Learning and Teaching Resource Package Related to the Geography of China
Topic 3 Agriculture and Food Supply
(Worksheet, Senior Secondary)
Theme: Land, Technology and Food Security

Pre-lesson task

In this unit, we will study our country's pathways to food security. Land is one of the most important resources for food production. Read Knowledge Box 3.1 and discuss the following questions.

Knowledge Box 3.1

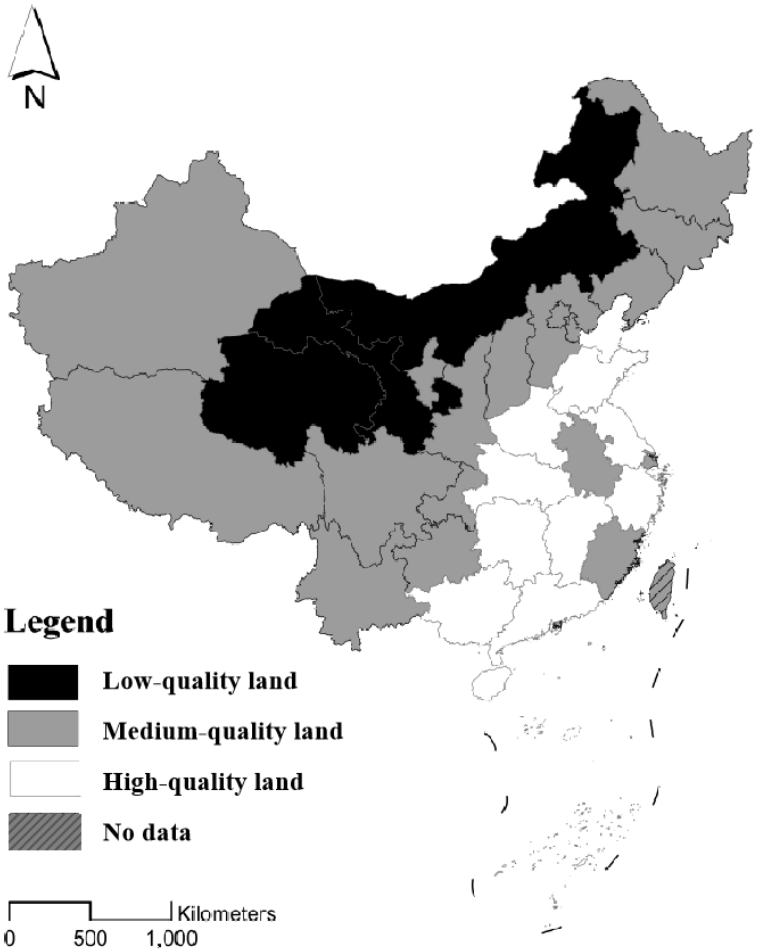
The production of food relies on cultivating crops like rice, wheat, maize, and soybeans. The overall food production is determined by the amount of arable land and the yield per unit area. It is influenced by factors such as the quantity and quality of the arable land, as well as the distribution of resources like heat, water and sunlight in the region where the land is situated. Our country, with its vast population, significant monsoon climate, extensive arid regions, and numerous hilly and mountainous areas, exhibits the following characteristics in its arable land resources:

- Our country faces challenges in terms of arable land availability. The amount of arable land per person is relatively low, and the potential for acquiring new arable land is limited. Despite our country having approximately 7.0% of the world's total arable land, the per capita arable land area is only around 40% of the global average in 2022. As the population continues to grow and various types of construction land expand, the per capita arable land area is steadily declining. Moreover, the potential for obtaining new arable land is limited, as the available land is of poor quality and development is challenging.
- The quality of our country's arable land is a significant concern, as it faces issues of degradation and pollution. Around 70% of the arable land in our country produces medium or low yields. Even the reclaimed arable land is plagued by problems such as soil erosion, desertification, and decreased fertility. Additionally, it is impacted by pollution from various sources, including industrial waste, agricultural waste and domestic waste, as well as residues from chemical fertilisers and pesticides, and mulching film.
- The distribution of arable land in our country is uneven, and there is inadequate allocation of water and soil resources. Approximately 90% of the arable land is situated in the monsoon climate zone, with more than 70% concentrated in the eastern plains and hilly regions. The southern regions, which are rich in water and heat resources, mainly consist of paddy fields and encompass over 90% of the nation’s excellent-quality and high-quality land. Unfortunately, these areas are significantly impacted by urbanisation and industrialisation, leading to the encroachment upon high-quality arable land. In contrast, the northern regions experience limited water and heat resources, with drylands dominating the landscape. These areas contain 75% of the

nation’s medium-quality arable land and 90% of the low-qulity arable land. Although these regions are the primary distribution areas for our country’s newly added arable land, the quality of the newly added land is often lower. Lastly, in the northwestern regions, arable land is only found in oases where water resources are relatively more abundant.

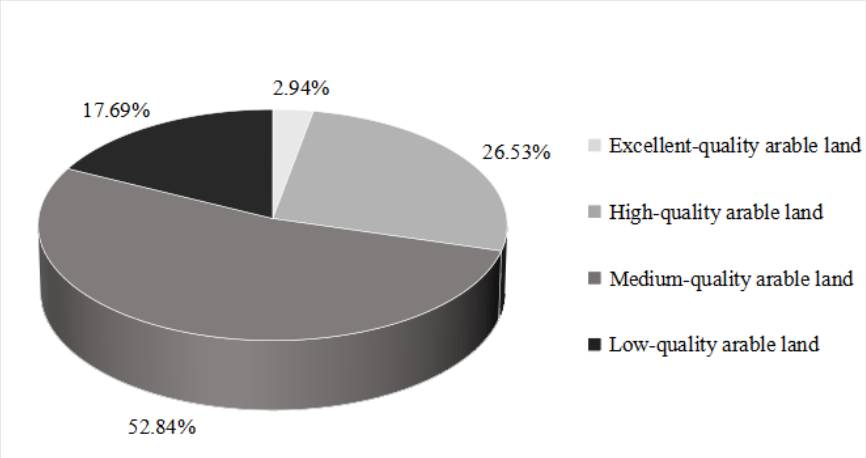
Reference: Chapter 2, Elective Volume 3, Senior High School Geography Textbook, People's Education Press

Figure 3.1 The average quality of arable land at the provincial level in 2015



Source: Chapter 2, Selective Compulsory Volume 3, People's Education Press.

Figure 3.2 Arable land distribution by quality in our country in 2015



Source: Chapter 2, Selective Compulsory Volume 3, People's Education Press.

(a) Select the correct answer for the following multiple-choice questions.

(a1) Which type of arable land is found in Heilongjiang Province?

A. High-quality arable land

B. Medium-quality arable land

C. Low-quality arable land

(a2) Which type of arable land is found in Guangdong Province?

A. High-quality arable land

B. Medium-quality arable land

C. Low-quality arable land

(a3) Which type of arable land is found in the Nei Mongol Zizhiqu?

A. High-quality arable land

B. Medium-quality arable land

C. Low-quality arable land

[Answer:(a1)B; (a2)A; (a3)C]

(b) What are the spatial distribution of high-quality, medium-quality, and low-quality arable land in our country?

[Hints: The spatial distribution of high-quality, medium-quality, and low-quality arable land in our country vary across different regions.

High-quality arable land: High-quality arable land is typically found in the eastern coastal regions, such as the Yangtze River Delta, Zhujing Delta, and the provinces of Shandong and Henan. These areas have fertile soil, favorable climate conditions and well-developed agricultural infrastructure. High-quality arable land is characterised by high productivity and is suitable for growing a wide range of crops.

Medium-quality arable land: Medium-quality arable land is more widely distributed across our country, covering a significant portion of the central, western and northerneastern regions. This includes provinces/autonomous regions such as Sichuan, Yunnan, Hebei, Xizang and Xinjiang. Medium-quality arable land may have slightly less fertile soil and face challenges such as water scarcity or extreme weather conditions. However, with proper management and agricultural practices, it can still support productive farming activities.

Low-quality arable land: Low-quality arable land is primarily found in the western and northern regions, including Gansu, Qinghai and Nei Mongol. These regions often have harsh climates, limited water resources, and poor soil conditions, making it difficult to cultivate crops. Low-quality arable land requires significant investment and technological advancements to improve its productivity.

It is important to note that these spatial characteristics are generalisations, and there can be variations within each region. Additionally, efforts are being made by the Chinese government to improve the quality of arable land through various land management and conservation measures.]

(c) What are the main challenges faced by our country in agricultural and food supply?

[Hint: Reliance on major food crops: Our country's food production is predominantly dependent on the cultivation of key crops such as rice, wheat, maize, and soybeans.

Scarcity of per capita arable land: Despite our country owning approximately 7.0% of the world's arable land area, the per capita arable land area is merely 40% of the global average in 2022. With the burgeoning population and increasing allocation of land for other purposes, the per capita arable land area is on a continual decline.

Substandard land quality: A significant portion, around 70%, of our country's arable land yields low to medium productivity. The extant arable land grapples with issues such as soil erosion, desertification, and a decline in soil fertility. It also faces pollution from industrial and agricultural waste, along with residues from fertilisers and pesticides.

Inequitable distribution of arable land: Arable land in our country is distributed unevenly. About 90% is situated in the monsoon climate zone, with over 70% concentrated in the eastern plains and hilly regions.]

In-class learning and teaching

Learning objectives:

- To understand the effects of arable land on food security in our country.
- To understand the influence of technology on food production in our country.

Development 1: Arable land and food security in our country

Watch Topic 3 Agriculture and Food Supply video (senior, 0:00-4:09), read Knowledge Box 3.2 and the data in Table 3.1, and discuss the questions below.

Knowledge Box 3.2

To ensure the **arable land resources necessary for food security**, our country has implemented the strictest arable land protection policy. This includes establishing a legally binding **"red line"** for arable land:

- The "red line" ensures that the amount of arable land remains above 1.8 billion areas.
- The basic farmland must not fall below 1.56 billion areas.

To safeguard the arable land "red line", it is essential to:

- Ensure that the predetermined "red line" is not breached.
- Ensure that the permanent basic farmland designated around cities is not arbitrarily used.

Additionally, any occupation of basic farmland for construction must be balanced with an equivalent amount and quality of supplementary basic farmland, achieving **a balance between land occupation and compensation.**

Nationally, there are strict controls on the conversion of arable land to non-agricultural construction land, with a focus on improving the **balance between land occupation and compensation.** This is enforced through:

- Compensating for arable land before converting it to non-agricultural construction, with an emphasis on one-for-one replacement, quality-for-quality replacement, and wetland-for-wetland replacement.
- Strict verification and recognition of supplemental arable land, establishing an open system to ensure their authenticity and reliability.
- Strict control over the conversion of arable land to other agricultural uses, implementing a "net balance" system. Any converted arable land must be compensated within the year with an equal amount and quality of arable land for stable and long-term use.

The **"red line"** for arable land is not only based on quantity but also quality. To protect and improve the quality and sustainable use of arable land, our country has implemented several projects for **soil and water resource protection:**

- Construction of high-standard farmland.

- Protection and enhancement of arable land quality.
- Remediation of heavy metal contamination in arable land.
- Soil and water conservation measures.
- Transformation of sloping farmland.
- Implementation of efficient water-saving measures.
- These projects aim to stabilise and conserve high-yield fields, enhance the fertility of medium and low-yield fields, increase the yield per unit area of food production, and reduce the pressure on the demand for arable land quantity.

Reference: Chapter 2, Elective Volume 3, Senior High School Geography Textbook, People's Education Press and Central People's Government of the People's Republic of China

Table3.1 Arable land and grain production in our country

	Total grain yield (million tons)	**Total grain sown area (million hectares)**	**Grain yield per hectare (kg/ha)**	**Population (10,000 person)**	**Grain yield per capita (kg/person)**
1949	113.2	85.63	1 035	54167	209
1952	163.92	123.98	1322	57482	285
1965	194.53	119.63	1626	72538	268
1978	304.77	120.59	2527	96259	317
2000	462.18	108.46	4261	126743	365
2005	484.01	104.27	4642	130756	370
2010	546.41	109.87	4973	134091	408
2015	621.43	113.34	5483	138326	452
2020	669.49	116.77	5734	141212	474

Source: National Bureau of Statistics of China

Note: Sown areas are the total areas sown with crops and orchards, which are smaller than the one of arable land.

(a) Read the data in Table 3.1. How has arable land and grain production in our country changed over the past 70 years?

[Hints: According to Table 3.1, there are several trends observed over the past 70 years:

Total Grain Yield: There has been a significant increase in the total grain yield in our country from 113.2 million tons in 1949 to 669.49 million tons in 2020. This suggests that our country 's grain production has been growing steadily over the past 70 years.

Total Grain Sown Area: The total grain sown area peaked in 1952 at 123.98 million hectares, and then it started to decline. However, it has been relatively stable since 1978, fluctuating around 110-120 million hectares. This indicates that the increase in grain yield is not due to an expansion of the sown area but rather improvements in yield per hectare.

Grain Yield Per Hectare: Grain yield per hectare has been increasing steadily from 1035 kg/ha in 1949 to 5734 kg/ha in 2020. This significant increase suggests improvements in farming practices, technology, and crop varieties over the past 70 years.

Grain Yield Per Capita: Despite the population growth, the grain yield per capita has also been increasing, from 209 kg/person in 1949 to 474 kg/person in 2020. This indicates that the growth in grain production has outpaced population growth.

In conclusion, over the past 70 years, our country has significantly increased its grain production, mainly through improvements in yield per hectare, despite a relatively stable sown area. The grain yield per capita has also grown, suggesting that our country has been able to provide more grain for its growing population.]

(b) Refer to Knowledge Box 3.2, what are the reasons behind our country's implementation of the “1.8 billion acres of arable land protection red line” policy?

[Hint: Our country has launched the “1.8 billion acres of arable land protection red line” for several reasons:

Food security: The primary reason is to ensure food security. By maintaining a certain amount of arable land, our country can ensure that it has the necessary resources to grow enough food for its population.

Balance between land occupation and compensation: The policy helps maintain a balance between land occupation and compensation. Any occupation of basic farmland for construction must be balanced with an equivalent amount and quality of supplementary basic farmland. This ensures that the total amount of arable land does not decrease significantly due to urbanisation and other non-agricultural uses.

Quality of arable land: The policy is not only concerned with the quantity of arable land but also its quality. Several projects have been implemented to protect and improve the quality and

sustainable use of arable land. These include the construction of high-standard farmland, protection and enhancement of arable land quality, remediation of heavy metal contamination in arable land, soil and water conservation, and efficient water-saving measures. This helps to increase the yield per unit area of food production and reduce the pressure on the demand for arable land quantity.

Sustainable use of land: The policy also aims to ensure the sustainable use of land. By implementing strict controls on the conversion of arable land to non-agricultural uses and requiring compensation for any such conversion, the policy encourages the efficient and sustainable use of land resources.

Legal protection: The policy provides a legally binding framework for the protection of arable land. This ensures that the protection of arable land is not just a policy goal but a legal requirement, providing a stronger guarantee for the protection of arable land.]

Development 2: Agriculture technology in our country

Watch Topic 3 Agriculture and Food Supply video (senior, 4:10-8:14), read Knowledge Box 3.3, and discuss the questions below.

Knowledge Box 3.3

The Development and Impact of Hybrid Rice

- Yuan Longping, recognised as the "Father of Hybrid Rice in the World," pioneered the promotion of hybrid rice in our country starting in 1976. By 1979, his work had led to its large-scale promotion across the country. This technology effectively increased rice yields, significantly maintained national food security, and aided millions of Chinese people in escaping hunger.

Important Years and Achievements:

- 1973 - Yuan Longping developed the first generation of hybrid rice.
- 1974 - Hunan Province conducted trial planting of hybrid rice, which achieved a yield of 650 kilograms per mu, significantly higher than that of traditional rice, demonstrating the great potential of hybrid rice.
- 1975 - The trial planting area of hybrid rice was expanded to 5,600 mu.
- 1976 - Nationwide demonstration and promotion of hybrid rice began, reaching an area of 2.08 million mu, with an average yield increase of over 20%.

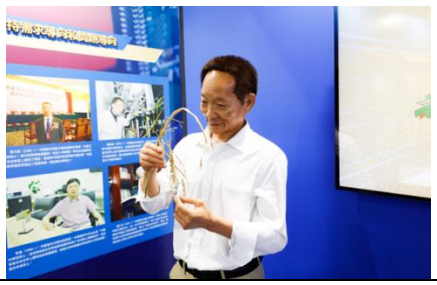
Changes in Food Production:

- 1973 - The nation's grain output was 265 million tons, with a per capita grain possession of 297 kilograms.
- 2020 - The nation's grain output reached 669 million tons, with a per capita grain possession increased to 480 kilograms.

Grain Self-sufficiency Rate and Contribution of Rice:

- By 2020, our country's grain self-sufficiency rate had exceeded 95%, and per capita grain possession was approximately 470 kilograms. This is a 126% increase from the 209 kilograms at the founding of the People's Republic of China in 1949, surpassing the global average. In terms of overall grain production, rice accounted for approximately 25% of the total sown area but contributed nearly 32% of the yield. This underscores the significant role of hybrid rice in increasing food production.

Figure3.3 Photo of Yuan Longping



Reference: Central People's Government of the People's Republic of China, 2009

https://www.gov.cn/jrzg/2009-08/31/content_1405572.htm

(a) What are the changes in rice production before and after applying hybrid rice technology?

[Hint: Before the application of hybrid rice technology, the yield of traditional rice was significantly lower. In 1973, the nation's grain output was 265 million tons, with a per capita grain possession of 297 kilograms. After the application of hybrid rice technology, there was a noticeable increase in rice yields. By 1976, the average yield increase

e was over 20% due to the nationwide demonstration and promotion of hybrid rice. By 2020, the nation's grain output had reached 669 million tons, with a per capita grain possession increased to 480 kilograms. The grain self-sufficiency rate had exceeded 95%, and rice accounted for approximately 25% of the total sown area but contributed nearly 32% of the yield. This highlights the significant role of hybrid rice in increasing food production.]

Knowledge Box 3.4

In 2017, Chinese agricultural scientist Yuan Longping and his team made an important research and development breakthrough, successfully cultivating a new variety of rice that is tolerant to saline-alkali soil. This variety is capable of growing under seawater irrigation conditions with salinity levels between 3% and 8%, and has been named "seawater rice."

Yuan Longping has publicly stated that the current yield of hybrid rice has reached 18 tons per hectare, and the next goal is to tackle the saline-alkali tolerant rice commonly referred to as "seawater rice," with an expected yield of 300 kilograms per mu.

After successful trial cultivation and widespread promotion, based on the estimated yield of 200-300 kilograms per mu, our country hopes to increase her grain production by 50 billion kilograms on the existing saline-alkali land, which could potentially feed an additional 200 million people. Such a scale of increased grain production has profound implications for food security in our country and the rest of the world.

Reference: Central People's Government of the People's Republic of China, 2021

https://www.gov.cn/xinwen/2020-09/27/content_5547692.htm

Figure3.4 Seawater Rice

Source: Central People's Government of the People's Republic of China, 2020
https://www.gov.cn/xinwen/2020-09/25/content_5547251.htm#7

(b) What are the changes in rice production before and after applying seawater rice technology?

[Hints: Before the application of seawater rice technology, rice could not be cultivated in saline-alkali soil or under seawater irrigation conditions. The yield of hybrid rice was around 18 tons per hectare. After applying seawater rice technology, a new variety of rice was developed that can tolerate saline-alkali soil and grow under seawater irrigation conditions with salinity levels between 3% and 8%. The expected yield of this seawater rice is 300 kilograms per mu. With the successful trial cultivation and widespread promotion of seawater rice, our country hopes to increase its grain production by 50 billion kilograms on the existing saline-alkali land, potentially feeding an additional 200 million people. This significant increase in grain production could have profound implications for food security in our country and the rest of the world.]

Knowledge Box 3.5 – Additional information

Soilless cultivation mainly comes in two forms: hydroponics and substrate cultivation. Hydroponics involves immersing part of the plant's roots in a nutrient solution for growth, with another part of the roots exposed to moist air. One type of hydroponics is to grow vegetables above, while below, fish are raised, allowing for an integrated fish-vegetable coexistence; substrate cultivation, on the other hand, uses solid substrates to grow fruits and vegetables, suitable for development on barren beaches.

Using soilless cultivation for vertical farming can reduce the use of chemical fertilisers and pesticides and increase the vegetable yield per unit area. Soilless cultivation not only increases the vegetable and fruit production of the people in Xizang but also effectively alleviates the conflict between grain and vegetable cultivation for land. After more than ten years of development, soilless cultivation technology in Xizang has become increasingly mature and is now being promoted throughout the region. Not long ago, at the Tanggula Pass in northern Xizang at an elevation of over 5,000 meters, researchers from the Xizang Zizhiqu Academy of Agriculture and Animal Husbandry successfully grew soilless vegetables, solving the problem of vegetable scarcity in high-altitude areas.

Reference: Central People's Government of the People's Republic of China, 2021

https://www.gov.cn/xinwen/2021-12/25/content_5664595.htm

Figure 3.5 Soilless cultivation

Post-lesson task

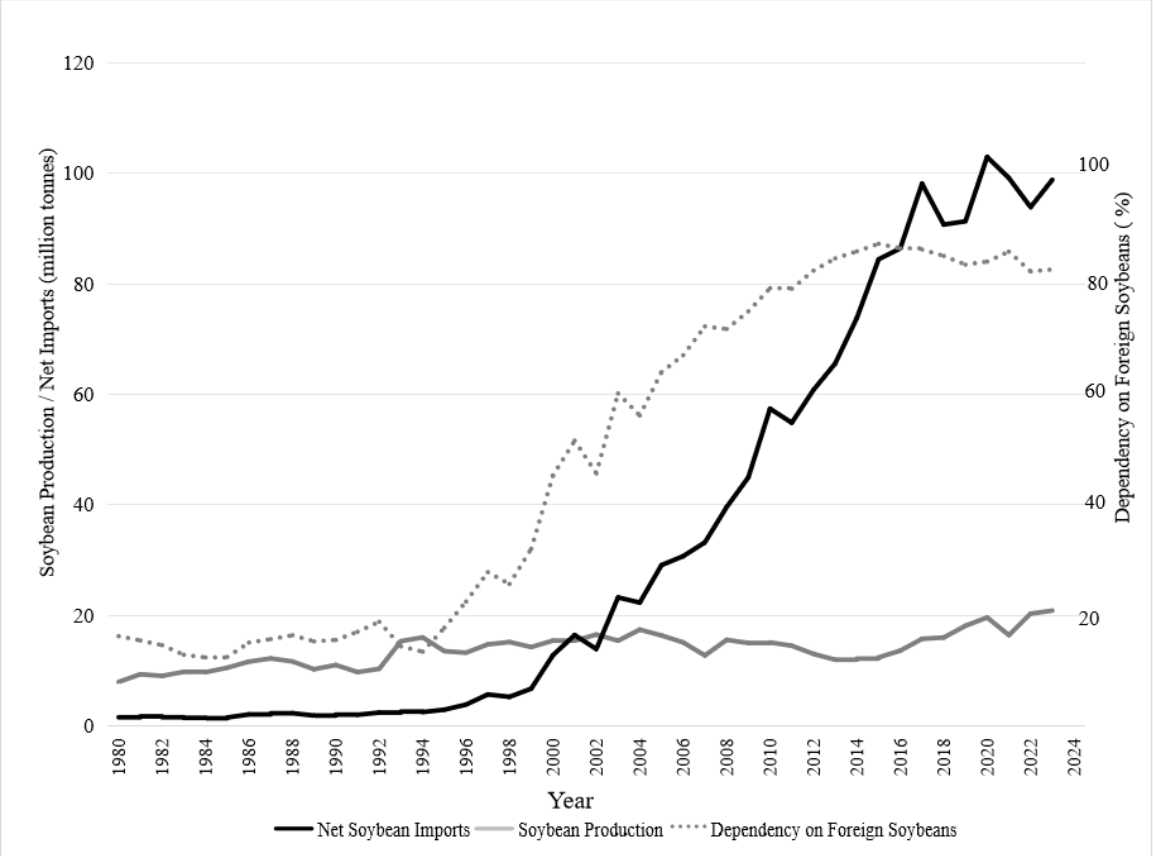
Read Knowledge Box 3.6, study the given data and discuss the questions below:

Knowledge Box 3.6

Fully utilising the international grain market (including cereals and soybeans) is one of the important auxiliary means for our country to ensure food security. Before the mid-1990s, our country was mainly a net importer of grain, primarily through the import of wheat, to solve the problem of insufficient total domestic grain consumption and structural shortages. From the mid-1990s to the early 21st century, our country's grain imports and exports were roughly balanced. Since the 21st century, our country's net grain imports have continued to increase, with imported soybeans accounting for about 60% of the total grain imports and more than 80% of the total soybean consumption. Importing soybeans can make full use of foreign natural resources, but excessive reliance on imports may cause our country's soybeans and soy-based products to be dependent on other countries, which to some extent affects food security.

Reference: Chapter 2, Elective Volume 3, Senior High School Geography Textbook, People's Education Press and Central People's Government of the People's Republic of China

Figure 3.6 Soybean production, net import volume, and dependency on foreign soybeans in our country



*Note: Dependency on Foreign Soybeans = Net imported volume of soybeans / (Domestic production volume of soybeans + Net imported volume of soybeans)

Source: Food and Agriculture Organization of the United Nations

(a) What are the trends of soybean production and net imports in our country?

[Hint: The trend of our country's soybean dependency on imports has shown a significant increase over time. Prior to the mid-1990s, soybean production was generally able to meet domestic demand. However, due to various factors such as dietary changes, rapid economic growth, and limited arable land, our country's demand for soybeans, especially for use in animal feed and cooking oil, has outpaced its domestic production capacity.

As a result, our country has turned to the international market to fill the gap between supply and demand. Since the early 21st century, the trend has been for our country to import a growing proportion of its soybeans. By the early 2000s, our country had become one of the world's largest importers of soybeans. This reliance has continued to grow, the imported soybeans accounted for about 60% of our country's total grain imports and more than 80% of its soybean consumption by the 2010s.]

(b) Should our country a reduce its dependence on soybean imports and what are the reasons behind this need for change?

[Hint: Our country might need to consider adjusting its reliance on imported soybeans for several reasons:

Food security: High dependence on imported soybeans could pose a risk if there are disruptions in the global supply chain. Events such as trade disputes, geopolitical conflicts, or pandemics could affect the availability and price of imported soybeans.

Economic stability: Fluctuations in global soybean prices can have a significant impact on our country's domestic market.

Agricultural development: Increasing domestic soybean production can reduce reliance on imports and also support local farmers, promoting the development and innovation of agricultural technology.]