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China, Factor #6: Sustainable Agriculture

Increasing Agricultural Sustainability in China

Is it really possible for one country to feed a fifth of the world's population with only ten percent of the world's cultivable land? Better yet, can this be done sustainably? To better understand this challenge and its solutions, one can look to China. Located in Southeast Asia along the Pacific coast, China is the third largest country in the world by size at approximately 9.6 million square kilometers. However, with a current population of 1.4 billion people, China is the most populous country. China's climate varies widely from region to region and from season to season, making agricultural conditions wildly different throughout the country. Southern China experiences hot, humid summers and mild winters. Monsoon season, between May and September, brings heavy rains while typhoons bring destructive winds and floods. Central China experiences similar summer weather to that of the Southern region but with drier, colder winters. The northern areas can face months of frost and snow at a time in the winter, alongside very cold temperatures, but face extremely windy and warm conditions in the summer. China's mountainous regions experience colder temperatures year-round because of their elevation.

Agricultural practices in China appeared between 1900 and 1600 BC. Production began to blossom between the tenth and seventh centuries BC. During this period, also known as the Iron Age, many iron objects and tools began to appear in China. These new tools helped farmers work more efficiently, therefore increasing annual yield. In the 17th and 18th centuries, the Enlightenment swept through Europe bringing a scientific revolution in its wake. New farming technology and ideas were spread across Europe and Asia. Globally, farming became more mechanized throughout the 18th and 19th centuries. Currently, large farms in China use tractors and other machinery. However, many small, typically family-owned farms, still rely heavily on hand cultivation and manual labor. As the population and need for food have grown, so has the nation's fertilizer use. China is the world's largest consumer of fertilizer - being responsible for almost 45 percent of the world's fertilizer consumption. While many agricultural practices have changed and evolved over centuries of China's history, China has retained its agricultural economy and has remained a key part of global food production.

Because of the One Child Policy, most families in China consist of two parents and a single child. However, many households are multigenerational with three generations, parents, grandparents, and children, all under the same roof. With Confucianism being the longest-standing belief system in China, filial piety is an important aspect of Chinese culture. Filial piety is an attitude of respect toward one's elders, meaning that the family's eldest member is the head of the household. Younger generations must ensure their parents' well-being, especially in old age. The average life expectancy in China is 78 years, three years longer than the world average. This statistic can be partially attributed to the Chinese healthcare system. China has free public healthcare which "provides basic coverage for the majority of the native population [... and] can be broken down into three subcategories: basic cover for urban enterprise employees, basic cover for other urban residents, and rural cooperative medical insurance for the farming population" (InterNations, n.d.). China's life expectancy can also be credited to the typical diet. Meals in China are typically very healthy and consist of grain and three to four side dishes, featuring fresh meat and vegetables. Many people in China are lactose intolerant, so soy products such as soy milk and tofu are used in place of many dairy products. Rice and noodles are arguably the most important and

prominent foods in the Chinese diet. To put their importance into the American perspective, they are “equivalent to potato and pasta in the Western diet” (Lin, 2000).

Agriculture is important to both China individually, and to the food supply chain on a global scale. China ranks first in global agricultural production, with the US falling in second, and Brazil in third. China produces enough agricultural products annually to feed one-fifth of the world’s population. Despite being the top producer of agricultural products, only ten percent of China’s land is cultivable. The 1.4 million square kilometers of farmland is divided up into 200 million individual farms, with the average farm size ranging from 0.5 to 1.5 acres per household. The nation’s most important crops are grains, fruits, vegetables, and tea, with 75% of the nation’s cultivated land being used to farm these foods. According to Encyclopedia Britannica, “Rice [is] China’s most important crop [and] is dominant in the southern provinces, many of which yield two harvests per year” (Lieberthal & DeWoskin, 2019). China produces one-fourth of the world’s grain supply. The latest statistics from China’s National Bureau of Statistics reveal that in 2022, “China’s total grain output was 686.53 million tons, an increase of 3.68 million tons or 0.5 percent compared with that in 2021” (National Bureau of Statistics, 2022).

With only ten percent of China’s land being cultivable and the population staying relatively constant, losing any agricultural ground could spell disaster for the country’s population and economy, as well as its environment. There are currently a multitude of barriers facing food production in China. Since many farms are relatively small and non-wealthy, much of China’s agriculture still depends on hand cultivation, and what little equipment is available in small, rural communities is shared between multiple farms/households (*Farms of the USA and China*, n.d.). Climate change has caused a decrease in rainfall across the country. Only 40% of China’s cropland is irrigated, meaning that with reduced precipitation due to climate change, the other 60% faces the threat of drought, therefore limiting grain production. One of the biggest obstacles currently facing Chinese farmers is the historical overuse of fertilizers, pesticides, and other chemicals (Hannink, 2018). The use of fertilizers strips nutrients from the land, while pesticides decrease biodiversity, harming local ecosystems. Another barrier to production is the changing designation of land. China’s growing population, alongside increased urbanization, leads to competition for land between urban and rural areas. With more of the population moving out of the countryside and into urban areas, agricultural land surrounding cities is being converted into residential and commercial properties. Only 35% of China’s population depends on agriculture to make a living, and the average age of farmers is rising. The majority of farmers are over the age of 45. The number of young farmers is not increasing as fast as the number of old farmers is decreasing, meaning that the total population of the agricultural sector is decreasing. A fall in agricultural laborers spells disaster not only for the non-mechanized farms but the rest of the country’s agricultural production in general. Without proper advances in technology, a shrinking farm population will cause a consequent decrease in agricultural production.

The biggest issue that faces Chinese agriculture is a lack of sustainability in farming practices. The United States Department of Agriculture has defined sustainable agriculture as “farming in such a way to protect the environment, aid and expand natural resources, and to make the best use of nonrenewable resources” (USDA, n.d.). Chinese agricultural practices, however, do not meet this description. Two factors affecting sustainability in China are proper fertilizer use and the over-taxation of bodies of water.

Due to the overuse of nitrogen-based fertilizers, as well as other chemical agents, nutrient depletion and chemical runoff have become major issues in China’s soil. According to a study conducted

by the Universities of Melbourne, Stanford, Fudan, Wuhan, and Zhejiang, China uses “more than 30 percent of global fertilizers and pesticides on only nine percent of the world’s cropland” (Kevey, 2022). According to the Chinese Ministry of Agriculture, “In 2013, China’s fertilizer input exceeded 59.12 million tons, and the fertilizer application intensity reached 328.5 kg/ha, far higher than the world average (120 kg/ha); 2.5 times that of the European Union and 2.6 times that of the United States” (Zhang et al., 2022). Farmers in China are applying almost three times more fertilizer to their crops than American farmers, but in China, only approximately 30 percent of the nutrients in these fertilizers are absorbed by plants, as opposed to 40 percent in Western nations. The excess nitrogen in this unused fertilizer is carried out of fields by rainwater causing groundwater pollution and drinking-water contamination. Ingesting nitrate-contaminated drinking water can cause thyroid conditions, diabetes, and various types of cancer. Water is also an issue when it comes to irrigation and climate change. 545,960 square kilometers of China’s land is irrigated, equaling approximately 40% of its agricultural cropland. According to Britannica, “Wet-rice cultivation is the most prevalent method of [rice] farming” (“Paddy | Agriculture | Britannica,” 2020). Paddies are flooded with 10-15 centimeters of water via rivers, monsoon rains, or irrigation. Climate change has caused decreased rainfall in some areas of China. Consequently, farmers are relying increasingly more on watering their fields via artificially collected sources, as opposed to natural precipitation. While containing rain in rice paddies has little to no adverse effects on the environment, diverting rivers toward fields as well as irrigating by pumping out bodies of water can harm local ecosystems. Removing large quantities of water from their original locations can cause water levels in rivers, lakes, and creeks to diminish, endangering plants and animals living in said bodies of water. With water being essential to agriculture, it is important to protect the availability and quality of this limited resource to facilitate successful and sustainable farming for future generations.

The majority of chemical overuse in China’s agriculture stems from small farms. The existence of so many small farms is due to standing land and migration policies, as well as laws limiting the transfer of cropland use rights. Owners of small farms believe that to maximize their harvests and profits, they must use a lot of fertilizers and pesticides. The aforementioned multi-university study reports that a “one percent increase in farm size was found to be associated with a 0.3 percent and 0.5 percent decrease in fertilizer and pesticide use per hectare respectively. This corresponded to an almost one percent increase in agricultural labor productivity” (Kevey, 2022). According to this data, increasing the size of farms will consequently decrease the quantity of chemicals used, therefore lowering the amount of carcinogens released into the environment. For this to happen, legislation blocking the transfer of land rights must be repealed. New efforts must be made to create a network of localized small farms that can connect to form larger cooperative farms. The public must also be educated about the effects of over-fertilizing their crops. To combat the over-depletion of water resources, farmers can implement rain collection systems. Rainwater harvesting systems in China would serve a dual purpose. They would prevent flooding during and after the monsoon season by collecting large amounts of precipitation, and they would also lessen the environmental effects of irrigation. By directing and repositioning rainwater, farmers will avoid overtaxing local waterways such as rivers and creeks. They will also keep rainwater from causing floods and therefore damage to land and houses. For the average citizen, an at-home rainwater collection system could consist of a gutter system funneling water off of the house’s roof and into a reservoir. This water would then be drained from the vessel and repurposed. It could be used as-is for irrigation, or filtered for domestic uses such as drinking or cooking. Though rainwater collectors are often only seen on a small scale, they can be sized up to fit the needs of a household or small farm. According to Ph.D. students from the University of Arizona, “Rainwater is renewable and can be a realistic source of water for homeowners living in remote areas” (Capehart & Eden, 2021). A government-funded grant providing simple rainwater collection systems to farms, especially in small rural communities, would kickstart this into motion. Taking advantage of rainwater, a resource that is already in abundance during certain times of the year will allow China’s agricultural system to boost its production while also decreasing its climate footprint.

Through changes in legislation and relatively small amounts of government funding, China can make its agriculture more sustainable and eco-friendly.

Rich in history, culture, and grain, China boasts the largest agricultural-based economy in the world. Having the largest national population makes agriculture even more vital to China's survival and prosperity as a country. Producing a quarter of the world's grain supply, China faces its share of agricultural issues. Climate change, chemical overuse, and farm mismanagement have led to various problems in Chinese agriculture. These issues negatively affect plant and human health, water supply, and ecosystem viability. To combat these issues, China must create legislation that makes it easier for small, local farms to join together, creating larger, more productive farms. The government must implement systems to lessen the effects of farming on rivers, lakes, and streams. This can be done by implementing rainwater harvesting systems to help curb the need for excessive taxation on these bodies of water to irrigate fields, and through the education of citizens on the effects of overusing fertilizer. Since the dawn of agriculture, China has seen its fair share of cultivation issues. However, with enough legislative reform and education of the public, farming in China will continue to grow prolifically.

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