

## Trend and Outlook of World Grain Market

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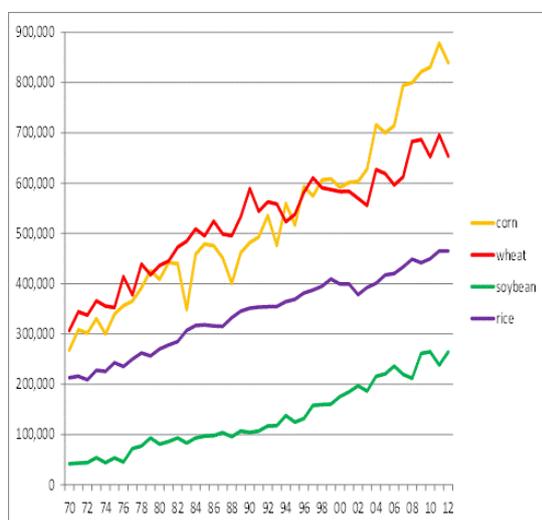
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According to the U.N. Food and Agriculture Organization (FAO), the total production of agricultural products in the world is 5.7 billion tons, almost half of which, i.e. 2.8 billion tons, are grains (including soybeans). Grains play an extremely important role as our energy source. This chapter discusses four grains: soybeans, corn, wheat and rice. Soybeans are included in the group of grains in this chapter, although it is generally classified as oilseed.

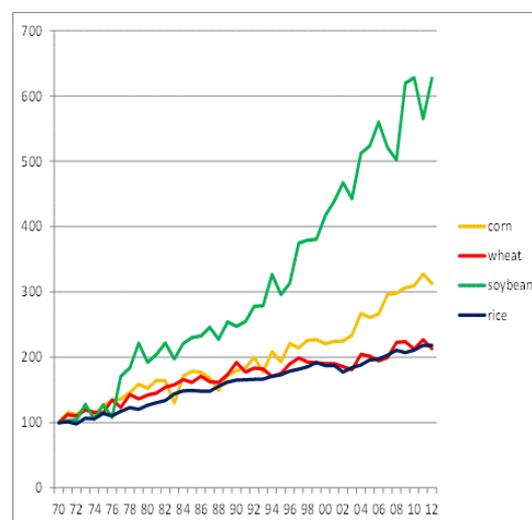
### 1-1. World Production of Major Grains (Fig. 1 and 2)

Since 1970, world production of grains has been in an upward trend. Currently, the production volume of soybeans is 270 million tons. That of corn, wheat or rice is 850 million tons, 650 million tons or 470 million tons, respectively. World productions of corn and wheat were at a similar level until the 1990s, however, corn was increasingly produced in the 2000s and has become a crop that is produced in the largest scale among others.

**Fig. 1 World Production of Grains (1,000 tons)**



**Fig. 2 World Production of Grains (1970 = 100)**



Soybeans have the highest growth rate during the past 30 years, followed by corn. Wheat and rice, on the other hand, show a relatively small increase. In the mid- and long-term perspectives, world grain production almost equals to world grain consumption. Grain consumption can be divided into multipliers of population and consumption per capita. The world population increased 1.9 times as much as from 3.7 billion in 1970 to 7 billion. The increases of wheat and rice productions are approximately balanced with the increase in the world population, on the other hand, the increases of soybeans and corn indicate that they have increased with not only the population growth but also the

growth of the per capita consumption.

Rice and wheat have been positioned as staple foods. Wheat has good storage property and weather resistance and can grow in rather dry weather. These easy-to-grow properties ensure high and stable production, which makes it suitable as a staple food. Rice has been produced in high-precipitation monsoon regions and consumed as the major energy source for people mainly in Asia.

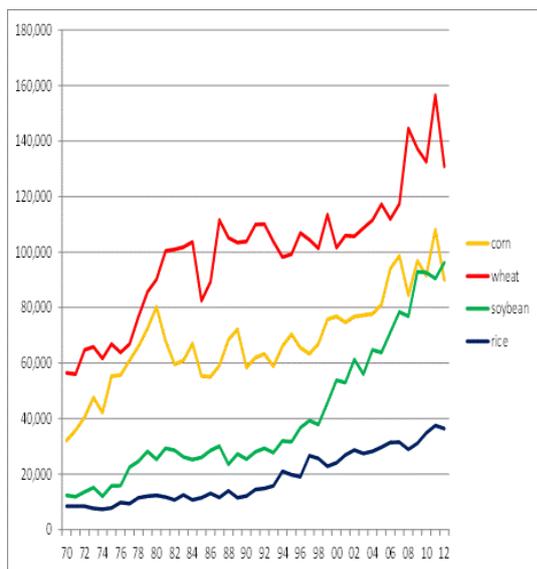
The improvement process of dietary habits indicates that people in the stage where they earn lower income mainly consume foxtail millet, Japanese millet and proso millet, which are gradually replaced by wheat and rice as their income rises. As their living standards rise, the dietary habits are diversified and they eat meat, dairy products, oils, vegetables and fruits. In Japan, people ate mainly rice shortly after the war and then added various dishes to their tables in the course of time. This is demonstrated by the fact that rice consumption per capita in 1960 was 120 kg which has decreased to half at present.

An increase in demand for meat and dairy products requires more corn for feeding livestock and soybean meal, the residue after the extraction of the oil from the soybeans, is also used to feed livestock animals. In other words, as income rises, demand for soybeans and corn increases and that for wheat and rice is suppressed.

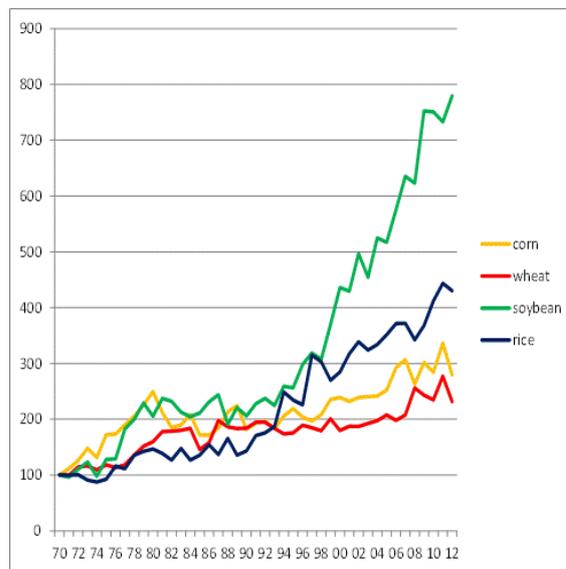
#### 1-2. World Trade of Major Grains (Fig. 3 to 5)

The world trade volumes of soybeans, corn, wheat and rice are 99 million tons, 90 million tons, 130 million tons and 37 million tons, respectively. Soybeans show a substantial increase, eight times as much as in 1970. This is explained by the sharp increase in imports of China. Rice also shows an increase of four times, reflecting the strong import demands in Asian countries, and corn and wheat, on the other hand, are kept at a relatively low level. An increase of meat demand not necessarily affects the corn trade volume. This may be explained by the fact that corn is traded as food rather than as feed. As to the slow growth of wheat trade, its production increase is slow, in the first place, and also the fact that production areas are scattered in various many countries.

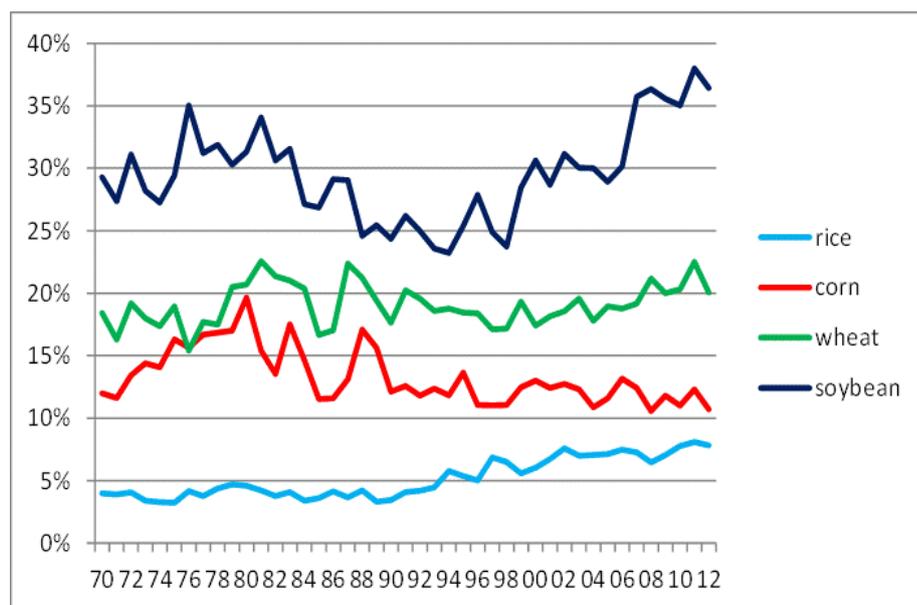
**Fig. 3 World Grain Trade (1,000 tons)**



**Fig. 4 World Grain Trade (1970 =100)**



**Fig. 5 Export to Production ratio of Grains (%)**



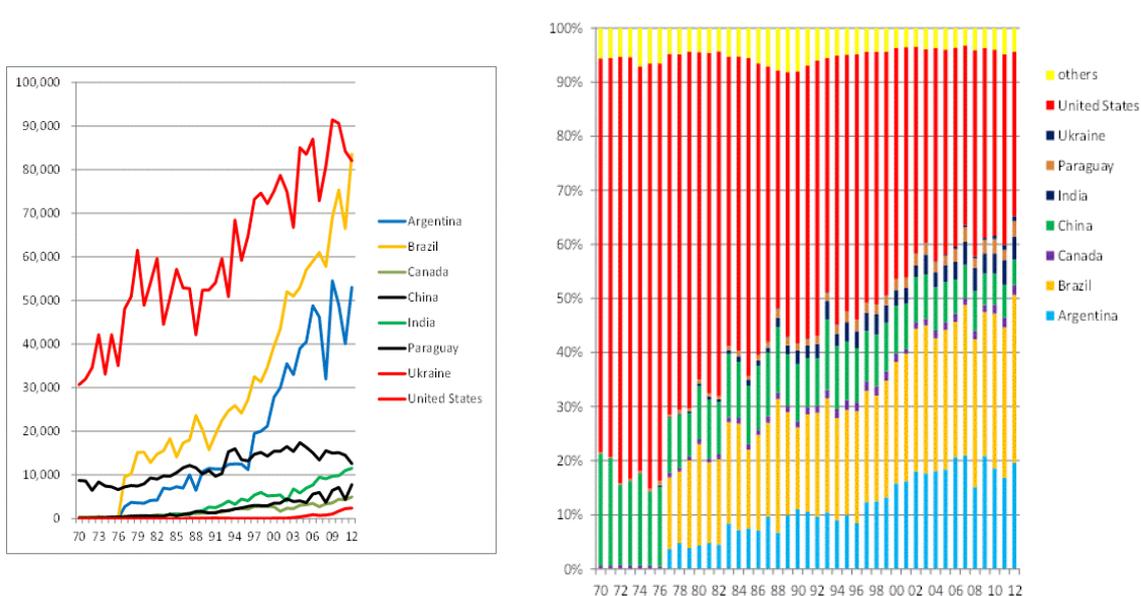
The trade dependency ratio (export to production ratio, %) of soybeans shows a sharp increase since the late 1990s and reaches 35% most recently. The ratio of wheat is hovering around 20%. That of corn is 10%, showing a downward trend. The ratio of rice does not reach even 10% because the grain is often controlled under a government’s protective policies, which prevents trade liberalization. However, the rice trade has increased within the Asian region in response to the growing demand in some Asian countries, and the dependency ratio shows a gradual increase since the middle of 1990s.

2-1. Soybean Production and Trade (Fig. 6 to 9)

Looking at the world soybean production, geographically, the Americas including the U.S., Brazil and Argentine accounts for a large share of about 80%. This has not changed largely since the 1970s. However the country by country analysis shows a different picture where the United States that was dominant in the 1970s has lost part of its share to Brazil and Argentine. In Brazil, traditional farming areas are concentrated in the south (areas close to Argentine and Uruguay) where a large number of small farms are located. Recently new agricultural land is developed in the middle west region of the country, in which the majority is medium or large scale farms that have achieved effective production. In fiscal 2012, Brazil caught up with the United States that suffered from heat waves and was forced to reduce soybean production. Soybean production areas are located both in North and South Americas and the seeding seasons are staggered by half a year. Therefore, good or bad harvest on one side is often offset by a decrease or increase in production on the other side.

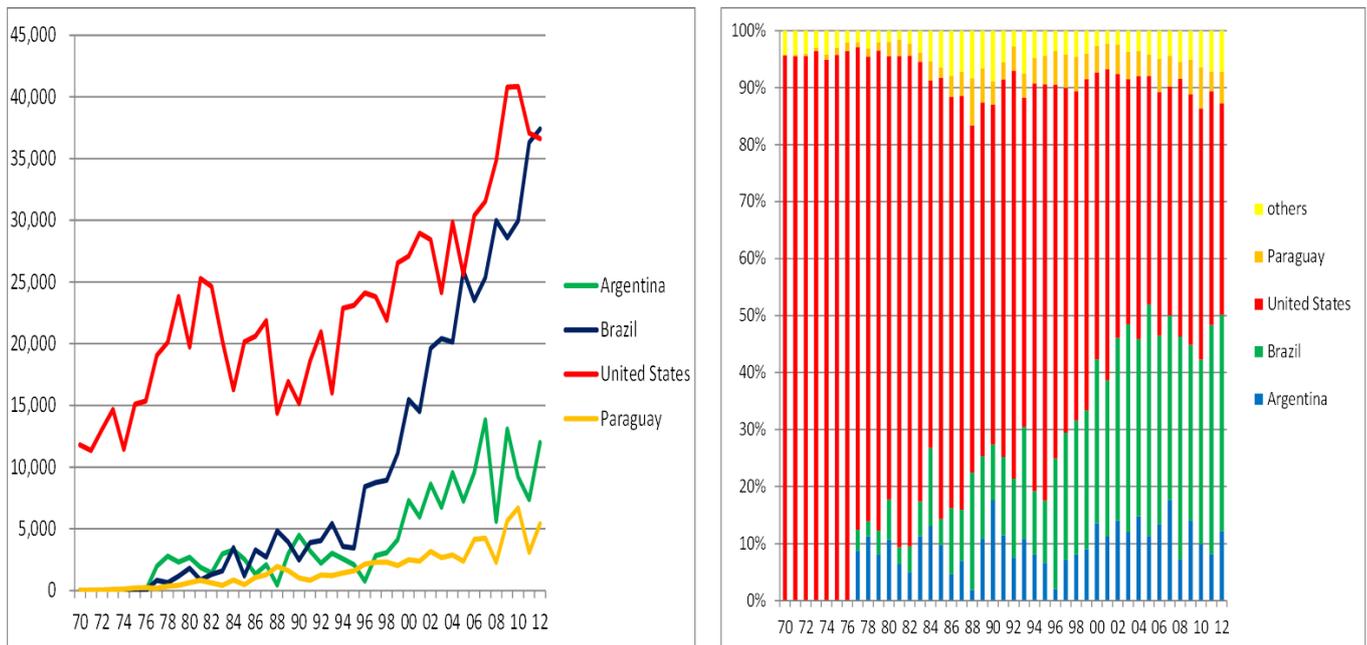
In addition to the North America, China, India, Paraguay and Ukraine are also soybean producers. India is catching up China whereas the production in China stays almost flat since the 1990s.

**Fig. 6 World Soybean Production (1,000 tons) and Share by Country (%)**



The share of the Americas in the world soybean export market exceeds 90% and is in an upward trend. Domestic demands for soybeans in other countries such as China and India are strong, which leaves no surplus for export. On the other hand, countries of which both production and demand are small such as Paraguay have room to export a certain amount of soybeans.

**Fig. 7 Soybean Exports by Country (1,000 tons) and World Share by Country (%)**

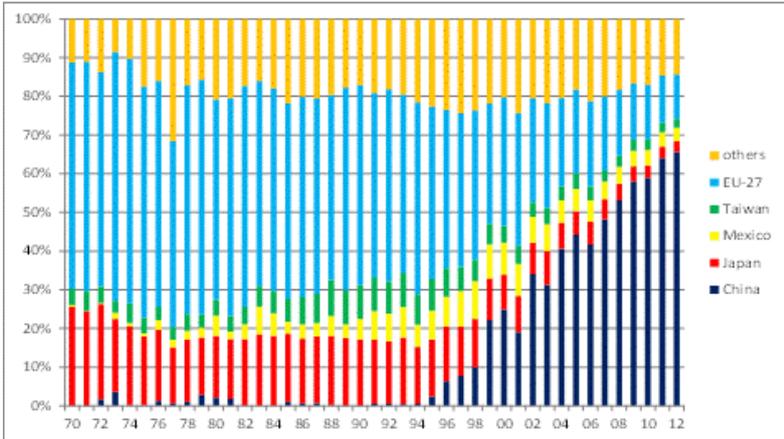
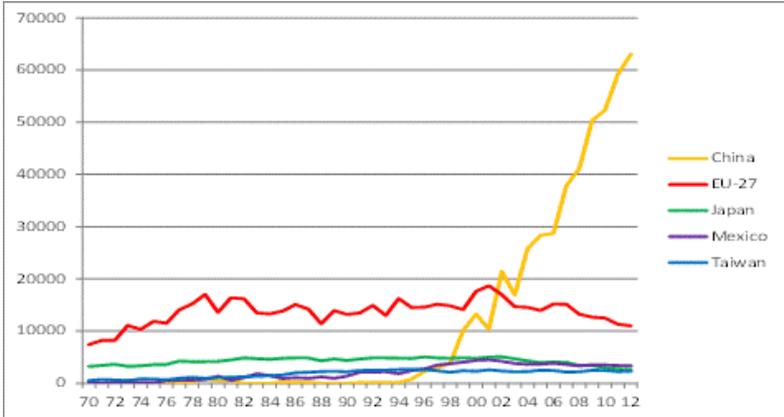


North America continued to dominate soybean export market in the 1970s, however, as seen in the production, the major exporter has been changed from United States to Brazil. Argentine stopped growing both in production and exports in the 2000s. It exports soybeans in the forms of oil and meal. The production of soybean oil in the country is 7 million tons, similar volume to that of Brazil, and the export volume is 4 million tons, which accounts for almost a half of the world exports. Similarly, exports of soybean meal, 28 million tons, represent a half of the world exports.

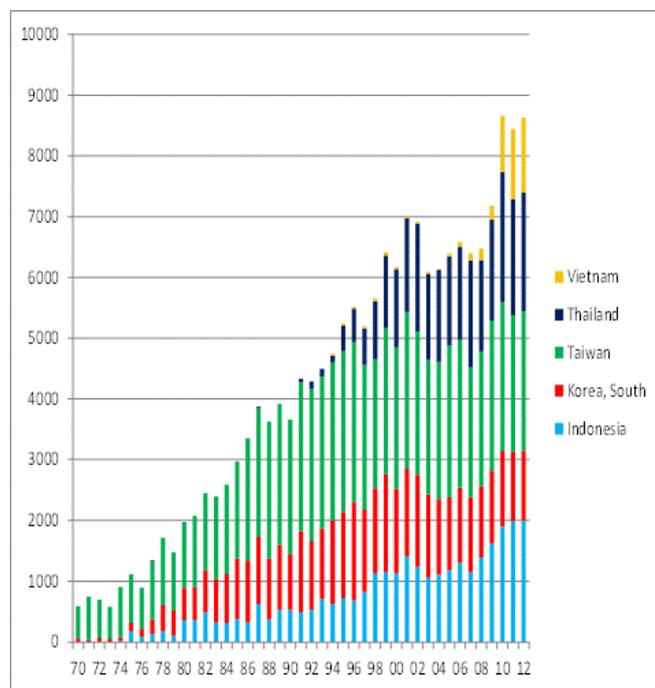
China accounts for more than 60% of the total soybean imports. Since reaching 10 million tons in the 2000s, China's soybean imports have sharply increased by six times. Demands for oil and feeds in China increased due to their improved dietary habits. In addition, soybeans are subject to trade liberalization and almost free from import controls. Unlike rice and wheat, soybeans are categorized as a luxury item rather than a staple food and the Chinese government does not take many preferential measures for soybean production including the grant of subsidy. Therefore, there is no strong motivation to produce soybeans.

EU, on the contrary, has decreased its soybean imports and switched oil ingredients from soybeans to rapeseeds, sunflower seeds and other crops. Japan has increased imports of oil and soybean meal and gradually has decreased imports of soybean partly because oil manufacturers have decreased their oil extraction volume. The imports of Taiwan and Mexico are almost flat.

**Fig. 8 Soybean Imports by Country (1,000 tons) and World Share by Country (%)**



**Fig. 9 Asia's Soybean Imports (1,000 tons)**



**2-2. Corn Production and Trade (Fig. 10 to 13)**

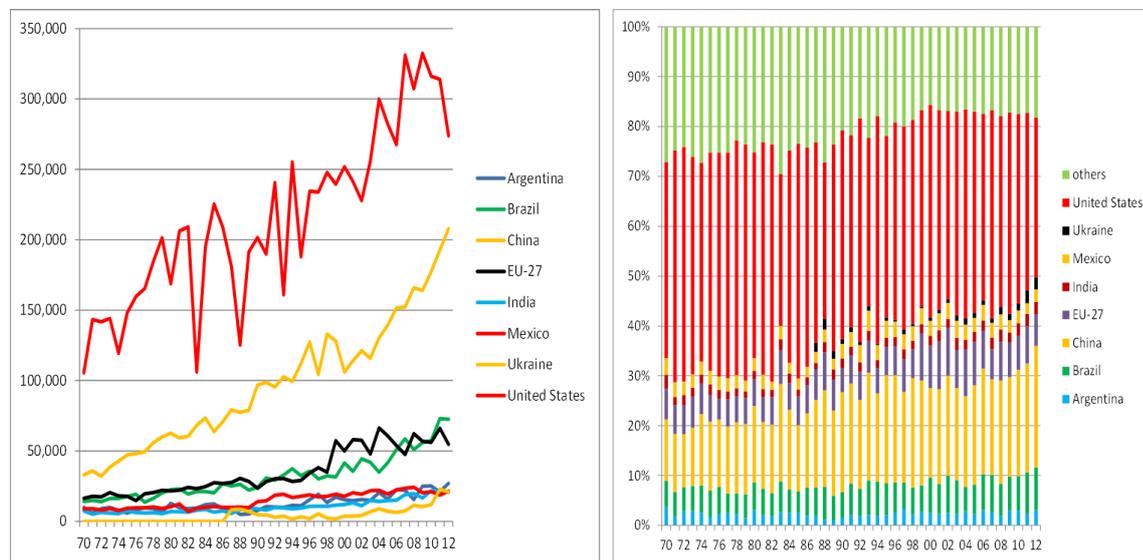
Corn production in the Americas accounts for nearly 50% of the world production. Although this region is not so overwhelmingly dominant in corn production as it is in soybean production, the United States remains in an obviously superior position when looking at the production volumes of the U.S., Brazil and Argentine. This is the point that is different from the situation of soybean production. Corn producers in the United States, mainly those in the Middle West, who have almost the same acreage of farms as the total area of Japan, enjoy a high yield of 9 tons/ha, as much as almost twice the world average. Corn is sent from on-farm storages to country elevators held by major grain companies, from which it is transported through the Mississippi River by barges to New Orleans. Stable delivery is ensured by the smooth and efficient corn transport line from the loading point in New Orleans through the Panama Canal to Japan or other Asian countries. This well-established logistics infrastructure also contributes to the enhancement of competitiveness of the U.S. corn. The corn production in fiscal 2012 was low due to heat waves, however, its normal production is 300 million tons.

Corn production in Brazil steadily grows. A two-crop system is increasingly used in the middle west region of the country, where corn is planted after soybean harvest. Its production volume is only one-fourth of that of the United States, but is comparable to EU. China also steadily increases corn production and now is the second largest producer in the world. Production in fiscal 2012 reached the level of 200 million tons for the first time thanks to good weather. Production in Ukraine increased to the level of 20 million tons.

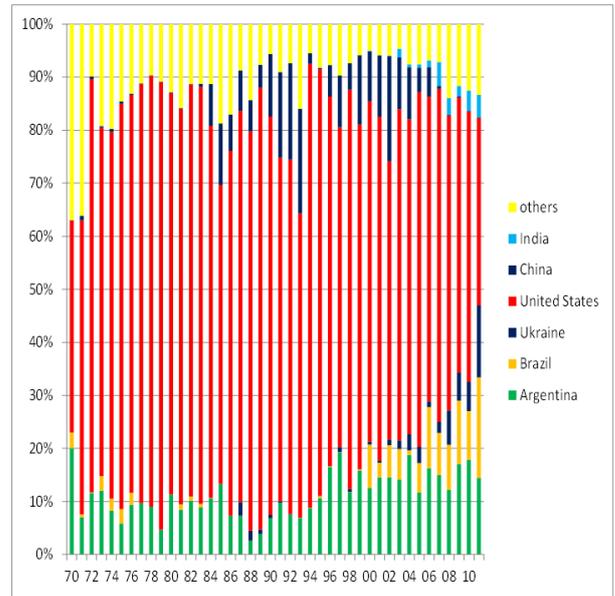
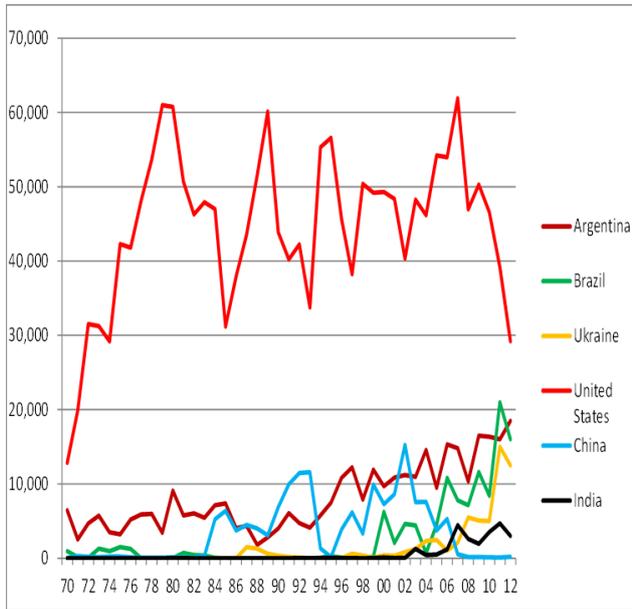
Corn exports of the United States account for about 40% of the world exports but gradually declines. The background factors of the decline include that Argentina has a large corn surplus for export, that Brazil has increased its exports since 2000, and that Ukraine, an emerging exporter, has also increased its export volume to about 15 million tons, which puts the country to the position just behind Brazil and Argentina. Another factor is an increase of (corn derived) ethanol demand in the United States. So far, at the maximum, 130 million tons (5 billion bushels) of corn are used as an energy source, which represents 40% of the total production and corresponds to three times the total export volume. The Bush government set the ethanol production target at 15 billion gallons which is to be met by 2015 and thereafter. This volume of ethanol requires about 140 million tons (5.5 billion bushels) of corn, which may vary depending on future possible technical innovation. Not much additional U.S. corn seems to be used for ethanol production in the future, and this works as a factor to accelerate corn exports.

Japan is the largest corn importer who imports 15 million tons, although its imports are almost flat due to a sluggish growth of meat demand and direct meat imports. Imports of Korea, a country having a unique meat culture, Taiwan and other advanced Asian countries also remain unchanged. Egypt, on the other hand, increases corn imports to 70 million tons at the peak, and its corn imports are reaching the level of Korea due to its growing population and young population structure.

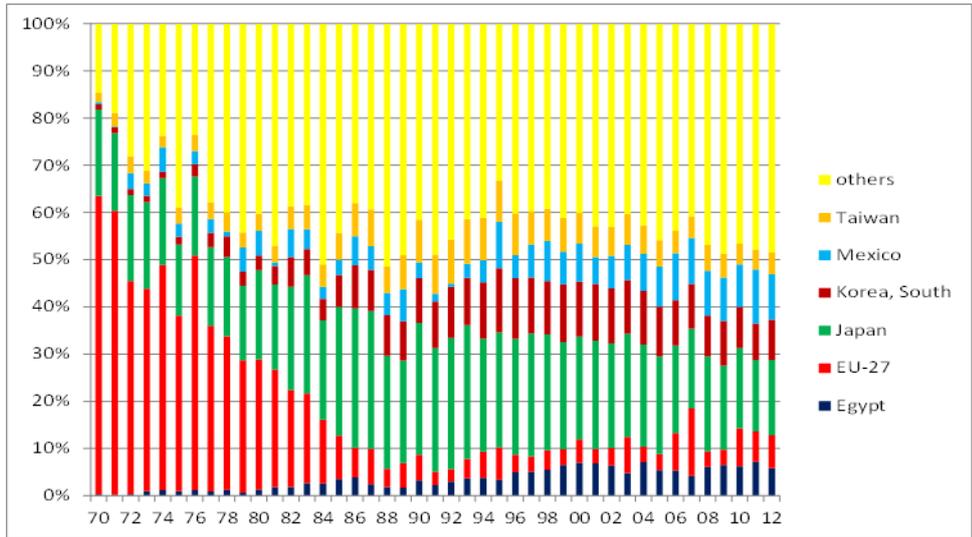
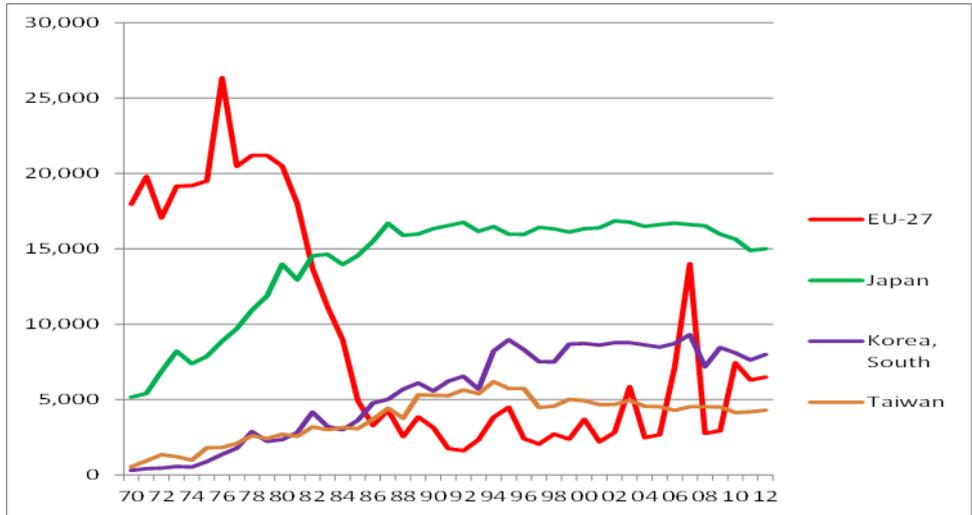
**Fig. 10 World Corn Production (1,000 tons) and Share by County**



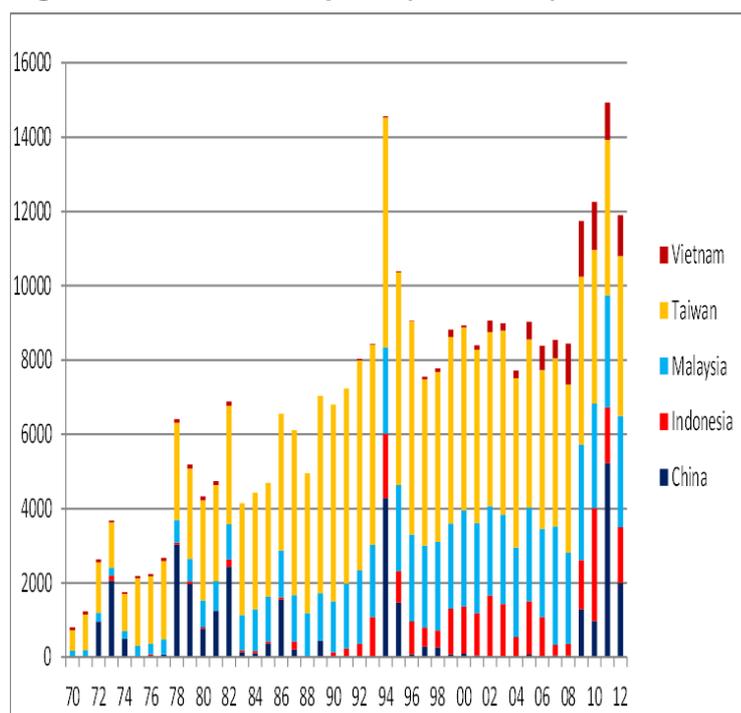
**Fig. 11 Corn Exports by Country (1,000 tons) and World Share by Country (%)**



**Fig. 12 Corn Imports by Country (1,000 tons) and World Share by Country (%)**



**Fig. 13 Asia's Corn Imports (1,000 tons)**



**2-3. Wheat Production and Trade (Fig. 14 to 17)**

The major wheat production countries/areas include EU, Asia, FSU (former Soviet Union), North America, all traditional agricultural countries in EU, that is, Germany, France and the UK, and China, India and Pakistan in Asia. Production volume in Asia has a strong correlation with population. Wheat production in China and India whose populations account for nearly 40% of the world population represents over 30% of the world production. Other major producers include Russia, the Black Sea region such as Ukraine and Kazakhstan in FSU, and the U.S. and Canada in North America. Spring wheat and winter wheat are grown in some areas near the border between the U.S. and Canada. Producers in Mid West and South in the U.S grow winter wheat only. The Middle East, North Africa and South America produce smaller amount of wheat. Unlike soybean and corn, wheat producing countries are scattered throughout the world.

The analysis of long-term production trend indicates that EU, India and Pakistan are in an upward trend and China, Russia and Ukraine remain at the same levels. The U.S. production has moved up and down around the level of 60 million tons for the past 30 years, and it is not in an upward trend.

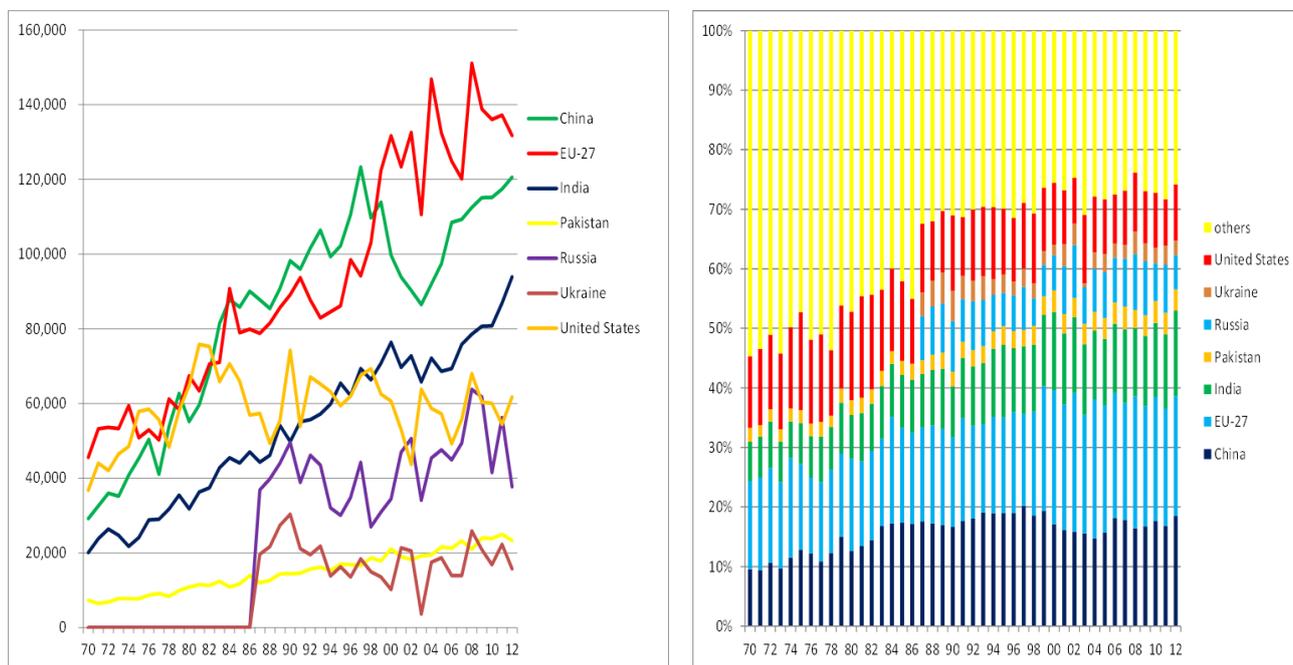
Looking at the world export shares, the U.S. wheat export share has decreased to 20% at present from 40% in the 1970s, however, it remains the largest exporter. The export share of North America including Canada accounts for 36 % of the world exports. An emerging wheat exporter since 2000 is FSU including Russia, Kazakhstan and Ukraine. FSU mainly exports to North Africa and the Middle East for geographical reason, and their exports to Japan are limited. Leading wheat production

countries are not necessarily leading wheat exporting countries. Asian countries such as China and India have a great domestic demand for wheat and no surplus for export. Less populated Canada and Australia, on the other hand, export 15 to 20 million tons of wheat, respectively, almost equal to the level of EU.

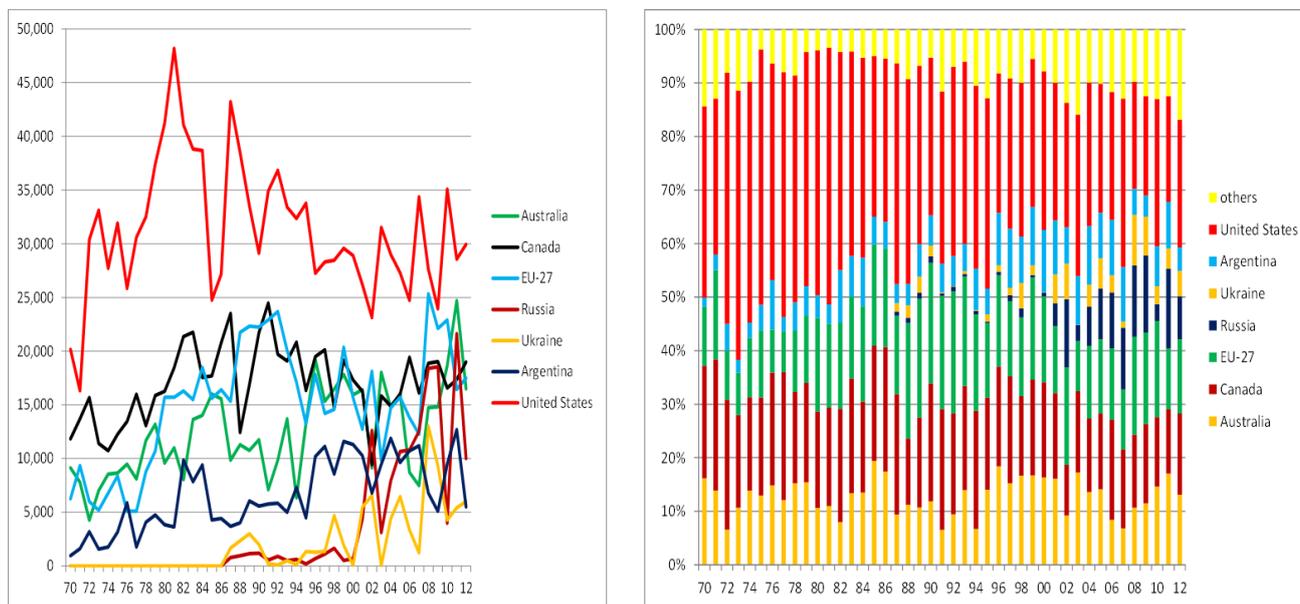
Recently, wheat production areas often suffer from abnormal weather and their exports are unstable. In 2010, Russia imposed an export control on wheat due to draught occurred in FSU, which made an impact even on the market prices of corn and soybeans. In 2012, Russia, Ukraine and Australia suffered from draught and were forced to reduce their exports.

While wheat imports of Egypt and Indonesia increase, those of Japan, Korea and Taiwan have hit a ceiling. There is no country that imports a prominent volume of wheat. Each government of importing countries takes protective measures to maintain a certain level of domestic wheat production by granting subsidies to wheat producers. Also in Japan, wheat is a state-trading item and a “quasi tariff” called markup is used as a revenue source for subsidies for wheat producers. In addition, the government resale price is decided according to specific rules, by which milling companies procure wheat at a single price.

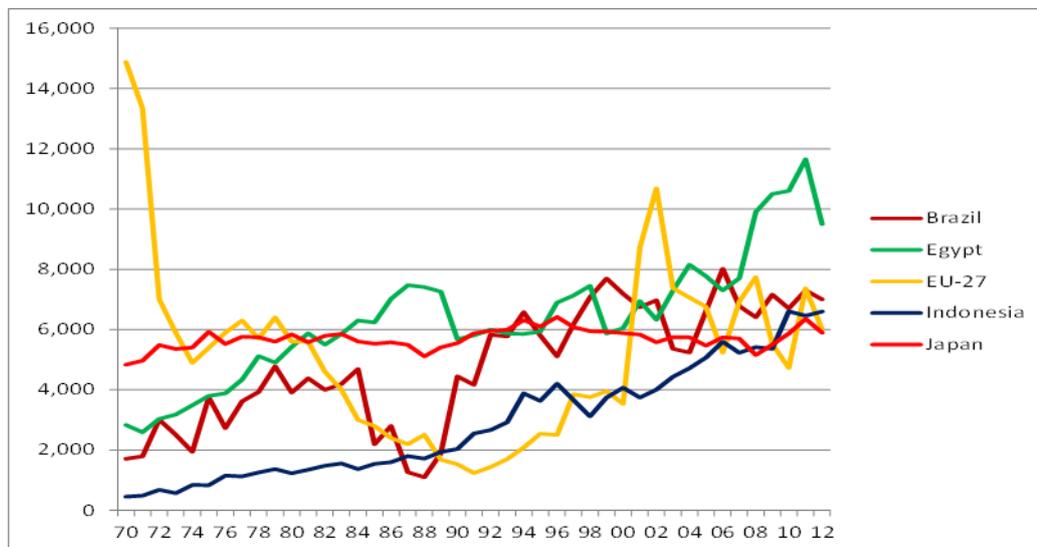
**Fig. 14 World Wheat Production (1,000 tons) and Share by Country (%)**

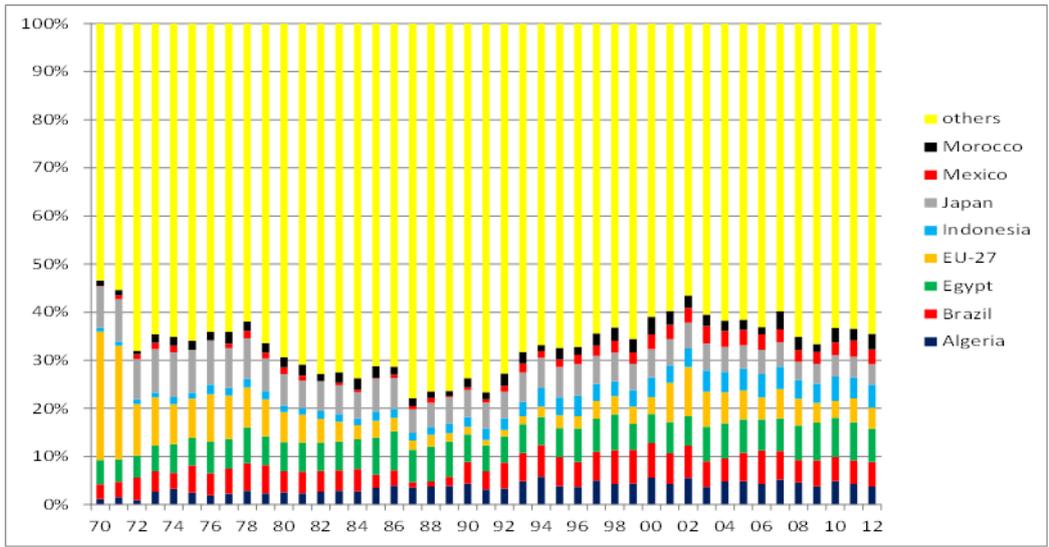


**Fig. 15 Wheat Exports by Country (1,000 tons) and World Share by Country (%)**

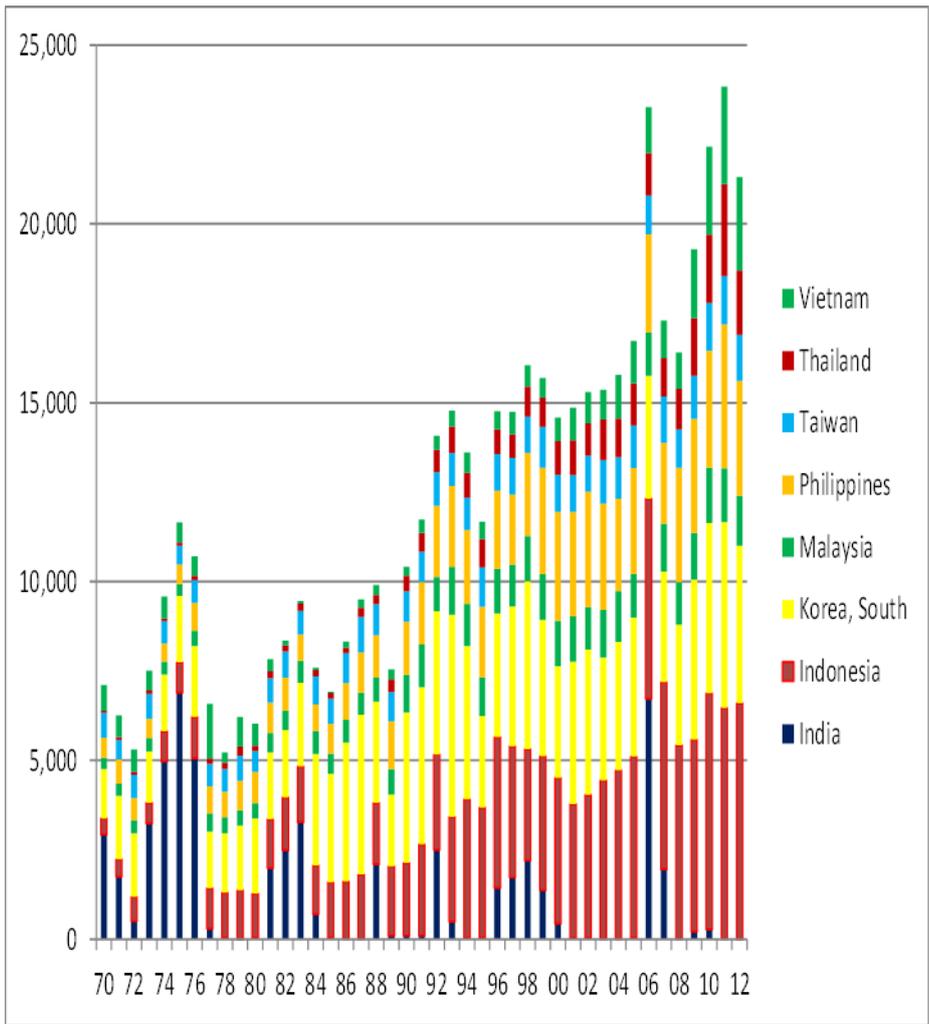


**Fig. 16 Wheat Imports by Country (1,000 tons) and World Share by Country (%)**





**Fig. 17 Asia's Wheat Imports (1,000 tons)**



## 2-4. Rice Production and Trade (Fig. 18 to 21)

Rice production is concentrated in the monsoon region because it requires a certain amount of water. China and India, large population countries, produce 140 million tons and 100 million tons of rice, respectively, and their total production accounts for 50% of the world production. The rice production in China does not show any increase since the late 1990s due to sluggish growth of domestic demand for rice whereas India steadily increases its rice production. Rice productions in Bangladesh and Vietnam are in an upward trend. Indonesia and Thailand among other ASEAN countries, on the other hand, are experiencing slowdown.

As is the case with wheat, rice is subject to trade controls by the government in quite a few countries, and domestic producers usually maintain their rice production under national protective policies. Subsequently, rice is positioned as a crop that is domestically produced and consumed, and most of rice is not traded. The Japanese government also designates rice as a state-trading item and imposes a tariff as high as nearly 800% on imported rice, which virtually prevents rice from being imported from other countries on a commercial basis. Japan imports about 800,000 tons of rice that represents a slightly less than 10% of the total consumption. Such imported rice is called Minimum Access (MA) rice, which is mostly used for food aid or as an ingredient of processed food. Only about 100,000 tons of the MA rice is consumed as staple food.

Thailand used to enjoy its position as the largest rice exporter, however, India and Vietnam have expanded their rice productions to the similar level to that of Thailand in these years. The United States exports rice mainly to Central and South Americas, and its exports remain constant at about 3 million tons for the past decade. As is the case with wheat, rice importing countries are scattered all over the world. China, Philippines and Malaysia are increasing imports of rice in these years.

## 3 Potential Variables of Grain Prices

Potential variables associated with demand and supply in grain market are discussed in the mid- and long-term perspective. The demand for grains is influenced by two factors, that is, the world population and income levels. The world population is expected to grow to 9.2 to 9.3 billion by 2050 from the present level of 7 billion. While developed countries will slightly increase their populations, Asian and African countries will increase their population by 1 billion respectively, which contributes to almost all the increase of 2 billion. When looking at grain demand, attention should be paid to those regions. Grain demand of most of the developed countries that are at higher income levels, on the other hand, is in a mature phase. In emerging countries, a middle class population is formed through income distribution and their living standards rise, and those countries show a steady growth of grain demand.

Emerging countries are divided into three groups from the viewpoint of population and income: ① countries with a higher population growth rate and a higher (or potentially higher) ratio of middle class

population that is above a certain income level such as Indonesia and Philippines, ② countries with a lower population growth rate but higher (or potentially higher) ratio of middle class population such as China, Thailand, Malaysia and Vietnam, and ③ countries with a higher population growth rate but a relatively lower ratio of middle class population such as India, Pakistan, Bangladesh and African countries. Countries in group ① and ② are expected to increase demands for crops used for feeds and oils such as soybeans and corn and countries in group ① and ③ will increase demands for crops used as staple food such as rice and wheat.

There are also factors to suppress the growth of grain demand. The primary suppressive factor is a price adjustment mechanism. As a general rule, a price raised by growing demand is pushed down to the level that corresponds to demand of the real buying capacity. In particular, people in the “middle-middle class” or a lower class tend to suppress their demand for oil and meat when their prices are increased. Furthermore, an increase in grain prices tends to work as a motivation to reduce residues as much as possible. The second factor is a ceiling placed on food demand from the viewpoint of calories consumed (health concerns). With this regard, demand for food is different from that for industrial products that is expected to grow without any limit. Therefore, when the calories consumed by people in “upper emerging countries” reach the ceiling, the demand no longer grows. The third factor is the concern about religious restrictions. Muslims and Hindus have the customs to avoid pork and beef, respectively. Even when their income standards increase, they may further expand the demand for chicken that requires feeds containing relatively lower feed energy. This will suppress the growth of feed demand. The fourth factor is improving efficiency of post-harvest operations. The streamlining of supply chain including feed production, livestock production, processing/manufacturing and distribution will make it possible to realize a “system for producing a larger amount of meat from a smaller amount of feeds, or better yields.”

Then, let's take a look at grain production in the perspective of supply. Production volume can be divided into multipliers of yield and harvesting area. One of the important factors raising the yield is the development of biological technology which produces improved varieties with resistance to weather, environment, insects, etc. Development of fertilizers and agricultural chemicals is also important. The improvement and widespread use of irrigation systems contribute to increase in productivity mainly in emerging countries. Furthermore, production efficiency is likely to be enhanced by the use of agricultural machines equipped with GPS.

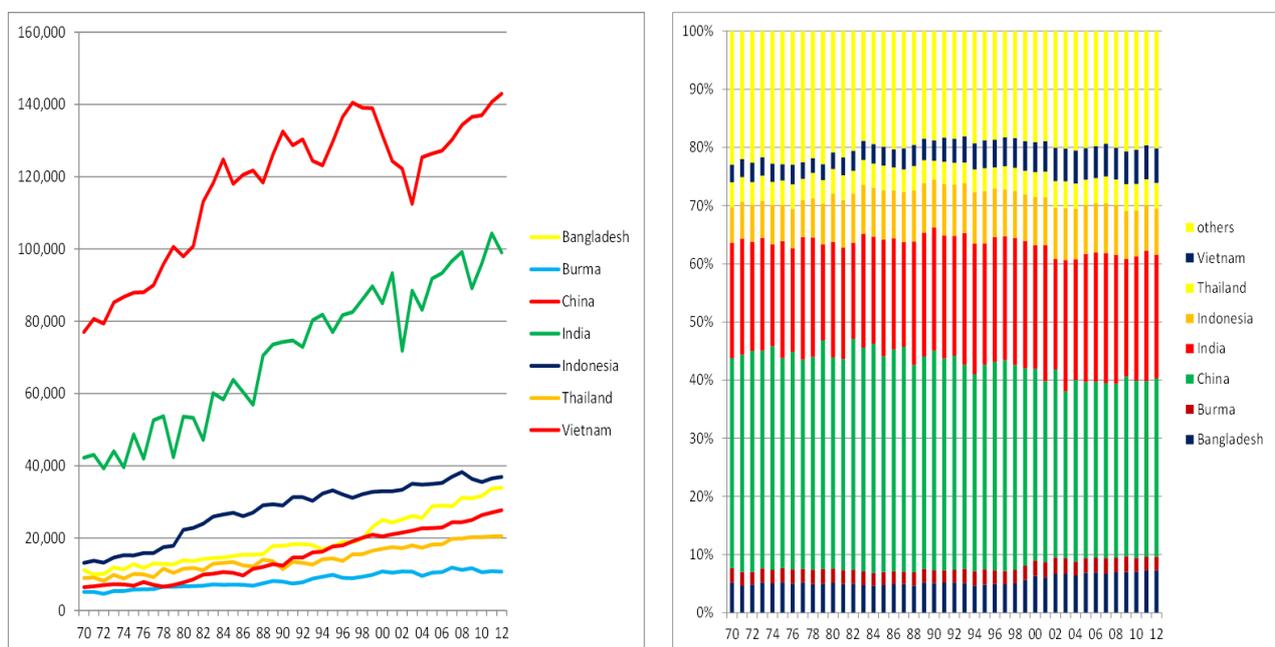
The introduction of genetically modified organism (GMO) is also important. GM corn accounts for 30% of total corn production in the world. The ratio is high in the United States and Argentine with more than 80% and low in Brazil with about 40%. The ratio of China is almost 0%. GM soybeans account for 80% of the total, and the ratio is over 90% both in the United States and Argentine whereas that of Brazil stays at the level of 60%. Therefore, attention should be paid to what extent the governments of Brazil and China will accept GMO promotional policies.

As to planted areas, there is a view that there is not much land left for farming. On the contrary, it

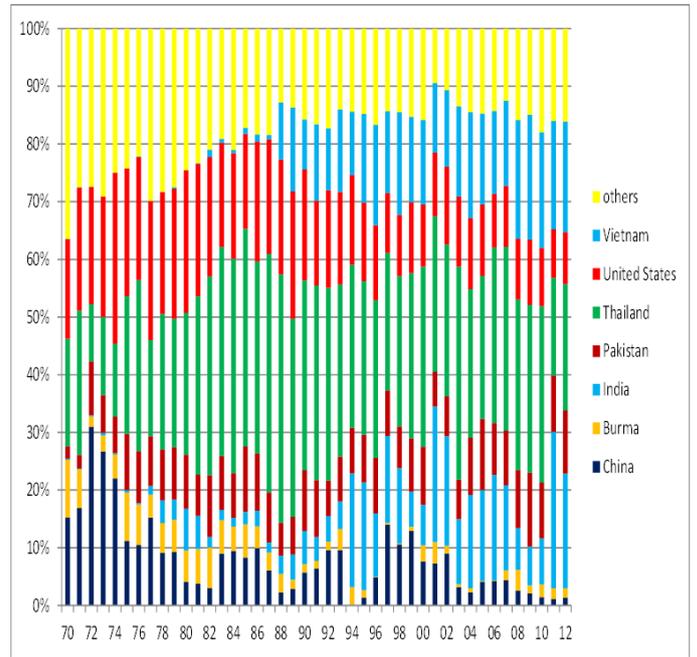
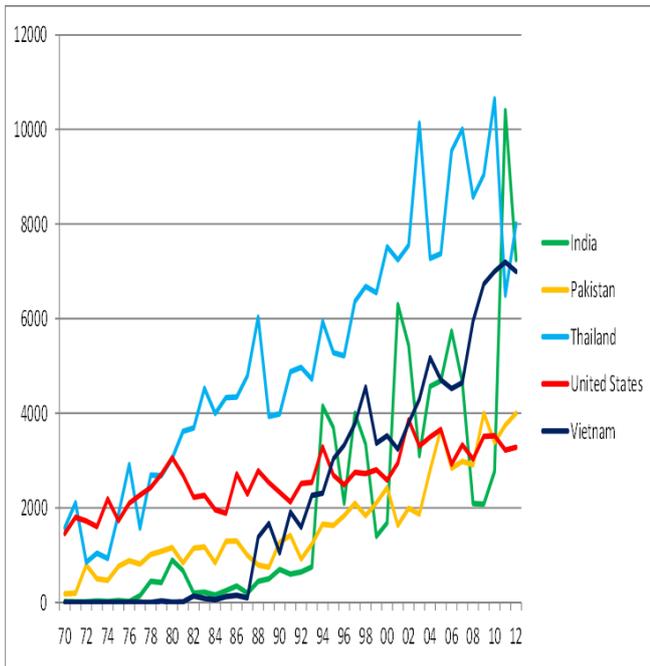
is said that Brazil has uncultivated potential crop land of about 100 million ha. in the Cerrado (a vast savanna of Planalto Brasileiro). This positively influences the potential of Brazil. A key challenge in the development of land in the Cerrado is the establishment of a logistics infrastructure. The erection of storage installations at a place close to an production area, the development of a transport route using a railway and/or river, the construction of a export terminal for shipment, etc. are all issues to be solved to develop the infrastructure required for post-harvest work.

Considerations must be also given to weather factors such as draught, water shortage, too much rain, flood, global warming and global cooling. They are highly variable factors in the short term, but the argument whether they constantly affect grain production or not has yet to be settled. In many cases, weather factors are regarded as neutral in the mid- and long-term outlook.

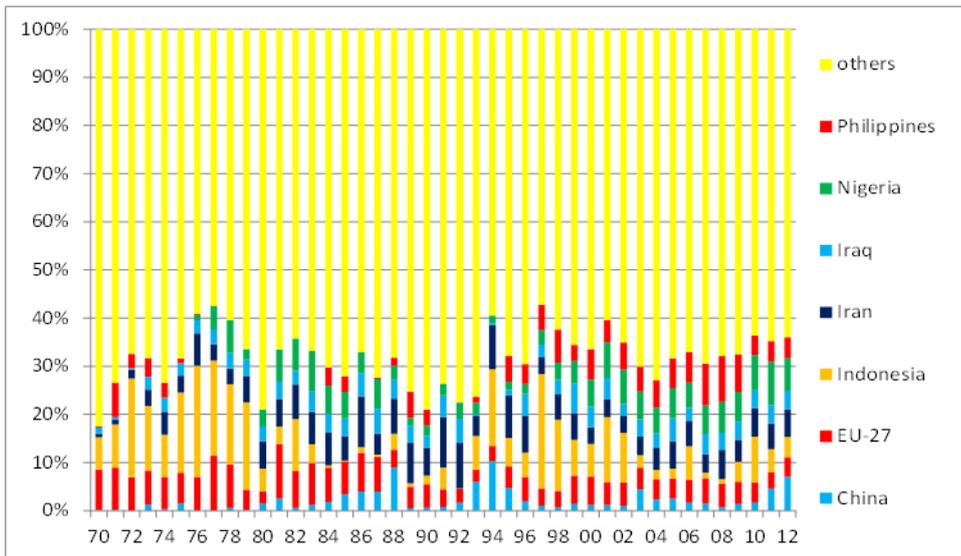
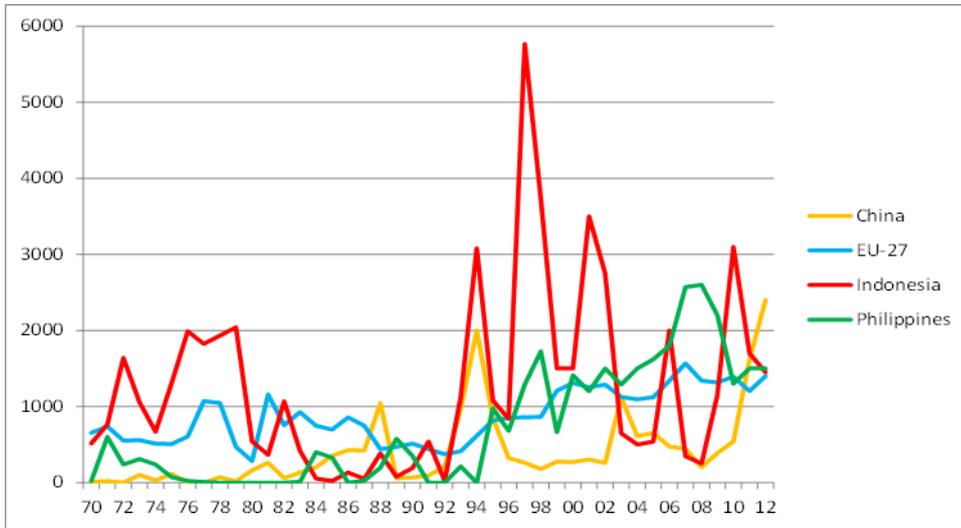
**Fig. 18 World Rice Production (1,000 tons) and Share by Country (%)**



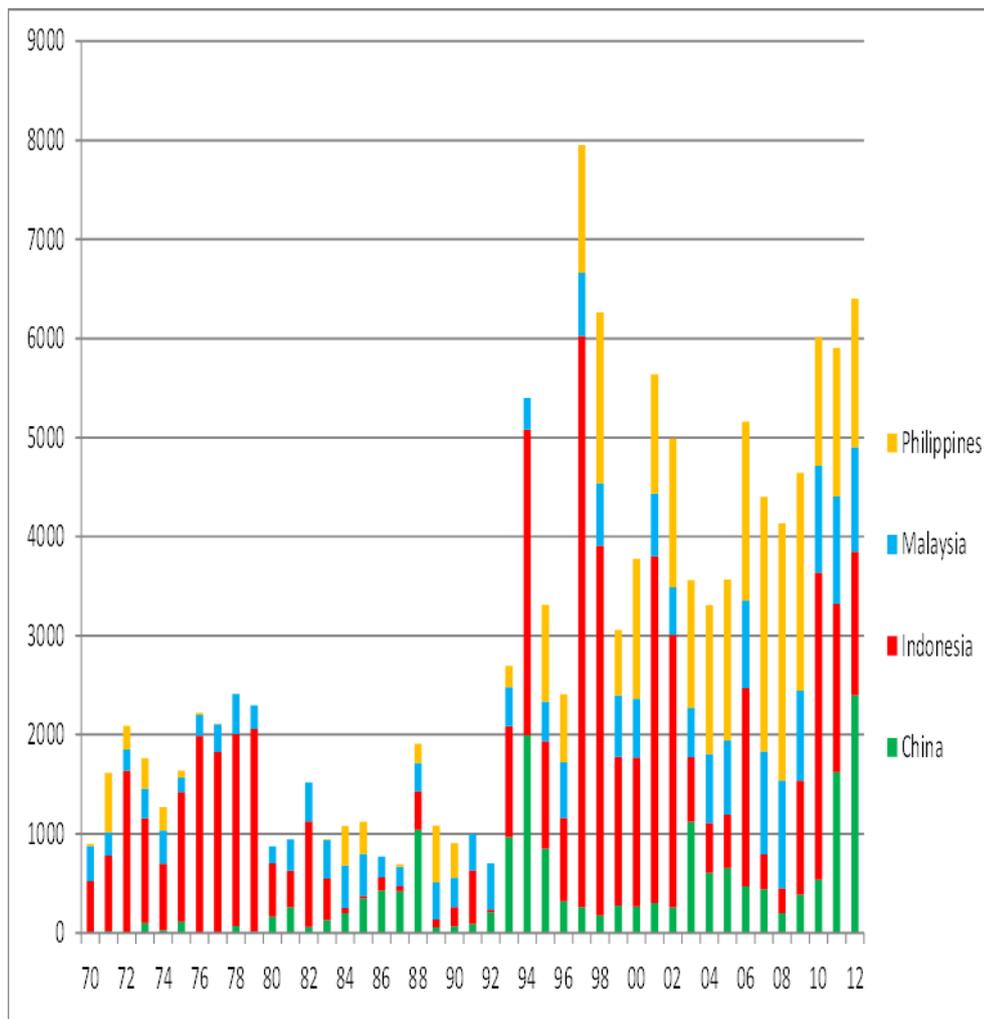
**Fig. 19 Rice Exports by Country (1,000 tons) and World Share by Country (%)**



**Fig. 20 Rice Imports by Country (1,000 tons) and World Share by Country (%)**



**Fig. 21 Asia's Rice Imports (1,000 tons)**



#### 4 Mid- and Long-term Outlook of Grain Trade (Fig. 22)

Let's see the possible changes of trade volumes of soybeans, corn and wheat during a decade from fiscal 2011 to 2021.

The trade volume of soybeans, 89 million tons in fiscal 2011, is estimated to increase by 51 million tons to 140 million tons in 2021. China of which imports represent 44 million tons of the total increase makes overwhelmingly large contribution to the growth and the other countries represent only 7 million tons. China will continue to account for 70% of the total imports in the world. Other Asian countries that are most expected to increase their soybean imports are Indonesia, Thailand and Vietnam.

Of the total increase in exported soybeans of 51 million tons, 25 million tons, 8 million tons and 10 million tons are from Brazil, the United States and Argentine, respectively. Brazil is expected to increase its farming area and yield and highly likely to leave the United States far behind in terms of soybean export.

The trade volume of corn was 111 million tons in the fiscal 2011, and is estimated to increase by 24 million tons to 135 million tons in 2021. Out of all importers, China accounts for 12 million tons of the total increase to make a great contribution to the growth and Mexico represents 5 million tons. Corn production in China is in an upward trend and was a leading corn exporter in the 1990s. Even today, its imports are 2 to 3% of its production and the country takes a basically self-sufficient policy in corn production. However, its production probably won't be able to keep up with the growing demand, and imports may gradually increase in the future. Corn imports of China are expected to be 18 million tons in 2021 and surpass the imports of Japan. Other Asian importers that are most expected to increase their corn imports are Malaysia, Indonesia and Vietnam.

Of the total increase of 24 million tons, 22 million tons, 4 million tons and 4 million tons of corn are exported from the United States, Argentine and FSU, respectively. Corn exports from Brazil decrease by 4 million tons. The competitiveness of the United States will be maintained, and the difference from other countries will expand.

The trade volume of wheat, 156 million tons at present, is estimated to increase by 5 million tons to 161 million tons in 2021. Asia, Middle East, North Africa and Other African countries represent 5 million tons, 3 million tons, 1 million tons and 6 million tons of the total increase, respectively. The increases of wheat imports are outstanding in Asia and Africa that have growing populations. Other Asian countries that are most expected to increase their wheat imports are Malaysia, Indonesia, Vietnam and Bangladesh. So far, China is almost self-sufficient in terms of wheat. Unlike corn, there is no possibility for China to increase wheat imports because of careful protective support given to wheat producers, controlled imports and a leveling-off of domestic demand, but careful attention should be paid to the balance of supply and demand in the future.

Of the total increase of 5 million tons, 8 million tons, 7 million tons and 3 million tons are exported from EU, Ukraine and Russia, respectively. The United States, Australia and Argentine, on the contrary to those growing exporters, show decreases by 3 million tons, 4 million tons and 6 million tons respectively.

**Fig. 22 Outlook of Grain Trade**

Outlook of Soybean Trade (million tons)

Exporters	Fiscal 2011①	World share	Fiscal 2021②	World share	②-①
Argentina	7	8%	17	12%	10
Brazil	36	40%	61	44%	25
U.S.	36	40%	44	31%	8
Others	10	11%	18	13%	8
World total	89		140		51
Importers	Fiscal 2011①	World share	Fiscal 2021②	World share	②-①
China	59	66%	99	71%	40
Others	30	34%	41	29%	11
World total	89		140		51

Outlook of Corn Trade (million tons)

Exporters	Fiscal 2011①	World share	Fiscal 2021②	World share	②-①
Argentina	16	14%	20	15%	4
Brazil	21	19%	18	13%	-3
FSU	17	15%	21	16%	4
U.S.	39	35%	62	46%	23
Others	18	16%	14	10%	-4
World total	111		135		24
Importers	Fiscal 2011①	World share	Fiscal 2021②	World share	②-①
China	5	5%	18	13%	13
Japan	15	14%	16	12%	1
Korea	8	7%	10	7%	2
Mexico	11	10%	16	12%	5
Others	72	65%	75	56%	3
World total	111		135		24

Outlook of Wheat Trade (million tons)

Exporters	Fiscal 2011①	World share	Fiscal 2021②	World share	②-①
Argentina	13	8%	7	4%	-6
EU	16	10%	25	16%	9
Russia	22	14%	25	16%	3
Ukraine	5	3%	12	7%	7
U.S.	29	19%	26	16%	-3
Canada	17	11%	18	11%	1
Australia	25	16%	21	13%	-4
Others	29	19%	27	17%	-2
World total	156		161		5
Importers	Fiscal 2011①	World share	Fiscal 2021②	World share	②-①
Asia	41	26%	46	29%	5
North Africa	17	11%	20	12%	3
Africa	35	22%	41	25%	6
Middle East	17	11%	20	12%	3
Others	46	29%	34	21%	-12
World total	156		161		5

Ends