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REVIEW

TRANSFORMATION OF AGRICULTURE ON THE LOESS PLATEAU OF CHINA TOWARD GREEN DEVELOPMENT

Gang HE (✉)[1], Zhaohui WANG[1], Jianbo SHEN[2], Zhenling CUI[2], Fusuo ZHANG[2]

1 College of Natural Resources and Environment, Northwest A&F University, Yangling 712100, China.
2 College of Resources and Environmental Sciences, National Academy of Agriculture Green Development, China Agricultural University, Beijing 100193, China.

KEYWORDS

agronomic technologies, economic returns, education, environmental cost, food production, government policy

HIGHLIGHTS

- Agriculture on Loess Plateau has transformed from food shortage to green development.
- Terracing and check-dams are the key engineering measures to increase crop yields.
- Agronomic measures and policy support greatly increased crop production.
- Increasing non-agricultural income is a key part of increasing farmers' income.
- Grain for Green Program had an overwhelming advantage in protecting environment.

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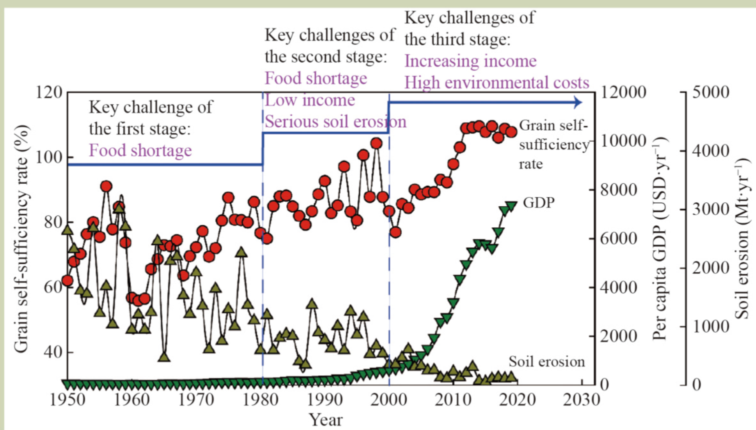
Correspondence: hegang029@nwafu.edu.cn

GRAPHICAL ABSTRACT



ABSTRACT

Loess Plateau of China is a typical dryland agricultural area. Agriculture there has transformed from food shortage toward green development over the past seven decades, and has achieved world-renowned achievements. During 1950–1980, the population increased from 42 to 77 million, increasing grain production to meet food demand of rapid population growth was the greatest challenge. Engineering measures such as terracing and check-dam were the crucial strategies to increase crop production. From 1981 to 2000, most of agronomic measures played a key role in increasing crops yield, and a series of policy support has benefited millions of smallholders. As expected, these measures and policies greatly increased crop production and basically achieved food security; but, low per capita GDP (only about 620 USD in 2000) was still a big challenge. During 2001–2015, the increase in agricultural and non-agricultural income together supported the increase in farmer income to 5781 USD·yr^{-1}. Intensive agriculture that relies heavily on chemicals increased crop productivity by 56%. Steadfast policy support such as "Grain for Green Program" had an overwhelming advantage in protecting the natural ecological environment. In the new era, the integration of science and technology innovations, policy support and positive societal factors will be the golden key

to further improve food production, protect environment, and increase smallholder income.

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1 INTRODUCTION

Food security, smallholder income, environmental degradation and climate change are the great challenges facing mankind, and agriculture is at the heart of these challenges. The greatest challenge of contemporary agriculture occurs in dryland areas, which cover about 47% of global land surface and is home to more than 3.5 billion people[1,2]. Dryland areas area often have low crop productivity, low incomes and environmental degradation, due to the dryland syndrome (low and high variable precipitation, low fertility and remoteness)[2,3]. Although there are many attempts at sustainable development of drylands, there are not many large-scale, long-term successful examples.

The Loess Plateau in North-west China is an example in point. Annual mean precipitation is often 200–550 mm, per capita water endowment is roughly a tenth the global average[4] and per capita arable area is roughly a third the global average (0.13 ha)[5,6]. During 1950–2019, grain self-sufficiency increased from 62% to 108% and per capita GDP increased from 68 to 7380 USD, even though population increased from 42 to 109 million (Fig. 1). At this stage, the environment is improving, e.g., the amount of sediment loss at Tongguan station decreased by 95%.

Facing the scarcity of resources and the rapid growth of population, agriculture on the Loess Plateau has made great achievements in food production, economic growth and environmental protection, and has achieved the transition from food shortage to green development over the past seven decades. This study divides the agricultural development of the Loess Plateau into three stages. In the first stage during 1950–1980, the greatest challenge was to increase food production to meet food demand of the rapidly growing population. In the second stage during 1980–2000, solving food shortage, increasing economic returns and reducing soil erosion were the greatest challenges. In the three stage during 2001–2015, the urgent need of further increasing economic returns and reducing environmental costs threatens the

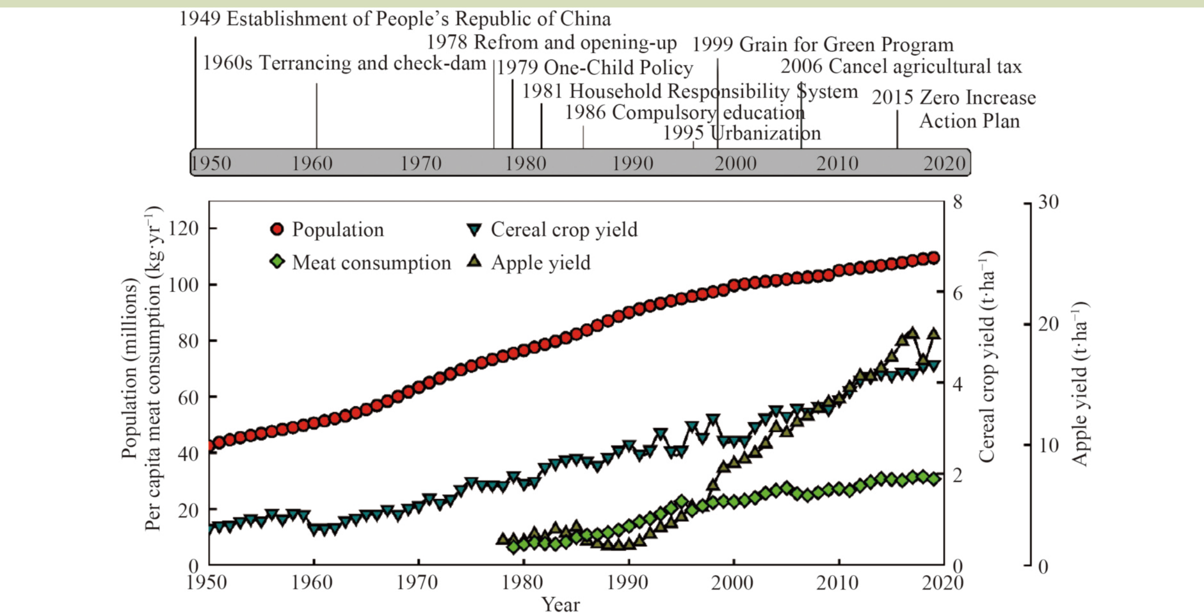

Fig. 1 Development trend of dryland agriculture on the Loess Plateau of China. Trends in population and cereal crop yield (1950–2019), apple yield (1978–2019) and meat consumption (1979–2019). For this study, we selected Gansu, Ningxia, Shaanxi and Shanxi in China to represent the Loess Plateau due to the difficulty in obtaining data for other areas. Data from National Bureau of Statistics of China, 1950–2019[5].

agricultural green development. Here, we focus on the Loess Plateau in part because the level of agriculture development already is relatively high, thanks to continued technology advancement and enduring steadfast policy support and, in part, because it addressed agriculture, economy and environmental challenges synthetically. We review the development of agriculture on the Loess Plateau, analyzing the experiences and lessons over the past seven decades to provide a reference for global dryland agriculture.

2 IMPROVING GRAIN PRODUCTION FOR SELF-SUFFICIENCY DURING 1950–1980

For dryland agriculture, the land suitable for farming is very limited due to insufficient precipitation[1], thus increasing the area of arable farmland is considered to be one of the most crucial measures to produce more food. Numerous ways have been developed to help farmland expansion, including building terraces and check-dams, reclaiming wasteland, transferring forest to farmland and improving saline-alkali land. Among these, terracing and check-dams are typical cases. Most studies show that terracing and check-dams were the most important engineering measures for increasing cultivated area[7] and improving yields per unit area due to increasing the content of soil water and nutrients[8–10]. Zhuanglang County, located in the north-west of the Loess Plateau, is an example of global terracing. The area of newly built terraces account for 40% of the total cultivated land during 1970–1978 alone[11], which was key to increasing grain production at that time. In addition, the number of check-dams increased to more than seven thousand in 1980 (Fig. 2(a)). This has greatly increased crop production due to the increase in arable area, and the enhancement of soil and water conservation capabilities[12]. Notably, the construction of these requires the organization of large-scale labor, which requires the support of relevant policies, especially collectivization, which is a vital strategy for achieving grain self-sufficiency at a low economic level stage.

Dryland is very sensitive to soil degradation, and 10% to 20% of the land has some form of severe land degradation[2]. A similar situation also occurred on the Loess Plateau. Due to the low level of socioeconomic development, farmers were unable to increase agricultural production inputs, especially chemicals, greatly limiting crop productivity. To provide more food and increase income, most farmers had to overexploit farmland, pastures and forests, resulting in environmental deteriorating and soil quality degradation. These negative burdens limited crop productivity, thus creating the traps of hunger, poverty and environmental degradation. For example, forests were seen as a resource to support industrialization and economic development, because they were the most available wood and fuel at that time, especially for steel-making[13]. As a result, deforestation intensified and forest cover in China has dropped from 11.4% in 1950 to 8.6% in 1962[14]. This resulted in serious environmental issues. For example, the annual mean soil erosion at Tongguan station exceeded 1800 Mt at that time. Although engineering measures, such as terracing and check-dams, had the ability to reduce wind and water erosion[15,16], they were powerless in terms of the degradation of the entire ecosystem.

During 1950–1980, the population increased from 42 to 77 million (2.6% per year), and the biggest achievement at the stage was to feed the rapidly growing population. In this

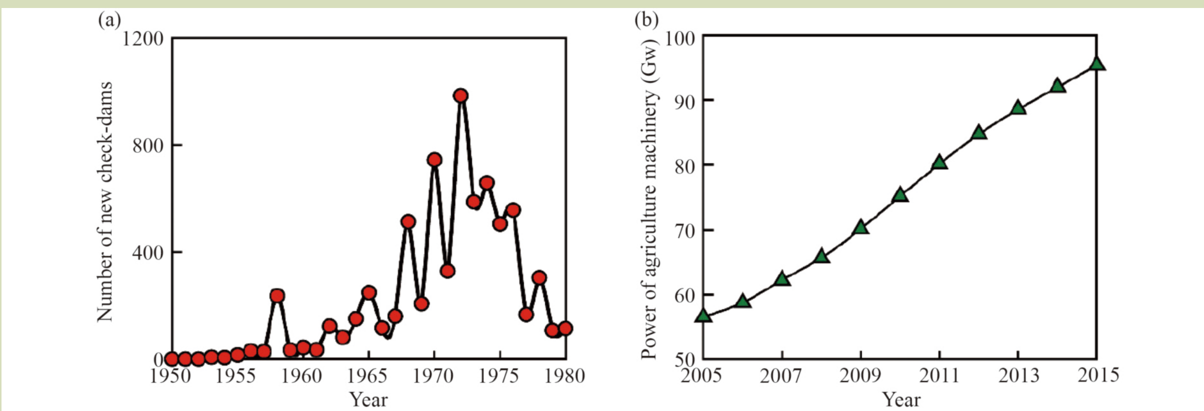

Fig. 2 Trends in check-dam development during 1950–1980 (a) and the power of agricultural machinery during 2005–2015 (b) on the Loess Plateau. Data from National Bureau of Statistics of China, 1950–2019[5].

historical period, the cereal crop yield per unit area only increased from 0.8 to 1.8 t·ha^{-1} (Fig. 1), and the increase in available farmland has greatly contributed to the increase in crop production. Engineering measures, such as terracing and check-dams, were the crucial strategies to increase available arable area and crop yield per unit area, and the policies related to collectivization were a vital guarantee for the construction of these engineering achievements. However, at this stage, food production has not greatly improved, and could only maintain basic grain self-sufficiency, despite great efforts that were made in policy and management, and a serious environmental cost was paid. If optimized crop cultivation was used as early as possible and better top-level designs for dryland agriculture were made, more food could have be produced at lower environmental cost.

3 IMPROVING BOTH GRAIN PRODUCTIVITY AND ECONOMIC DEVELOPMENT DURING 1980–2000

During 1980–2000, grain productivity and economic development developed greatly. Specifically, cereal crop productivity increased from 1.8 to 2.7 t·ha^{-1}, apple yield increased from 2.0 to 8.3 t·ha^{-1}, per capita meat consumption increased from 7.4 to 22.5 kg·yr^{-1}, per capita GDP increased from 137 to 619 USD·yr^{-1}, and soil erosion decreased from 793 to 518 Mt·yr^{-1} (Fig. 1). Advances in science and technology were the most crucial contributors. A series of meta-analysis and location-fixed field experiments were conducted to quantify the effects of key agronomic measures on crop production. The results showed that the adoption of plastic film mulching increased averaged yield of wheat and maize by 18%–27%[17], and film-mulching gave better yields[18]. Supplementary irrigation increased wheat yield by 16%–23%[19]. Additional manure application increased wheat yield by 5%–8%[20]. These measures seem effective in experimental fields, but they are not easy to apply in practice, especially at a large scale.

The steadfast policy support is one of the important factors that make the large-scale application of technologies possible. Gansu Province, located in North-west China, is a typical case. For most of the area, the low annual mean precipitation (< 500 mm) mean that water scarcity is the crucial factor limiting crop productivity, and the low annual mean air temperature (< 9°C) means that the accumulated temperature in certain farmlands cannot meet the needs of crop growth. Low crop yield and insufficient farmland limit crop production, consequently, food self-sufficiency has always been the biggest dream of the people there.

Successful policymaking has its roots in robust scientific evidence. Most of studies confirmed that the adoption of plastic film mulching have profound ability to reduce water evaporation and increase soil temperature, thus increasing crop yield[21,22]. In the 1990s, the Gansu Provincial Government made great efforts to promote plastic film mulching, e.g., established demonstration experiments to show yield gains and provided plastic film to farmers according to the area of farmland owned by smallholders. During 1991–2000, the amount of plastic film used increased from 15 to 64 kt, and substantially increased the area of plastic film application, which helped increase crop production. For example, maize yield was often higher, but its production required a higher accumulated temperature, compared with other cereal crops, such as millet and oat. In areas where the accumulated temperature was insufficient to grow maize in the past, maize could now be planted since with plastic film increasing soil temperature[23,24]. As expected, the harvested area of maize increased from 322 to 464 kha during 1991–2000 (Fig. 3). In addition, collecting rainwater for supplementary irrigation could increase crop yields[19]. To promote these technologies, the specific funding for the construction of rainfall collection facilities reached 6.2 million USD in 2000, and application area reached 400 kha, accounting for 10% of the total arable area. Owing to the great effort of policy and technology, the cereal crop production in Gansu Province increased from 4.9 to 7.1 Mt during 1981–2000 (Fig. 3), and grain self-sufficiency was achieved for the first time in history.

During 1980–2000, China undertook reforms that ended collective agriculture and restored traditional household production, i.e., the Household Responsibility System (land is allocated to redistribution to farm households, but remains collectively owned). The effective re-privatization of farmland from communes to households greatly improved farmer enthusiasm for agricultural production, thus providing an unprecedented opportunity for improving crop production and economic returns. For example, to increase income, certain farmland that was historically used to grow cereals was diverted to growing cash crops or to feeding animals. Adjusting planting structure from planting naked oats change to planting potato increased net economic return by more than 10-fold[25]. The increase in cereal crop productivity indicated that less farmland was required to produce the same grain. This was a key progress for agricultural development, because more farmland could be devoted to non-grain crops and livestock production. This offered a potential approach to increase diversification of diets as well as economic returns.

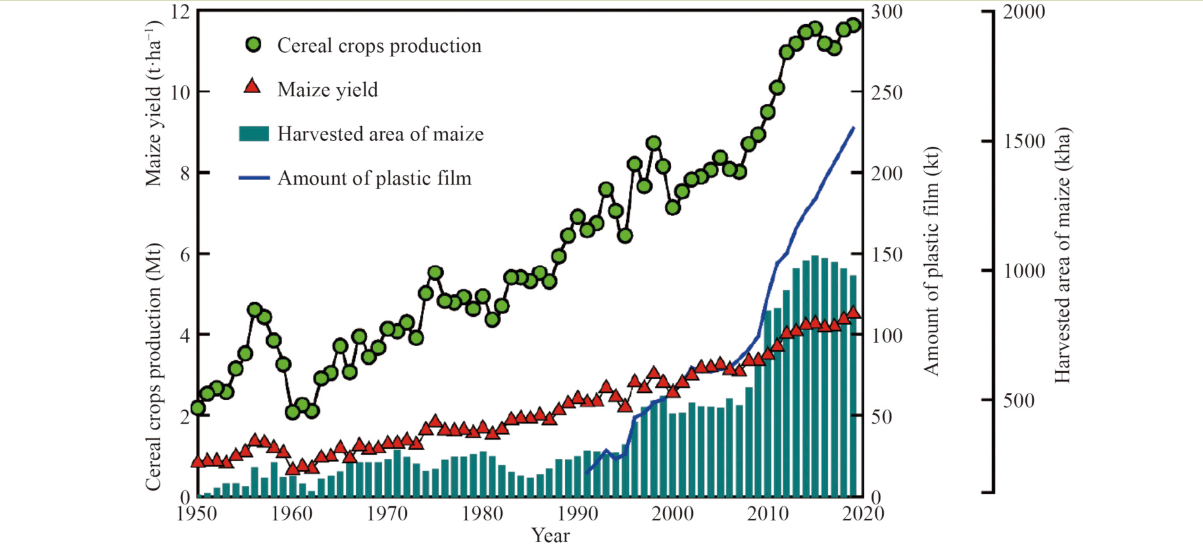

Fig. 3 Trends in cereal crops production in Gansu Province. Plastic film mulching technology was used in cereal crops to increase grain production. Data from National Bureau of Statistics of China, 1950–2019, and data for amount of plastic film are available only from 1991 to 2019[5].

In combination, technological development and steadfast policy support, increased crop production achieved food self-sufficiency. The advancement in science and technology provided a golden opportunity for increasing crop production. The policies related to technological transfer were a vital guarantee for the widespread application of advanced technology. The Household Responsibility System has greatly improved farmer enthusiasm for agricultural production. The One-Child policy reduced the rate of population growth, and thus decreased the demand for food. These policies and technologies were very important for increasing the food self-sufficiency. However, the per capita GDP was still very low, only 619 USD in 2000. In addition, the forest cover was still only 32% in 2000[26], and soil erosion in Tongguan Station still reached 349 $Mt \cdot yr^{-1}$. The urgent need of economic growth and serious environmental issues still threatened agricultural green development on the Loess Plateau. If we pay more urgent attention to economic growth and environmental costs, the economy growth may be faster and the environment may be more protected.

4 SYNERGISTIC IMPROVEMENT IN FOOD, ECONOMY, AND ENVIRONMENT DURING 2001–2015

During 2001–2015, cereals crop productivity increased from 2.7 to 4.2 $t \cdot ha^{-1}$, apple yield increased from 8.7 to 17.1 $t \cdot ha^{-1}$, per capita meat consumption increased from 23.0 to 30.5 $kg \cdot yr^{-1}$, per capita GDP increased from about 680 to 5780 USD per year and soil erosion dropped from 474 to 143 $Mt \cdot yr^{-1}$ on the Loess Plateau. Innovative technology, steadfast policy support, and positive societal factors have worked together to achieve great development.

For crop production, high chemical input, particularly chemical fertilizer, was the key driving factor for increasing crop yields in intensive agriculture[27]. Low-priced fertilizers made averrable through a subsidy policy was a key strategy to stimulate the application of fertilizer in agricultural production. For example, the use of chemical fertilizer in Shaanxi Province rapidly increased by 76% (from 1.31 to 2.31 Mt) during 2001–2015[5]. In addition, the mechanization of technology greatly expanded the area of application of technology. For example, deep plowing creates a more favorable soil environment and a more suitable spatial distribution of roots, thus increasing yield[28]. Agricultural machinery makes it easy to realize deep ploughing on a large scale. To increase the utilization of mechanization, a policy to subsidize machinery was introduced in 2004. As a result, the power of agricultural machinery increased from 57 to 95 Gw during 2005–2015 (Fig. 2(b)). Finally, to increase crop production through stimulating farmer enthusiasm, a series of agricultural policies have been formulated and implemented. For example, agricultural tax, which had existed for thousands of years, was abolished in 2006 (Fig. 1). The implementation of

these measures and policies has ensured the continuous growth of food production over the years.

In pursuit of higher income, millions of rural workers moved from rural to urban and found non-agricultural employment opportunities[4]. The increase of mechanization (including mechanized planting and harvest) greatly reduced the demand of manpower, which provided opportunities for farmers to enter the cities to obtain non-agricultural income. For example, wages income, an important non-agricultural income, increased more than threefold (from 96 to 327 USD) during 2003–2012 in Shaanxi Province[5]. This greatly increased the per capita income of the rural population.

Changing the way of farmland is used is one of the important strategies to increase income. For example, planting kiwi fruit instead of cereal crops greatly increased economic returns due to higher yield per unit area and higher prices. However, the cost of this success was reflected in high environmental impact due to the huge increase in chemicals, especially fertilizers[29,30]. A study in the central of the Loess Plateau showed that nitrate accumulation in 2 m soil depth was only 282 $kg \cdot ha^{-1} \cdot yr^{-1}$ N in the wheat-maize system but reached 1206 $kg \cdot ha^{-1} \cdot yr^{-1}$ N with kiwi fruit production[31]. The Ministry of Agriculture and Rural Affairs (MARA) of China announced the Zero Increase Action Plan in 2015 for managing fertilizer use nationwide (Fig. 1). Given the high fertilizer application rate in the field used for it, vegetable and tea production, MARA of China proposed a special action to replace chemical fertilizers with manure. In conclusion, these national actions strongly controlled the use of chemical fertilizer, which achieved negative growth in 2018.

During 2001–2015, livestock production on the Loess Plateau has made great progress, and meat products increased from 2.3 to 3.3 Mt (Fig. 1), greatly enriching the diversity of food. However, for a long time, livestock production was a key source of environmental pollution. This was mainly because large-scale livestock production cannot occupy core farmland, so it was mostly distributed in remote mountain areas, preventing animal manure from being returned to farmland[32]. Bai et al.[33] estimated that in 2010 about 80% of manure N and 40% of manure P were lost to the environment. The efficient use of manure is key to optimal combination of crop and livestock production. Although most studies showed that combining manure with chemical fertilizer could increase crop yield[34,35], manure were rarely used in crop production, particularly for cereal crops, due to their lower economic returns[36]. In addition, the lack of application technology and machinery was also key factor limiting the use of manure. For example, before manure is applied to farmland, mitigation measures for ammonia volatilization should be adopted to minimize environmental impacts[37]. The utilization of manure in farmland requires scientific management based on the nutrient requirements of crops and the nutrient supply in the manure and soil[38]. We believe that the combination of crop and livestock production is a key strategy to achieve a win-win for grain production and environmental protection, but many steps are needed to apply manure to millions of farms managed by smallholders.

As a result of deforestation and transformation to forests to farmland, the Loess Plateau is one of the world's most forest-deficient regions, with only 0.1 ha of forest per person, compared with a world average of 0.6 ha[39]. Owing to overgrazing, climate change and mining, the grassland area has also been declining at a rate of 15,000 $km^2 \cdot yr^{-1}$ since the early 1980s[39]. Soil erosion on the Loess Plateau has been especially devastating, with an erosion area of about 70%[40] with deforestation and grassland degradation the major reasons. These environmental impacts severely undermine our ability to continue to feed a growing population. For natural ecosystems, steadfast policy support was the most fundamental strategy and its benefits were obvious in a short-term. The Grain for Green Program is a typical case. The central government designed the sustainability programs, set high-level goals, provided most of the funding and delegated responsibilities to relevant ministries, commissions and administrations. More than 32 million rural households have directly benefitted from this action, particularly on the Loess Plateau. The government subsidized farmers with seeds or seedlings, grain and cash. Subsidies lasted 8 years for ecological forest, 5 years for economic forest and 2 years for grassland plantation. At the end of 2015, the central and local governments had invested 54.6 billion USD. The implementation area reached 31.3 Mha during 1999–2015, and forest coverage due to this action increased by more than 3%[13]. Soil erosion and wind erosion has been dramatically reduced.

In general, cereals crop yield increased by 56% and apple yield doubled during 2001–2015. High chemical input and the use of key agricultural technologies are the core of increasing crop production for intensive agriculture. The mechanization of technology greatly expanded their application area and reduced the need for manpower, thus providing opportunities for farmers to enter cities to obtain non-agricultural income. At this stage, the per capita GDP has increased from about 680 to 5780 $USD \cdot yr^{-1}$, and the increase in agricultural and non-agricultural income supported the substantial increase in per capita GDP. The policy centered on the Grain for Green

Program has an overwhelming advantage in protecting the natural ecological environment. However, agroecosystems, particularly for orchards, are still facing huge environmental pressures, and the combination of crop and livestock production may be a key strategy to deal with this challenge; however, it is not easy to put this into practice. If we could give more attention to environmental impacts of agriculture production, more food could be produced at lower environmental costs; if we could give more attention to economic growth, the per capita GDP of farmers may grow faster. In the future, further reduction of the environmental cost of agriculture production and increase in farmer income will be the urgent need for agricultural green development in dryland areas.

5 OUTLOOK

To date, population on the Loess Plateau has risen 2.6 fold since 1950, yet per capita food production has grown by 73% over the same period, creating a huge agricultural miracle. In the future, the increase in population and per capita food demand, as well as the decrease in farmland due to urbanization and land appropriation for mining will further increase the pressure on food. The current yield level on the Loess Plateau is already a high compared to global dryland standards. Although there is still scope to achieve growth, future increase in crop productivity will not come as easily as in the past.

The per capita GDP on the Loess Plateau has increased by more than a hundredfold during 1950–2015, creating a huge economic miracle. However, it was still less than achieved overall in China, especially for farmers. Further increasing farmer income will be important for improving their livelihood. Sustainable management depends on the understanding of human-nature relationships, and sustainable development has higher requirements for environmental protection. Food production leads to air, water and land pollution and other forms of environmental damage. For example, the total CO_2 emission from the Loess Plateau increased threefold from 1961 to 2015[6]. Minimizing environmental costs is huge challenge for future agricultural development.

On the Loess Plateau, addressing resource and environmental constraints, maintaining robust growth in agricultural production, transitioning to a more environmentally-friendly production methods, and coordinating grain growth, economic development and environmental protection are the key challenges. New technologies, policy support and positive societal factors are needed to address these challenges. Below, we provide three broad sets of recommendations.

5.1 Developing new technologies to produce more food with less resource

In the past, the adoption of agronomic technologies to produce more food has achieved remarkable gains. For example, Chen et al.[41] demonstrated that applying integrated soil-crop system management substantially increased crop yields; if farmers could reach 80% of the system yield level, it would be sufficient to meet food demand. In the future, the increase in food demand and the decrease in arable farmland will further increase the pressure on crop production, so the development of more productive technologies will be an urgent challenge for us to address.

The lack of soil water has always been the most important factor limiting crop productivity. Improving water use efficiency is a key approach for agricultural green development in dryland. In the past four decades, mulching soil surface using plastic film has played a key role on increasing crop production. For example, Chen et al.[42] indicated that applying the plastic film mulching increased crop yield by 12% to 68% on the Loess Plateau. However, the negative impact of long-term use of plastic film mulching on the soil and the environment has been highlighted in recent years. For example, Zhang et al.[43] reported that the mean plastic film residue due to the use of plastic film mulching technologies has reached 34 $kg \cdot ha^{-1}$ in China. Kim et al.[44] found that the application of plastic film mulching increased N_2O emission by 20%–31%. In the future, more breakthrough technologies that can increase soil water with lower environmental and economic costs should be carefully considered for agricultural green development in dryland areas.

Agriculture is an important source of carbon emissions, accounting for about 12% of global anthropogenic carbon emissions[45]. Intensive agriculture that relies heavily on chemicals, poses a huge environmental risk of causing air, water and land pollution, creating serious carbon loss hotspots. The Chinese government solemnly promises to reach peak of carbon emissions by 2030. There is no doubt that this imposes higher requirements on agricultural technologies, that is, reducing carbon emissions as much as possible while increasing crop productivity. In the future, exploring more critical and breakthrough technologies that increase crop yields with less environmental damage should receive greater attention.

5.2 Improvement of the education and capacity building

In the past, the low use of new agricultural technology, low crop productivity and low public awareness of the environment were partly due to the low investment in education. In 2018, the total investment in education was only 647 billion USD, accounting for only 4.3% of GDP[5], less than half of that in developed countries. A substantial increase in education investment directly promotes the development of 9 years compulsory education and the increase in university enrollment, greatly improving the per capita education level and overall quality. This can greatly increase environmental awareness and ameliorate environmental issues on the Loess Plateau. In addition, investments in education would help more children to go to college and have better opportunities to find jobs and resettle elsewhere, and thus reduce human pressure on biodiversity-rich and environmentally fragile regions[39]. Continuing to increase investment in education and improving the quality life for the whole population will be a decisive for the agricultural green development on the Loess Plateau.

5.3 The strong support from policies

The Chinese government has made tremendous efforts to promote food growth and economic development. Policy is the biggest driving factor for agricultural development[46]. In the past, policy formulation mainly focused on increasing crop productivity and farmer income, however, minimizing the environmental impact of agricultural production did not receive sufficient attention. In 2017, the central government proposed a new development concept, emphasizing green development, which will make a decisive contribution to coordinating socioeconomic progress and environmental protection.

On the Loess Plateau, the development of industry and urbanization, as well as increased production of meat products, vegetables and fruits, has intensified competition for limited farmland. Although a policy guaranteeing basic grain farmlands was introduced in 1998, the area has been decreasing due to a multiplicity reasons. The lack of strict implementation of policies may be one of the more important reasons. Establishing policy measures offers opportunities for the synergistic improvement of grain, economy and environment, and strict implementation of these policies will be the most critical step for long-term success.

Of course, increasing crop yields has received most attention due to the huge pressure to achieve food security; however, the improvement of crop quality seems to have been neglected. Survey results showed that the price of high-quality apples is usually two to five times than that of low-quality apples. Therefore, improving crop quality will be a key approach for farmers to increase their income. However, farmers often mistakenly think that the high input of chemicals, including fertilizers and pesticides, guarantees production of high-quality food. On the contrary, there is no doubt that the high input of chemicals will lead to higher environmental impacts. Therefore, effective transfer agricultural technology will be key to improving crop quality and increasing farmer income.

For a long time, the promotion of agricultural technology has been dominated by government agencies, and heavily relied on government investment. In recent years, many new entities of agricultural technology promotion have emerged, such as agricultural universities and scientific research institutes, agricultural enterprises and agricultural technology intermediaries, and rural economic cooperatives. Appropriate policy support to allow these extension entities to have a leading role is critical for the effective transfer of agricultural technology to millions of smallholders. This will be decisive for food and environmental security, and economic growth at a regional and national scale.

Food security, economic growth and environmental sustainability will be the priority focus for future practices on the Loess Plateau. Over the last seven decades, the people of the Loess Plateau have created agricultural and economic miracles. We hope that, in the next three decades, these people will also create environmental miracle and set an example for similar regions and countries facing similar challenges. The outcome will not only affect the Loess Plateau, but also the dryland regions throughout the world.

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Compliance with ethics guidelines

Gang He, Zhaohui Wang, Jianbo Shen, Zhenling Cui, and Fusuo Zhang declare that they have no conflicts of interest or financial conflicts to disclose. This article does not contain any study with human or animal subjects performed by any of the authors.

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