fruits) and the animal husbandry industry should be developed in these regions.

In Inner Mongolia, arable lands that suffer from severe desertification should be converted into grasslands. Rainwater utilization should be maximized, alongside the intensification of the construction of basic pasture and farmlands. Farmlands in the dry, windy, and sandy areas of Northwestern China should be reduced in size via the Grain for Green program. Additionally, it is important to prioritize water saving measures. In windy, sandy, salinized, and alkalinized areas, endeavors should be made to increase the proportion of farmlands using grass-crop rotation systems, increase the soil organic matter content, fix soils, control desertification, and rehabilitate saline/alkaline soils.

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