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Farm Prices in Wuchin, Kiangsu, China

By L. L. Chang
Department of Agricultural Economics
University of Nanking

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The importance of price changes in the economic life of Chinese farmers is well shown in the statement made by Professor J. L. Buck in his excellent work, *Chinese Farm Economy*. "Chinese farming is often thought of as self-sufficient and therefore farm products are supposed to be an unimportant item of commerce. It is found, however, after separating all the products raised into two classes, that the products sold constitute in value 53 per cent of the total." Through the introduction of modern industry in China the degree of commercialization in agriculture is becoming greater and greater. The Chinese farmer is no longer keeping away from the world's market. Besides the products used by the family, he has to produce enough surplus to exchange with other groups of people for ready cash to meet his other requirements. He is busy in buying and selling and, therefore, prices are very important in his economic life.

SCOPE AND METHOD

During the last thirty years, great changes have taken place in prices in China, but very few persons know the real causes and effects of these changes. In this study farm prices received by farmers for their produce are compared with the retail prices paid by farmers for commodities used in living, to see whether the farmers are well paid or not. Secondly, the trend of the prices of different farm products is determined. This is very helpful in the forecasting of prices. Farmers may be benefited by knowing how to make adjustments as the price situation changes.

*The author is very much indebted to Professor J. L. Buck and Dr. S. W. Warren of the University of Nanking for their help in the preparation and editing of this paper.

Thirdly, the seasonal variation of prices and of quantities sold by farmers is studied. This knowledge will help the farmer to sell his products at the right time and to regulate his production according to the market demands. Lastly, the currency and prices are studied to discover the effects of currency in prices.

For the purpose of comparing the prices received by farmers for farm products with retail prices paid by farmers for commodities used in living, two series of index numbers have been constructed. The working procedure can be briefly stated in the following steps; namely, (1) location, (2) sampling, (3) collection of data and (4) formula.

(1) *Location*:—Since the purpose of this study is to investigate the farm prices received by farmers and retail prices paid by farmers, the information must be secured from a typical rural community. The price data were collected from six small market towns situated in the south-eastern part of Wuchin *Hsien* (武進縣) of Kiangsu Province. These market towns are only about one hundred and thirty miles from Shanghai. They have had the advantages of railway transportation since 1908, and the distance to the railway station is only a few miles. The communication among these market towns is mainly by means of steamboats and native boats on rivers and canals. Rice, mulberry, and wheat are the three most important crops of this region, but broad beans, barley, field peas, and soybeans are also produced to some extent.

(2) *Sampling*:—Theoretically all the commodities properly belonging to the field delimited for investigation, should be included, but it was impossible to do so in this case. Mulberry leaves and silk cocoons are very important enterprises of the farmers in this locality, but owing to the fact that they are so seasonal and perishable, no one keeps a continuous account, so these products were not included in our index number. With these exceptions the commodities selected are those of chief importance in the market. There are nine commodities included in the index number of farm prices received by farmers, and sixty-three commodities are included in the index number of retail prices paid by farmers.

(3) *Collection of data*:—Since statistical records of any sort are extremely rare in China, our price data must be collected from old accounts. These accounts were borrowed from shops of various kinds for a long enough period to have the information transcribed in the office. Among 522 books of old accounts collected, only 194 books were usable. Many of these accounts recorded only the name and value of the commodity and did not give prices per unit and total quantities. It is rather a difficult task to collect the old accounts, because merchants are very suspicious and difficult to convince. The most useful accounts were collected from grain *hongs*, oil shops, cloth shops, groceries, blacksmith shops, and pawn shops. Since all accounts are dated by lunar calendar, the first step was to convert the lunar calendar into solar calendar. Monthly quotations were obtained by taking the average of daily quotations. If there were two quotations appearing within a day, the average was taken, and if more than two, the median was accepted. Values of rice land were obtained from one or two deeds for each year.

(4) *Formula*:—For computing the monthly aggregative index numbers of prices paid to producers for farm products, the formula $\frac{\Sigma p_1 q_0}{\Sigma p_0 q_0}$ (1) was used. Weights are base period quantities appearing in transactions in the accounts (appendix 1). The yearly aggregative index number of prices paid to producers for farm products is the average of the monthly aggregative index numbers. In computing the index numbers of retail prices paid by farmers for commodities used in living the absence of data needed in finding out weights made it necessary to use the simple arithmetic average. For the purpose of keeping away from seasonal variation in both cases, the base period is the corresponding months of the years 1910 to 1914.

ARE FARMERS WELL PAID?

(1) *Comparison of prices paid to producers for farm products and retail prices paid by farmers for commodities*

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(1) p_1 = given period price
p_0 = base period price
q_0 = base period quantity

used in living:—In the period 1894 to 1926, the aggregative index number of prices paid to producers for farm products in terms of silver increased about four times (table 1, appendix 2), and in terms of copper the difference is even greater. From 1905 to 1926, the index number of prices paid to producers for farm products in terms of copper increased more than seven times. This difference is mainly because silver currency has been much more stable than copper currency. The excessive minting of copper coins and the reduction of the amount of copper in the coins tends to lower the value of copper currency. Absence of data limits the index number of prices paid by farmers for commodities used in living to the period 1910-1926. Either in terms of silver or in terms of copper, the prices increased rapidly (tables 2 and 3).

After careful observation, therefore, we find that between 1914 and 1919, prices increased rapidly. The major cause was the great world war. Imported goods could not be obtained easily for blockade was commonly practised, and also prices were rising the world over. The Chinese farmer is no longer separated from the world market and he is badly affected by the rise of prices for things which he buys. During this period the prices he received still remained practically the same. (figs. 1 and 2). From 1915 to 1921, the purchasing power of farm products decreased greatly (fig. 3). This shows that the world is gradually being linked by our modern methods of communication. We are depending upon each other more and more. The world war was a major factor in causing the rise of prices paid by farmers, especially for those commodities belonging to the groups of cloth and clothing materials, fuel and light, and metals, which increased very rapidly, because they are mostly imported goods and necessities for living (figs. 1 and 2, tables 2 and 3, and appendices 3 and 4). Needles are the most outstanding example. Their price increased more than 15 times as compared with the base period. It was thought best not to give too much weight to this single product and they were finally excluded in the computation of the general index number.

Crop conditions have some great influences on the prices paid to producers for farm products. The *hsien*

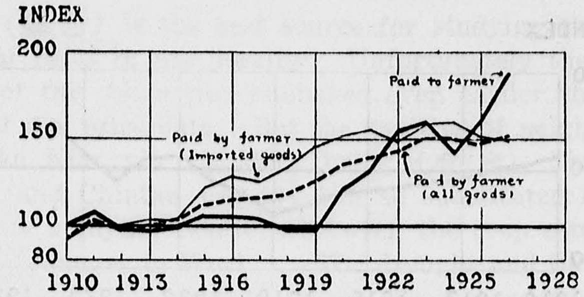

FIG. 1.—Index Numbers of Prices in Silver Currency Paid to Producers for Farm Products Compared with Index Numbers of Retail Prices Paid by Farmers for Commodities used in Living in Wuchin, Kiangsu, China.

1910—1914=100

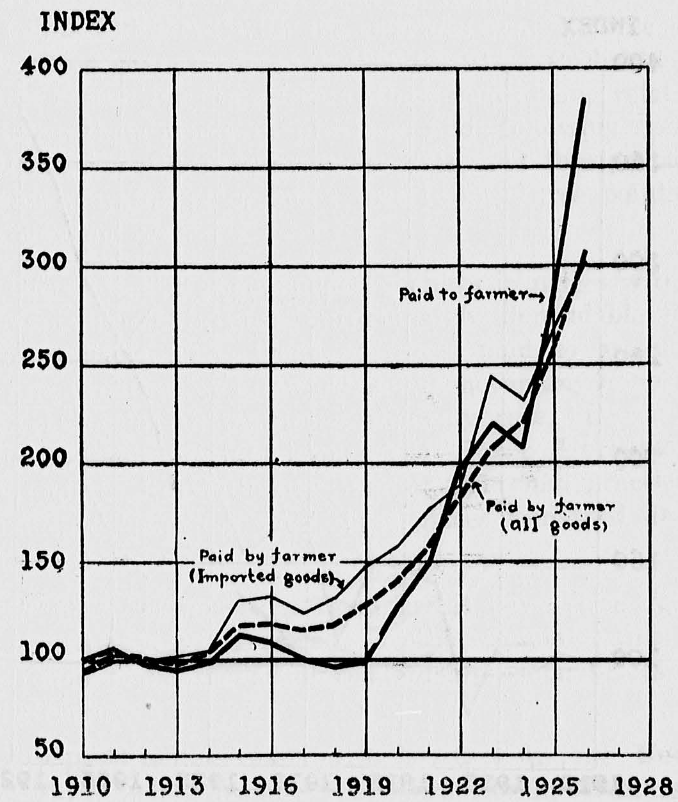

FIG. 2.—Index Numbers of Prices in Copper Currency Paid to Producers for Farm Products Compared with Index Numbers of Retail Prices Paid by Farmers for Commodities Used in Living in Wuchin, Kiangsu, China.

1910—1914=100

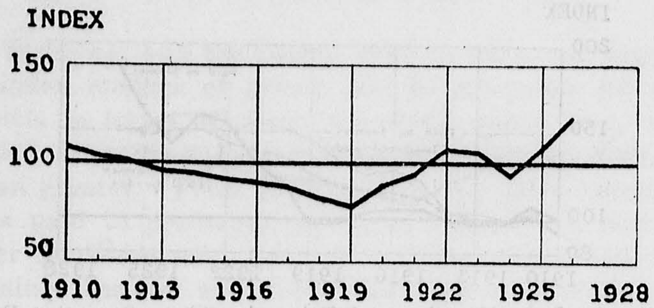

FIG. 3.—Purchasing Power of Prices of Farm Products in Terms of Retail Prices Paid by Farmers for Commodities Used in Living in Wuchin, Kiangsu, China.
1910—1914=100

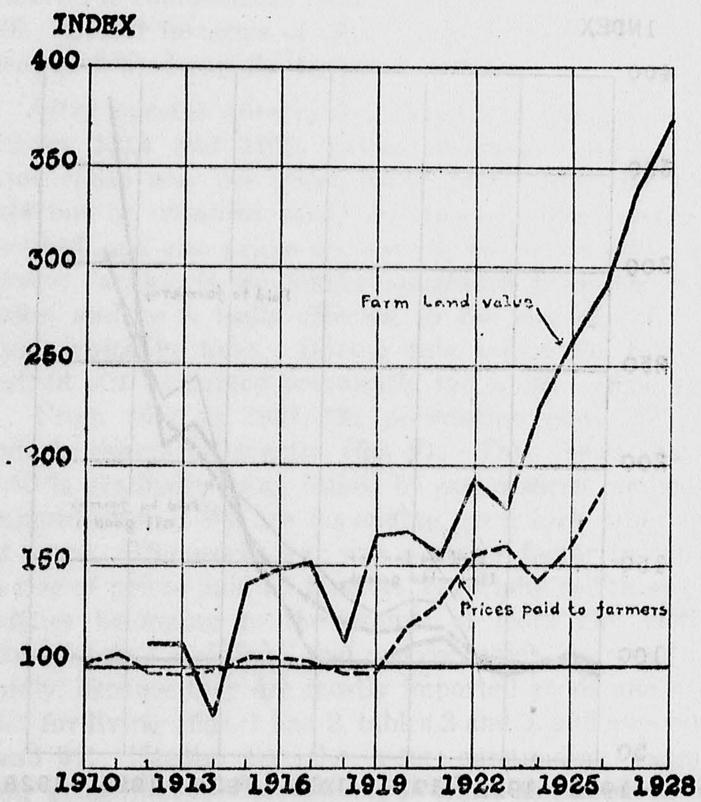

FIG. 4.—Index Numbers of Farm Land Value in Silver Currency Compared with Index Numbers of Prices Paid to Producers for Farm Products in Wuchin, Kiangsu, China.
For farm products, 1910—1914=100
For land values, 1912—1914=100

gazette (縣志) is the best source for studying the local historical facts in any locality. Unfortunately the latest gazette of this *hsien* was published even earlier than the period of our price data. But the gazettes of neighboring *hsien* like Kiangyin (江陰), Ihsing (宜興), Changshu (常熟) and Chintan (金壇) can be substituted for the purpose of studying relations between the crop conditions and price changes in Wuchin. The drought and the locust infestation of 1895 probably were the major causes for the price index of 1896 being double that of the previous year. The great flood year of 1906 was not localized in the area along Tai-lake (太湖), but many places along the Yangtze were also severely affected, so the aggregative index number of prices received by farmers rose twenty-two points compared with the previous year. Three successive flood years occurred in 1909 to 1911. Probably this was the reason for the prices of these years being relatively higher than prices in previous and following years. Another severe flood occurred in 1921, and this probably explains why the price index rose twenty-three points in the following year.

There are still some sudden changes in prices without any explanation, because unfortunately dependable data are unavailable. The trend of prices paid to producers for farm products was upward, so whenever any abnormal crop year occurred, the prices suddenly rose, but did not decline to their original level. The Boxer Uprising in 1900, and the Revolutionary War of 1911 had practically no influence on prices since these places remained undisturbed.

In more recent years, farm prices have risen faster than prices paid by farmers. In other countries this has been found to be the usual relationship when prices are rapidly rising.

(2) *Land values and farm prices*:—In the United States farm prices usually rise more rapidly than farm land values and also fall more rapidly but here we find farm land leads farm prices (table 4 and fig. 4). This is probably because the growth of farm population is too rapid, causing a greater demand for farm land. Besides

this, the internal political disturbances have been more severe in recent years, thus causing unstable economic conditions. Therefore men like to invest their money in farm land, for it is much safer. It is very common for the land value to exceed its economic value for farming purposes. This is especially true in this part of the country near the big cities. This explains why tenants are more numerous in the south and east central part of China than in north China.

(3) *The near future*:—According to the index numbers of wholesale prices in Shanghai compiled by the National Tariff Commission, the index number for January 1932 was 119.9 when the average of 1926 is taken as a base period. Contrasted to Japan, India, the United Kingdom, the United States and most of the rest of the world, prices in China have been increasing rapidly. The major reason is that China is the only important country which still uses silver as the standard exchange medium. Excessive mining of silver by Mexican and American miners and the disposal of surplus silver by India and other countries caused a slump in the silver situation and resulted in the rise of prices in China. Commodity prices in terms of gold are falling the world over. Silver, in terms of gold, is also a commodity, and naturally it can not be an exception. History tells us that there is usually a period of falling prices after a great war. We can hardly expect a rise of prices in the world market in the near future. The value of silver has been declining, and therefore, prices in China, contrary to those in other countries, have been rising, especially those of imported goods, the prices of which are in terms of gold. Most of these products have risen two to three times, and some of them even more. A large part of the commodities farmers buy consist of imported goods. A rise of the prices of these commodities means a decrease in the purchasing power of farm products. The best thing for farmers to do at present is to produce as much as possible and buy as little as possible.

THE TREND OF PRICES OF FARM PRODUCTS

(1) *Actual prices of farm products with line of trend*: —There are nine important commodities sold by farmers, and all of their prices were fitted to a straight line (figs. 5 to 13 and appendix 5).

For the purpose of comparing the trends in the prices of the different products, the yearly increase in the price for each product has been expressed as a percentage of the middle year (table 5). It was found that unhulled late rice increased the most; polished white rice was next; then polished glutinous rice, hulless barley, wheat, broad beans, field peas, yellow soybeans, and cottonseed-soybean oil follow in order. Rice is the staple food of our people in this region, and with the rapid growth of the big city, Shanghai, naturally its price rises most quickly. The annual increase of the price of polished white rice was $0.0019 per *Sheng*, that is, nineteen cents per *tan* (appendix 5). This explains why the imports of rice from Siam, Dutch East India and French Indo-China are increasing year by year. The development of the hog industry in this region explains the high annual increase of the price of hulless barley. The annual increase of the price of wheat can not be compared with that of rice, because wheat is not very much desired by the rice-eating people. This condition has been a little improved since 1915, because the milling industry, which makes a higher demand for wheat, has been gradually developed since that time. The annual increase of the prices of broad beans, field peas, and especially yellow soybeans are rather small. This probably is the major reason why the annual increase of the price of cottonseed-soybean oil is the lowest, because soybeans are a very important raw material in making cottonseed-soybean oil.

There is about one oil mill to twenty families. The ordinary practice is to buy cotton seed from Kiangyin, (江陰) and oil beans (one kind of soybeans with small kernels) from Hwaiyuan (懷遠) and then mix them together before grinding and extracting the oil. This kind of oil is sold to oil shops, and then shipped to other neighbouring counties for cooking use. Pure soybean oil is too expensive for the poor consumers and pure cotton seed oil is not good in taste, so the mixed oil is demanded. The cotton seed-soybean cakes are used for fertilizers and feed.

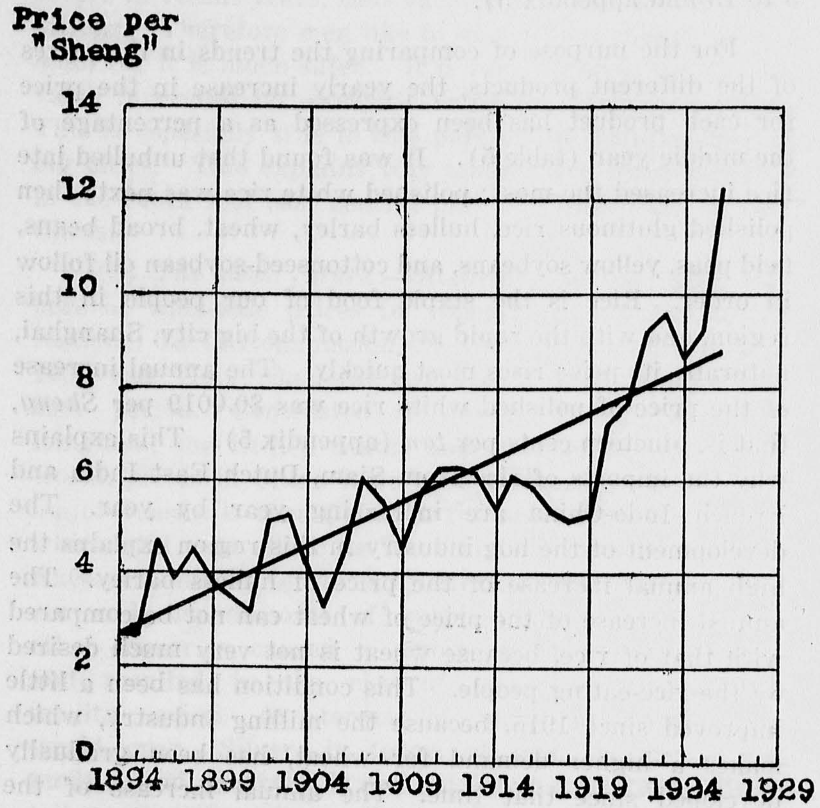

FIG. 5.—Prices (Silver Currency) Paid to Farmers for White Rice (Polished) with Line of Trend.

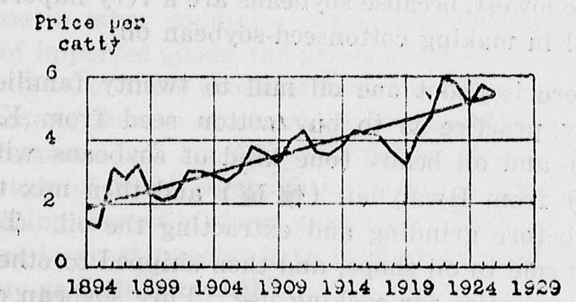

FIG. 6.—Prices (Silver Currency) Paid to Farmers for Hulless Barley with Line of Trend.

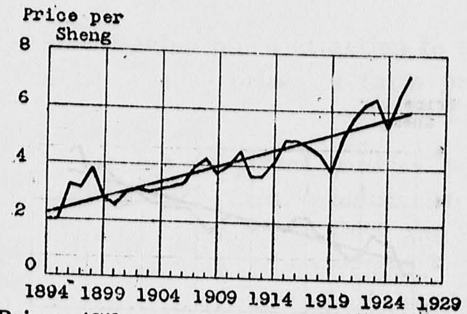

FIG. 7.—Prices (Silver Currency) Paid to Farmers for Wheat with Line of Trend.

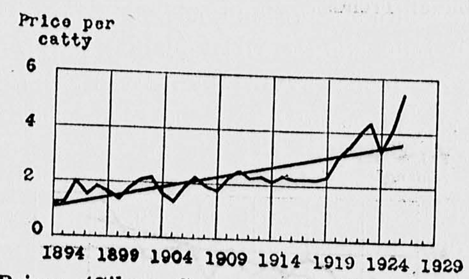

FIG. 8.—Prices (Silver Currency) Paid to Farmers for Late Rice (Unhulled) with Line of Trend.

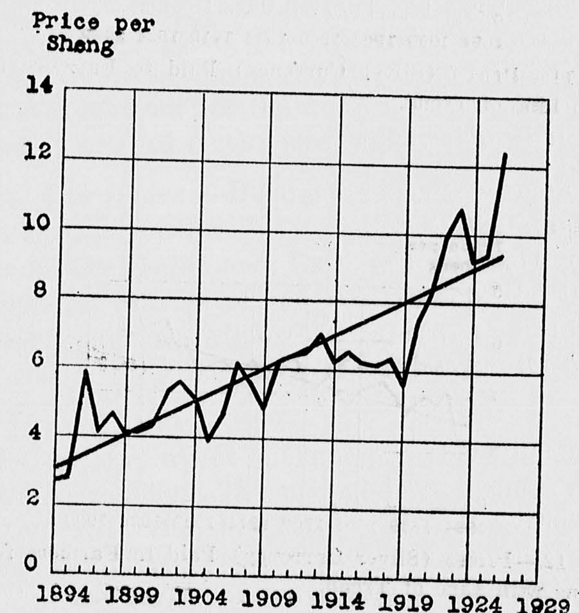

FIG. 9.—Prices (Silver Currency) Paid to Farmers for Glutinous Rice (Polished) with Line of Trend.

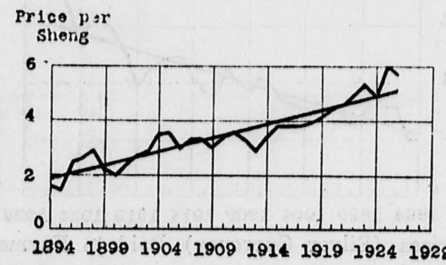

FIG. 10.—Prices (Silver Currency) Paid to Farmers for Broad Beans with Line of Trend.

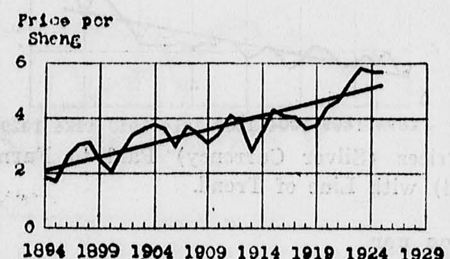

FIG. 11.—Prices (Silver Currency) Paid to Farmers for Field Peas with Line of Trend.

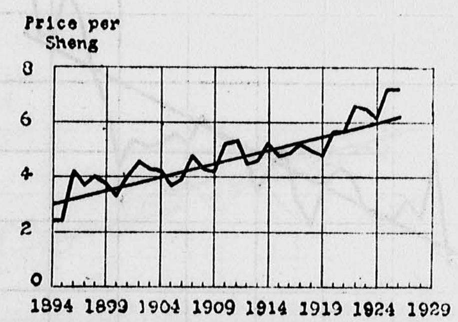

FIG. 12.—Prices (Silver Currency) Paid to Farmers for Yellow Soy Beans with Line of Trend.

Farmers have been paying much attention to the fertilization of their fields, because prices of farm products have been increasing.

(2) *Index numbers of prices paid to producers for farm products*:—For each farm product, we have computed a series of index numbers to show the up-and-down swings in prices. The upward movement of the prices both in copper and silver currency of all the nine farm products is also shown in the index numbers (table 6 and appendix 2). From 1894 to 1926, the price in silver of both polished glutinous rice and unhulled late rice increased 4.7 times. White polished rice stands next and increased 4.4 times; hulless barley, 4.2 times; wheat, 3.8 times; broad beans, 3.5 times; field peas 3.3 times; and last of all, soybeans increased 3.2 times. The increased acreage of soybeans in Manchuria has probably retarded the rapidity of the upward movement of the price of soybeans. From May 1914 until May, 1915 the price of wheat increased much more rapidly than that of rice. Wheat prices remained relatively higher than rice prices in 1915, 1916, 1917, and 1918. This was because the world war stimulated the establishment of the flour industry in China. The price of flour was abnormally high, and therefore China exported much flour for the world market. Thus the price of wheat increased much more rapidly than that of rice.

(3) *The future*:—During the next few years, the price of rice probably will still rise. Rice is the staple food of people in the South and East central part of China. Through the process of industrialization, the increase in population probably will exceed the increase in food supply. Since rice is the staple food of our people, its price tends to increase easily.

The price of wheat in China probably will also increase but not so rapidly. The up-and-down swings are less as compared with rice, because wheat is a world-wide cash crop. The international supply and demand tends to minimize the degree of fluctuation. Taking the world as a whole, the price of wheat is tending to decrease. The increased acreage in the United States, Canada, and Australia, world-wide economic depression, declining com-

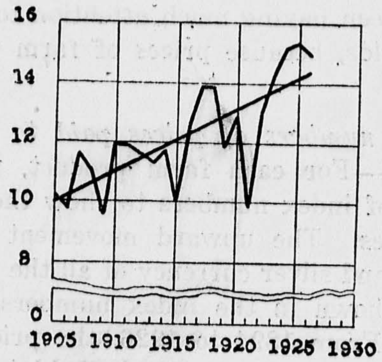

FIG. 13.—Prices (Silver Currency) Paid to Farmers for Cotton Seed—Soybean Oil with Line of Trend.

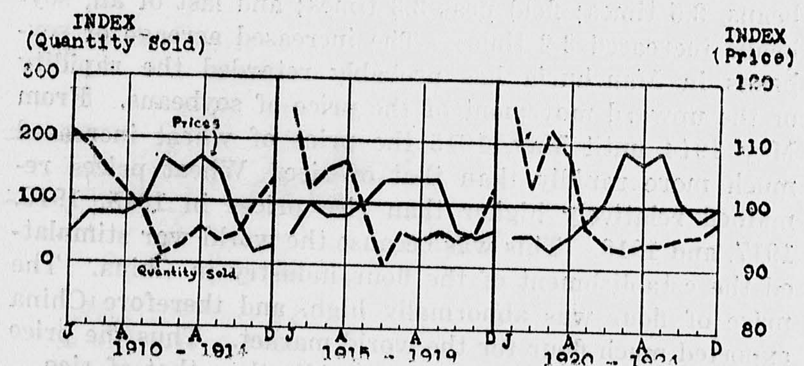

FIG. 14.—Index Numbers of Seasonal Variation in Prices in Silver Currency of White Rice (Polished) Compared with that of Quantity sold, Wuchin, Kiangsu, China.

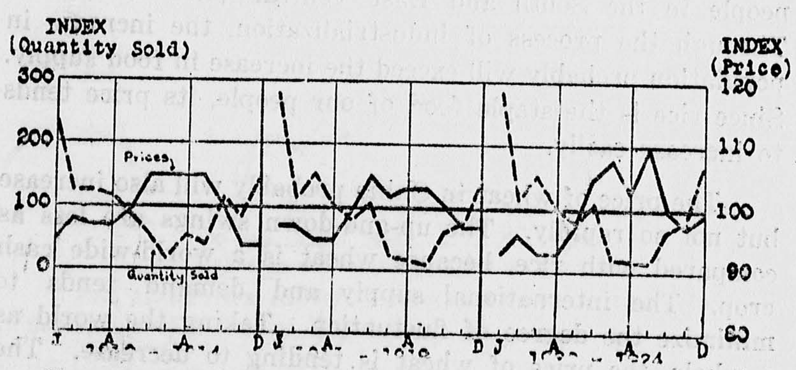

FIG. 15.—Index Numbers of Seasonal Variation in Prices in Silver Currency of Glutinous Rice (Polished) Compared with that of Quantity sold, Wuchin, Kiangsu, China.

modity prices and the decreased demand of European markets tends to make the world wheat market very unfavorable. It is predicted by the Bureau of Agricultural Economics of the United States Department of Agriculture that in the next 6 to 10 years, the wheat price on the average will be below the average price of the past seven years. The wheat situation probably will not be so bad in China for our basic currency, silver, is cheap in terms of gold.

The price of soybeans probably will not rise so rapidly as the price of rice, because the production and acreage are being greatly increased in Manchuria where climatic and soil conditions are more favorable for soybeans, and where land is much cheaper. The yield of soybeans in 1930 was abnormally good but the exportation was checked by the economic depression in Japan and other importing countries. The prices of hulless barley, field peas, and broad beans are also tending to increase, but they also probably will increase less rapidly than rice.

SEASONAL VARIATION OF PRICES AND OF QUANTITIES SOLD.

(1) *White rice (polished)*:—On the average about 60 to 70 per cent of the total quantity of polished white rice marketed is sold in the months of December to April when the price in silver currency is more than three per cent below the yearly average. (tables 7 and 8, figs. 14 to 19 and appendix 2). If this is compared with the highest price, which occurs in September, it is more than ten per cent lower. This condition has been more prevalent in recent years. In 1929, the yield of rice was very poor because of drought in most places. Because of their need for money, farmers in Nanking sold nearly all of their product at the price of $0.124 per *sheng* of polished white rice in September and October just after harvest time. Then in the next spring, having nothing to eat, they were forced in April and May to buy or borrow polished rice of the same quality from the grain merchant at the price of $0.162 per *sheng*. Only a few months had passed since they sold their products, and the price had risen 30 per cent.

Then, in 1930, when the harvest was very good, the price of rice dropped to $0.081 per *sheng* in October. The farmers had to sell their products to clear up their debts made in the spring. Two units of products were only enough to pay one unit of debt because the price in the fall was just one-half of that of the spring. Besides this, the farmer had also to pay an exceedingly high interest. Such interest is generally twenty to thirty per cent annually. This is one of the major reasons why the poor become poorer and the rich richer, and it also tells us why good credit and marketing systems should be listed as two of the most important items in the program of agricultural improvement in China.

(2) *Glutinous rice (polished)*:—The seasonal variation of glutinous rice both in quantity and price is quite similar to that of white rice. It is also mostly sold in the months of December to April when the price in silver currency on the average is about four per cent below the yearly average and more than ten per cent below the highest price of September.

(3) *Unhulled rice (late crop)*:—On the average more than 50 per cent of the total quantity of unhulled rice marketed is sold by farmers in the months of November and December. This is the time when farmers are most in need of money. The index number of seasonal variation of prices for this crop has not been computed because the data are rather incomplete.

(4) *Wheat*:—On the average nearly 85 per cent of the total quantity of wheat to be marketed is sold in the months of June to August when the price in silver currency is about eight per cent below the yearly average and about sixteen per cent below the highest price of February. The variation both in quantity and in price within a year is much greater than that of rice, because the latter is the staple food of this locality and wheat is primarily a cash crop.

(5) *Hulless barley*:—On the average more than 70 per cent of the total quantity of hulless barley marketed is sold in the months of May to August when the price in silver currency is more than seven per cent below the yearly

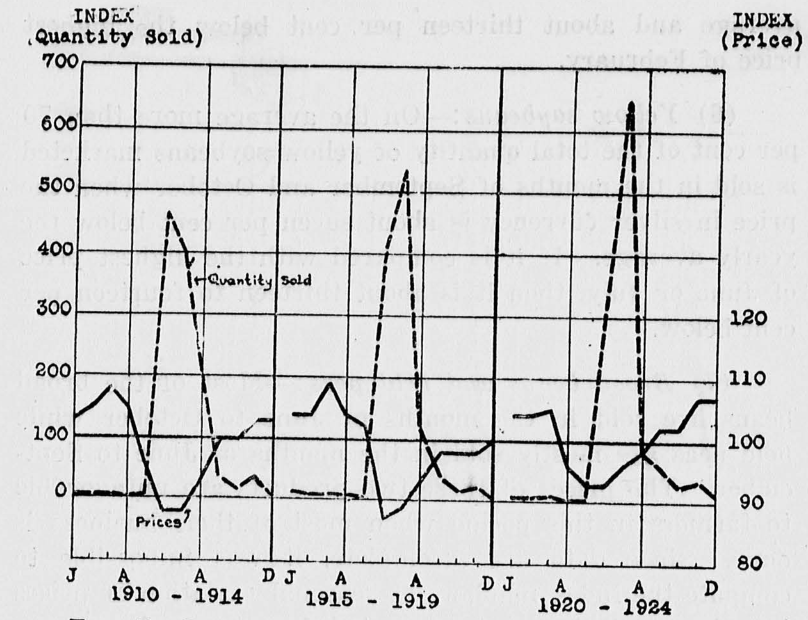

FIG. 16.—Index Numbers of Seasonal Variation in Prices in Silver Currency of Wheat Compared with that of Quantity sold, Wuchin, Kiangsu, China.

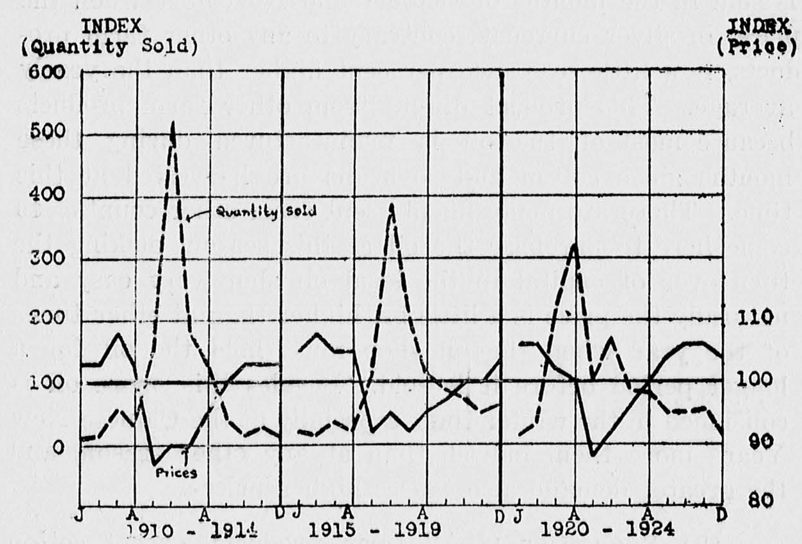

FIG 17.—Index Numbers of Seasonal Variation in Prices in Silver Currency of Hulless Barley Compared with that of Quantity Sold, Wuchin, Kiangsu, China.

average and about thirteen per cent below the highest price of February.

(6) *Yellow soybeans*:—On the average more than 70 per cent of the total quantity of yellow soybeans marketed is sold in the months of September and October when the price in silver currency is about seven per cent below the yearly average. If it is compared with the highest price of June or July, then it is about thirteen to fourteen per cent below.

(7) *Broad beans and field peas*:—Most of the broad beans are sold in the months of June to October while field peas are mostly sold in the months of June to September. The prices of these two products are unfavorable to farmers in this period when most of their business is done. Since data are incomplete, it was impossible to compute the index numbers of seasonal variation of prices in order to tell the exact per cents below the yearly average and the highest price.

(8) *Cotton seed-soybean oil*:—On the average, more than 50 per cent of the cotton seed-soybean oil marketed is sold in the months of October and November when the price, in silver currency, contrary to any other farm products, is a little over two per cent higher than the yearly average. This product differs from other farm products because most of the oil is manufactured during these months since cotton and soybeans are harvested at this time. There are many agents sent from other counties to come here to purchase the oil at this season, making the turn over of capital in the local oil shop very easy and naturally the price is a little bit higher than at other times of the year when the oil shop must hold the oil for a longer period before it is sold. Besides this, more oil is consumed in the winter time, especially at the Chinese New Year—more then, indeed, than at any other season, and the greater demand also causes higher prices.

(9) *Suggestions*:—All farm products, except cotton seed-soybean oil, are mostly sold in the period when prices are lower than the yearly average. This is generally due

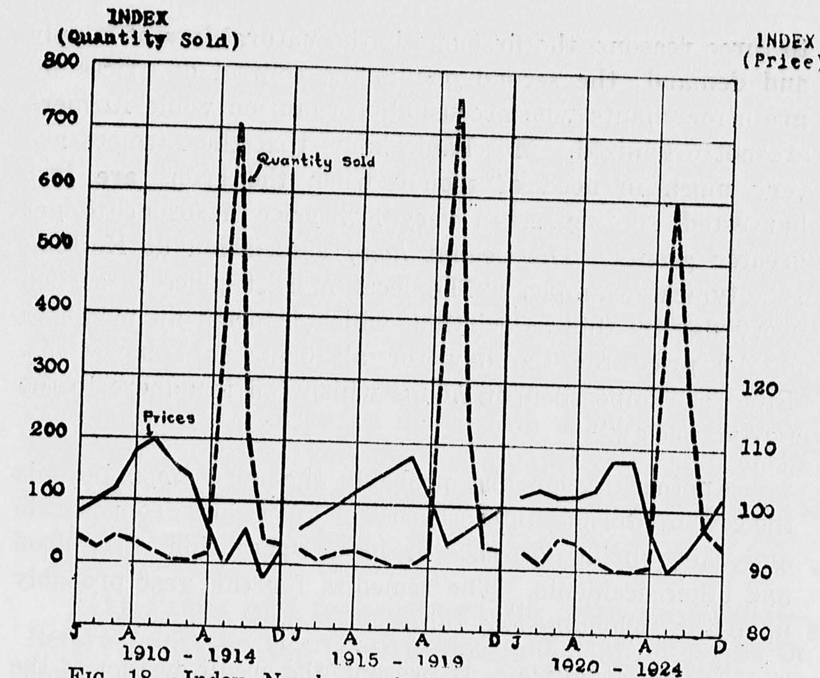

FIG. 18.—Index Numbers of Seasonal Variation in Prices in Silver Currency of Yellow Soybeans Compared with that of Quantity Sold, Wuchin, Kiangsu, China.

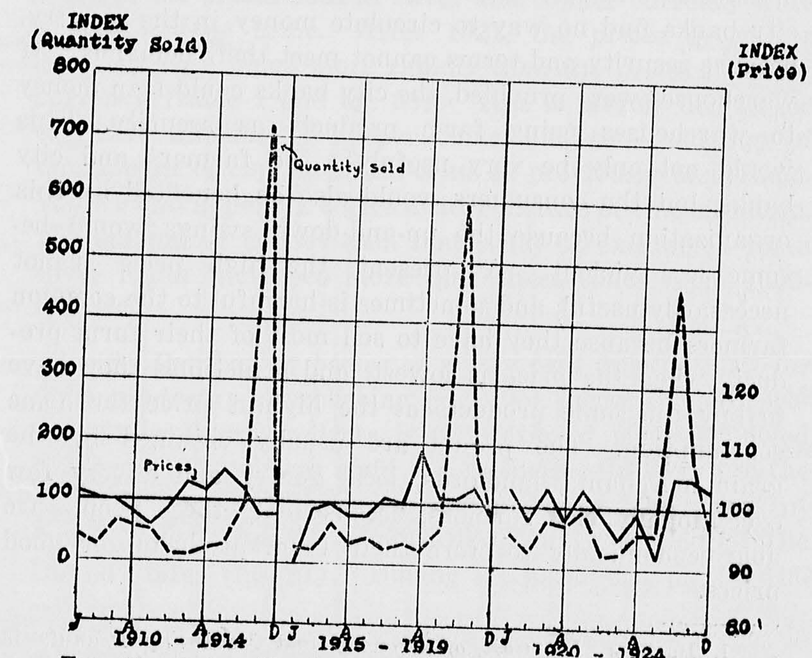

FIG. 19.—Index Number of Seasonal Variation in Prices in Silver Currency of Cotton Seed-Soybean Oil Compared with that of Quantity Sold, Wuchin, Kiangsu, China.

to three reasons, the first one is the natural law of supply and demand; the second one is the control of prices by grain merchants who are usually organized while farmers are not organized. Merchants know that the farmers are very much in need of money when the crops are just harvested, so they set a very low price in order to get greater profits. The peanut *hong* association at Kaifeng is a typical example. "The local market price is settled every day by this association, which informs all members of the price for the day for all business transactions. Fines are imposed upon *hongs* which fail to adhere to the agreed prices."[1]

Another reason and probably the most important, is the cost of storage, interest, cost of labor, loss from insects and rats, shrinkage, risk in price fluctuation, fire, flood and other accidents. The remedies for this rest probably upon the following two things:

(a) *Warehouses.* At present, the credit system of the country is practically separated from that of the city. The interest rate is very much higher than in the city, and the city banks find no way to circulate money in the country, because security and terms cannot meet their demands. If warehouses were provided, the city banks could loan money to warehouses using farm products as security. This would not only be very useful to the farmers and city banks, but the consumers would also be benefited by this organization because the up-and-down swings would become less violent. At present, the high price is not necessarily useful, and sometimes is harmful to the common farmers because they have to sell most of their farm products when the price is lowest, and sometimes they have to buy the same products at the highest price for home consumption. The profits are usually obtained by the grain merchants, landlords, local gentry and a very few exceptionally rich farmers, because only these people are able economically to store their farm products for good prices.

1. Buck, J. L. *"Cost of Growing and Marketing Peanuts in China."* Chinese Economic Journal, Vol. 5, No. 3. pp. 778.

(b) *Cooperative Marketing.* The Chinese marketing system is very inefficient and wasteful. There are many middlemen between the producers and consumers. The study by Professor Buck already referred to, reveals the fact that about 8 to 22 per cent of the destination market price is middleman's profit, and only about 56 to 60 per cent of the price actually reaches the farmer's pocket.[2] By means of cooperative marketing, both the producers and consumers will be benefited, for a great many middlemen can thus be avoided. The producers can get a higher price, and the consumers can get a cheaper product at the same time. The prices in destination markets are fairer than in primary markets, for there is more competition in the big cities.

CURRENCY AND PRICES

(1) *Prices paid to producers for farm products*:—Before 1909, the aggregative index numbers of prices in copper currency paid to producers for farm products were relatively lower than that in silver currency. From 1909 to 1920, the prices both in silver and copper currency were practically the same. After 1921, the prices in copper currency rose much more rapidly than the prices in silver currency (table 1 and fig. 20). This is largely due to the excessive minting of copper coins, and the reduction of the amount of copper in the coins as previously mentioned. Table 9 and appendix 6 give a clear picture of this situation. The amount of copper cash that could be exchanged for a silver dollar increased more than three times from 1905-1928.

(2) *Purchasing power of prices paid to producers for farm products*:—Purchasing power of prices paid to producers for farm products is the ratio of prices received by farmers to prices paid by farmers. In Wuchin the recent history of the purchasing power of the prices of farm products has been quite different from that of the United States (fig. 21). During the great war period, the

2. Buck, J. L. *"Cost of Growing and Marketing Peanuts in China."* Chinese Economic Journal, Vol. 5, No. 3. pp. 779.

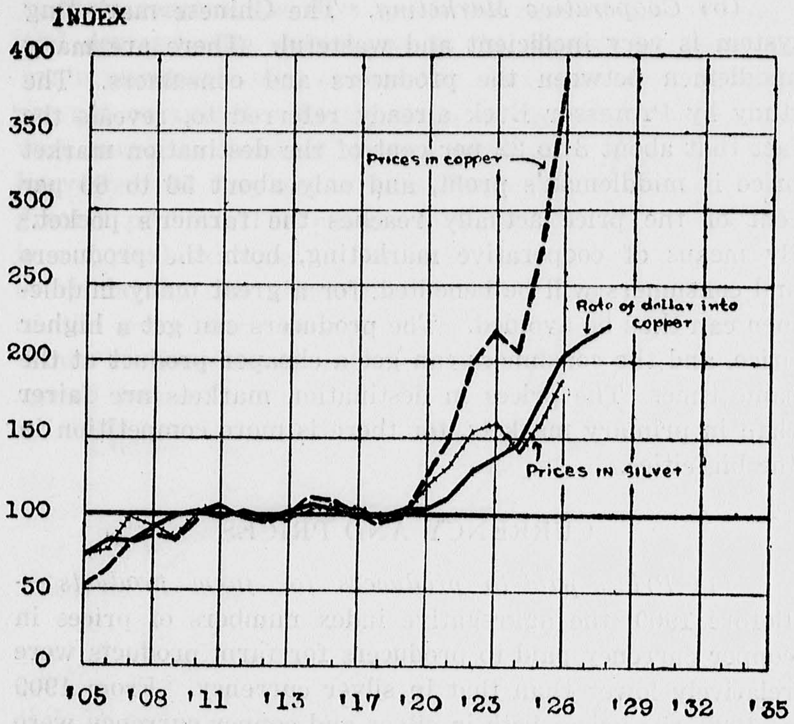

FIG. 20.—Aggregative Index Numbers of Prices in Copper Currency Paid to Producers for Farm Products Compared with Prices in Silver Currency, Wuchin, Kiangsu, China.
1910—1914=100

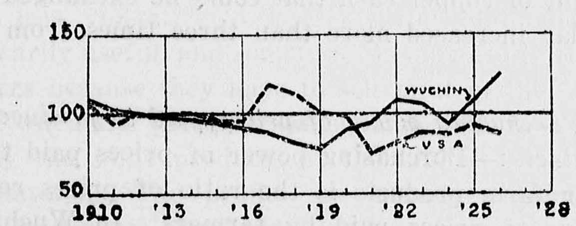

FIG. 21.—Purchasing Power of Prices Paid to Producers for Farm Products in Wuchin, Kiangsu, China and in the United States.
1910—1914=100

(Data for United States from *The Agricultural Situation. Volume 16, Number 3, March 1, 1932, page 19. Published by the United States Department of Agriculture.*)

purchasing power of the prices of farm products was very high in the United States, but in Wuchin at the same period it fell very low. Since 1920, the purchasing power of the prices of farm products has been very low in the United States, but it has gradually risen in Wuchin. The major reason for this difference is due to the fact that two different kinds of metal are being accepted as the standard by these two big countries. During the great war period, prices in gold rose the world over, but now they are declining everywhere. Chinese prices are in terms of silver, which is cheaper than before, so our prices instead of falling have been rapidly rising in recent years. Farm prices usually lead when prices are rising, and they also drop first when prices are falling, so these strange phenomena resulted. This shows how the monetary system plays a very important role in influencing our economic life.

(3) *Purchasing power of silver currency*:—Purchasing power of money is the reciprocal of prices. In 1926, the retail prices in silver currency paid by farmers for commodities used in living were 53 per cent above the base period of 1910 to 1914. Certainly purchasing power has decreased very much (table 2 and fig. 22). If some one buried one hundred dollars for future use in the years 1910 to 1914, and dug the money out now, he would have lost 35 dollars although the quality and quantity of the money would be actually the same as before, because prices had risen. Therefore the purchasing power of the silver is much lower, and one dollar only equals 65 per cent of what it was before.

(4) *Purchasing power of copper currency*:—In 1926, the retail prices in copper currency paid by farmers for commodities used in living were 208 per cent above the base period of 1910 to 1914, so the purchasing power of copper has decreased tremendously (table 3 and fig. 23). If one mortgaged a piece of land with one hundred thousand (串) cash during the years 1910 to 1914, and now the mortgager returns the same amount of money to take back the land, apparently it is all right, but in reality 68 thousand cash have been lost, since the purchasing power of

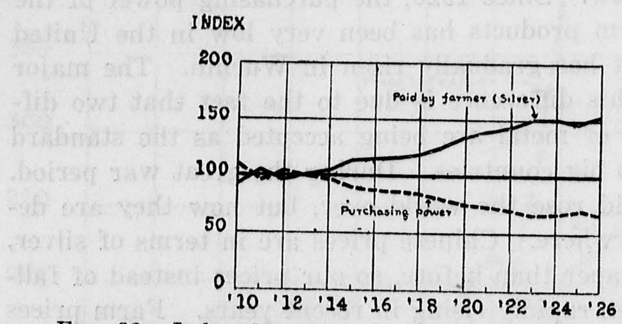

FIG. 22.—Index Numbers of Prices in Silver Currency Paid by Farmers for Commodities Used in Living Compared with Purchasing Power of Silver, Wuchin, Kiangsu, China. 1910—1914=100

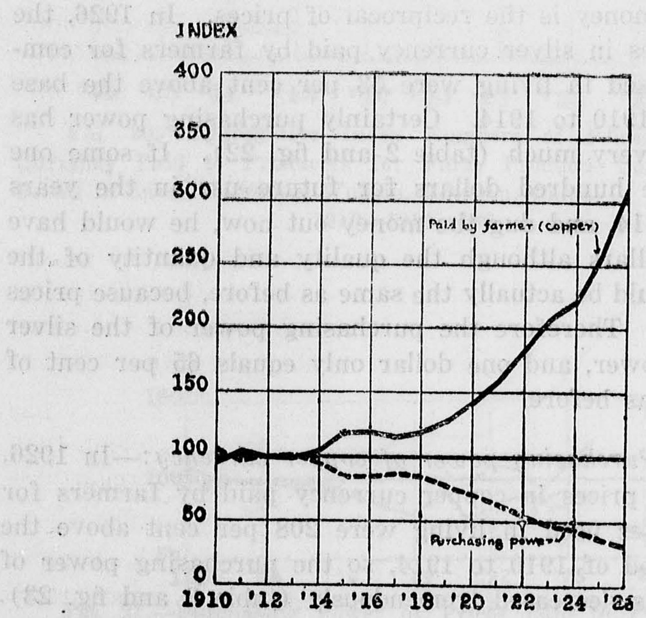

FIG. 23.—Index Numbers of Prices in Copper Currency Paid by Farmers for Commodities Used in Living Compared with Purchasing Power of Copper, Wuchin, Kiangsu, China. 1910—1914=100

copper currency has decreased 68 per cent as compared with the base period. The value of one hundred cash at present only equals 32 cash in 1910-14.

CONCLUSION

By studying the data, we can draw the following conclusions:—

1. Prices in China, contrary to other parts of the world, are tending to increase, owing to the fact that the value of silver is tending to decrease.

2. The up-and-down swings probably will be much more violent than before. This is because of the excessive minting of copper coins, and the reduction of the amount of copper in the coins together with the slump and instability in the value of silver.

3. Prices may be expected to lag behind farm land values because men like to invest their money in farm lands since it is much safer than anything else. The rapid increase in farm population also probably results in a greater demand for land.

4. Prices of food products are tending to increase more rapidly than prices of feeds.

5. Nearly all farm products are sold in the season when the prices are lowest because of the natural law of supply and demand, price control by merchants and cost of storage, such as interest, rent, losses and risk.

6. Currency should be stabilized. Bad currency has caused the up-and-down swings to be more violent than before. This causes people to lose or gain money regardless of their ability.

7. The purchasing power both of copper and silver has been decreasing rapidly, but the former much more than the latter. When silver is compared with copper, it is much better as a medium for exchange.

8. Good credit facilities, improved marketing systems for farm products, and stabilized currency seem to be the best means for the improvement of the farm price situation.

TABLE 1. INDEX NUMBERS OF PRICES PAID TO PRODUCERS OF FARM PRODUCTS IN WUCHIN, KIANGSU, CHINA

(Corresponding months 1910-1914=100)

Year	Jan.		Feb.		Mar.		Apr.		May		June		July	
	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver
1894	—	46	—	48	—	44	—	41	—	46	—	47	—	48
1895	—	46	—	45	—	45	—	38	—	42	—	49	—	42
1896	—	81	—	60	—	68	—	70	—	73	—	76	—	87
1897	—	76	—	84	—	80	—	60	—	90	—	72	—	76
1898	—	76	—	75	—	77	—	74	—	86	—	107	—	100
1899	—	73	—	72	—	75	—	72	—	69	—	64	—	62
1900	—	60	—	69	—	68	—	57	—	59	—	65	—	61
1901	—	63	—	63	—	55	—	64	—	65	—	68	—	61
1902	—	86	—	72	—	87	—	70	—	83	—	96	—	88
1903	—	91	—	86	—	86	—	89	—	83	—	77	—	88
1904	—	67	—	82	—	80	—	82	—	79	—	85	—	81
1905	—	—	—	—	—	—	45	64	47	67	62	88	60	86
1906	46	56	49	56	54	64	52	64	60	72	64	77	66	80
1907	73	92	78	97	86	108	82	103	80	100	84	103	88	106
1908	88	102	—	—	—	—	—	—	—	—	—	—	—	—
1909	77	81	76	75	71	71	68	69	77	79	96	98	93	93
1910	94	94	93	91	97	95	99	98	105	104	101	101	106	105
1911	109	110	110	107	110	110	109	110	116	117	107	108	109	111
1912	91	90	89	85	97	96	102	101	103	101	113	112	98	99
1913	105	108	108	112	101	106	96	97	91	93	86	87	77	79
1914	100	101	102	102	95	94	91	93	85	86	94	94	108	109
1915	103	97	105	97	110	101	101	94	105	99	122	115	126	120
1916	109	104	109	101	107	98	103	98	105	100	118	114	132	127
1917	93	97	94	93	93	91	93	94	111	114	121	124	108	122
1918	89	92	93	93	101	101	100	102	104	106	100	103	102	105
1919	91	91	93	99	92	89	84	83	78	77	95	95	104	104
1920	115	111	116	109	117	111	115	111	116	113	130	127	133	129
1921	138	130	127	116	115	103	120	110	130	117	149	135	162	147
1922	174	148	162	146	184	152	185	150	190	149	201	156	220	171
1923	218	165	215	162	209	152	203	147	207	149	227	167	229	169
1924	222	159	210	147	196	137	187	132	181	127	198	136	215	151
1925	214	138	206	127	217	127	217	125	255	143	280	165	310	182
1926	367	189	345	172	353	179	353	178	338	168	364	181	386	193

Note 1:—Wherever the word "copper" appears in this report, it indicates that the prices are in terms of copper cash. Wherever the word "silver" appears it indicates that the prices are in terms of Chinese silver dollars.

Year	Aug.		Sept.		Oct.		Nov.		Dec.		Yearly Average		Prices paid by farmers for commodities purchased		Ratio of prices received to prices paid	
	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver
1894	—	49	—	45	—	48	—	52	—	56	—	48	—	—	—	—
1895	—	51	—	42	—	55	—	49	—	58	—	47	—	—	—	—
1896	—	81	—	90	—	99	—	104	—	102	—	83	—	—	—	—
1897	—	70	—	77	—	71	—	72	—	77	—	75	—	—	—	—
1898	—	91	—	79	—	75	—	81	—	81	—	84	—	—	—	—
1899	—	65	—	62	—	72	—	79	—	75	—	70	—	—	—	—
1900	—	58	—	57	—	68	—	63	—	58	—	62	—	—	—	—
1901	—	56	—	85	—	—	—	83	—	77	—	67	—	—	—	—
1902	—	83	—	93	—	98	—	97	—	89	—	87	—	—	—	—
1903	—	80	—	80	—	95	—	97	—	93	—	87	—	—	—	—
1904	—	80	—	73	—	83	—	73	—	68	—	78	—	—	—	—
1905	55	76	55	73	53	68	49	65	49	64	53	72	—	—	—	—
1906	67	81	73	89	77	90	77	98	77	98	64	77	—	—	—	—
1907	82	97	80	95	76	88	82	100	88	104	82	99	—	—	—	—
1908	94	101	89	96	93	96	80	86	77	79	87	93	—	—	—	—
1909	91	90	97	97	94	90	84	83	87	87	84	84	—	—	—	—
1910	107	107	101	98	100	107	102	101	107	105	101	101	95	93	106	109
1911	108	108	104	107	110	110	87	91	91	93	106	107	103	104	103	103
1912	98	97	89	90	90	89	106	109	105	103	98	98	100	98	98	100
1913	78	80	96	98	97	96	102	104	100	102	95	97	99	100	96	97
1914	109	107	109	108	104	99	100	98	97	94	100	99	104	103	96	96
1915	130	123	118	112	109	98	113	106	109	103	113	105	118	113	96	93
1916	122	116	108	103	106	99	97	100	95	98	109	105	119	115	92	91
1917	111	113	99	101	98	97	92	97	88	93	100	103	115	117	87	88
1918	97	98	92	93	95	94	93	94	90	92	96	98	118	119	81	82
1919	101	100	103	101	113	108	115	116	114	111	99	98	128	126	77	78
1920	126	121	107	103	125	117	153	149	155	149	126	121	141	136	89	89
1921	156	139	144	128	169	140	188	163	184	157	149	132	158	139	94	95
1922	220	163	184	136	193	138	232	173	230	172	198	155	182	143	109	108
1923	215	159	191	138	225	155	251	181	247	180	220	160	207	151	106	106
1924	219	151	173	121	212	134	227	149	240	159	207	142	221	151	94	94
1925	308	174	291	162	324	168	381	201	394	210	283	160	259	148	109	108
1926	368	182	309	149	421	193	519	247	481	236	384	189	308	153	125	124

Note 2:—An index number of 46, indicates that the price for that year was 46 per cent of the average prices for 1910-14, the base period. That is, the prices for 1910-14=100.

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Table 2. INDEX NUMBERS OF RETAIL PRICES (IN SILVER CURRENCY†) PAID BY FARMERS FOR COMMODITIES USED IN LIVING IN WUCHIN, KIANGSU, CHINA

(1910-1914=100)

	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927
Agricultural Products:																		
White rice (polished)	100	109	108	97	86	102	97	92	89	86	123	129	155	159	141	153	209	208
Glutinous rice (polished)	99	101	101	104	95	99	90	100	90	88	96	122	138	159	144	142	185	204
Rice (early crop)	93	103	111	95	93	107	98	92	85	92	134	136	152	157	143	167	218	210
Wheat	109	111	86	77	116	98	116	107	91	107	120	132	141	152	157	159	177	193
Barley, hulless	107	117	90	88	102	110	102	102	88	88	105	121	145	124	119	131	155	157
Barley (with hulls)	108	120	76	100	104	108	100	100	80	92	112	124	136	140	132	148	168	160
Bran	100	111	89	111	111	122	100	100	100	111	133	122	167	178	167	211	211	200
Cotton seed	95	110	100	100	100	100	110	110	114	110	129	105	129	138	138	124	138	143
Yellow soybeans	104	105	93	95	105	96	93	107	104	100	111	119	139	144	139	144	149	158
Broad beans	105	108	92	89	108	113	113	126	116	116	129	124	145	155	147	145	174	205
Soybeans (for oil)	100	104	92	98	104	102	96	102	91	98	117	121	134	128	132	142	149	157
Soybeans (green)	96	98	85	98	123	98	98	111	104	113	111	125	149	145	140	153	160	189
Chestnuts	107	97	100	102	93	93	116	79	107	95	123	161	152	175	115	161	—	—
Walnut kernels	78	127	87	108	101	84	80	82	101	122	128	196	183	158	146	178	146	227
Average	100	109	94	97	103	102	101	101	97	101	119	131	148	151	140	154	172	185

	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927
Other food products:																		
Salt	77	109	100	104	109	109	115	123	126	134	132	134	134	134	140	145	162	172
Soybean oil	99	103	97	99	101	90	97	115	110	96	102	92	107	117	127	136	122	144
Rape seed oil	80	107	100	103	110	104	109	125	121	115	115	102	120	134	139	147	136	161
Sesame oil	85	93	108	112	102	63	75	96	98	85	97	98	117	114	124	133	116	173
Tea	81	83	95	117	122	127	143	146	146	146	146	146	146	151	134	120	128	130
Sugar, white (No. 425)*	103	102	103	96	96	140	130	125	95	123	179	149	113	150	142	116	108	122
Rock candy	99	117	106	87	91	139	137	134	95	137	175	128	116	148	150	112	125	137
Liquor (barley)	101	109	104	90	94	109	103	106	101	96	107	146	145	127	125	139	170	—
Dried bamboo shoots	93	100	90	100	118	108	153	158	178	168	148	150	158	193	250	245	235	193
Dried jelly fish*	94	93	82	103	125	225	185	87	86	87	149	187	185	175	161	172	189	175
Juda's ear	72	81	90	118	138	159	127	111	111	144	186	220	205	157	135	135	185	258
Salted fish, native	—	106	92	95	108	152	103	111	134	127	127	133	156	170	159	173	214	180
Sweets No. 1 (wheat flour, sugar and bean oil)	98	102	100	99	102	115	114	114	119	121	139	162	164	173	183	162	163	204
Sweets No. 2 (wheat flour, sugar and bean oil)	87	109	97	100	105	125	116	126	128	129	157	155	174	176	174	170	179	195
Sweets No. 3 (Sugar and glutinous rice flour)	98	102	98	102	99	115	112	108	103	116	144	155	146	159	163	140	146	158
Sweets No. 4 (Sesame and flour)	105	103	95	93	102	110	111	104	99	112	136	143	138	156	152	124	112	143
Sweets No. 5 (Wheat flour sugar, and bean oil)	96	105	99	98	104	117	118	121	124	123	135	140	141	154	151	147	150	153
Average	91	101	97	101	107	124	120	118	116	121	140	144	145	152	153	148	155	169

TABLE 2.—(Continued)

	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927
Cloth and clothing materials:																		
Fine cotton cloth	90	99	100	113	98	104	106	138	148	191	156	149	162	187	179	165	158	—
Course cotton cloth	96	95	107	104	99	94	87	109	133	151	135	122	126	126	142	153	126	—
Shirtings, bleached*	93	103	103	99	101	99	108	123	145	162	165	174	160	168	211	163	166	—
Glazed cotton cloth*	82	103	95	108	113	90	110	105	140	154	187	197	191	199	205	189	215	—
Cotton flannel, white*	88	85	100	116	111	96	94	97	123	131	152	170	153	150	162	171	156	—
Twill*	87	130	97	103	83	110	92	122	112	145	146	169	184	197	166	187	141	—
Striped cloth	91	98	102	96	113	98	100	122	122	151	149	110	120	158	181	126	136	—
Check	95	100	106	102	96	89	112	104	113	136	146	106	100	113	177	167	139	—
T-Cloth*	77	83	86	140	114	128	146	168	137	178	134	168	160	183	164	162	144	—
Main sook*	96	90	106	109	99	104	102	84	110	125	115	179	180	168	164	126	119	—
Sateen*	100	104	108	88	—	—	132	153	145	164	177	174	173	167	193	176	173	—
Poplin*	90	93	100	106	111	116	121	123	123	107	107	94	118	—	—	—	—	—
Cotton venetians*	97	102	108	95	97	103	100	119	139	124	114	116	133	132	138	119	127	—
Hangchow silk	91	99	101	102	106	109	—	160	—	103	125	126	133	131	147	116	125	—
Knitting yarn*	89	114	101	96	98	160	196	154	174	194	186	219	165	183	165	171	171	—
Cotton yarn (counts 16)*	95	106	105	102	93	92	95	120	152	183	163	142	134	150	165	164	140	—
Cotton yarn (counts 14)*	94	107	105	103	92	91	96	116	152	177	165	144	138	152	168	167	139	—
Cotton, raw	93	110	103	97	96	94	93	100	107	97	95	103	105	115	138	121	138	—
Average	91	101	102	104	101	105	111	123	134	149	145	148	146	158	169	155	148	—
Fuel and light:																		
Oil, kerosene, "Brilliant"*	88	86	97	108	122	130	106	108	118	100	104	107	97	136	141	149	156	—
Safety matches, native	104	107	96	85	107	137	178	170	152	148	156	137	130	130	126	133	144	—
Candles, native	92	115	92	96	106	101	110	127	136	127	122	108	112	125	150	153	174	—
Candles, 12 oz.*	88	105	98	101	109	114	134	143	157	138	136	131	118	117	123	117	—	—
Average	93	103	96	98	111	121	132	137	141	128	130	121	114	127	135	138	158	—
Metals:																		
Wire nails*	104	106	104	100	89	180	261	203	192	223	266	196	190	204	155	141	—	—
Brass foot stoves	90	108	102	101	100	108	121	118	113	103	117	111	99	104	108	107	118	—
Average	97	107	103	101	95	144	191	161	153	163	192	154	145	154	132	124	118	—
Miscellaneous:																		
Wood oil	96	110	98	100	97	93	106	120	148	123	124	120	132	171	171	150	152	—
Umbrellas	94	105	102	106	93	93	98	107	107	123	140	—	—	—	—	123	125	—
Soap (Peh Chi)*	100	102	99	99	101	114	119	122	106	123	114	111	109	106	107	108	105	—
Hemp rope	100	105	90	95	105	95	75	65	95	70	70	65	80	95	75	50	55	—
Hemp thread	60	127	106	103	105	97	103	102	97	97	114	113	120	157	150	133	122	—
Gypsum	76	112	119	110	84	80	102	130	139	205	186	159	176	176	184	203	213	—
Cigarettes (Pirates)*	88	98	98	108	108	111	121	127	134	131	125	131	123	122	153	130	130	—
White buttons	92	110	105	98	93	111	139	98	89	84	113	197	192	174	156	138	125	—
Average	88	109	101	102	98	99	108	109	114	120	123	128	133	143	142	129	128	—
General Index	93	104	98	100	103	113	115	117	119	126	136	139	143	151	151	148	153	—
Purchasing Power of Silver currency	108	96	102	100	97	89	87	85	84	79	74	72	70	66	66	68	65	—
General Index of Imported goods	92	101	100	104	103	122	129	126	134	146	152	156	149	159	160	152	149	—
General Index of Native goods	94	106	98	100	103	109	109	113	113	118	129	132	140	147	148	146	154	—

*Imported goods.

†Prices in copper were converted to silver equivalents.

TABLE 3. INDEX NUMBERS OF RETAIL PRICES (IN COPPER CURRENCY†) PAID BY FARMERS FOR COMMODITIES USED IN LIVING IN WUCHIN, KIANGSU, CHINA
(1910-1914=100)

	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927
Agricultural Products:																		
White rice (polished)	101	108	108	94	87	108	101	90	87	89	128	145	199	216	205	270	424	445
Glutinous rice (polished) ..	100	100	102	101	96	105	93	98	89	88	98	138	177	217	207	254	364	442
Rice (early crop)	95	103	114	94	96	114	103	90	86	94	141	154	200	216	208	308	448	461
Wheat	110	110	86	76	121	105	117	103	91	109	124	150	190	212	240	291	369	419
Barley, hulless	107	114	89	84	102	116	104	98	88	88	107	136	193	168	171	221	316	330
Barley (with hulls)	109	115	74	94	103	109	97	94	85	88	112	135	174	188	185	256	329	338
Bran	100	100	92	100	108	133	100	100	92	107	133	133	208	242	233	333	425	417
Cotton seed	96	104	100	93	100	107	114	104	111	107	132	118	157	186	200	218	275	304
Yellow soybeans	104	104	95	93	105	103	96	104	101	100	115	136	179	197	199	253	305	340
Broad beans	106	108	94	86	110	122	118	124	114	116	134	142	190	218	216	254	350	450
Soybeans (for oil)	103	104	96	96	104	109	99	101	88	101	120	141	170	177	190	246	304	333
Soybeans (green)	99	97	84	96	126	104	101	110	103	116	116	143	201	201	204	280	334	414
Chestnuts	109	95	99	99	96	99	121	78	105	96	127	185	207	242	180	296	—	—
Walnut kernels	79	127	88	104	102	91	82	80	100	124	134	226	233	218	218	308	298	495
Average	101	106	94	94	104	109	103	98	96	102	123	149	191	207	204	271	349	399

	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927
Other food products:																		
Salt	79	108	102	103	111	118	121	121	125	138	139	152	175	185	207	259	331	372
Soybean oil	100	103	98	97	102	96	100	112	109	98	107	106	134	162	188	247	242	314
Rape seed oil	82	106	102	101	110	109	113	122	121	115	119	117	147	187	205	251	268	349
Sesame oil	86	93	109	109	102	67	79	95	97	86	102	111	146	159	180	239	232	379
Tea	83	83	96	115	123	137	150	144	145	149	153	169	188	212	196	210	251	285
Sugar, white (No. 425)* ..	106	102	104	94	96	149	136	122	93	124	185	165	143	208	212	198	217	261
Rock candy	101	116	107	84	92	149	143	128	95	140	183	151	144	206	221	201	253	298
Liquor (barley)	105	108	105	89	94	116	107	105	100	98	111	172	180	175	186	249	343	—
Dried bamboo shoots	94	100	90	100	119	115	158	154	175	171	156	175	200	269	371	433	485	431
Dried jelly fish*	98	92	83	102	127	240	192	87	84	88	155	219	241	242	240	312	374	382
Juda's ear	74	80	91	116	139	169	134	108	109	147	192	254	261	217	206	247	355	559
Salted fish, native	—	104	93	93	108	160	106	107	132	128	131	151	204	234	238	316	440	388
Sweets No. 1 (wheat flour, sugar and bean oil)	99	102	101	96	103	124	118	112	117	123	145	190	198	242	277	284	319	437
Sweets No. 2 (wheat flour, sugar and bean oil)	88	108	99	99	107	133	122	124	126	132	163	177	229	244	251	299	364	421
Sweets No. 3 (Sugar and glutinous rice flour)	100	102	98	100	101	124	117	106	103	118	150	175	188	220	234	250	291	346
Sweets No. 4 (Sesame and flour)	107	103	97	91	101	118	114	103	99	115	142	170	163	220	236	218	219	316
Sweets No. 5 (Wheat flour, sugar and bean oil)	98	103	99	96	104	124	122	117	122	124	140	160	176	212	225	256	294	329
Average	94	101	98	99	108	132	125	116	115	123	145	166	183	211	228	263	310	367

TABLE 3.—(*Continued*)

	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927
Cloth and clothing materials:																		
Fine cotton cloth	91	98	101	111	99	111	111	136	146	193	161	164	206	255	255	283	311	—
Coarse cotton cloth	97	94	108	102	99	100	90	107	131	153	141	137	161	172	207	269	252	—
Shirtings, bleached*	95	103	105	97	101	106	112	121	142	165	171	195	206	231	301	280	331	—
Glazed cotton cloth*	82	103	96	105	114	96	114	104	138	157	196	219	245	272	297	318	427	—
Cotton flannel, white*	90	83	100	114	113	102	95	94	121	132	159	198	196	200	241	307	324	—
Twill*	89	129	98	101	83	116	97	120	111	147	153	189	239	263	242	329	284	—
Striped cloth	92	97	102	94	115	103	105	119	121	153	155	124	159	216	258	220	272	—
Check	97	99	107	100	97	95	117	102	115	137	153	118	124	150	258	300	279	—
T-Cloth*	78	83	87	137	115	138	152	166	137	181	140	195	210	252	236	285	290	—
Main sook*	97	89	108	107	99	112	107	82	108	126	119	200	227	233	236	224	240	—
Sateen*	101	103	110	86	—	—	136	151	141	167	185	194	208	225	274	295	346	—
Poplin*	92	93	101	102	111	124	124	121	123	109	112	109	152	—	—	—	—	—
Cotton venetians*	99	101	109	92	97	109	103	116	137	126	119	129	169	180	199	203	262	—
Hangchow silk	93	98	103	100	106	116	—	157	—	106	129	141	171	181	212	202	255	—
Knitting yarn*	91	113	103	94	99	171	206	152	173	197	192	247	200	255	236	306	354	—
Cotton yarn (counts 16)*	96	105	106	99	94	98	98	118	150	186	170	160	175	206	243	289	285	—
Cotton yarn (counts 14)*	95	106	106	100	93	97	99	114	151	180	172	162	176	208	247	294	284	—
Cotton, raw	93	109	103	96	99	99	95	97	105	99	99	120	135	154	211	212	290	—
Average	93	100	103	102	102	111	115	121	132	151	151	167	187	215	244	272	299	—
Fuel and light:																		
Oil, kerosene, "Brilliant"*	89	85	98	105	122	139	109	105	116	101	108	120	124	186	203	260	317	—
Safety matches, native	103	106	97	83	108	144	181	164	150	147	158	150	167	175	181	222	294	—
Candles, native	93	114	92	94	107	108	114	124	134	129	126	124	141	173	225	271	346	—
Candles, 12 oz.*	89	104	99	99	109	122	138	141	155	141	142	150	152	161	180	213	—	—
Average	94	102	97	95	112	128	136	134	139	130	134	136	146	174	197	242	319	—
Metals:																		
Wire nails*	105	103	104	96	89	190	270	198	186	224	273	219	230	279	223	234	—	—
Brass foot stoves	92	106	103	97	102	115	125	115	112	104	122	123	127	142	159	186	244	—
Average	99	105	104	97	96	153	198	157	149	164	198	171	179	211	191	210	244	—
Miscellaneous:																		
Wood oil	96	109	99	99	97	100	112	118	148	124	129	138	170	237	250	265	303	—
Umbrellas	96	105	103	103	94	99	102	105	106	126	144	—	—	—	—	224	248	—
Soap (Peh Chi)*	101	101	101	96	101	122	123	119	105	124	119	126	138	148	153	188	217	—
Hemp rope	100	104	92	96	104	100	77	65	92	73	69	77	100	135	112	88	108	—
Hemp thread	61	125	107	101	105	104	107	99	95	99	118	129	157	218	216	236	247	—
Gypsum	77	110	121	108	84	85	108	128	138	209	192	179	230	243	268	351	433	—
Cigarettes (Pirates)*	90	97	99	105	110	120	125	124	130	134	130	152	156	169	228	245	256	—
White buttons	95	109	106	95	94	119	145	96	88	84	119	220	225	236	226	224	256	—
Average	90	108	104	100	99	106	112	107	113	122	128	146	168	198	208	228	259	—
General index	95	103	100	99	104	118	119	115	118	128	141	158	182	207	221	259	308	—
Purchasing power of copper currency	105	97	100	101	96	85	84	87	85	78	71	63	55	48	45	39	32	—
General index of imported goods	94	100	101	102	104	131	133	124	132	148	158	176	189	244	233	266	301	—
General index of native gooods	95	104	99	97	104	113	113	111	112	119	133	150	179	203	217	257	311	—

*Imported goods.

†Prices in silver were converted to copper equivalents.

TABLE 4. INDEX NUMBERS OF RICE LAND VALUES IN WUCHIN, KIANGSU, CHINA
(1912-1914=100)

Year	Value per mow* (in silver dollars)	Index numbers
1912	41.78	112
1913	41.67	112
1914	28.57	77
1915	53.13	142
1916	55.56	149
1917	57.14	153
1918	42.05	113
1919	61.29	164
1920	62.50	167
1921	57.78	155
1922	72.34	194
1923	66.67	179
1924	85.29	228
1925	97.73	262
1926	108.33	290
1927	127.27	341
1928	139.34	373

*A *mow* equals 0.18 of an acre.

TABLE 5. YEARLY INCREASE IN PRICES FOR 33 YEARS† EXPRESSED AS A PERCENTAGE OF THE MIDDLE YEAR (1910)

Calculated from Equations of Secular Trends for 1894-1926, Wuchin, Kiangsu, China.

Commodities	Yearly increase (per cent)
Late rice (unhulled)	3.42
White rice (polished)	3.30
Glutinous rice (polished)	3.24
Barley hulless	3.04
Wheat	2.93
Broad beans	2.87
Field peas	2.72
Yellow soybeans	2.32
Cotton seed-soybean oil	2.32

†Field peas and cotton seed-soybean oil are exceptions, the former is for 32 years while the latter is for 22 years only.

TABLE 6. INDEX NUMBERS OF PRICES (IN SILVER AND COPPER CURRENCY) PAID TO PRODUCERS FARM PRODUCTS IN WUCHIN, KIANGSU, CHINA
(Corresponding months 1910-1914=100)

Years	White rice (polished)		Glutinous rice (polished)		Rice (unhulled) late		Wheat		Hulless barley		Yellow soybeans		Field peas		Broad beans		Cotton seed-soybean oil	
	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper
1894	47	—	42	—	52	—	50	—	35	—	46	—	51	—	49	—	—	—
1895	46	—	43	—	55	—	51	—	34	—	48	—	48	—	47	—	—	—
1896	78	—	90	—	91	—	82	—	80	—	85	—	73	—	76	—	—	—
1897	65	—	64	—	71	—	78	—	74	—	77	—	81	—	80	—	—	—
1898	74	—	71	—	81	—	95	—	86	—	80	—	87	—	87	—	—	—
1899	64	—	64	—	70	—	71	—	61	—	77	—	71	—	69	—	—	—
1900	59	—	66	—	61	—	62	—	55	—	68	—	57	—	60	—	—	—
1901	54	—	67	—	78	—	73	—	60	—	79	—	77	—	75	—	—	—
1902	87	—	82	—	100	—	78	—	77	—	94	—	96	—	80	—	—	—
1903	89	—	86	—	100	—	75	—	79	—	85	—	103	—	88	—	—	—
1904	71	—	80	—	70	—	80	—	76	—	84	—	106	—	106	—	—	—
1905	56	41	61	44	61	45	82	59	72	53	75	55	105	77	111	81	85	62
1906	74	62	71	58	76	63	82	68	77	64	79	66	87	71	90	74	80	66
1907	102	84	96	78	99	81	97	80	100	82	96	79	103	85	102	84	99	81
1908	95	88	88	81	90	83	106	98	92	85	92	85	93	86	99	92	93	85
1909	77	77	75	75	76	77	92	93	86	86	85	86	88	88	90	90	78	79
1910	96	98	96	98	94	95	102	103	104	104	105	105	97	99	102	104	103	104
1911	106	105	100	99	106	105	114	113	111	110	107	107	114	113	107	105	102	101
1912	105	106	100	100	100	100	91	91	95	96	91	92	106	108	101	102	99	100
1913	103	100	109	107	103	101	90	88	90	88	93	91	82	81	88	86	96	94
1914	90	91	97	97	97	98	104	105	102	100	105	105	100	101	104	105	100	100
1915	102	109	100	107	104	111	123	131	112	120	97	104	116	125	115	123	82	87
1916	98	103	95	99	100	104	123	128	110	114	99	103	118	121	116	122	109	113
1917	90	88	94	92	96	95	119	117	107	105	105	103	115	113	117	116	123	121
1918	87	86	98	97	96	95	112	110	93	92	100	99	99	98	117	115	125	124
1919	89	89	88	90	102	103	98	99	84	85	97	99	105	107	123	124	102	104
1920	121	127	115	119	136	143	125	130	09	113	114	119	126	132	132	138	112	117
1921	130	146	126	142	151	171	143	161	122	137	115	129	133	151	138	156	82	92
1922	155	200	153	197	175	227	156	201	155	200	133	172	153	201	152	197	114	146
1923	162	222	165	225	188	256	162	221	152	207	132	180	163	225	160	220	126	172
1924	146	212	142	206	153	226	138	200	133	193	126	184	162	239	150	218	136	198
1925	154	273	146	257	197	359	165	290	48	261	147	260	167	296	177	316	138	244
1926	207	423	199	402	245	502	191	389	147	302	148	302	—	—	172	353	—	—

TABLE 7. INDEX NUMBERS OF SEASONAL VARIATION IN QUANTITIES OF FARM PRODUCTS SOLD BY FARMERS IN WUCHIN, KIANGSU, CHINA.‡

WHITE RICE* (polished)

Months	1905–1909	1910–1914	1915–1919	1920–1924
January	181	213	263	260
February	118	187	123	132
March	137	150	156	221
April	153	117	169	181
May	49	83	94	69
June	6	18	6	36
July	72	31	57	33
August	135	61	45	41
September	88	47	60	43
October	64	56	47	51
November	95	98	58	55
December	102	139	122	76

GLUTINOUS RICE* (polished)

Months	1905–1909	1910–1914	1915–1919	1920–1924
January	197	233	282	182
February	153	125	115	117
March	91	123	151	90
April	102	116	105	72
May	56	86	82	113
June	110	63	108	138
July	5	18	24	10
August	96	52	19	57
September	89	40	14	45
October	83	113	64	22
November	109	83	78	250
December	105	142	164	98

RICE (unhulled)† (late crop)

Months	1905–1909	1910–1914	1915–1919	1920–1924
January	73	50	79	35
February	10	8	9	14
March	5	7	34	13
April	9	17	11	14
May	8	6	26	41
June	—	57	—	—
July	6	9	2	—
August	—	—	—	—
September	—	—	—	—
October	86	159	84	92
November	384	425	368	323
December	319	262	287	268

*in shen
†in catties
‡In computing index numbers of seasonal variation, the average monthly sales for the period are taken as 100. If the index number for a certain month is 181, it means that the sales during that month were 81 per cent higher than the average monthly sales.

WHEAT*

Months	1905–1909	1910–1914	1915–1919	1920–1924
January	9	6	14	8
February	1	6	8	8
March	8	5	10	11
April	16	3	8	2
May	4	4	2	2
June	396	466	404	306
July	509	399	536	649
August	142	210	123	81
September	38	39	42	58
October	35	17	20	24
November	27	34	24	37
December	15	11	9	14

BARLEY (hulless)*

Months	1905–1909	1910–1914	1915–1919	1920–1924
January	9	11	19	13
February	4	13	13	33
March	38	57	39	218
April	36	32	23	320
May	155	149	108	102
June	472	521	389	170
July	197	186	215	89
August	110	132	114	78
September	67	43	89	52
October	40	15	73	53
November	37	28	51	57
December	35	13	66	18

YELLOW SOYBEANS*

Months	1905–1909	1910–1914	1915–1919	1920–1924
January	44	42	29	35
February	23	28	12	11
March	22	44	22	52
April	33	37	28	43
May	42	22	17	20
June	8	5	2	5
July	21	4	3	1
August	12	17	21	10
September	602	704	754	598
October	284	219	242	302
November	82	43	36	73
December	28	34	35	49

Broad Beans*

Months	1905–1909	1910–1914	1915–1919	1920–1924
January	21	6	14	—
February	—	2	8	—
March	—	8	5	—
April	—	6	5	—
May	7	28	8	38
June	63	154	68	147
July	151	152	565	191
August	92	238	111	171
September	179	238	111	47
October	361	266	189	158
November	25	78	70	38
December	6	18	41	7

Field Peas*

Months	1905–1909	1910–1914	1915–1919	1920–1924
January	39	82	111	20
February	10	47	6	—
March	18	29	—	30
April	110	6	17	—
May	51	53	—	30
June	165	135	156	120
July	387	76	228	170
August	175	494	156	280
September	113	135	100	290
October	90	35	50	50
November	23	47	61	10
December	23	24	111	40

Cotton Seed-soybean Oil†

Months	1905–1909	1910–1914	1915–1919	1920–1924
January	87	40	28	57
February	17	27	21	28
March	92	66	64	78
April	165	57	37	70
May	65	53	44	94
June	14	13	26	22
July	24	13	34	26
August	31	20	25	57
September	38	27	59	57
October	325	92	596	462
November	174	718	193	178
December	169	74	72	73

Table 8. INDEX NUMBERS OF SEASONAL VARIATION IN PRICES (IN CHINESE DOLLARS) OF SIX FARM PRODUCTS FOR THE YEARS 1910-1914, 1915-1919, AND 1920-1924. WUCHIN, KIANGSU, CHINA*

Months	White rice (polished)			Glutinous rice (polished)			Wheat			Hulless barley			Yellow soybeans			Cotton seed soy-bean oil		
	1910-1914	1915-1919	1920-1924	1910-1914	1915-1919	1920-1924	1910-1914	1915-1919	1920-1924	1910-1914	1915-1919	1920-1924	1910-1914	1915-1919	1920-1924	1910-1914	1915-1919	1920-1924
January	95	95	95	95	97	93	103	104	104	103	105	106	98	96	102	101	90	103
February	98	100	95	98	97	96	105	104	104	103	108	106	100	98	103	100	99	98
March	98	98	93	97	95	93	108	109	105	108	105	102	102	100	102	100	100	103
April	98	98	94	97	95	93	105	104	96	103	105	100	108	102	102	98	98	98
May	100	100	98	100	100	97	95	102	93	87	92	88	110	104	103	96	98	103
June	107	104	101	105	105	105	88	87	93	90	95	92	106	106	108	99	102	99
July	105	104	109	105	102	108	88	89	96	90	92	96	104	108	108	103	100	95
August	107	104	107	105	103	103	93	93	98	95	95	100	96	102	97	102	109	99
September	105	104	109	105	103	110	100	98	102	100	97	104	90	94	90	105	101	92
October	97	96	101	100	100	101	100	98	102	103	100	106	96	96	93	102	101	105
November	92	95	98	94	97	97	103	98	107	103	100	106	88	98	97	98	103	105
December	93	96	100	94	97	99	103	100	107	103	103	104	92	100	102	98	98	103

*The yearly average of each five-year period=100.

TABLE 9. INDEX NUMBERS OF EXCHANGE RATE OF ONE SILVER DOLLAR INTO COPPER CASH IN WUCHIN, KIANGSU, CHNIA (1905-1928)
(Corresponding months 1910-1914=100)

Months	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928
January	—	82	80	87	97	101	100	102	98	99	107	105	97	97	100	104	107	118	132	139	157	195	210	—
February	—	85	80	88	101	101	101	103	95	99	107	107	100	98	102	105	108	118	132	140	161	198	213	—
March	—	85	80	88	100	102	100	102	95	100	108	108	101	100	103	104	111	121	138	143	170	197	221	—
April	71	83	80	88	99	101	99	102	99	98	108	105	98	99	102	104	111	124	139	141	174	199	214	—
May	70	83	81	90	99	101	99	102	99	99	107	106	98	99	101	104	112	128	138	143	178	201	219	—
June	71	85	82	91	100	102	98	102	99	99	106	105	98	98	101	103	111	129	137	144	172	203	216	219
July	71	84	83	92	101	102	99	101	98	101	106	104	98	99	102	104	112	131	137	145	172	203	216	223
August	72	83	83	93	101	101	99	101	97	101	106	104	98	99	102	104	113	135	137	145	177	203	219	223
September	75	83	84	93	101	102	99	99	98	102	106	105	98	100	101	104	114	135	138	142	182	210	221	230
October	75	83	83	94	101	102	98	99	98	102	107	104	98	99	102	104	116	136	138	153	188	212	219	230
November	76	80	84	94	101	102	97	99	98	104	107	98	97	100	101	104	116	136	139	153	191	211	—	224
December	77	77	83	94	100	101	98	101	97	104	105	96	95	98	101	104	116	132	137	150	186	208	—	—
Average	73	83	82	91	100	102	99	101	98	101	107	104	98	99	102	104	112	129	137	145	176	203	217	225

INDEX NUMBERS OF EXCHANGE RATE OF ONE SILVER DIME INTO COPPER CASH IN WUCHIN, KIANGSU, CHINA
(Corresponding months 1910-1914=100)

Months	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928
January	—	86	78	88	101	103	103	101	96	97	103	106	106	98	99	103	106	116	129	134	140	185	201	—
February	—	88	79	91	103	103	103	99	95	99	109	106	98	98	100	104	107	116	129	134	145	181	199	—
March	—	90	80	91	103	103	103	100	95	99	109	108	101	100	101	104	109	120	135	139	144	181	201	—
April	78	88	79	90	103	103	103	98	97	98	109	106	98	100	101	104	110	121	135	137	147	182	200	—
May	78	89	81	91	103	103	103	99	98	98	109	107	99	101	102	105	112	126	135	136	150	184	201	—
June	78	89	81	91	103	103	103	99	98	99	109	105	98	101	100	105	113	128	134	135	149	184	197	204
July	77	86	80	92	102	101	102	100	97	99	108	103	97	100	99	104	112	127	132	126	147	181	199	203
August	77	85	81	93	103	103	100	100	98	100	109	104	99	101	100	106	114	131	134	126	151	185	201	206
September	79	85	81	95	103	103	98	100	98	103	108	105	100	102	103	105	115	132	135	129	156	187	203	211
October	80	85	82	96	103	103	98	98	98	103	108	104	100	100	103	104	116	132	135	132	162	189	205	209
November	81	81	83	97	103	103	98	99	97	103	109	99	98	99	102	104	116	131	136	133	166	197	—	208
December	81	79	85	98	103	103	98	98	97	103	107	97	98	98	101	105	115	130	135	133	171	197	—	—
Average	79	86	81	93	103	103	101	99	97	100	108	104	99	100	101	104	112	126	134	133	152	186	201	207

APPENDIX 1. WEIGHTS* USED IN COMPUTING AGGREGATIVE INDEX NUMBERS OF PRICES PAID TO PRODUCERS OF FARM PRODUCTS IN WUCHIN, KIANGSU, CHINA.

Months	White rice (polished)	Glutinous rice (polished)	Rice (unhulled late	Wheat	Barley (hulless)	Yellow soy beans	Field peas	Broad beans
January	30.0	8.4	38.8	3.5	2.4	16.2	0.6	0.1
February	48.9	8.4	10.9	5.6	5.2	20.2	0.7	0.1
March	32.9	6.9	9.1	4.6	19.3	26.5	0.4	0.3
April	28.8	7.3	23.4	2.8	12.2	25.2	0.1	0.2
May	18.7	4.9	6.9	2.7	51.5	13.7	0.6	1.0
June	0.6	0.5	10.6	60.0	26.7	0.5	0.3	0.8
July	1.6	0.3	2.5	79.2	14.5	0.5	0.2	1.2
August	5.1	1.1	—	67.7	16.9	4.0	2.2	3.0
September	2.1	0.4	—	6.6	2.9	86.1	0.3	1.6
October	3.3	1.7	51.7	4.0	1.4	35.4	0.1	2.4
November	3.5	0.8	84.7	4.7	1.5	4.3	0.1	0.4
December	7.8	2.0	81.2	2.5	1.1	5.2	0.1	0.1

*These are the percentages computed from the quantities appearing in the transactions in the years 1910-14. All units are in *sheng* (升) except unhulled rice and hulless barley which are in *catties* (斤), but in this case, both *sheng* and *catties* are approximately the same.

APPENDIX 2. PRICES (IN SILVER AND COPPER CURRENCY) PAID TO PRODUCERS OF FARM PRODUCTS* IN WUCHIN, KIANGSU, CHINA.

		White rice (polished)		Glutinous rice (polished)		Rice (unhulled) late		Wheat		Hulless barley		Yellow soy-beans		Field peas		Broad beans		Cotton seed-soy-bean oil	
		Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper
1894	January	.026	—	.025	—	.011	—	.021	—	.012	—	—	—	—	—	.017	—	—	—
	February	—	—	.027	—	.011	—	.019	—	—	—	.026	—	—	—	—	—	—	—
	March	.027	—	.027	—	—	—	.020	—	.015	—	.023	—	.017	—	—	—	—	—
	April	—	—	—	—	—	—	.020	—	.012	—	.024	—	.017	—	.016	—	—	—
	May	.028	—	.028	—	—	—	.019	—	—	—	—	—	.018	—	.015	—	—	—
	June	.027	—	—	—	—	—	.017	—	.015	—	.024	—	.019	—	.016	—	—	—
	July	—	—	.027	—	—	—	.017	—	—	—	.023	—	.017	—	.015	—	—	—
	August	—	—	—	—	—	—	.018	—	—	—	—	—	.018	—	—	—	—	—
	September	—	—	—	—	—	—	.019	—	.014	—	—	—	—	—	.016	—	—	—
	October	.029	—	.029	—	—	—	.021	—	.014	—	—	—	.018	—	—	—	—	—
	November	—	—	—	—	.011	—	.022	—	.014	—	—	—	—	—	.015	—	—	—
	December	.027	—	.027	—	.013	—	.023	—	—	—	—	—	.019	—	—	—	—	—
1895	January	.026	—	.026	—	.011	—	.022	—	.014	—	—	—	.016	—	—	—	—	—
	February	.027	—	—	—	—	—	0.21	—	.013	—	—	—	.016	—	.016	—	—	—
	March	—	—	.028	—	—	—	—	—	—	—	—	—	.018	—	—	—	—	—
	April	—	—	.028	—	—	—	.020	—	.012	—	—	—	—	—	.017	—	—	—
	May	.028	—	—	—	—	—	—	—	.013	—	.023	—	.016	—	.015	—	—	—
	June	—	—	—	—	—	—	.017	—	—	—	.022	—	.017	—	—	—	—	—
	July	—	—	—	—	—	—	—	—	—	—	.022	—	.016	—	.014	—	—	—
	August	—	—	.029	—	—	—	.019	—	—	—	—	—	.016	—	—	—	—	—
	September	.026	—	—	—	—	—	—	—	—	—	—	—	.016	—	.014	—	—	—
	October	—	—	—	—	—	—	.022	—	—	—	—	—	—	—	—	—	—	—
	November	.027	—	.027	—	—	—	—	—	—	—	—	—	.018	—	—	—	—	—
	December	.027	—	—	—	.013	—	—	—	—	—	.030	—	—	—	.016	—	—	—

*All units are in *sheng* (升) except unhulled rice, hulless barley and cotton seed-soybean oil which are in *catties* ( )

1896	January	.030	—	.058	—	.024	—	—	—	.038	—	.050	—	.022	—	—	—	—	—
	February	.031	—	—	—	.014	—	—	—	.028	—	.039	—	—	—	—	—	—	—
	March	.036	—	—	—	.015	—	.034	—	.027	—	.040	—	.024	—	—	—	—	—
	April	.037	—	—	—	.015	—	.034	—	.028	—	.045	—	.023	—	—	—	—	—
	May	.038	—	—	—	—	—	.033	—	.027	—	.038	—	.024	—	.023	—	—	—
	June	.049	—	.055	—	—	—	.028	—	.024	—	.034	—	.025	—	—	—	—	—
	July	.060	—	—	—	—	—	.031	—	.028	—	.039	—	.028	—	.024	—	—	—
	August	.064	—	—	—	—	—	.030	—	.027	—	.035	—	.028	—	.027	—	—	—
	September	.055	—	.062	—	.023	—	.034	—	.035	—	.041	—	.028	—	.026	—	—	—
	October	.054	—	.056	—	.022	—	.030	—	.036	—	.046	—	—	—	—	—	—	—
	November	.056	—	.056	—	.022	—	—	—	.038	—	.048	—	—	—	—	—	—	—
	December	.052	—	.060	—	.023	—	—	—	.036	—	.049	—	.030	—	—	—	—	—
1897	January	.040	—	.042	—	.019	—	.037	—	.036	—	.038	—	.029	—	.026	—	—	—
	February	—	—	—	—	—	—	—	—	—	—	—	—	.030	—	—	—	—	—
	March	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.026	—	—	—
	April	—	—	—	—	—	—	—	—	—	—	—	—	.032	—	—	—	—	—
	May	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.027	—	—	—
	June	.037	—	.041	—	—	—	.027	—	.022	—	.033	—	—	—	—	—	—	—
	July	.040	—	—	—	.016	—	.027	—	.027	—	.045	—	.030	—	—	—	—	—
	August	.041	—	.043	—	.015	—	.028	—	.027	—	.040	—	.030	—	.027	—	—	—
	September	.037	—	—	—	.012	—	.028	—	.027	—	.035	—	.029	—	—	—	—	—
	October	.037	—	.039	—	.014	—	—	—	—	—	.035	—	.028	—	.026	—	—	—
	November	.037	—	.038	—	.015	—	.033	—	—	—	.033	—	.030	—	—	—	—	—
	December	.041	—	.042	—	.017	—	.037	—	—	—	.036	—	—	—	—	—	—	—
1898	January	.040	—	.041	—	.018	—	.038	—	.031	—	.042	—	—	—	.025	—	—	—
	February	.042	—	—	—	.019	—	.039	—	—	—	.041	—	—	—	—	—	—	—
	March	.044	—	.043	—	—	—	.040	—	.033	—	.041	—	.034	—	—	—	—	—
	April	.043	—	.047	—	.021	—	.038	—	—	—	.039	—	.033	—	.025	—	—	—
	May	.050	—	.048	—	—	—	.034	—	.031	—	.044	—	.032	—	—	—	—	—
	June	.053	—	.054	—	—	—	.040	—	.033	—	.049	—	.033	—	.032	—	—	—
	July	.060	—	—	—	—	—	.036	—	.032	—	.035	—	.031	—	.030	—	—	—
	August	.048	—	.053	—	—	—	.036	—	.031	—	.036	—	.027	—	.024	—	—	—
	September	.038	—	.047	—	.015	—	.038	—	.033	—	.035	—	.027	—	.033	—	—	—
	October	.036	—	—	—	.016	—	.040	—	—	—	.036	—	.028	—	.032	—	—	—
	November	.039	—	.041	—	.017	—	.038	—	.033	—	.037	—	—	—	—	—	—	—
	December	.041	—	.039	—	.018	—	.039	—	—	—	.041	—	.030	—	—	—	—	—

APPENDIX 2.—(*Continued*)

		White rice (polished)		Glutinous rice (polished)		Rice (unhulled) late		Wheat		Hulless barley		Yellow soy-beans		Field peas		Broad beans		Cotton seed-soybaen oil	
		Silver	Cop-per	Silver	Cop-per	Silver	Cop-per	Silver	Cop-per	Silver	Cop-per	Silver	Cop-per	Silver	Cop-per	Silver	Cop-per	Silver	Cop-pre
1899	January	.039	—	.043	—	.017	—	.030	—	.025	—	.040	—	.028	—	—	—	—	—
	February	.041	—	.041	—	.018	—	.038	—	—	—	.039	—	—	—	.028	—	—	—
	March	.041	—	—	—	.019	—	—	—	—	—	.042	—	—	—	—	—	—	—
	April	.041	—	.042	—	.013	—	—	—	—	—	.042	—	—	—	—	—	—	—
	May	.041	—	.043	—	.016	—	.026	—	.022	—	.044	—	—	—	—	—	—	—
	June	.040	—	.042	—	.012	—	.024	—	.020	—	.044	—	.023	—	.021	—	—	—
	July	.036	—	—	—	.013	—	.022	—	.021	—	.043	—	.025	—	.020	—	—	—
	August	.033	—	.037	—	—	—	.025	—	.023	—	.030	—	.023	—	.020	—	—	—
	September	.035	—	.035	—	.012	—	.026	—	.022	—	.028	—	.025	—	.023	—	—	—
	October	.034	—	—	—	.016	—	.030	—	.021	—	.033	—	.025	—	—	—	—	—
	November	.040	—	.043	—	.017	—	.028	—	.024	—	.037	—	—	—	—	—	—	—
	December	.038	—	.044	—	.017	—	.030	—	.025	—	.037	—	—	—	—	—	—	—
1900	January	.031	—	.042	—	—	—	.020	—	—	—	.031	—	.020	—	.019	—	—	—
	February	.039	—	.043	—	.016	—	.028	—	.025	—	.039	—	.021	—	—	—	—	—
	March	.038	—	—	—	—	—	.032	—	.024	—	.040	—	.022	—	—	—	—	—
	April	.035	—	.044	—	.014	—	.027	—	.020	—	—	—	—	—	.019	—	—	—
	May	.035	—	—	—	.014	—	—	—	.019	—	.037	—	.019	—	—	—	—	—
	June	.037	—	—	—	—	—	.024	—	.020	—	.028	—	.017	—	—	—	—	—
	July	.036	—	.046	—	—	—	.022	—	.018	—	.031	—	.020	—	—	—	—	—
	August	.037	—	—	—	—	—	.022	—	.019	—	.031	—	.018	—	—	—	—	—
	September	.036	—	—	—	—	—	.021	—	.020	—	.026	—	.019	—	.022	—	—	—
	October	.036	—	—	—	.013	—	.024	—	.022	—	.035	—	—	—	.021	—	—	—
	November	.030	—	.037	—	.013	—	.025	—	—	—	.035	—	.022	—	—	—	—	—
	December	.031	—	.036	—	.013	—	.027	—	.022	—	.034	—	—	—	.021	—	—	—

1901	January	.030	—	.040	—	.016	—	.028	—	.022	—	.035	—	.023	—	.024	—	—	—
	February	.034	—	.042	—	.018	—	.030	—	.023	—	.037	—	.024	—	.024	—	—	—
	March	.033	—	.041	—	.019	—	.031	—	.024	—	.039	—	.026	—	.025	—	—	—
	April	.032	—	.041	—	.018	—	.030	—	.023	—	.041	—	.028	—	.024	—	—	—
	May	.032	—	.044	—	.018	—	.030	—	.022	—	.042	—	.029	—	.023	—	—	—
	June	.033	—	.047	—	—	—	—	—	—	—	.041	—	.028	—	—	—	—	—
	July	.032	—	—	—	—	—	—	—	.021	—	.042	—	.029	—	.026	—	—	—
	August	.033	—	—	—	—	—	—	—	—	—	—	—	.027	—	—	—	—	—
	September	.031	—	—	—	—	—	—	—	.023	—	.039	—	.026	—	—	—	—	—
	October	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	November	.031	—	—	—	.018	—	.031	—	.024	—	.041	—	.029	—	—	—	—	—
	December	.033	—	.043	—	.018	—	.029	—	.026	—	—	—	.029	—	.025	—	—	—
1902	January	.049	—	.051	—	.020	—	.030	—	.027	—	.044	—	.030	—	.026	—	—	—
	February	—	—	—	—	—	—	—	—	.028	—	—	—	.031	—	.025	—	—	—
	March	.051	—	.055	—	.022	—	.032	—	—	—	—	—	.033	—	.026	—	—	—
	April	—	—	—	—	—	—	—	—	.028	—	—	—	.035	—	—	—	—	—
	May	.052	—	—	—	—	—	—	—	.027	—	.046	—	.036	—	—	—	—	—
	June	.056	—	—	—	—	—	—	—	—	—	—	—	.035	—	—	—	—	—
	July	—	—	.055	—	—	—	.031	—	.029	—	—	—	.036	—	—	—	—	—
	August	.058	—	.055	—	—	—	.030	—	.030	—	.043	—	.034	—	.027	—	—	—
	September	.057	—	.054	—	.022	—	.030	—	.031	—	.043	—	.033	—	.028	—	—	—
	October	.049	—	.053	—	.022	—	.031	—	.031	—	.046	—	—	—	—	—	—	—
	November	.047	—	.052	—	.021	—	.032	—	.032	—	.046	—	.034	—	—	—	—	—
	December	.048	—	.050	—	.020	—	.031	—	.032	—	.045	—	.034	—	.029	—	—	—
1903	January	.049	—	.056	—	.022	—	.029	—	.032	—	.047	—	.035	—	.029	—	—	—
	February	.051	—	.056	—	.022	—	.029	—	.031	—	—	—	.036	—	.029	—	—	—
	March	.054	—	.061	—	.024	—	.029	—	.033	—	.040	—	.038	—	—	—	—	—
	April	.058	—	—	—	—	—	.030	—	—	—	.043	—	.039	—	.030	—	—	—
	May	.053	—	—	—	—	—	.029	—	.027	—	—	—	.038	—	—	—	—	—
	June	.051	—	.057	—	—	—	.027	—	.027	—	.039	—	.036	—	—	—	—	—
	July	.059	—	.055	—	—	—	.031	—	.029	—	.042	—	.037	—	.028	—	—	—
	August	.056	—	.051	—	—	—	.029	—	.030	—	—	—	.035	—	—	—	—	—
	September	.059	—	—	—	—	—	.029	—	.030	—	—	—	.034	—	.029	—	—	—
	October	.051	—	—	—	.020	—	.032	—	.030	—	—	—	—	—	.030	—	—	—
	November	.049	—	—	—	.021	—	.033	—	.031	—	.047	—	.034	—	.028	—	—	—
	December	.050	—	—	—	.021	—	.030	—	.031	—	.045	—	—	—	.030	—	—	—

APPENDIX 2.—(*Continued*)

		White rice (polished)		Glutinous rice (polished)		Rice (unhulled) late		Wheat		Hulless barley		Yellow soy-beans		Field peas		Broad beans		Cotton seed-soybean oil	
		Silver	Cop-per	Silver	Cop-per	Silver	Cop-per	Silver	Cop-per	Silver	Cop-per	Silver	Cep-per	Silver	Cop-per	Silver	Cop-per	Silver	Cop-per
1904	January	.034	—	.046	—	.014	—	.032	—	.027	—	.038	—	.036	—	.030	—	—	—
	February	.048	—	—	—	—	—	.032	—	.031	—	.042	—	.037	—	—	—	—	—
	March	.047	—	.053	—	—	—	.032	—	.030	—	.043	—	.039	—	.031	—	—	—
	April	.047	—	.054	—	.019	—	.033		.030	—	.049	—	.040	—	—	—	—	—
	May	.043	—	—	—	—	—	.032	—	.027	—	.048	—	.039	—	—	—	—	—
	June	.043	—	.055	—	—	—	.030	—	.029	—	—	—	.037	—	.036	—	—	—
	July	.041	—	—	—	—	—	.028	—	.030	—	.041	—	.039	—	.034	—	—	—
	August	.041	—	.056	—	—	—	.030	—	.028	—	.040	—	.037	—	.039	—	—	—
	September	.045	—	—	—	—	—	—	—	.028	—	—	—	.036	—	—	—	—	—
	October	.041	—	.056	—	.015	—	.031	—	.029	—	.040	—	—	—	—	—	—	—
	November	.040	—	.046	—	.015	—	—	—	.030	—	.038	—	.037	—	—	—	—	—
	December	.036	—	.044	—	.015	—	—	—	.029	—	—	—	—	—	.039	—	—	—
1905	January	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	February	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.085	82
	March	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.084	81
	April	.031	29	.040	37	—	—	.034	31	.029	27	.040	37	—	—	—	—	.086	80
	May	.031	29	.040	37	.014	13	.033	30	.026	24	.040	37	—	—	—	—	.088	81
	June	.032	30	.041	38	—	—	.033	31	.026	24	.040	38	.034	32	.038	36	.091	85
	July	.035	33	.040	38	—	—	.031	29	.027	25	.040	38	.038	36	.038	36	.091	86
	August	.035	34	.042	40	—	—	.029	28	.026	25	.033	32	.038	36	.035	34	.084	80
	September	.035	35	.040	40	—	—	.029	29	.027	27	.033	33	.035	35	—	—	.083	82
	October	.035	35	.041	41	.012	12	.032	32	.028	28	.035	35	.037	37	—	—	.074	74
	November	.034	34	.037	37	.013	13	.033	33	.029	29	.036	36	—	—	—	—	.072	73
	December	.033	34	.034	35	.014	14	.030	31	.028	29	.035	36	.033	34	.034	35	.067	68

1906	January	.029	31	.033	35	.012	13	.030	32	.028	30	.033	35						
	February	.030	33	.033	36	.013	14	.030	32	.027	29	.034	37	—	—	—	—	.065	69
	March	.034	37	.035	38	.015	16	.030	33	.027	30	.037	40	—	—	—	—	.072	78
	April	.035	38	.035	38	.014	15	.033	36	.028	31	.039	42	—	—	—	—	.082	90
	May	.038	42	.040	44	.021	23	.031	34	.026	29	.041	45	—	—	—	—	.078	85
	June	.047	52	.048	54	—	—	.027	30	.027	30	.040	45	—	—	—	—	.070	77
	July	.051	56	.048	53	.021	23	.028	31	.027	30	.039	43	.028	31	.029	32	.072	80
	August	.056	61	.056	61	—	—	.030	33	.029	32	.038	42	.026	29	.028	31	.071	79
	September	.057	63	.056	62	—	—	.035	38	.032	35	.040	44	.028	31	.028	31	.074	81
	October	.053	58	.057	63	.019	21	.040	44	.035	38	.041	45	.030	33	.030	33	.079	87
	November	.051	54	.052	55	.021	22	.040	42	.035	37	.041	44	.032	35	.035	38	.089	98
	December	.053	54	.055	56	.022	23	.037	38	.034	35	.046	47	.032	34	—	—	.088	94
1907	January	.052	54	.053	55	.020	21	.036	37	.037	38	.048	49	.033	34	—	—	.094	96
	February	.058	59	.056	57	.024	24	.039	40	.039	40	.048	49	.035	36	.039	38	.097	100
	March	.064	66	.053	65	.026	27	.044	45	.048	49	.054	56	.036	37	—	—	.095	97
	April	.063	66	.062	65	.025	26	.040	42	.046	48	.053	56	.040	41	—	—	.099	102
	May	.062	66	.061	65	.023	25	.035	37	.035	37	.051	54	.042	44	—	—	.096	101
	June	.064	69	.065	70	.026	28	.036	39	.036	39	.050	54	.034	36	.031	33	.086	92
	July	.068	75	.070	77	—	—	.037	41	.038	42	.050	55	.036	39	.032	35	.087	94
	August	.063	70	.067	74	—	—	.036	40	.036	40	.043	48	.037	41	.036	40	.104	114
	September	.062	69	.065	72	.018	20	.036	40	.034	38	.043	48	.037	41	.034	38	.091	100
	October	.057	63	.061	67	.017	19	.037	41	.035	39	.042	47	.035	39	.032	36	.085	94
	November	.056	62	.059	65	.021	23	.041	45	.037	41	.043	48	.036	40	.033	36	.099	109
	December	.060	67	.060	66	.023	26	.045	50	.039	43	.045	50	.036	40	0.32	35	.104	116
1908	January	.061	68	.060	67	.023	26	.044	49	.040	45	.046	51	.036	40	.034	38	.108	120
	February	—	—	—	—	—	—	—	—	—	—	—	—	.037	41	.030	34	.101	113
	March	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.102	114
	April	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.095	109
	May	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.089	102
	June	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.090	107
	July	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	.078	94
	August	.060	74	.061	76	—	—	.040	49	.033	41	.037	46	—	—	—	—	.085	104
	September	.060	74	.061	75	—	—	.042	52	.035	43	.043	53	.032	40	.032	39	.088	109
	October	.059	73	.060	75	.019	24	.044	55	.037	46	.045	56	.034	42	.034	42	.094	116
	November	.051	64	.051	64	.017	21	.043	54	.037	46	.044	55	.034	42	.039	49	.100	124
	December	.044	56	.045	57	.017	22	.040	50	.035	44	.041	52	.032	40	.035	44	.084	105
														.032	40	—	—	.075	94

APPENDIX 2.—(*Continued*)

		White rice (polished)		Glutinous rice (polished)		Rice (unhulled) late		Wheat		Hulless barley		Yellow soy beans		Field peas		Broad beans		Cotton seed-soybean oil	
		Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper
1909	January	.045	56	.045	56	.018	22	.041	51	.034	43	.042	52	.034	42	.034	42	.074	93
	February	.043	55	.044	56	.017	22	.033	42	.034	43	.040	51	.031	40	—	—	.076	98
	March	.039	50	.042	54	.015	20	.038	49	.031	40	.039	50	.031	40	—	—	.067	87
	April	.039	50	.042	54	.015	19	.039	51	.032	41	.039	51	.033	43	—	—	.067	87
	May	.041	53	.043	56	—	—	.037	49	.030	39	.040	52	.032	42	.031	40	.067	88
	June	.046	61	.050	66	—	—	.035	46	.033	43	.044	58	.030	39	.030	40	.071	93
	July	.050	67	.051	68	—	—	.033	44	.031	42	.044	59	.030	40	.028	38	.075	100
	August	.052	70	.054	72	—	—	.034	46	.033	44	.043	57	.030	40	.028	38	.082	110
	September	.052	69	.055	74	.016	22	.038	51	.034	45	.044	59	.031	42	.029	39	.084	112
	October	.049	66	.052	70	.016	22	.038	51	.034	45	.047	63	.031	42	.029	39	.087	117
	November	.048	64	.052	69	.017	23	.036	48	.035	46	.041	55	.030	40	.030	40	.081	108
	December	.049	65	.052	69	.019	25	.036	48	.034	46	.041	55	.031	41	.029	39	.083	111
1910	January	.052	68	.057	75	.021	27	.038	49	.037	48	.048	62	.031	40	.031	40	.081	106
	February	.053	68	.59	76	.019	25	.038	49	.039	50	.048	62	.031	40	.031	40	.083	107
	March	.054	71	.060	79	.020	27	.039	52	.039	51	.052	69	.032	42	.032	42	.091	120
	April	.056	74	.063	83	.024	32	.038	50	.038	50	.057	76	—	—	.034	45	.094	125
	May	.059	78	.064	85	.025	33	.040	53	.037	49	.059	78	.030	40	—	—	.098	130
	June	.060	81	.066	88	.024	32	.035	47	.036	48	.055	74	.031	42	.032	43	.102	137
	July	.062	83	.066	89	.024	32	.037	50	.037	50	.053	71	.033	44	.033	45	.106	142
	August	.064	86	.067	90	—	—	.040	53	.040	53	.050	67	.035	47	.034	46	.101	135
	September	.064	86	.065	88	—	—	.041	55	.040	54	.044	60	.034	46	.035	47	.111	150
	October	.054	73	.061	83	.018	24	.044	59	.043	58	.057	63	.037	50	.038	51	.110	149
	November	.053	72	.057	77	.021	28	.045	61	.045	61	.048	65	.039	53	.039	53	.110	148
	December	.059	79	.060	81	.023	31	.046	62	.045	60	.051	68	.037	50	—	—	.112	150

		White rice (polished)		Glutinous rice (polished)		Rice (unhulled) late		Wheat		Hulless barley		Yellow soy beans		Field peas		Broad beans		Cotton seed-soybean oil	
		Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper
1911	January	.061	79	.063	82	.025	32	.048	62	.045	58	.056	72	.044	57	—	—	.115	149
	February	.062	80	.063	82	.025	33	.053	69	.046	59	.055	71	.043	55	—	—	.119	154
	March	.062	80	.065	85	—	—	.055	72	.050	65	.056	73	.046	60	—	—	.111	144
	April	.064	83	.065	85	.028	36	.056	73	.046	60	.061	79	.046	60	—	—	.103	134
	May	.065	85	.066	86	—	—	.048	62	.043	56	.063	82	—	—	.031	40	.091	119
	June	.066	86	.070	91	—	—	0.38	50	.038	50	.061	79	.031	40	.030	39	.087	113
	July	.069	90	—	—	.031	40	.039	51	.039	51	.056	73	.037	48	.038	49	.089	116
	August	.070	91	.068	89	—	—	.040	53	.040	53	.050	65	.042	55	.039	51	.091	119
	September	.071	93	.073	95	—	—	.044	57	.044	57	.048	62	.044	57	.039	51	.094	123
	October	.067	87	.070	91	.023	30	.045	59	.046	60	.051	67	.043	56	.041	53	.102	133
	November	.051	65	.054	69	.019	24	.039	50	.039	50	.041	53	.036	46	.031	40	.092	118
	December	.050	65	.050	66	.021	27	.036	47	.037	48	.043	57	—	—	—	—	.096	126
1912	January	.051	67	.052	68	.021	27	.036	47	.038	50	.044	58	.043	56	—	—	.109	143
	February	.050	66	.053	69	.019	25	.034	45	.034	45	.044	58	—	—	—	—	.088	116
	March	.058	76	.059	78	.022	29	.038	50	.039	51	.048	63	—	—	.038	50	.100	132
	April	.063	84	.061	82	.028	37	.036	48	.038	51	.051	68	—	—	.034	46	.093	125
	May	.067	90	.068	91	—	—	.033	44	.033	44	.052	70	—	—	.031	42	.089	119
	June	.076	102	.075	101	—	—	.039	52	.040	54	.050	67	—	—	.035	47	.099	133
	July	.074	99	.076	101	—	—	.034	45	.036	48	.053	71	.037	50	.034	46	.109	146
	August	.072	97	.074	99	—	—	.035	47	.036	48	.040	53	.036	48	.034	45	.101	135
	September	.065	85	.068	89	.019	25	.037	49	.038	50	.040	53	.039	51	.034	44	.096	126
	October	.057	75	.062	81	.020	26	.033	43	.032	42	.039	51	.034	45	.031	41	.090	118
	November	.059	78	.062	81	.024	31	.036	48	.037	49	.040	53	—	—	.032	42	.091	120
	December	.060	81	.064	86	.023	31	.038	51	.036	48	.042	56	.041	55	.031	42	.090	121
1913	January	.066	83	.070	88	.024	30	.041	52	.040	50	.044	56	—	—	.032	40	.083	105
	February	.070	85	.074	90	.027	33	.043	52	.040	49	.048	58	—	—	.032	39	.096	117
	March	.068	84	.072	88	.024	29	.042	52	.042	52	.048	59	—	—	.033	40	.088	108
	April	.063	82	.070	91	.022	29	.039	51	.038	49	.046	60	—	—	.029	37	.088	114
	May	.062	80	.070	91	—	—	.031	40	.030	39	.045	58	.031	40	.028	36	.090	117
	June	.067	74	.070	92	—	—	.031	41	.029	38	.042	55	.028	37	.027	35	.088	115
	July	.057	74	—	—	—	—	.028	36	.026	34	.043	55	.026	33	.026	33	.089	115
	August	.057	73	.070	90	.023	30	.029	37	.029	38	.043	56	.026	33	.026	33	.098	126
	September	.059	76	.075	97	.020	26	.033	43	.032	42	.045	59	.028	36	.026	34	.102	132
	October	.055	71	.068	89	.020	26	.035	46	.035	45	.046	60	.026	34	.028	36	.102	133
	November	.057	74	.066	86	.022	29	.038	49	.036	46	.048	62	.027	35	.029	37	.099	128
	December	.058	75	.068	88	.022	29	.039	50	.039	50	.050	65	.030	39	.033	43	.098	127

APPENDIX 2.—(*Continued*)

		White rice (polished)		Glutinous rice (polished)		Rice (unhulled) late		Wheat		Hulless barley		Yellow soybeans		Field peas		Broad beans		Cotton seed-soybean oil	
		Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper
1914	January	.057	73	.067	86	.021	27	.040	51	.039	50	.053	68	.038	48	.033	42	.100	128
	February	.058	73	.069	87	.023	29	.043	54	.040	51	.055	70	.033	42	.032	40	.101	128
	March	.053	69	.059	76	.023	30	.040	52	.038	49	.052	67	.031	40	.028	36	.096	125
	April	.050	65	.057	73	—	—	.040	51	.039	50	.054	70	—	—	.031	40	.095	123
	May	.049	64	.058	75	—	—	.038	50	.028	36	.054	70	—	—	.028	37	.097	126
	June	.050	65	.061	80	—	—	.034	45	.031	41	.055	72	.031	40	.028	37	.102	134
	July	.051	68	.063	83	—	—	.039	52	.035	46	.056	74	.032	42	.032	42	.107	142
	August	.057	76	.063	84	—	—	.041	55	.038	51	.056	75	.037	49	.036	48	.104	139
	September	.055	75	.058	79	.020	27	.043	58	.041	55	.049	66	.039	53	.038	52	.106	143
	October	.055	75	.063	85	.018	25	.044	60	.043	59	.049	66	.042	57	.043	58	.090	122
	November	.055	76	.065	89	.020	27	.046	63	.043	59	.044	60	—	—	.043	59	.084	116
	December	.055	76	.065	90	.020	27	.047	65	.043	60	.044	61	—	—	.041	57	.080	110
Five-years average, 1910-1914																			
	January	.057	74	.062	80	—	—	.041	52	.040	51	.049	63	—	—	—	—	.098	126
	February	.059	74	.064	81	—	—	.042	54	.040	51	.050	64	—	—	—	—	.097	124
	March	.059	76	.063	81	—	—	.043	56	.042	54	.051	66	—	—	—	—	.097	126
	April	.059	78	.063	83	—	—	.042	55	.040	52	.054	71	—	—	—	—	.095	124
	May	.060	79	.065	86	—	—	.038	50	.034	45	.055	72	—	—	—	—	.093	122
	June	.064	82	.068	90	—	—	.035	47	.035	46	.053	69	—	—	—	—	.096	126
	July	.063	83	.068*	91*	—	—	.035	47	.035	46	.052	69	—	—	—	—	.100	132
	August	.064	85	.068	90	—	—	.037	49	.037	49	.048	63	—	—	—	—	.099	131
	September	.063	83	.068	90	—	—	.040	52	.039	52	.045	60	—	—	—	—	.102	135
	October	.058	76	.065	86	—	—	.040	53	.040	53	.048	61	—	—	—	—	.099	131
	November	.055	73	.061	80	—	—	.041	54	.040	53	.044	59	—	—	—	—	.095	126
	December	.056	75	.061	82	—	—	.041	55	.040	53	.046	61	—	—	—	—	.095	127

*Three years only.

1915	January	.055	76	.063	87	.022	30	.049	67	.044	61	.043	59	—	—	.033	45	.080	110
	February	.056	77	.063	86	.022	30	.051	70	.049	67	.045	62	.044	60	—	—	.080	110
	March	.057	80	.061	85	.027	38	.055	77	.046	64	.049	69	.043	60	—	—	.084	117
	April	.055	78	.059	83	.023	33	.049	69	.046	65	.047	67	.042	60	—	—	.080	113
	May	.058	81	.062	87	—	—	.050	70	.035	49	.049	68	—	—	.028	40	.079	111
	June	.064	90	.070	98	—	—	.041	58	.039	55	.050	70	—	—	.037	52	.078	109
	July	.066	93	.064	90	—	—	.043	60	.039	55	.049	68	.042	59	.037	52	.078	109
	August	.068	96	.070	98	—	—	.048	67	.041	58	.054	76	.043	61	.040	56	.074	104
	September	.069	97	.067	94	.026	36	.050	70	.043	60	.050	70	.043	60	.041	57	.071	99
	October	.061	86	.067	94	.018	26	.048	68	.045	64	.047	67	.042	60	.043	61	.077	109
	November	.060	85	.066	93	.022	31	.048	68	.045	64	.046	65	—	—	.044	63	.083	118
	December	.061	85	.066	92	.022	31	.050	70	.046	64	.047	66	—	—	.043	60	.090	126
1916	January	.059	80	.063	86	.023	31	.053	72	.046	62	.049	67	—	—	.041	56	.093	126
	February	.059	80	.063	85	.023	31	.052	71	.051	70	.049	67	—	—	.040	55	.092	125
	March	.058	81	.061	86	.024	34	.051	71	.044	62	.046	65	—	—	.043	60	.099	139
	April	.059	82	.062	86	.023	32	.048	66	.046	64	.049	68	—	—	.036	50	.101	139
	May	.060	84	.063	87	.024	34	.047	65	.035	48	.050	70	—	—	.036	50	.105	146
	June	.060	83	.061	85	—	—	.041	57	.038	52	.051	70	.040	56	.036	50	.107	148
	July	.063	87	.061	84	—	—	.046	64	.039	54	.050	69	.040	55	.038	52	.110	152
	August	.061	84	.062	85	—	—	.046	64	.039	54	.048	66	.040	55	.037	51	.111	153
	September	.060	83	.064	89	.023	32	.048	67	.040	56	.046	64	.039	54	.037	51	.115	159
	October	.057	78	.062	85	.019	26	.051	70	.041	57	.047	65	.041	57	.039	54	.113	157
	November	.055	71	.061	79	.020	26	.052	67	.043	56	.049	64	.042	54	.039	51	.118	153
	December	.053	68	.057	73	.021	27	.051	65	.044	56	.050	64	.042	53	.038	48	.106	135
1917	January	.053	66	.056	70	.022	27	.050	62	.041	51	.050	62	.040	50	.036	45	.102	127
	February	.053	68	.055	70	.021	27	.049	63	.041	52	.049	63	—	—	.035	45	.113	144
	March	.051	67	.054	71	.021	28	.048	63	.038	50	.049	64	—	—	.038	50	.119	156
	April	.054	70	.057	74	.023	30	.053	68	.040	51	.052	67	.039	50	.033	43	.117	151
	May	.056	73	.066	85	.024	31	.053	69	.046	59	.055	71	.042	54	—	—	.115	149
	June	.061	79	.073	94	—	—	.044	57	.043	56	.059	76	.045	58	.040	52	.129	166
	July	.058	75	.066	86	—	—	.039	51	.039	51	.063	81	.040	52	.036	46	—	—
	August	.055	71	.064	83	.025	33	.043	56	.041	53	.061	79	.037	48	.042	55	.147	191
	September	.054	70	.065	84	.020	26	.046	60	.041	53	.045	59	.036	47	—	—	.126	164
	October	.050	65	.062	81	.019	25	.047	61	.040	52	.046	60	.042	54	.046	60	.117	152
	November	.048	61	.056	72	.020	25	.047	60	.040	51	.047	60	.041	53	—	—	.117	150
	December	.050	63	.058	74	.020	25	.046	59	.039	50	.046	58	—	—	—	—	.108	137

APPENDIX 2.—(*Continued*)

	White rice (polished)		Glutinous rice (polished)		Rice (unhulled) late		Wheat		Hulless barley		Yellow soybeans		Field peas		Broad beans		Cotton Seed-soybean oil	
	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper
1918 January	.050	63	.058	73	.020	25	.048	60	.040	50	.046	58	—	—	—	—	—	—
February	.052	65	.062	77	.025	31	.051	64	.040	50	.049	61	—	—	—	—	.129	161
March	.056	72	.063	81	.022	29	.057	74	.044	57	.053	68	—	—	—	—	.126	163
April	.058	75	.065	85	.025	32	.052	67	.043	56	.056	73	—	—	—	—	.124	161
May	.058	75	.067	87	.023	30	.052	68	.038	49	.058	75	—	—	—	—	.125	163
June	.057	74	.068	89	—	—	.037	48	.034	44	.055	71	—	—	.044	57	.122	159
July	.051	67	.069	90	—	—	.038	49	.031	41	.055	72	—	—	.042	55	.126	165
August	.050	65	.065	86	.024	31	.039	51	.031	41	.042	55	.033	43	.034	44	.124	163
September	.050	66	.066	87	.017	23	.040	53	.032	42	.042	55	.038	50	.033	43	.114	150
October	.047	62	.062	82	.019	25	.040	52	.032	42	.045	59	—	—	—	—	.110	145
November	.046	61	.058	76	.020	26	.038	50	.031	41	.045	60	—	—	.040	53	.110	145
December	.049	64	.058	76	.020	26	.039	51	.032	42	.048	62	—	—	.040	52	.104	135
1919 January	.050	65	.059	76	.020	26	.039	50	.033	42	.048	62	—	—	—	—	.101	130
February	.061	67	.058	76	.024	31	.038	50	.031	41	.047	62	—	—	—	—	.100	131
March	.053	70	.058	77	.025	33	.038	51	.032	43	.047	63	.037	49	—	—	.094	125
April	.048	64	.052	69	.023	30	.036	48	.029	39	.046	61	.029	39	.041	55	.088	117
May	.046	61	.052	69	.019	25	.035	47	.025	33	.045	60	.033	44	.038	50	.087	116
June	.046	61	.054	72	—	—	.035	47	.029	39	.045	60	.038	50	.038	50	.093	124
July	.054	72	.057	77	.022	30	.038	51	.031	41	.046	61	.038	51	.033	44	.100	134
August	.055	74	.058	78	.021	28	.039	52	.032	43	.043	58	.037	50	.037	50	.107	144
September	.055	74	.060	80	.025	33	.040	53	.034	46	.046	62	.038	51	.040	53	.098	131
October	.055	74	.056	76	.024	32	.041	55	.037	50	.050	68	.038	51	.046	63	.110	149
November	.057	77	.060	80	.025	33	.041	55	.037	49	.054	73	.039	52	.051	69	.109	146
December	.058	78	.060	80	.025	34	.042	56	.037	50	.055	74	.039	52	—	—	.104	139

	White rice (polished)		Glutinous rice (polished)		Rice (unhulled) late		Wheat		Hulless barley		Yellow soybeans		Field peas		Broad beans		Cotton Seed-soybean oil	
	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper
Five-years average, 1915-1919																		
January	.053	70	.060	78	—	—	.048	62	.041	53	.047	62	—	—	—	—	.094†	123
February	.056	71	.060	79	—	—	.048	64	.042	56	.048	63	—	—	—	—	.103	134
March	.055	74	.059	80	—	—	.050	67	.041	55	.049	66	—	—	—	—	.104	140
April	.055	74	.059	79	—	—	.048	64	.041	55	.050	67	—	—	—	—	.102	136
May	.056	75	.062	83	—	—	.047	64	.036	48	.051	69	—	—	—	—	.102	137
June	.058	77	.065	88	—	—	.040	53	.037	49	.052	69	—	—	—	—	.106	141
July	.058	79	.063	85	—	—	.041	55	.036	48	.053	70	—	—	—	—	.104†	140
August	.058	78	.064	86	—	—	.043	58	.037	50	.050	67	—	—	—	—	.113	151
September	.058	78	.064	87	—	—	.045	61	.038	51	.046	62	—	—	—	—	.105	141
October	.054	73	.062	84	—	—	.045	61	.039	53	.047	64	—	—	—	—	.105	142
November	.053	71	.060	80	—	—	.045	60	.039	52	.048	64	—	—	—	—	.107	142
December	.054	72	.060	79	—	—	.046	60	.040	52	.049	65	—	—	—	—	.102	134
1920 January	.060	81	.060	81	.028	38	.048	64	.040	53	.057	76	—	—	—	—	.122	163
February	.062	83	.063	85	.028	38	.051	69	.049	65	.058	78	—	—	—	—	—	—
March	.065	88	.067	90	.027	37	.052	70	.044	59	.059	80	.044	60	—	—	.119	161
April	.067	91	.068	92	.030	41	.046	62	.040	54	.060	82	.041	56	—	—	.124	169
May	.070	95	.073	99	.032	43	.039	53	.037	50	.062	84	.046	62	.042	57	.124	169
June	.074	101	.080	109	—	—	.047	64	.039	53	.066	90	.048	65	.044	60	.117	159
July	.084	116	.080	110	—	—	.046	63	.041	57	.065	90	.044	60	.044	60	.107	147
August	.083	115	.076	105	—	—	.046	64	.040	55	.049	68	.043	59	.038	53	.103	142
September	.087	120	.090	124	.030	42	.049	68	.042	58	.045	62	.043	60	.043	60	.097	134
October	.071	98	.080	110	.029	40	.053	73	.043	60	.047	65	.043	60	.042	58	.100	138
November	.070	97	.076	105	.033	45	.058	80	.044	61	.054	74	.044	61	.053	73	.095	131
December	.076	105	.079	109	.035	48	.059	81	.043	60	.056	77	.045	62	—	—	.091	126

†Four years only.

APPENDIX 2.—(*Continued*)

		White rice (polished)		Glutinous rice (polished)		Rice (unhulled) late		Wheat		Hulless barley		Yellow soybeans		Field peas		Broad beans		Cotton seed-soybean oil	
		Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper
1921	January	.075	103	.077	106	.031	43	.057	79	.049	68	.057	78	.044	61	.045	62	.089	123
	February	.067	93	.071	98	.037	51	.055	76	.041	57	.056	78	.038	53	—	—	.081	112
	March	.060	87	.065	94	.028	41	.059	85	.040	58	.051	74	—	—	—	—	.080	115
	April	.066	95	.070	101	.034	49	.054	79	.039	56	.054	78	—	—	—	—	.077	112
	May	.076	111	.078	115	.031	45	.055	80	.039	57	.055	81	.044	65	.041	60	.072	106
	June	.084	123	.091	133	—	—	.050	73	.042	62	.062	80	.037	55	.039	58	.070	103
	July	.084	125	.086	128	—	—	.053	78	.045	66	.054	80	.047	70	.043	64	.071	105
	August	.082	122	.086	128	.039	59	.054	80	.049	73	.053	79	.048	72	.042	63	.078	117
	September	.086	130	.095	143	.032	48	.064	96	.054	81	.056	84	.050	75	.048	72	.074	112
	October	.084	129	.091	140	.033	51	.058	89	.053	82	.060	93	.049	75	.050	77	.080	123
	November	.081	125	.084	130	.036	55	.060	93	.054	84	.060	93	.056	86	.052	80	.089	137
	December	.084	129	.087	134	.036	56	.060	93	.057	88	.061	94	—	—	.052	80	.090	139
1922	January	.085	129	.087	133	.037	57	.060	91	.060	91	.063	96	.050	76	.053	80	.097	148
	February	.087	132	.092	139	.038	57	.061	92	.066	100	.067	101	—	—	.050	75	.094	142
	March	.089	139	.094	147	.044	69	.067	105	.069	108	.071	111	—	—	—	—	.112	175
	April	.092	149	.093	152	.045	73	.062	102	.061	100	.071	116	—	—	.043	70	.113	184
	May	.092	155	.100	167	—	—	.051	85	.053	89	.070	118	—	—	.048	80	.113	190
	June	.094	161	.107	182	—	—	.056	96	.052	89	.072	122	.051	87	.046	78	.114	194
	July	.102	176	.107	185	.043	74	.061	105	.056	97	.073	127	.052	90	.048	83	—	—
	August	.100	179	.108	193	.038	68	.062	111	.058	104	.068	122	.055	98	.050	90	—	—

	September	.098	175	.115	206	.040	72	.062	111	.060	107	.060	108	.044	78	.048	86	.107	192
	October	.093	168	.096	173	.033	59	.064	116	.060	109	.055	100	.061	110	.055	99	.120	216
	November	.087	156	.093	168	.038	68	.066	119	.061	110	.059	107	.056	100	.055	99	.116	209
	December	.090	159	.097	172	.040	71	.067	118	.059	105	.061	107	.057	100	.057	100	.114	201
1923	January	.094	161	.101	173	.044	75	.072	122	.063	108	.064	109	.047	80	.046	78	.115	196
	February	.097	163	.109	183	.046	77	.074	124	.067	112	.068	114	—	—	—	—	.118	198
	March	.094	167	.103	183	.044	78	.071	126	—	—	.066	117	—	—	—	—	.118	210
	April	.092	167	.101	183	.045	82	.062	112	.061	111	.063	114	—	—	.051	92	.115	209
	May	.094	170	.100	182	—	—	.068	124	.052	95	.069	126	—	—	.042	77	.119	216
	June	.093	169	.113	204	—	—	.060	108	.056	102	.067	121	—	—	.052	95	—	—
	July	.105	190	.122	220	.045	81	.060	109	.056	101	.067	121	.054	98	.053	96	.113	205
	August	.099	180	.109	198	—	—	.060	108	.056	101	.061	110	.052	94	.055	100	.115	209
	September	.099	182	.107	195	—	—	.063	115	.055	100	.061	112	.060	110	.060	110	.123	225
	October	.096	176	.108	198	.037	68	.062	114	.057	104	.064	117	.082	150	061	112	.133	244
	November	.096	177	.101	185	.040	74	.062	114	.060	110	.065	119	.053	98	.054	100	.141	259
	December	.097	177	.104	190	.042	76	.056	102	.052	96	.065	119	—	—	—	—	.141	258
1924	January	.093	168	.101	182	.039	71	.056	100	.058	105	.067	120	.054	97	—	—	.137	246
	February	.091	163	.101	180	.031	55	.053	95	.046	83	.067	121	—	—	.050	90	.135	242
	March	.086	159	.095	175	—	—	.053	98	.056	103	.063	117	—	—	—	—	.129	239
	April	.084	156	.091	169	—	—	.050	92	.055	102	.062	115	—	—	—	—	—	—
	May	.083	155	.090	168	—	—	.053	100	.043	81	.057	106	—	—	.048	90	.133	250
	June	.084	161	.091	174	—	—	.050	95	.046	87	.063	120	—	—	.052	100	.130	248
	July	.089	170	.093	178	—	—	.054	103	.047	90	.070	134	.061	118	.052	99	.126	242
	August	.090	172	.093	179	.035	67	.058	112	.051	97	.063	120	.056	108	.051	97	.134	257
	September	.094	176	.092	173	.027	50	.052	97	.052	97	.054	102	.053	100	.052	97	—	—
	October	.087	176	.086	174	.031	63	.054	110	.056	113	.057	116	.059	120	.054	110	.138	279
	November	.082	165	.087	175	.032	65	.057	116	.051	104	.059	119	.059	120	.045	90	.131	265
	December	.080	160	.083	166	.037	75	.063	126	.052	105	.066	133	.060	120	.041	82	.122	245

APPENDIX 2.—(*Continued*)

	White rice (polished)		Glutinous rice (polished)		Rice (unhulled) late		Wheat		Hulless barley		Yellow soybeans		Field peas		Broad beans		Cotton seed-soybean oil	
	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper
Five-years average, 1920-1924																		
January	.081	128	.085	135	—	—	.059	91	.054	85	.062	96	—	—	—	—	.112	175
February	.081	127	.087	137	—	—	.059	91	.054	83	.063	98	—	—	—	—	.107†	174†
March	.079	128	.085	138	—	—	.060	97	.052†	82†	.062	100	—	—	—	—	.112	180
April	.080	132	.085	139	—	—	.055	89	.051	85	.062	101	—	—	—	—	.107†	169†
May	.083	137	.088	146	—	—	.053	88	.045	74	.063	103	—	—	—	—	.112	186
June	.086	143	.096	160	—	—	.053	87	.047	79	.066	107	—	—	—	—	.108†	176†
July	.093	155	.098	164	—	—	.055	92	.049	82	.066	110	—	—	—	—	.104†	175†
August	.091	154	.094	161	—	—	.056	95	.051	86	.059	100	—	—	—	—	.108†	181†
September	.093	157	.100	168	—	—	.058	97	.053	89	.055	94	—	—	—	—	.100†	166†
October	.086	149	.092	159	—	—	.058	100	.054	94	.057	98	—	—	—	—	.114	200
November	.083	144	.088	153	—	—	.061	104	.054	94	.059	102	—	—	—	—	.114	200
December	.085	146	.090	154	—	—	.061	104	.053	91	.062	106	—	—	—	—	.112	194
1925 January	.075	151	.078	158	.034	68	.059	119	.053	107	.070	141	.045	91	—	—	.118	238
February	.073	150	.075	153	—	—	.060	123	.053	109	.068	139	.051	104	.054	110	—	—
March	.071	156	.075	164	—	—	.065	142	.061	135	.064	140	—	—	—	—	.126	277
April	.076	174	.076	173	—	—	.059	135	.055	125	.063	144	—	—	—	—	.126	288
May	.088	206	.093	217	—	—	.058	135	.048	113	.077	181	.059	138	—	—	.127	297
June	.094	213	.099	225	—	—	.061	138	.051	115	.079	180	.053	120	.044	100	.132	300
July	.106	240	.106	240	—	—	.065	148	.059	133	.079	180	.063	143	.066	150	.133	302
August	.098	230	.103	240	—	—	.068	160	.057	133	.068	158	.064	150	.059	137	.143	334
September	.102	245	.101	243	.041	99	.065	155	.056	135	.073	175	.061	147	.059	142	.133	319
October	.104	258	.107	267	.038	94	.066	164	.060	150	.074	185	.057	141	.061	152	.140	348
November	.103	262	.104	263	.044	111	.075	189	.066	168	.078	198	.063	160	.063	160	.146	370
December	.112	278	.112	279	.049	122	.080	198	.063	156	.075	186	.058	144	.071	177	.147	365
1926 January	.103	260	.109	275	.053	133	.072	180	—	—	.079	200	—	—	.058	146	.133	335
February	.103	260	.111	280	.052	131	—	—	—	—	.076	193	—	—	—	—	.130	328
March	.114	290	.122	310	—	—	—	—	—	—	.079	200	—	—	—	—	.130	331
April	.122	318	.123	320	—	—	—	—	.064	167	.077	201	—	—	—	—	.129	336
May	.121	320	—	—	.060	159	.076	200	.047	125	—	—	—	—	—	—	—	—
June	.117	314	—	—	—	—	.069	185	.051	137	.077	207	—	—	.054	145	.128	344
July	.132	354	—	—	—	—	.071	190	.050	134	.060	161	—	—	.053	142	.130	348
August	.132	355	—	—	—	—	.071	190	.053	142	.065	174	—	—	.061	165	.130	349
September	.133	370	—	—	—	—	.072	200	.057	158	.065	180	—	—	—	—	.130	360
October	.135	380	—	—	.049	138	.075	210	.062	175	.077	216	—	—	.057	160	—	—
November	.138	387	.138	385	.056	157	.078	217	.058	162	.069	193	—	—	.061	170	—	—
December	.130	360	.140	387	.055	152	—	—	.057	158	.072	200	—	—	—	—	—	—
Yearly averages:																		
1894	.027	—	.027	—	.012	—	.020	—	.014	—	.024	—	.018	—	.016	—	—	—
1895	.027	—	.028	—	.012	—	.020	—	.013	—	.024	—	.017	—	.015	—	—	—
1896	.047	—	.058	—	.020	—	.032	—	.031	—	.042	—	.026	—	.025	—	—	—
1897	.039	—	.041	—	.015	—	.031	—	.028	—	.037	—	.030	—	.026	—	—	—
1898	.045	—	.046	—	.018	—	.038	—	.032	—	.040	—	.031	—	.029	—	—	—
1899	.038	—	.041	—	.016	—	.028	—	.023	—	.038	—	.025	—	.022	—	—	—
1900	.035	—	.041	—	.014	—	.025	—	.021	—	.033	—	.020	—	.020	—	—	—
1901	.032	—	.043	—	.018	—	.030	—	.023	—	.040	—	.027	—	.024	—	—	—
1902	.052	—	.053	—	.021	—	.031	—	.030	—	.045	—	.034	—	.027	—	—	—
1903	.053	—	.056	—	.022	—	.030	—	.030	—	.043	—	.036	—	.029	—	—	—
1904	.042	—	.051	—	.016	—	.031	—	.029	—	.042	—	.038	—	.035	—	—	—
1905	.033	33	.039	38	.013	13	.032	30	.027	26	.037	36	.036	35	.036	35	.082	79
1906	.045	48	.046	50	.018	19	.033	35	.030	32	.039	42	.030	32	.030	33	.078	85

†Four years only.

APPENDIX 2.—(*Continued*)

	White rice (polished)		Glutinous rice (polished)		Rice (unhulled) late		Wheat		Hulless barley		Yellow soybeans		Field peas		Broad beans		Cotton seed-soybean oil	
	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper	Silver	Copper
1907	.061	66	.061	67	.022	24	.039	41	.038	41	.048	51	.037	40	.034	37	.096	103
1908	.056	68	.056	69	.019	23	.042	52	.036	44	.043	52	.034	41	.034	42	.090	108
1909	.046	61	.049	64	.017	22	.037	48	.033	43	.042	55	.031	41	.030	39	.076	100
1910	.058	77	.062	83	.022	29	.040	53	.040	53	.052	68	.034	45	.034	45	.100	133
1911	.063	82	.064	84	.025	32	.045	59	.043	56	.053	69	.041	53	.036	46	.099	129
1912	.063	83	.065	86	.022	29	.036	47	.036	48	.045	60	.038	51	.033	45	.096	128
1913	.062	78	.070	90	.023	29	.036	46	.035	44	.046	59	.028	36	.029	37	.093	120
1914	.054	71	.062	82	.021	27	.041	55	.038	51	.052	68	.035	46	.034	46	.097	128
1915	.061	85	.065	91	.023	32	.049	68	.043	61	.048	67	.043	60	.038	54	.080	111
1916	.059	80	.062	84	.022	30	.049	67	.042	58	.049	67	.041	55	.038	52	.106	144
1917	.054	69	.061	79	.022	28	.047	61	.041	52	.052	67	.040	52	.038	50	.119	153
1918	.052	67	.063	82	.022	28	.044	57	.036	46	.050	64	.036	47	.039	51	.119	155
1919	.053	70	.057	76	.023	30	.039	51	.032	43	.048	64	.037	49	.041	54	.099	132
1920	.072	99	.074	102	.030	41	.050	68	.042	57	.057	77	.044	61	.044	60	.109	149
1921	.077	144	.082	121	.034	50	.057	83	.047	69	.057	83	.046	68	.046	68	.079	117
1922	.092	157	.099	168	.040	67	.062	104	.060	101	.066	111	.053	92	.050	85	.110	185
1923	.096	173	.107	191	.043	76	.064	115	.058	104	.065	117	.058	105	.053	96	.123	221
1924	.087	165	.092	174	.033	64	.054	104	.051	97	.062	119	.057	112	.049	95	132	251
1925	.092	214	.094	219	.041	99	.065	151	.057	132	.072	167	.057	134	.060	141	.134	313
1926	.123	331	.124	326	.054	145	.073	197	.055	151	.072	193	—	—	.057	155	.130	341

APPENDIX 3. RETAIL PRICES (IN SILVER CURRENCY†) PAID BY FARMERS FOR COMMODITIES USED IN LIVING IN WUCHIN, KIANGSU, CHINA

Description of goods	Units	1910	1911	1912	1913	1914	1910-1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927
Agricultural products:																				
White rice (polished)	Shen	.066	.072	.071	.064	.057	.066	.067	.064	.061	.059	.057	.081	.085	.102	.105	.093	.101	.138	.137
Glutinous rice (polished)	Shen	.072	.074	.074	.076	.069	.073	.072	.066	.073	.066	.064	.070	.089	.101	.116	.105	.104	.135	.149
Rice (early crop)	Shen	.057	.063	.068	.058	.057	.061	.065	.060	.056	.052	.056	.082	.083	.093	.096	.087	.102	.133	.128
Wheat	Shen	.048	.049	0.38	.034	.051	.044	.043	.051	.047	.040	.047	.053	.058	.062	.067	.069	.070	.078	.085
Barley hulless	Shen	.045	.049	.038	.037	.043	.042	.046	.043	.043	.037	.037	.044	.051	.061	.062	.050	.055	.065	.066
Barley with hulls	Shen	.027	.030	.019	0.25	.026	.025	.027	.025	.025	.020	.023	.028	.031	.034	.035	.033	.037	.042	.040
Bran	Shen	.009	.010	.008	.010	.010	.009	.011	.009	.009	.009	.010	.012	.011	.015	.016	.015	.019	.019	.018
Cotton seed	Catty	.020	.023	.021	.021	.021	.021	.021	.023	.023	.024	.023	.027	.022	.027	.029	.029	.026	.029	.030
Yellow soybeans	Shen	.059	.060	.053	.054	.060	.057	.055	.053	.061	.059	.057	.063	.068	.079	.082	.079	.082	.085	.090
Broad beans	Shen	.040	.041	.035	.034	.041	.038	.043	.043	.048	.044	.044	.049	.047	.055	.059	.056	.055	.066	.078
Soybeans (for oil)	Shen	.053	.055	.049	.052	.055	.053	.054	.051	.054	.048	.052	.062	.064	.071	.068	.070	.075	.079	.083
Soybeans (green)	Shen	.051	.052	.045	.052	.065	.053	.052	.052	.059	.055	.060	.059	.066	.079	.077	.074	.081	.085	.100
Chestnuts	Catty	.065	.059	.061	.062	.057	.061	.057	.071	.048	.065	.058	.075	.098	.093	.107	.070	.098	—	—
Walnuts kernel	Catty	.143	.234	.160	.198	.186	.184	.155	.147	.151	.186	.224	.236	.360	.336	.291	.269	.327	.268	.418
Other food products:																				
Salt	Catty	.036	.051	.047	.049	.051	.047	.051	.054	.058	.059	.063	.062	.063	.063	.063	.066	.066	.076	.081
Soybean oil	Catty	.142	.149	.139	.143	.146	.144	.129	.139	.165	.159	.138	.147	.132	.154	.168	.183	.196	.175	.208
Rape seed oil	Catty	.110	.147	.137	.141	.151	.137	.142	.150	.171	.166	.157	.157	.140	.164	.184	.190	.201	.186	.221
Sesame oil	Catty	.166	.183	.211	.219	.200	.196	.123	.147	.188	.193	.167	.191	.192	.229	.224	.244	.261	.228	.340
Tea	Catty	.159	.164	.188	.231	.241	.197	.251	.282	.288	.288	.288	.288	.288	.288	.298	.264	.236	.252	.256
Sugar white No. 425*	Catty	.095	.094	.095	.088	.088	.092	.129	.120	.115	.087	.113	.165	.137	.104	.138	.131	.107	.099	.112
Rock candy	Catty	.126	.148	.134	.110	.115	.127	.176	.174	.170	.121	.174	.222	.162	.147	.188	.191	.142	.159	.174
Liquor (barley)	Catty	.068	.073	.070	.060	.063	.067	.073	.069	.071	.068	.064	.072	.098	.097	.085	.084	.093	.114	—
Dried bamboo shoot	Catty	.037	.040	.036	.040	.047	.040	.043	.061	.063	.071	.067	.059	.060	.063	.077	.100	.098	.094	.077
Dried jelly fish*	Catty	.067	.066	.058	.073	.089	.071	.160	.131	.062	.061	.062	.106	.133	.131	.124	.114	.122	.134	.124
Juda's ear	Catty	.392	.440	.490	.640	.750	.542	.860	.688	.602	.600	.780	1.006	1.190	1.110	.850	.730	.730	1.000	1.400
Fish, salt, native	Catty	—	.068	.059	.061	.069	.064	.097	.066	.071	.086	.081	.081	.085	.100	.109	.102	.111	.137	.115
Sweets No. 1 (wheat flour, sugar and bean oil)	Catty	.082	.086	.084	.083	.086	.084	.097	.096	.096	.100	.102	.117	.136	.138	.145	.154	.136	.137	.171
Sweets No. 2 (wheat flour, sugar and bean oil)	Catty	.066	.083	.074	.076	.080	.076	.095	.088	.096	.097	.098	.119	.118	.132	.134	.132	.129	.136	.148
Sweets No. 3 (sugar and glutinous rice flour)	Catty	.089	.093	.089	.093	.090	.091	.105	.102	.098	.094	.106	.131	.141	.133	.145	.148	.127	.133	.144
Sweets No. 4 (sesame and flour)	Catty	.112	.110	.102	.100	.109	.107	.118	.119	.111	.106	.120	.145	.153	.148	.167	.163	.133	.120	.153
Sweets No. 5 (wheat flour, sugar and bean oil)	Catty	.101	.110	.104	.103	.109	.105	.123	.124	.127	.130	.129	.142	.147	.148	.162	.159	.154	.157	.161
Cloth and clothing materials:																				
Fine cotton cloth	Piece	5.79	6.38	6.43	7.28	6.35	6.45	6.72	6.83	8.93	9.54	12.31	10.03	9.58	10.44	12.05	11.57	10.65	10.18	—
Coarse cotton cloth	Piece	5.80	5.78	6.46	6.31	5.97	6.06	5.70	5.27	6.61	8.07	9.16	8.21	7.37	7.63	7.64	8.63	9.25	7.65	—
Shirtings bleached*	Piece	7.58	8.40	8.41	8.08	8.21	8.14	8.06	8.76	10.01	11.78	13.19	13.41	14.13	13.01	13.70	17.20	13.27	13.51	—
Glazed cotton cloth*	Piece	3.57	4.50	4.13	4.73	4.93	4.37	3.92	4.79	4.60	6.13	6.71	8.17	8.63	8.34	8.68	8.96	8.25	9.40	—
Cotton flannel white*	Piece	7.10	6.82	8.04	9.33	8.97	8.05	7.74	7.58	7.80	9.87	10.53	12.22	13.68	12.31	12.11	13.04	13.75	12.59	—
Twill*	Piece	4.63	6.87	5.14	5.47	4.38	5.30	5.81	4.86	6.47	5.91	7.70	7.76	8.96	9.73	10.44	8.82	9.93	7.47	—
Striped cloth	Piece	2.75	2.94	3.06	2.90	3.41	3.01	2.94	3.02	3.67	3.67	4.56	4.48	3.30	3.61	4.77	5.45	3.78	4.08	—
Check	Piece	2.96	3.11	3.28	3.16	2.99	3.10	2.77	3.46	3.23	3.51	4.21	4.54	3.28	3.09	3.51	5.49	5.19	4.32	—
T-cloth*	Yard	0.148	.161	.166	.270	.220	.193	.248	.282	.324	.264	.343	.258	.325	.309	.353	.316	.313	.277	—
Main sook*	Yard	0.308	.289	.342	.350	.319	.322	.336	.329	.269	.353	.402	.371	.575	.578	.542	.529	.406	.384	—
Sateen*	Yard	0.295	.307	.321	.259	—	.296	—	.391	.453	.430	.485	.523	.516	.513	.495	.572	.521	.511	—
Poplin*	Yard	0.586	.610	.651	.690	.728	.653	.757	.788	.800	.806	.698	.701	.615	.770	—	—	—	—	—
Cotton venetians*	Yard	0.601	.632	.667	.589	.598	.617	.636	.615	.734	.860	.768	.705	.714	.821	.815	.854	.737	.781	—
Hangchow silk	Liang	.685	.750	.760	.770	.803	.754	.820	—	1.21	—	.780	.940	.951	1.000	.990	.111	.873	.945	—
Knitting yarn*	Liang	0.107	.137	.121	.115	.118	.120	.192	.235	.185	.209	.233	.223	.263	.198	.220	.198	.205	.205	—
Cotton yarn (counts 16)*	Bale	3.39	3.79	3.75	3.65	3.34	3.58	3.28	3.39	4.30	5.44	6.55	5.83	5.08	4.81	5.36	5.91	5.86	5.00	—
Cotton yarn (counts 14)*	Bale	3.26	3.69	3.63	3.55	3.17	3.46	3.15	3.31	4.03	5.27	6.14	5.71	4.98	4.77	5.25	5.82	5.77	4.81	—
Cotton, raw	Catty	0.229	.272	.255	.240	.237	.247	.231	.230	.246	.264	.240	.234	.255	.260	.285	.340	.300	.340	—
Fuel and light:																				
Oil kerosene, "Brilliant"*	Tin	1.17	1.15	1.29	1.44	1.62	1.33	1.73	1.41	1.43	1.57	1.33	1.38	1.42	1.29	1.81	1.87	1.98	2.08	—
Safety matches, native	Dozen	0.028	.029	.026	.023	.029	.027	.037	.048	.046	.041	.040	.042	.037	.035	.035	.034	.036	.039	—
Candles, native	Catty	0.194	.244	.194	.203	.225	.212	.215	.234	.269	.288	.270	.258	.228	.237	.265	.317	.324	.368	—
Candles, 12 oz.*	½ dozen	0.128	.153	.143	.148	.159	.146	.167	.196	.209	.229	.202	.199	.191	.172	.171	.179	.171	—	—
Metals:																				
Needles*	Package	0.017	.017	.017	.017	.017	.017	.049	.230	.266	.245	.150	.184	.120	.087	.058	.048	.041	.044	—
Wire nails*	Lb.	0.074	0.75	.074	.071	.063	.071	.128	.185	.144	.136	.158	.189	.139	.135	.145	.110	.100	—	—
Brass stoves	Catty	0.214	.257	.244	.242	.240	.239	.258	.290	.281	.269	.246	.279	.265	.236	.249	.258	.255	.283	—
Miscellaneous:																				
Wood oil	Barrel	7.60	8.72	7.81	7.91	7.67	7.94	7.38	8.43	9.55	11.77	9.75	9.83	9.53	10.51	13.55	13.60	11.89	12.08	—
Umbrella	Piece	0.126	.141	.137	.142	.125	.134	.125	.131	.143	.143	.165	.187	—	—	—	—	.165	.167	—
Soap (Peh chi)*	Case	6.17	6.31	6.16	6.11	6.24	6.20	7.06	7.40	7.58	6.57	7.62	7.08	6.90	6.76	6.60	6.62	6.71	6.53	—
Hemp rope	Catty	0.020	.021	.018	.019	.021	.020	.019	.015	.013	.019	.014	.014	.013	.016	.019	.015	.010	.011	—
Hemp thread	Catty	0.069	.146	.122	.119	.121	.115	.112	.118	.117	.111	.112	.131	.130	.138	.181	.173	.153	.140	—
Gypsum	Picul	0.74	1.09	1.16	1.07	.820	.976	.780	1.00	1.27	1.36	2.00	1.82	1.55	1.72	1.72	1.80	1.98	2.08	—
Cigarettes (pirates)*	10 pieces	1.58	1.75	1.75	1.93	1.94	1.79	1.99	2.17	2.27	2.39	2.35	2.24	2.35	2.21	2.18	2.73	2.33	2.32	—
White buttons	Card	0.056	0.067	.064	.060	.057	.061	.068	.085	.060	.054	.051	.069	.120	.117	.106	.095	.084	.076	—

*Imported goods.

†Prices in copper were converted to silver equivalents.

APPENDIX 4. RETAIL PRICES (IN COPPER CURRENCY)† PAID BY FARMERS FOR COMMODITIES USED IN LIVING IN WUCHIN, KIANGSU CHINA

Description of goods	Units	1910	1911	1912	1913	1914	1910-1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927
Agricultural products:																				
White rice (polished)	Shen	88	94	94	82	76	87	94	88	78	76	77	111	126	173	188	178	235	369	387
Glutinous rice (polished)	Shen	96	96	98	97	92	96	101	89	94	85	84	94	132	170	208	199	244	349	424
Rice (early crop)	Shen	76	82	91	75	77	80	91	82	72	69	75	113	123	160	173	166	246	358	369
Wheat	Shen	64	64	50	44	70	58	61	68	60	53	63	72	87	110	123	139	169	214	243
Barley hulless	Shen	60	64	50	47	57	56	65	58	55	49	49	60	76	108	94	96	124	177	185
Barley with hull	Shen	37	39	25	32	35	34	37	33	32	29	30	38	46	59	64	63	87	112	115
Bran	Shen	12	12	11	12	13	12	16	12	12	11	14	16	16	25	29	28	40	51	50
Cotton seed	Catty	27	29	28	26	28	28	30	32	29	31	30	37	33	44	52	56	61	77	85
Yellow soybean	Shen	78	78	71	70	79	75	77	72	78	76	75	86	102	134	148	149	190	229	255
Broad beans	Shen	53	54	47	43	55	50	61	59	62	57	58	67	71	95	109	108	127	175	225
Soybeans (for oil)	Shen	71	72	66	66	72	69	75	68	70	61	70	83	97	117	122	131	170	210	230
Soybeans (green)	Shen	69	68	59	67	88	70	73	71	77	72	81	81	100	141	141	143	196	234	290
Chestnuts	Catty	88	77	80	80	78	81	80	98	63	85	78	103	150	168	196	146	240	—	—
Walnuts kernel	Catty	189	304	212	250	245	240	218	197	193	240	298	322	543	560	522	522	738	716	1187
Other food products:																				
Salt	Catty	48	66	62	63	68	61	72	74	74	76	84	85	93	107	113	126	158	202	227
Soybean oil	Catty	189	194	185	184	193	189	181	189	212	206	185	202	200	253	306	356	466	457	594
Rape seed oil	Catty	147	191	183	181	198	180	197	203	219	218	207	215	211	264	337	369	452	483	628
Sesame oil	Catty	221	238	280	280	260	256	172	201	242	249	221	261	284	373	408	460	613	594	969
Tea	Catty	214	213	248	296	316	257	352	385	371	372	384	394	434	483	544	504	540	644	733
Sugar white No. 425*	Catty	128	123	126	114	116	121	180	165	148	113	150	224	200	173	252	256	239	263	316
Rock candy	Catty	168	192	177	140	152	166	247	237	212	158	232	303	250	239	342	367	334	420	494
Liquor (barley)	Catty	92	95	92	78	83	88	102	94	92	88	86	98	151	158	154	164	219	302	—
Dried bamboo shoot	Catty	49	52	47	52	62	52	60	82	80	91	89	81	91	104	140	193	225	252	224
Dried jelly fish*	Catty	91	86	77	95	118	93	223	179	81	78	82	144	204	224	225	223	290	348	355
Juda's ear	Catty	527	573	648	823	987	712	1205	953	772	778	1047	1369	1807	1857	1546	1470	1762	2527	3978
Fish, salt, native	Catty	—	88	79	79	92	85	136	90	91	112	109	111	128	173	199	202	269	374	330
Sweets No. 1 (wheat flour, sugar and bean oil)	Catty	109	112	111	106	113	110	136	130	123	129	135	159	209	218	266	305	312	351	481
Sweets No. 2 (wheat flour, sugar and bean oil)	Catty	88	108	99	99	107	100	133	122	124	126	132	163	177	229	244	251	299	364	421
Sweets No. 3 (sugar and glutinous rice flour)	Catty	119	121	117	119	120	119	147	139	126	122	141	179	208	224	262	279	297	346	412
Sweets No. 4 (sesame and flour)	Catty	149	143	135	127	141	139	164	159	143	137	159	198	236	227	306	328	303	304	439
Sweets No. 5 (wheat flour, sugar and bean oil)	Catty	136	143	138	134	144	139	172	170	163	169	172	194	223	245	295	313	356	409	457
Cloth and clothing materials:																				
Fine cotton cloth	Piece	7755	8297	8620	9411	8381	8493	9452	9426	11575	12370	16427	13691	13908	17472	21627	21680	24038	26427	—
Coarse cotton cloth	Piece	7769	7528	8594	8123	7938	7990	7980	7185	8527	10488	12185	11233	10913	12900	13768	16545	21488	20163	—
Shirtings bleached*	Piece	10100	10939	11185	10367	10767	10672	11289	11915	12908	15159	17600	18283	20830	21987	24628	32134	29909	35289	—
Glazed cotton cloth*	Piece	4658	5850	5473	6002	6468	5690	5471	6474	5908	7834	8925	11126	12449	13950	15491	16919	18112	24296	—
Cotton flannel white*	Piece	9554	8868	10643	12083	11962	10622	10833	10058	9981	12859	14033	16860	20979	20829	21192	25583	32580	34432	—
Twill*	Piece	6170	8976	6810	6995	5781	6946	8066	6724	8329	7676	10204	10601	13145	16572	18259	16830	22825	19699	—
Striped cloth	Piece	3625	3830	4045	3729	4528	3951	4076	4133	4715	4784	6049	6126	4893	6275	8552	10195	8680	10746	—
Check	Piece	3953	4028	4349	4048	3953	4066	3868	4773	4157	4665	5588	6201	4794	5047	6090	10470	12196	11326	—
T-cloth*	Yard	197	210	218	344	290	252	349	383	419	346	456	352	492	529	636	594	717	732	—
Main sook*	Yard	413	376	458	453	421	424	473	454	347	459	535	505	848	963	986	1001	948	1019	—
Sateen*	Yard	392	399	426	334	—	388	—	529	584	549	647	716	752	806	872	1062	1144	1344	—
Poplin*	Yard	788	795	866	874	949	854	1060	1059	1031	1050	932	957	927	1299	—	—	—	—	—
Cotton venetians*	Yard	801	823	883	750	789	811	885	839	943	1115	1025	964	1048	1370	1456	1612	1646	2126	—
Hangchow silk	Liang	919	978	1019	996	1055	993	1149	—	1560	—	1049	1285	1405	1702	1794	2106	2002	2535	—
Knitting yarn*	Liang	143	178	161	147	155	157	269	323	239	272	310	302	388	314	400	370	480	556	—
Cotton yarn (counts 16)*	Bale	4504	4934	4969	4664	4409	4696	4587	4610	5537	7057	8730	7961	7510	8197	9661	11389	13568	13399	—
Cotton yarn (counts 14)*	Bale	4304	4807	4816	4538	4219	4537	4413	4506	5190	6842	8186	7787	7358	7968	9459	11219	13356	12880	—
Cotton, raw	Catty	303	354	336	312	321	325	323	308	315	342	322	321	389	440	502	687	688	943	—
Fuel and light:																				
Oil kerosene, "Brilliant"*	Tin	1562	1490	1715	1845	2142	1751	2426	1915	1838	2036	1772	1888	2096	2174	3264	3561	4552	5546	—
Safety matches, native	Dozon	37	38	35	30	39	36	52	65	59	54	53	57	54	60	63	65	80	106	—
Candles, native	Catty	259	318	258	261	298	279	301	319	347	374	360	352	347	394	483	627	755	965	—
Candles, 12 oz.*	½ dozen	170	199	189	190	209	191	233	264	269	296	269	272	286	290	307	343	407	—	—
Metals:																				
Needles*	Package	23	22	23	22	22	22	69	312	342	312	201	252	176	142	105	89	97	120	—
Wire nails*	Lb.	99	97	98	90	84	94	179	254	186	175	211	257	206	216	262	210	220	—	—
Brass stoves	Catty	288	333	321	305	319	313	361	392	360	349	327	381	384	397	444	497	581	764	—
Miscellaneous:																				
Wood oil	Barrel	10030	11356	10379	10289	10105	10432	10384	11707	12324	15425	12973	13436	14448	17754	24689	26098	27643	31570	—
Umbrella	Piece	169	184	181	182	165	176	175	179	184	186	221	253	—	—	—	—	394	436	—
Soap (Peh chi)*	Case	8180	8231	8199	7836	8246	8138	9938	10017	9690	8527	10067	9647	10251	11234	12041	12428	15337	17659	—
Hemp rope	Catty	26	27	24	25	27	26	26	20	17	24	19	18	20	26	35	29	23	28	—
Hemp thread	Catty	92	190	162	154	160	152	158	163	151	145	151	180	196	239	331	329	359	376	—
Gypsum	Picul	993	1419	1549	1389	1075	1285	1093	1383	1643	1776	2680	2470	2296	2954	3118	3445	4505	5568	—
Cigarettes (pirates)*	10 piece	2116	2276	2313	2456	2569	2346	2805	2930	2911	3050	3144	3052	3562	3661	3958	5352	5737	6005	—
White buttons	Card	76	87	85	76	75	80	95	116	77	70	67	95	176	180	189	181	179	205	—

*Imported goods.

†Prices in silver were converted to copper equivalents.

APPENDIX 5. EQUATION OF SECULAR TREND (YEARLY) OF PRICES* PAID TO PRODUCERS OF FARM PRODUCTS IN WUCHIN, KIANGSU, CHINA, 1894-1926†

Farm Products	Equations of Secular Trend
Late rice (unhulled)	Y=.0008×+.0234
White rice (polished)	Y=.0019×+.0575
Glutinous rice (polished)	Y=.0020×+.0618
Barley hulless	Y=.0011×+.0362
Wheat	Y=.0012×+.0409
Broad beans	Y=.0010×+.0349
Field peas	Y=.0010×+.0362
Yellow soybeans	Y=.0011×+.0474
Cottonseed-soybean oil	Y=.0021×+.1021

*All units are in *sheng* (升) except unhulled rice, hulless barley, and cotton seed-soybean oil which are in *catties* (斤).

†Field peas and cotton seed-soybean oil are exceptions, the former is 1894-1925 and the latter is 1905-1926.

APPENDIX 6. EXCHANGE RATE OF ONE SILVER DOLLAR INTO COPPER CASH IN WUCHIN, KIANGSU, CHINA

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ave
1905	—	—	—	925	923	937	941	958	988	1000	1010	1022	967
1906	1057	1084	1093	1090	1097	1116	1107	1097	1100	1100	1063	1026	1086
1907	1031	1020	1029	1051	1064	1084	1098	1104	1109	1106	1111	1109	1076
1908	1116	1120	1144	1151	1189	1203	1218	1236	1237	1243	1250	1259	1197
1909	1253	1283	1298	1298	1307	1316	1335	1337	1337	1342	1332	1337	1315
1910	1305	1291	1323	1326	1329	1340	1344	1340	1349	1350	1348	1341	1332
1911	1292	1294	1298	1301	1305	1300	1303	1309	1304	1305	1283	1313	1301
1912	1311	1313	1317	1340	1337	1345	1337	1341	1311	1313	1317	1340	1327
1913	1261	1215	1230	1297	1296	1307	1290	1290	1297	1300	1295	1291	1281
1914	1275	1265	1297	1290	1302	1310	1328	1340	1352	1356	1375	1381	1323
1915	1375	1369	1394	1415	1408	1401	1401	1409	1400	1412	1417	1401	1400
1916	1356	1360	1399	1380	1389	1386	1379	1380	1383	1375	1296	1276	1363
1917	1247	1277	1308	1287	1294	1290	1294	1300	1300	1299	1280	1271	1287
1918	1249	1250	1290	1300	1300	1300	1306	1313	1317	1314	1320	1300	1297
1919	1290	1306	1328	1331	1330	1331	1340	1345	1340	1356	1340	1340	1328
1920	1340	1340	1349	1360	1360	1357	1375	1379	1380	1380	1380	1380	1365
1921	1379	1383	1440	1450	1466	1469	1481	1495	1508	1542	1542	1541	1475
1922	1523	1512	1563	1629	1677	1704	1730	1786	1891	1804	1800	1766	1690
1923	1706	1682	1781	1819	1814	1813	1810	1815	1830	1833	1840	1830	1798
1924	1798	1791	1850	1855	1876	1907	1920	1919	1875	2021	2021	2006	1903
1925	2020	2050	2201	2287	2336	2275	2267	2337	2402	2489	2534	2481	2307
1926	2517	2525	2547	2608	2645	2686	2680	2684	2773	2806	2795	2774	2670
1927	2710	2717	2860	2805	2875	2850	2847	2895	2918	2905	—	—	2838
1928	—	—	—	—	—	2897	2940	2956	3040	3043	2965	—	2974

EXCHANGE RATE OF ONE SILVER DIME INTO COPPER CASH IN WUCHIN, KIANGSU, CHINA

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ave
1905	—	—	—	91	91	91	91	90	93	94	95	95	92
1906	100	102	104	103	104	104	101	100	100	99	95	92	100
1907	91	92	93	92	95	95	94	95	95	96	97	100	95
1908	102	105	105	105	106	106	108	109	111	112	113	115	108
1909	117	120	120	120	120	120	120	120	120	120	120	120	120
1910	120	120	120	120	120	120	119	120	120	120	120	120	120
1911	119	120	120	120	120	120	120	117	115	115	115	115	118
1912	117	115	116	115	116	116	118	117	117	115	116	115	116
1913	111	110	110	114	115	115	115	115	115	115	114	114	114
1914	113	115	115	115	115	116	117	117	120	120	120	120	117
1915	120	126	127	128	128	127	127	127	126	126	127	125	126
1916	123	123	125	124	125	123	122	122	123	122	116	114	122
1917	123	114	117	115	116	115	114	116	117	117	115	115	116
1918	114	114	116	117	118	118	118	118	119	117	116	115	117
1919	115	116	117	118	119	117	117	117	120	121	119	118	118
1920	119	121	121	122	123	123	123	124	123	122	122	123	122
1921	123	124	126	129	131	132	132	133	135	136	136	135	131
1922	135	135	139	142	148	150	150	153	155	155	153	152	147
1923	150	150	157	158	158	157	156	157	158	158	159	158	156
1924	156	156	161	160	159	158	149	148	151	154	156	156	155
1925	163	168	167	172	176	174	174	177	183	189	194	200	178
1926	215	210	210	213	215	215	214	216	219	221	230	230	217
1927	233	231	233	234	235	231	235	235	238	240	—	—	235
1928	—	—	—	—	—	239	240	241	247	245	243	—	243

UNIVERSITY OF NANKING
COLLEGE OF AGRICULTURE AND FORESTRY
NANKING, CHINA

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MAPPING THE RURAL COMMUNITY

CHIAO CHI MING

THE term "rural community" has been defined by Professor Walter Burr of Kansas State Agricultural College, as "a population group in an agricultural area of such size and unity to permit its citizens to co-operate readily in group activities." The chief group activities of common interest to the rural population in China are business, educational, religious and social. The significance of rural community units in developing the rural church is quite evident. One way of most clearly apprehending the detailed information which a survey of a rural community brings to light, is to map it.

Such a survey and map have been recently made by the writer, of the Yao Hwa Men area near Nanking. Yao Hwa Men is a market town and the rural community of which it is the business center includes seventy-two villages, one modern school, thirty old fashioned schools, three temples, and is traversed by the Shanghai-Nanking Railway.

Preliminary information was secured from the school teachers, from one of the leading merchants, from the village leader, from the temple and from a prominent farmer. After the survey had been explained to them, they were quite willing to help. The merchants furnished the names of the villages that traded there and these were located on the map as accurately as possible.

After visiting the market town, each village was in turn visited and all the information secured at the market center was checked by questioning the villages. In this way fairly accurate data were secured. A rather incomplete military map and a postal map furnished an outline on which the unindicated villages and their positions and distances from the market town were indicated. It will be noted on the map that some villages in the area have two market centers with which they trade. Also

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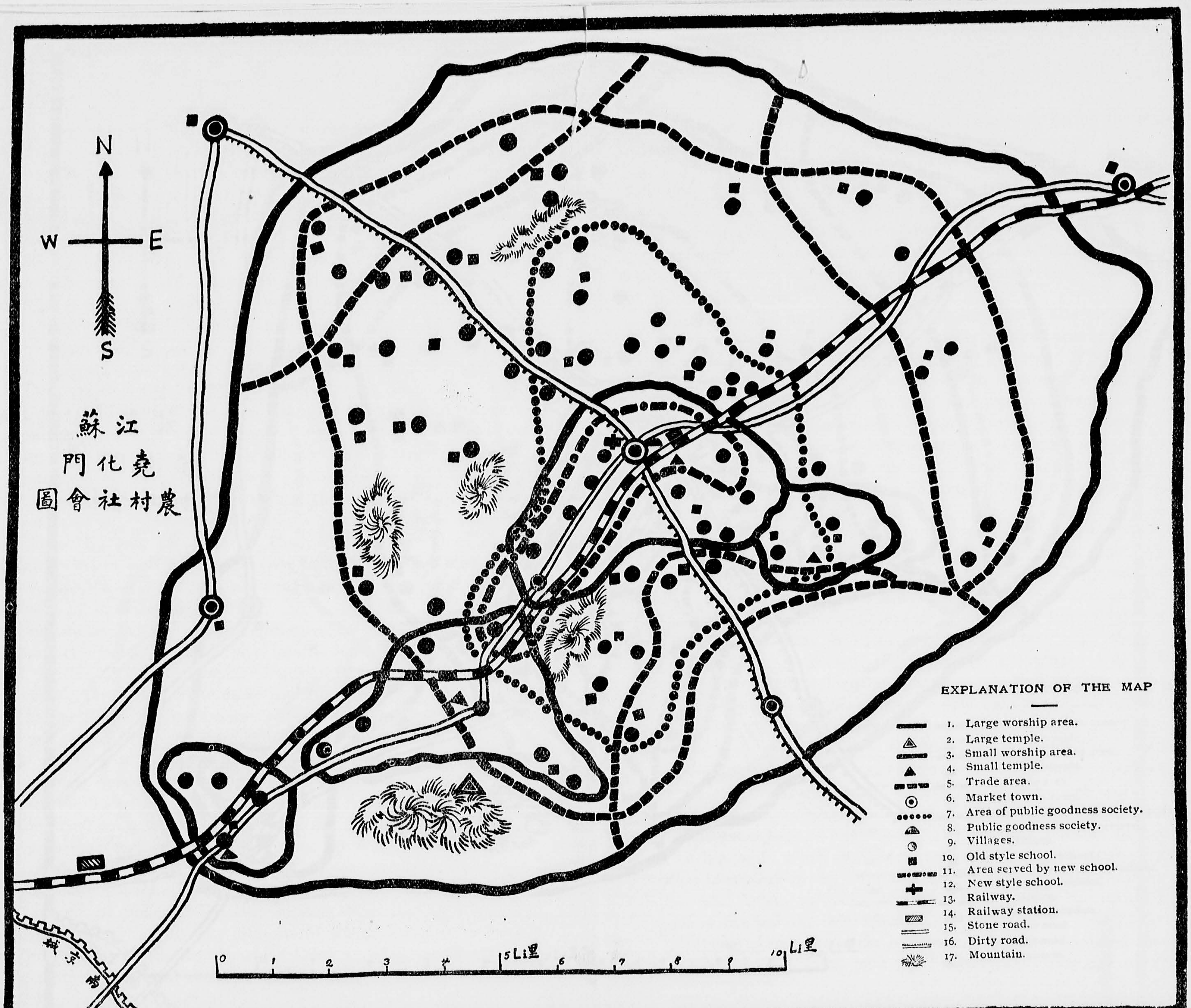

"Mapping the Rural Community."—The scale on the map is indicated by Chinese li. Each division indicates 1 Chinese li. The distances are measured from the market center to the different villages by using this scale.

that the larger worship area includes several minor temples, but that no serious conflict is involved. The large trade area, the large worship area and the modern school area are easily and clearly fixed.

Each farm village has its worship place and the temples are the chief centers of their religious activities. Although the villages differ on many other matters, in religious life and activities they are one. Idol worship functions more strongly in binding the farmers into a group than any other influence. All matters of good and evil, prosperity and misfortune are handled by the idols. Incense burning is an important institution. The idols largely dominate human activities and thus effectively retard community progress. The local divinities or agricultural gods are worshipped twice a year during the lunar second and seventh months. The small worship areas are indicated on the map.

The large worship area serves a radius of 20 *li* and all the villagers make an annual pilgrimage to the temple. Each large village has its own worship club, but several of the smaller villages usually co-operate together to organize a small worship club. Each club has its own name given to it by its members and often reflects the dominant interests of the club membership. Each club also has a president and a business manager, chosen by turn each year. The order of the name list is posted on a permanent wall for this purpose in a prominent place in the village. The meetings of the club are held either in the home of one of the farmers or in the tea shop.

The funds to be collected for the expenses of the worship are divided equally among the farm families. If a family does not wish to attend the annual worship at the big temple, no money is collected from them. March is usually the month of worship and on a prearranged date the club goes to the temple. The incense, paper money and perhaps local musicians are prepared by the president and business manager of the club. The members of the club proceed to the temple in a body. The worshippers kneel before the altar and after the incense is burned, it is placed in the incense box by the president. After this act of worship, the priest asks the president for a contribution. The name of the club subscribing the largest amount is put on a stone tablet roll of honor. During the day, the members of the club are fed from the public funds of the club. Custom prescribes that the president shall contribute the largest amount of money. The same process is repeated each year.

In the same way the business interests of the area can be learned. Space forbids giving all the details which loom so large in the village life of the market town and the surrounding villages, but it will help

us to picture the simplicity of the farmers' wants by listing the principal products which supply their daily demands.

1. Groceries: The principal items handled in the grocery shop are oils, salt, sauce, vinegar, wine, papers, eggs, cigarettes, cane sugar and candy. The goods which the farmers are most in need of and buy for home use are, oils, salt, sauce, vinegar and paper. The wine, sugar, cigarettes and candy are, for the most part, sold to the people who live in the market town. The outside farmers consume very small quantities of these commodities.

2. House Furniture and Farm Implements: The carpenter shops are the most important shops in the market village because most of the farm tools and house furniture are supplied by them. The demands of the farmers constitute a large share of the business of these shops, principally for new farm implements and repairs. Bamboo products, such as flails, brooms and baskets are also furnished by them.

3. Cloth Shops: The rough cotton cloth worn by the farmers constitutes the principal article for sale. Small quantities of finer cloths such as silk, cotton and wool can be bought, but the demand is largely limited to wedding garments.

4. Meat Shops: There are two meat shops, but business is not good because the majority of the farmers do not eat meat. This is because the meat is more expensive than the grains. Pork and beef are the chief meats. Most of the meat consumers live in the market town. The farmers seldom have meat except at weddings, funerals or the New Year holiday. Twenty years ago there were many meat shops in the market town, but at present these two are maintained with difficulty because of the fact that farm products are more expensive. The grains which were formerly fed to cattle, are now used directly as human food.

Most of the farmers within this rural community get their green vegetables from the Yao Hwa Men market. Farmers bring their eggs to the market each market day and use them in exchange for other goods which they wish to take back. When the farmers need money, they ordinarily sell grain to the grain shop. The largest part of the farmer's production must be sold immediately after harvest in order to pay their rents or the debts which have been incurred during the past year. Interest on borrowed money is as high as 40-50% per year. Grain shops are the chief money lenders. Money is paid back in the form of grain as soon as the harvest is finished.

The survey discloses one interesting character; a good man who lent money to the farmers at a much more reasonable rate of interest.

He usually charged about 25% per year, but the farmers who borrowed money from him had to show how they wanted to use the loan. If a productive purpose was involved, the loan was made; if it was a cash loan to be used for gambling and drinking purposes, it was refused. If loans made were misused and the lender discovered it, the borrower was brought back and severely punished. The influence of this good money lender was felt throughout the district and has resulted in much less gambling and drinking among the farmers. This money lender is a strong local leader and is very eager to improve the rural conditions of the community.

The social service activities are few. One organization, known as "the public goodness society" was found. The society is not free from political influences. The members of the society are strong believers in the doctrines of Buddhism, and their chief activity is to furnish medicine for the poor, who during the summertime become sick and are unable to see a doctor. The society has two officers; a chairman and a business manager elected by the members of the society. The influence of this society is shown on the map.

Both modern and old time educational facilities exist. The new school located in the market town draws its students from a number of villages, all of them, it is interesting to note, located along a modern stone road. The area of influence of this school is plotted on the map and its relation to the new road should be noted. All the other villages have an old fashioned school of their own or co-operate with a nearby village in maintaining a school. The modern school is a two teacher school, both teachers with normal school training.

In all the thirty old style village schools, the old time methods of teaching are used, the emphasis placed on writing and memorizing and nothing is done to give the students any knowledge that would serve them in any practical way in their everyday living.

It would seem to be quite evident that the above information and more that has been collected and for which there has not been space to present, would be of very great value to any missionary, pastor or Christian teacher who is trying to Christianize any rural community. A few days will suffice to secure the bulk of the information, and the mapping of this information when secured helps to get it more clearly in mind and to keep it before one in planning and carrying out Christian educational or evangelistic work.

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安徽九華山植生區之觀察

(英　　文)

THE VEGETATION OF CHIU HWA SHAN, ANHWEI

(IN ENGLISH)

樊　　慶　　生

FAN CHING-SENG

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安徽九華山植生區之觀察
THE VEGETATION OF CHIU HUA SHAN, ANHWEI

FAN CHING-SENG 樊慶生

In order to secure for our herbarium a more complete collection of plant specimens from Chiu Hua Shan (九華山), an important botanical collecting site in southern Anhwei, and to study its vegetation, a trip was made to this area in the summer of 1934.

The journey, which takes only two days, was made from the 27th to the 29th of July. After a voyage of 20 hours by Yangtze River steamer to Tatung (大通), we travelled by small boat to Tsien Chai Lung (錢家壠), where we spent the night, and started the 60 li's overland walk early the next morning.

Upon reaching Chiu Hua Shan, we settled in a temple, The Fah Hua Sze (法華寺), and began collecting work on the following day. During 23 days work there, and 2 days at Tien Tai Shan (天台山), 288 numbers were collected including approximately 3,000 herbarium specimens of herbaceous and woody plants.

Chiu Hua Shan (九華山)........Lies in southern Anhwei 90 li southward from Yangtze River at Tatung. It has an elevation of 2,000 feet. The climatic conditions on the upper slopes are somewhat different from those of foothills. The precipitation is abundant. In the spring and early summer the peaks and high ridges are mostly in fog or clouds. The temperature is low usually not over 90°F. in summer and rather cold in winter. Snow ordinarily comes in late November or early December.

Vegetation .. .... The two features which first impressed us after reaching Tsien Chai Lung, were the tree form of *Ilex cornuta* Lindl. and Pax. and the abundance of large bamboo, *Phyllostachys edulis* A. and C. Riviere. These growth forms were very interesting to us since the *Phyllostachys edulis* does not grow in Nanking; and although the *Ilex cornuta* is commom enough here, it never reach such a height as 20 feet. As indicated by these features, plant growth on Chiu Hua Shan is more luxurious than at Nanking.

The vegetation of this mountain may be divided into three areas according to the difference in the elevation, and the degree of destruction of the natural aspect. The **lower vegetation area,** from the mountain foot up to the altitude of 800 feet, has gentle slopes. The comparatively level parts have been opened up into crop fields, and others are covered with shrubs, bushes and herbs. Due to the prevailingly severe cutting, there is no considerable area in which large trees are growing. Some shrubs and bushes found in this region are:

Acer ginnala Maxim.	*Rosa laevigata* Maxim.
Benzoin glaucum Sieb. and Zucc.	*Rosa multiflora* Thunb.
Crataegus cuneata Sieb. and Zucc.	*Rubus parvifolius* Linn.
Quercus Fabri Hance	*Vanieria tricuspidata* (Beauv.) Hu
Rosa cathayensis Bailey	*Vitex Negundo* Linn.

Among the climbing plants are:

Ampelopsis japonica Maxim.	*Clematis grata* Wallich
Cissus japonica Willd.	*Clematis paniculata* Thunb.
Clematis apiifolia DC.	*Cynanchum auriculatum* Royle
Clematis Armandi Franch.	*Pueraria Thunbergiana* Benth.

The scattering trees include:

Albizzia kalkora Prain.	*Liquidambar formosana* Hance
Celtis sinensis Pers.	*Pinus tabulaeformis* Carr.
Cunninghamia lanceolata Hook.	*Ulmus pumila* Linn.

Some parts of the slope, where the rocks are exposed, and the soil if present is very thin, support only a very few perennial or annual herbs which are able to survive in this dry habitat. The trees or shrubs if there are any, are in very poor condition. Our visit was made in an extraordinarily dry summer, and mountain slopes appeared as though there had just been a fire. Many plants were wilted and dead, and the soil had become very dry and loose. It was obvious that the vegetation had been severely damaged. The result is the washing down of soil from the steep slopes, so that no large trees are able to grow there.

In the **middle vegetation area,** between 800 feet and 1,400 feet altitude, the destruction of vegetation was not prominent. There are many forests. *Pinus tabulaeformis* and *Cunninghamia lanceolata* grow in pure or in mixed stands. The broad-leaf-trees as *Liquidambar formosana, Quercus glauca* Thunb., and *Q. variabilis* Blume, also grow in some mixed forests. A large area of pure forest of *Lithocarpus spicata* Rehd. and Wils. grows near Si Hung Ling (西紅嶺). These forest trees usually attain a height of 40 to 50 feet. They grow well and have several layers of undergrowth. *Phyllostachys edulis* grow luxuriously in this region. It forms societies of considerable area and is continuous over several mountain slopes near Si Hung Ling, where the farmers help its propagation by clearing off shrubs and bushes on these slopes. This bamboo attains a height of 40 feet and a diameter of 6-7 inches.

Besides these forest trees and the bamboo, *Phoebe neurantha* Gamble and *Benzoin touyunense* Rehd. are found near Kan Lu Sze (甘露寺), while *Castanopsis sclerophylla* Schott. and *Pittosporum glabratum* Lindl. occur in the valley of Ming Yuan (閔源). There are only a very few of these plants, and none were seen in the upper or lower areas. The vegetation of this area is of interest because of the extensive forest formation, and on account of the presence of some rare species which are not found elsewhere on this mountain.

The **higher vegetation area** is at an altitude from 1,400 feet to 2,000 feet. Temples are numerous, and this mountain is a famous center of Buddhism. (Fig. 1) Many people come in and settle, so here again there is widespread destruction of the natural vegetation. The slopes near Chiu Hua Street are not now a woodland, only a few scattered trees are found, remnants of the ancient forests. *Pinus* and *Cunninghamia* rarely reach a height of 40 feet and a diameter of 7-8 inches (Fig. 2). However, a few *Pseudolarix amabilis* Rehd. can be found in temple yards, with a height of 70-80 feet and a diameter of 1½ feet (Fig. 3). Other needle-leaf-trees are rarely seen in this region.

The broad-leaf trees which mostly common grow here are:

Acanthopanax ricinifolius Seem.	*Juglans cathayensis* Dode
Albizzia kalkora, Prain.	*Magnolia denudata* Desr.
Aralia sinensis Linn.	*Platycarya strobilacca* Sieb. & Zucc.
Carpinus laxiflora Bl. var. macrostachys Oliv.	*Pterocarya Paliurus* Batal.
Cornus controversa Hemsl.	*Quercus variabilis* Bl.
Evodia hupehensis Dode	*Sassafras tsumu* Hemsl.

The most usual shrubs are:

Acer pictum Thunb.	*Rhododendron ovatum* Pl.

0575

Euonymus alata Req.	*Thea sinensis* Linn.
Hydrangea paniculata Sieb.	*Vaccinium bracteatum* Thunb.
Kerria japonica DC.	*Viburnum erosum* Thunb.
Rhododendron Simsii Planch.	*Viburnum tomentosum* Thunb.

As to the herbs, *Lilium Brownii* F. E. Br., *Lilium speciosum* Thunb., and *Polygonatum multiflorum* All. are of unusual interest to a plant collector as the former two species have large and beautiful flowers, while the latter one has a rhizome prized for its medicinal value. They are abundant in this area occurring either under the trees or shrubs or among the grasses.

Here, the vegetation is subjected to successive destruction by timber and fuel cutters. This practice tends toward the extinction of the majority of the woody species and brings much change to the species of the grasslands. The local government has promulgated laws to prohibit the cutting of woody plants within an area of 20 li from Chiu Hua Street, in order to maintain continuous growth of the forest and conserve the nature scenery of this famous mountain. But these laws are no longer kept in force and the increase of population from immigration has resulted in the opening up of many new crop fields. The slopes, where the soil layer is comparatively thick, have been developed into cultivated fields, which are terraced and irrigated by introducing spring water (Fig. 4). There is one crop in a year, rice or corn, which is harvested as late as early October. Tea plants are commonly grown on these slopes, and tea is one of the famous products of this mountain.

The mountain is situated at 30.5° N. L., in the subtropic zone. In accordance with the usual distribution of plants on the earth, this mountain should be covered with evergreen broad-leaf-trees such as *Pheobe neurantha, Castanopsis sclerophylla, Quercus glauca, Lithocarpus spicata,* and *Sassfras tsumu.* The few we have found of this group of species may represent the earlier flora of this region. The deciduous forests now covering the slopes of the middle vegetation area might, with proper protection, support a plant succession which would bring about the return of many of these nearly lost evergreen species. Since the natural vegetation of the upper and lower slopes of the mountain has been so nearly destroyed by the activities of men, these areas require more than protection to bring about recovery. Consequently, the middle area is the only remaining possibility for securing a return to the original aspect simply by protecting existing vegetation.

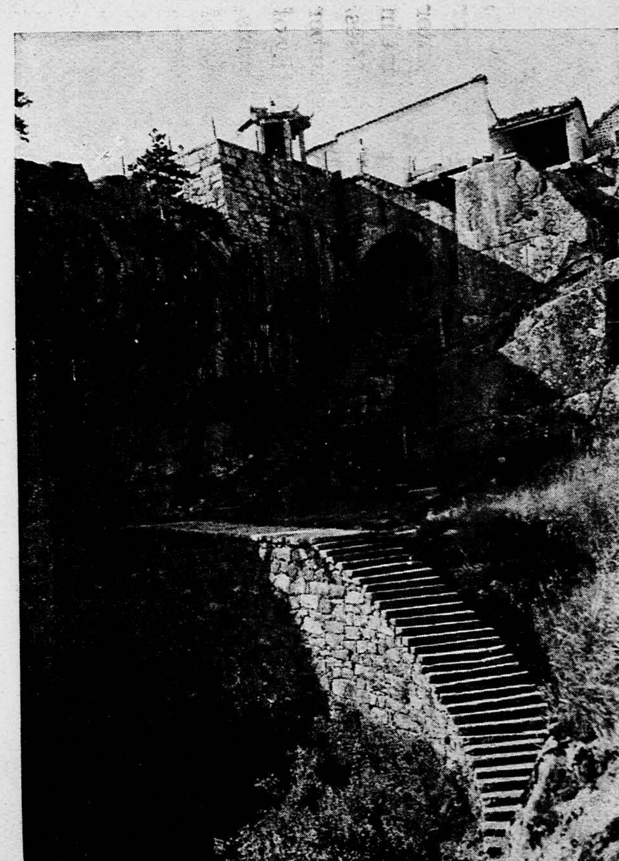

Fig. 1 T'ien Tai Cheng T'ing (天台正頂)
A temple on the top of T'ien Tai Shan.

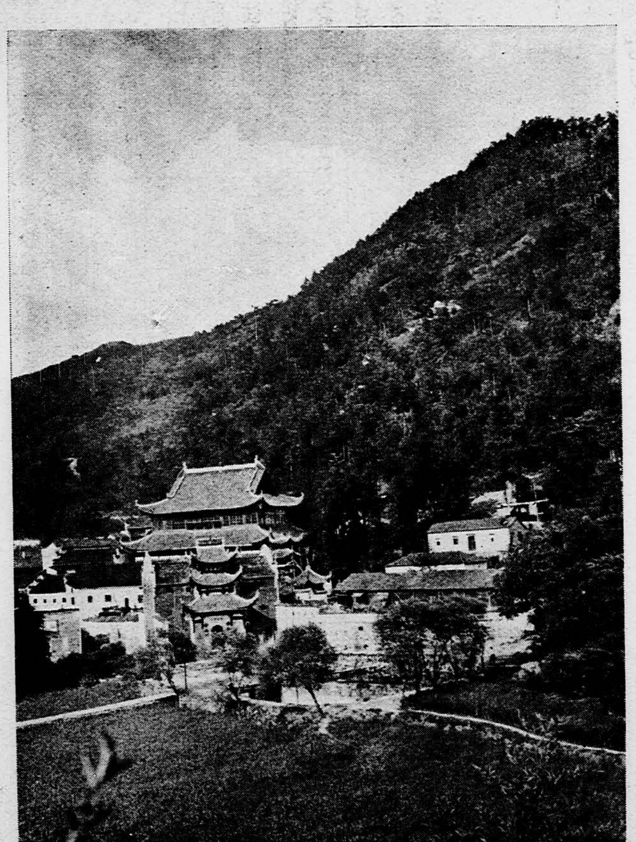

Fig. 2 A mixed forest of Pinus and Cunninghamia on the mountain slope above a temple, near Chiu Hua Street.

Fig. 3 Pseudolarix amabilis Rehd......70 feet in height, 1½ feet in D.B.H...... Near Hwei Hsiang Ko (迴香閣).

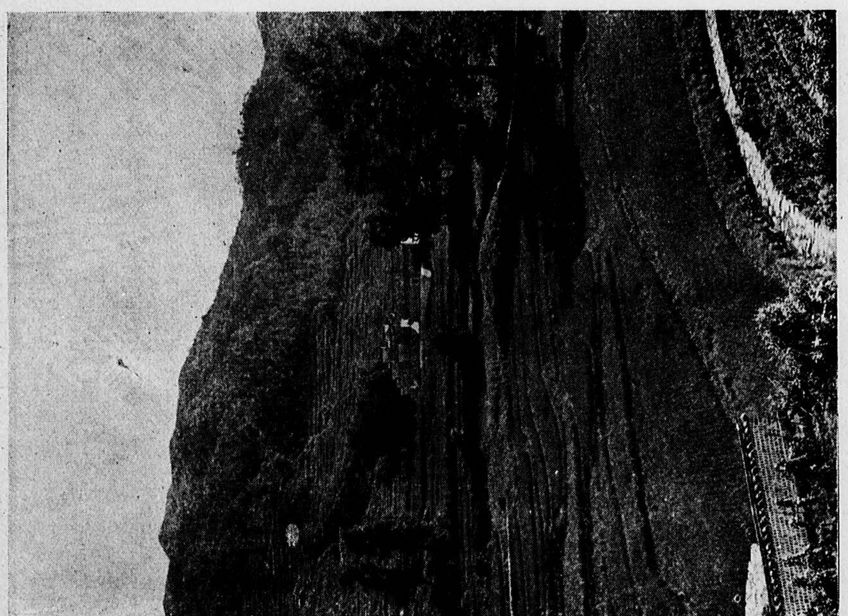

Fig. 4 Terraced rice fields near Chiu Hua Street.

安徽九華山植生區之觀察

提要

樊慶生

1. 九華山爲江東名勝，屬安徽靑陽縣，離大通南行九十里，高峯峻嶺，崛起競秀，周圍百餘里，其中孕育之植物，可以代表皖南一帶之分佈狀況.

2. 下層植生區域——自山麓至拔海高八百呎間，大部山坡盡爲雜木與蔓草所叢生，未見有較大面積之樹林，地勢平坦之處，嘗闢爲農田，引谿水以灌溉．此層植物，荒廢已極，當由於人工之濫伐所致.

3. 中層植生區域——自拔海高八百呎至一千四百呎間，植物有顯著之良好生長狀態：如油松，杉木或爲純林，或爲混生；闊葉樹，多混交成林；孟宗竹亦分佈特多，生長繁茂；且有數種特殊之常綠闊葉樹，於此層內見之.

4. 上層植生區域——自拔海高一千四百呎至二千呎間居民衆多，蓋由於寺庵林立，有以招徠。農田日闢，森林漸廢．松杉之生長雖佳，但大者甚少，疏落散布於山坡．此層植物因濫伐而失其舊觀，僅於寺廟周圍，保存有較大之落葉闊葉數種.

1918

FORESTS AND CHIHLI FLOODS*

D. Y. LIN, M.F.

While in Tientsin during the months of November and December of 1917 I had the opportunity of going through the flooded sections of the city, and it was a terrible sight indeed! The boatmen who took us around through the flooded streets would indulge in pointing out to us the highest marks made by the flood water on the different walls, and also tell us that millions of natives were rendered homeless, that thousands had already perished, and that coffins were seen floating in the flooded area. The country which was under crop ready for the harvest is now a great inland sea with boats plying between points or islands formed by rising ground. The damage that has been done to crops and houses, the loss caused by stoppage of trade, interruption of railway traffic on the Peking-Hankow and the Tientsin-Pukow railways—this has been estimated at hundreds of millions of dollars. It is further estimated that in the city of Tientsin alone there are more than 120,000 flood sufferers, but thank goodness, most of these sufferers are being properly taken care of by different organizations and for their shelter thousands of mud huts have been put up.

According to the latest report of the general Relief Committee, which gives detailed information of each of the hsien that has suffered from the floods, we learn that there are altogether 103 hsien or 17,646 villages affected by the floods, and that in these hsien there are as many as 5,611,759 sufferers who are either homeless or starving.

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* This article, written for English reading public, contains the substance of a pamphlet written in Chinese by the same author during his recent investigation trip north.

When we come to think of prosperous and peaceful Switzerland as having a population of only 3,425,000 and an area of 15,975 square miles as compared with 5,611,749 sufferers and 15,000 square miles of flooded districts here, we at once comprehend the severity and the extent of devastation by the floods; and it is no wonder that they have been called phenomenal floods or something that Chihli province has not experienced for the last 170 years.

Actually to see the results of such record floods is no more interesting than to learn of what some people have said as to the real cause of such floods. So before I discuss the problem from a purely forestry standpoint, I wish to quote at the outset what some of the engineers or scientists who have been for some time connected with Chihli conservancy work have said.

Mr. J. B. Taylor, in his attempt to arouse the people in Chihli to the necessity of inaugurating a permanent Chihli Conservancy Board, suggested among other things that reforestation is the most important remedial measure which must be taken in the control of Chihli floods, and he emphasized the point by saying: "It is absolutely essential to ameliorate the rivers, especially the Hun Ho, in the mountainous collecting basin, by reforestation and by the erection of barrages. The first effect of this is to delay the waters during heavy rains and so reduce the freshets and the liability to floods. But these improvements have a much more important effect, namely the keeping back of the silt which is so injurious to the rivers. Forests act as a sponge, retaining moisture and furnishing a protective coating that prevents erosion."

Mr. P. L. Yang, chief hydraulic engineer of the Conservancy Bureau, Ministry of Agriculture and Commerce, in his study of the river system in Chihli, wrote: "There are three ways of solving the flood problem in Chihli, namely: (1) reforestation; (2) erection of barrages; and (3) construction of reservoirs. But the erection of barrages and the construction

of reservoirs require such an enormous expenditure of money, and besides they do not have a permanent effect. So we may safely say that reforestation is the best and the most important measure to be considered in the control of floods in Chihli province."

Again Dr. P. E. Licent, a well-known scientist, who conducted perhaps more scientific investigation through the flooded districts than anybody else, said: "It is to be feared that next fall there will be another big flood around Tientsin, because the five rivers in this province are badly silted up and the embankments are in bad repairs. For instance, along the Tze-ya Ho from Sienhsien to Tientsin, I saw twelve places at which the embankments are broken. Now it is on account of a long continued deforestation which has deprived the different watersheds of their protective covering that all these rivers have become silted up." Then pointing to the map, he continued: "I was traveling in the mountains near Paotingfu last August, and I saw hundreds of corpses washed down with houses, dead cattle, bowlders, etc., by the terrific torrents. In one place called Tai Lun Mung near Chochow, I saw eighty-four corpses floating gruesomely on a little pond. The terrible mountain torrents must have been responsible for such a state of affairs. China cannot hope to harness her water or regulate her streams until these torrents are stopped and to stop them permanently a systematic program of reforestation similar to that in our country must be carried out."

Then again Mr. T. Pincione, engineer-in-chief of the Hai Ho Conservancy Bureau, observed: "Providing a sufficient outlet to sea of rain water is essential, but the only way to cure the evil of the quick inrush of freshets is to arrest in the mountainous regions the sand which causes the silting up of different channels to the sea. It is said that forests can hold on nearly 50% of rain water, so forests by reducing the capacity of channels by 50% will greatly regulate the downflow of water.

"The Chihli rivers during freshets have an output from 150 to 200 times the output during dry seasons. For instance the Yung-ting Ho or Hun Ho in dry season has an output of scarcely 1,500 cubic feet of water per second, but during freshets its output rises to 200,000 cubic feet per second. It is evident that if a channel is prepared for this large output it will silt up during dry seasons on account of the meager supply of water. On the other hand if the channel is good for 1,500 cubic feet, it cannot carry down to the sea 200,000 cubic feet during rainy seasons. Only reforestation is able to prevent this great difference of output, holding on nearly one half of the rainfall during heavy rains, and giving it subsequently to the channel. Therefore forests can be compared to a sponge for retaining rainfall and giving it up gradually. Then also we must consider that the vapor from the sea when encountering with forests is bound to condense and restitute to the sea the water taken, with a process more uniform than would take place on the bare mountains.

"Therefore," stated Mr. Pincione, "In my opinion, reforestation is absolutely indispensable for the proper regulation of rainfall and the improvement of the channels carrying the water back to the sea."

Perhaps the most convincing account of the need of reforestation in the regulation of Chihli floods is that by Mr. H. Vander Veen, C. E., who has been for many years consulting engineer to the Natural Conservancy Bureau in Peking. At the conclusion of one of his recent reports he wrote as follows: "I have dealt in the foregoing pages with the causes of the frequent floods in the Chihli province and have endeavored to explain how the conditions can be improved by providing a sufficient outlet for the flood water. But with that the danger of floods has not been removed altogether, for there remains still the difficult problem to settle what to do with the quantities of silt which the river could not bring down to the sea, notwithstanding the improved outlet.

"As long as the slope of the water level is such that a current can be maintained strong enough to carry all the matter held in suspension along, no harm is done. But as I explained in the beginning of this report, the natural slope of the plain is, for several rivers, insufficient. In such a case the river is therefore forced to get rid of the soil, held in suspension, along its way, consequently its bed gets raised and on the long run the river has to find another course, which it does by bursting its dikes to find in the lower lying land the place where it can deposit its burden, which it could carry no longer and for which no more room could be found in the old bed. This is the case more or less with every river running through the plain of China.

"The only way to diminish this evil is to diminish the amount of soil brought down from the mountains. And the reason for this enormous quantity of silt coming down from the mountains is that those mountains are bare so that during a heavy rain nothing prevents the water from rushing downward practically immediately after it has fallen, taking with it large quantities of soil, so that it reaches the river down below more like torrents of mud than of water. Now if those mountains were planted with trees not only would then the water be unable to take away so much soil but it would also reach the river gradually in a regular flow divided over a longer period and not within a few hours in fierce torrents.

"It is impossible, therefore, as I have said on several former occasions, but I wish to repeat it again, to lay too much stress upon the enormous importance of reafforestation. The deterioration of the various rivers in China and specially of those in this province, would never have reached its present stage if deforestation had not taken place. I say specially the rivers in this province because they all take their rise in the mountains west of the Peking-Hankow line, which for a great part consist of loess, a soil which is easily carried away by the rain.

"To build reservoirs in the hills in order to regulate the flow of the water, as has sometimes been suggested, is not only far too expensive but moreover wrong as it does not do away with the problem of silt. Sooner or later these reservoirs would become filled, consequently new ones would have to be built, a process which would have to be carried on into eternity.

"Reafforestation is most imperative, for without reafforestation the improvement of rivers can only be partly accomplished, but all these processes going hand in hand, the improvement of the hydraulic conditions of the country will be decisive."

The foregoing statements as to the importance of reforestation are made by prominent engineers or men who have been closely identified with the conservancy work in Chihli. These men are not foresters, but the fact that they have repeatedly emphasized forestry shows conclusively how the problem of flood in Chihli, yes in all China, can never be *permanently* solved unless a systematic program of reforestation is carried out together with the hydraulic engineering works. As a forester I wish to show what has already been written about the relation of forests to floods and to bring out how different elements come into play to make this relation so close. It is hoped that the information thus set forth will help my readers to understand and appreciate better the importance of tree planting in the regulation of streamflow and in the control of destructive waters.

For the sake of clearness we shall first discuss the effect of forests on floods under the following heads:

1. Forests and streamflow.
2. Forests and soil erosion.
3. Forests and floods.

I. *Forests and Streamflow.* It has been proved that the effect of forests upon streams in level countries is unimportant, but in hilly and mountainous countries they are conservers of water and tend to maintain a steady flow of water in the streams.

In the mountains the greatest loss of rain water is through surface run-off (water that washes off the surface of the ground); and the most important influence of a forest cover is in reducing this. It is stated that the amount of water saved in this way by the forest is 20% to 35% and often more with higher altitudes.

The reasons why the forest is able to check surface run-off and save portions of it to the soil are first, the trunks and the underbrush in the forest offer mechanical obstruction; second, the litter of the forest floor checks rapid surface drainage of the water and also acts as a sponge; and third, the network of deeply penetrated roots, living and decayed, make the forest soil more porous and permeable; hence the water sinks into it more readily.

It is evident that the ability of the forest to check surface run-off is greatest when the forest is dense and when the ground beneath it is covered with an unbroken leaf litter.

It must be borne in mind, however, that when water is precipitated from the clouds, a portion of it is prevented from reaching the ground through interception by the leaves, branches, and trunks of the trees. This intercepted portion varies according to the tree species and the density of the woods. According to Bavarian investigations, it averages twenty-three per cent of the total rainfall. So after a rain, we often find that water continues to drip from the leaves and twigs for hours.

With this knowledge of the different factors which tend to influence the amount and the rapidity of running water in forest clad watersheds, we are in a position to understand the relation of forests to streamflow.

In forested regions, rain water is conserved in such a way that it is allowed to drip slowly down. So we find that in such regions streams do not rise high immediately after rains and do not dry up when there is no rain, and there is always a great abundance of springs which go to feed such streams. Forests and forest soil are like large reservoirs for the conservation of rain water for streamflow.

Forests regulate streamflow by conserving not only water but also snow. That forests retard the melting of snow has been demonstrated in a series of observations carried on at Moscow. Results show that the period of snow melting within forests is from twenty-six to fifty-seven days, while snow in the open disappears within six or seven days. The ability of the forest to retard the melting of snow is due chiefly to the shade and protection given by the trees and the underbrush, and each gradual thawing (this would be the case if the mountains in North China climate were well wooded), will render it possible for streams to be slowly fed—hence a more even streamflow.

II. *Forests and Soil Erosion.*—When water rushes down a bare slope, it possesses great mechanical power. It loosens the soil and carries it downhill. It makes gullies and ravines and causes landslips. The soil brought down not only renders the fertile land below valueless, but also, as brought out in previous paragraphs, goes to the silting up of streams.

It is generally understood, however, that of all the vegetable covers forests are most efficient in protecting slopes from the erosive action of water. This is because first, the roots of the trees hold the soil firmly in place and so increase its resistance to erosive action; second, the crowns of the trees protect the earth from the violence of beating rain and intercept a considerable portion of it; and third, the velocity of the moving water is checked, because of the reduced amount of the run-off, hence the erosive force of the run-off itself is minimized. On the whole we may say that on a forested slope a series of obstacles is always present to oppose the movement of the water and reduce its velocity and force, and consequently its erosive action.

The importance of a forest as an effective agency for protecting the soil from erosion has been recognized for centuries in Europe. The so-called "Protection Forests" in

France, Switzerland, and Austria were created with the express purpose of protecting mountains and hills and of preventing communities from being impoverished by floods and torrents which destroy and silt over fertile lands at the foot of the mountains. History has shown time and again that wherever extensive deforestation has taken place, the consequence has been the gradual formation of a series of torrents, the abandonment of farms, the rapid silting up of river channels, and frequent visitations by floods. To remedy these evils great efforts have to be made to reafforest the denuded areas. France has experienced this and millions of dollars have been spent in the work of reforestation.

III. *Forests and Floods.*—From their relation to streamflow and soil erosion, we can readily see the relation of forests to floods. On all denuded mountains, a heavy rain is generally followed by the formation of a system of gullies. These gullies begin a short distance below the divide and then form lines of least resistance to the passage of water. As these gullies or furrows extend down the slope they join neighboring furrows and become rapidly wider and deeper until large gullies of many feet deep are formed. Where hills are thoroughly drained by a system of gullies, the water from a storm will sweep down through them in a fraction of the time that would be required if it had to trickle down in a thin sheet or amidst vegetable obstacles. Now if the main channel is unable to discharge the influx of water as fast as it rushes down, the result is a flood.

The high rate of run-off, which is characteristic of streams arising from denuded hills and mountains, enables them to carry an enormous amount of silt and bowlders of extraordinary size. The transporting power of water varies as the sixth power of its velocity, so that if the velocity of a stream is increased ten times for instance, its transporting power is increased 1,000,000 times. This is why, in the case of Chihli rivers, they speak of stones and bowlders of large sizes carried down to the foot of mountains, and of the enormous quantity of silt brought down to raise the beds that have already been silted up.

With this general knowledge of the relation of forests to streamflow, to soil erosion, and to flood waters, we are in a position now to appreciate better the statements made by the engineers and to understand why they all should have emphasized the importance of reforestation as an indispensable supplement to their hydraulic works.

The river system in Chihli, with which we are concerned, may be briefly said to consist of the Pei-yun Ho, the Yung-ting Ho, the Ta-ching Ho, the Dze-ya Ho, and the Yu Ho. The first four of these rivers have upland collecting basins in the mountains to the west of Chihli and in Shansi, while the Yu Ho or Grand Canal receives all the water from the Wei Ho, a river rising in the western hills of Honan. These five waterways drain altogether a basin of 75,000 square miles, and of these about 60,000 square miles are mountainous. The five rivers have as a matter of fact only one outlet, i.e., the Hai Ho. The maximum capacity of the Hai Ho is 30,000 to 35,000 cubic feet of water per second, but as has been brought out before, the Yung-ting Ho alone carries down as much as 200,000 cubic feet per second during summer freshets. It is evident then that all the water that comes down in excess of the volume disposed of by the Hai Ho must necessarily overflow and become flood water on every side. It requires very little imagination to picture to ourselves the enormous amount of water that the 60,000 square miles of deforested mountains and hills must shed during torrential rains, and then to think further how the water rushes down the hillsides, unhindered by vegetation, making gullies, and carrying with it enormous amounts of silt. If any of our readers had seen the flow of the Hai Ho, he could not have helped comparing it to the flow of liquid mud. Since the Hai Ho cannot discharge such an influx of heavily laden water, the only alternative will be for the water to break through the

embankments and overflow the surrounding country; hence we hear of 5,611,759 people rendered homeless and 17,646 villages partly or wholly under water.

It is obvious therefore that provision must be made for adequate outlet to the sea for the five streams ; and until this is done, inundations are bound to occur regularly every year.

But granting that a more adequate outlet to the sea has been effected—which we know is a prodigious engineering task—are we going to consider the problem of flood in Chihli as solved? What about the silt problem? Can it be taken care of *permanently* by barrages, reservoirs, weirs, dikes, outlets, and other engineering works? Will not the reservoirs, outlets, etc., be silted up again after a few years of usefulness, just as the different streams have been silted up? Have we not heard that at some places the bed of the Yung-ting Ho is twenty feet higher than the adjacent country? What about the torrential run-off? Can it be permanently checked, harnessed, and conserved for commerce and navigation, and for the use of millions of agricultural people who have year after year suffered from either drought or famine? One could go on and ask countless questions of such character, but suffice it to say that though engineering works are all necessary remedial measures, they are not sufficient by themselves and unless they are supplemented by reforestation at the sources of the different rivers, their effect can only be *temporary*.

The problem of flood in Chihli, therefore, is fundamentally a forest problem. A systematic program of reforestation will have to be carried out before the problem of silt, the problem of unrestrained run-off of rainfall, and the problem of reservoirs, of dikes and outlets can be permanently solved.

It must be remembered, however, that China is not the only country where floods occur. History has shown that all countries have experienced floods. In fact, floods have always played the rôle of a sounding bell to nations that have not paid enough attention to the proper handling of forest lands or lands that are not fit for agriculture. The creation of "Protection Forests" in different European countries was but the result of an effort put forth by people who suffered from floods and who wanted to stop their recurrence. France has perhaps furnished the best example, showing where reforestation has been undertaken on a large scale to reclaim waste lands in order to regulate streamflow and to stop floods. It might be well for us at this time to turn to history to see how, before the Revolution, the mountains in the Vosges and the Jura Alps in France were protected and no clearing was allowed. But during the Revolution restriction vanished and ruthless cutting began. Cutting, forest fires, etc., went on until millions of acres of lands were rendered useless on account of torrents doing great damage, inundating plains, tearing away fertile lands, and silting up rivers. This went on until Surell, in 1841, made a special study of the regions, and in his "Etude sur les Torrents," he called the attention of the people to the relation of forests to torrents, and emphasized the need of tackling the problem at the sources. Then work was started, but it was not until 1882 when the Reboisement Law was passed that systematic work was taken up. The work is still going on, and millions of dollars have been spent already but it is estimated that many more millions will have to be spent to complete the work. Now what has been the result? It is said that of the 1,462 torrents, 163 are entirely controlled, and about 650 have begun to be "cured." It is also said that among the 163 that are controlled are thirty-one which fifty years ago were considered by engineers as incurable.

France, then, like every other country, has had a sad forestry story to tell; but doubtless such experiences as she had, are invaluable and should be an object lesson to us at this time.

It is hoped, therefore, that our country will soon realize that want, loss, and misery are inevitable results of a long continued deforestation, and that this may act as a spur to wake her up to do something to start this all-important

work—forestry. We have not mentioned here the direct benefits that China will derive from practicing forestry, but let it be sufficient to say that forestry and agriculture are the greatest of all industries, and that unless both of them are developed China cannot hope to utilize fully her greatest of all resources—the land. It is hoped that all well-wishers of China, and especially the engineers who have worked so assiduously to improve the hydraulic conditions in this country, will coöperate to bring this message to our officials and gentry, *that the problem of flood in the north cannot be permanently solved until the different watersheds are properly clothed with trees and protected.*

UNIVERSITY OF NANKING,

NANKING, MARCH, 1918.

中國中部木材之强度試驗

MECHANICAL STRENGTH OF WOODS GROWING IN CENTRAL CHINA

BY

W. F. TSU　　C. H. LOH

朱 會 芳　　陸 志 鴻

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中國中部木材之强度試驗

金陵大學農學院　中央大學工學院

朱會芳　　陸志鴻

目　次

緒　言

吾國幅員，雖具有溫寒熱三帶，而溫帶實居其大半，故樹木之品種，爲數甚夥，尤以溫帶植物之豐富，爲世所罕有。然樹木之品種既不一，則木材之機械性質亦異，又因其機械性質不同，則木材使用之途，亦自有殊。是以

各屬樹種，欲知其造林之價值，適當之用途，則材性之研究，尤爲必要。

夫木材强度性質之研究，在歐洲林學先進諸國，已於數十年前，着手試驗，最近美國日本印度朝鮮及台灣等，咸注力於各材性質之探討，頗有顯著之進步。環顧吾國，對於與國家經濟有關之木材，迄今尙鮮有加以研究者。著者有感於斯，自一九三一年以來，卽從事搜集國內主要木材及主要輸入材，凡其外觀之性質比重及諸種機械性質等，均經加以鑑別與試驗，以供林業界及工程界之參考資料。

本篇「中國中部木材之强度試驗」爲一初步之比較試驗，但以材料搜集之範圍極狹，所得供試材之數甚少，未能得充分之結果。頗引以爲憾焉，尙祈讀者有以諒之。

II　供試材

1.　供試材之種類

本試驗中之供試材種，爲中國中部建築土木及其他工藝應用之木材。其森林之分布，依森林植物帶而論，一部雖屬於寒煖二帶，而其大部分，則屬於溫帶之區域。

玆將各供試材種別分布採集地供試木之狀態及外觀之性質等，摘要如次。

A.　針葉樹材

中名	學名	分布	採集地	森林狀況	供試木 採集號目	供試木 樹齡	供試木 樹高(m.)	供試木 胸高直徑(cm.)	外觀之性質
銀杏	Ginkgo biloba, Linn.	中國及日本吾國寺院附近尤多此樹	浙江天目山	林相疎多與杉林混生	78	三一	一六・四	一九・五	材黃白色心邊材之境界不甚顯明春材向秋材之移行極漸進材質緻密柔靱
三尖杉	Cephalotaxus fortunei, Hook.	浙江湖北四川雲南及廣東等省	同上	與杉木柳杉等混生	97	三五	一〇・〇	一四・五	材赤黃白色心邊材之區別全不明春秋材之移行緩急不一材質緻密而硬
榧樹	Torreya grandis, Fort.	產浙江江西四川湖北	同上	同上	83	二八	九・三	一五・〇	邊心材之區別稍明瞭邊材淡赤黃白色心材黃白色年輪界之判明度隨年輪幅之廣狹而異材質緻密堅硬有特殊之香氣
馬尾松	Pinus massoniana, Lamb.	中國中部及南部	南京蟠龍山	與櫟林混生林相疎	104	二九	一八・〇	二一・〇	心邊材之區別判明心材帶赤褐色邊材淡赤黃白色春材向秋材之移行急年輪境界顯明香氣强
金錢松	Pseudolarix amabilis, Rehd.	爲中國之特產分布於浙江江西安徽	浙江天目山	與杉馬尾松等混生	6	三二	一四・三	一五・〇	心邊材之區別不明春材與秋材之境界秋材爲紅棕色木理通直材質柔靱
杉木	Cunninghamia lanceolata, Hook.	爲中國之原產分布於中國南部	同上	純林林相疎密適中生長頁好	82	二一	一一・五	一四・五	邊材黃白色心材紅棕色切口常分泌有烈香之白色結晶物材質軟而靱木理通直

中名	學名	分布	採集地	森林狀況	供試木 採號集目	樹齡	樹高(m.)	胸高直徑(cm.)	外觀之性質
柳杉	Cryptomeria japonica, D. Don.	爲中國南部之樹材在湘黔粵桂等省多天然林	同上	純林生育優良	81	三二	一七・四	二〇・五	心材與邊材之境界顯明邊材黃白色心材暗赤褐色或濃赤色色愈濃者使用愈耐久年輪境界判明木理通直加工容易
扁柏	Thuja Orientalis, Linn.	爲中國之原產分布於吾國東北部及朝鮮寺廟或墓地多栽植之	南京老虎山	針闊混交林林相疏	105	四二	一九・二	二四・五	心材黃褐色邊材黃白色春秋兩材部顏色濃淡之差不著材質緻密稍硬
圓柏	Juniperus Chinensis, Linn	分布於我國東北數省其他寺院墓地附近亦多植之	南京北崗山	散生	113	四七	二一・七	二二・〇	心邊材之區別極明瞭心材赤褐色邊材黃白色而狹年輪幅廣狹不一狹者槪呈緩行波狀材質堅實緻密鉋削之有光澤富有極强之香氣

B. 闊葉樹材

中名	學名	分布	採集地	森林狀況	供試木 採號集目	樹齡	樹高(m.)	胸高直徑(cm.)	外觀之性質
響葉楊	Populus adenopoda, Maxim.	分布於黃河及揚子江流域	浙江天目山	闊葉樹混交林林相疏	80	二六	一三・〇	一九・〇	心邊材同爲白色或帶淡赤白色有時因腐朽而生特殊之色材質緻密而軟有光澤纖維强韌
垂柳	Salix babylonica, Linn.	分布區域甚廣我國河岸到處見之	南京太平門外	河岸樹	107	一五	九・〇	二五・〇	邊材白色心材帶赤褐色年輪不易判別材質輕軟有光澤乾時不易彎曲老材中心多腐朽

中名	學名	分布	採集地	森林狀況	供試木 採號集目	樹齡	樹高(m.)	胸高直徑(cm.)	外觀之性質
化香樹	Platycarya strobilacea, S. et Z,	分布於長江流域尤以江浙爲最多	浙江天目山	散生	25	二九	一二・五	一七・〇	心材暗褐色邊材淡黃白色導管爲環孔材材質粗糙不易割裂
青錢李	Pterocarya Paliurus, Batal.	分布於浙江四川湖北	同上	同上	39	二四	九・四	一三・〇	心材赤褐色邊材白色有光澤材質堅硬割裂難
野核桃	Juglans cathayensis, Dode.	分布於浙江四川湖北及雲南	同上	同上	71	二八	一一・三	一六・五	心材赭褐色邊材灰白色質輕軟粘韌無反張折裂之虞
山核桃	Carya cathayensis, Sarg.	爲浙江之特產尤以昌化孝豐等縣出產最著	同上	與其他闊葉樹混生林相疏	79	三一	一一・五	一七・〇	心材暗褐色邊材帶黃灰白色材質堅韌
千筋榆	Carpinus fargesiana, Winkl.	產浙江湖北四川及貴州等省	同上	多與櫟枹櫧等樹混交林相疏	10	三〇	一二・三	一四・五	材灰白色肌理有鋸磨之有光質亦堅硬難割裂
錐栗	Castanea henryi, R. and w.	產浙江江西四川湖北及貴州等省	同上	同上	101	一七	七・六	一二・五	材黃白色質堅硬而重
板栗	Castanea mollissima, Bl.	分布區域甚廣以長江流域爲最多	同上	同上	1	三八	一三・〇	二八・〇	材黃白色久浸於水中則變爲黑色材質堅硬而重易割裂能耐水濕

中名	學名	分布	採集地	森林狀況	供試木 採集號目	樹齡	樹高 (m.)	胸高直徑 (cm.)	外觀之性質
茅栗	Castanea sequinii, Dode.	產浙江江西安徽湖北及四川等省	同上	散生於常綠闊葉樹林中	8	二二	九・五	二三・〇	材色似板栗而暗質亦堅硬而重易剖裂
石櫟	Lithocarpus henryi, Rehd. and wils.	產浙江湖南福建及廣東等省	浙江天目山	與其他常綠闊葉樹混生	15	二四	八・五	一三・〇	木材淡褐色而微帶紫色材質堅硬緻密
槲櫟	Quercus aliena, Bl.	分布於江浙湖北四川等省	同上	散生於櫟枹等闊葉樹林中	59	二五	一二・五	一六・〇	邊材淡赤色心材暗褐色材質堅硬易反張
枹樹	Quercns glandulifera, Bl.	分布於中國中北部	同上	與其他闊葉樹混生	18	二九	一〇・五	一五・〇	邊材灰白色心材帶黃暗褐色材質硬而粗
青剛櫟	Quercus glauca, Thunb.	分布於中國南部諸省	同上	與其他常綠闊葉樹混生	100	二九	九・五	一三・五	材灰白色污狀心材色稍暗材質堅韌
青栲	Quercus myrsinaefolia, Bl.	產浙江湖北四川廣東雲南等省	同上	同上	4	二四	八・〇	一一・五	邊材灰白色心材赭褐色材質硬重易割裂乾時易反張
櫟樹	Quercus serata, Thunb.	我國南部及中部皆產之尤以長江及黃河流域爲最多	南京蟠龍山	多與馬尾松混交林內雜草叢生	111	一五	八・〇	一七・〇	心材淡紅色邊材灰白色材有粗大之髓綫甚明材質硬重易割裂乾時易反張

中名	學名	分布	採集地	森林狀況	供試木 採集號目	樹齡	樹高 (m.)	胸高直徑 (cm.)	外觀之性質
鑽天榆	Ulmus japonica, sarg.	分布於東三省河北及山東浙江亦產之	浙江天目山	散生於闊葉樹混交林中	102	二六	一一・〇	一五・〇	邊材淡褐色心材赤褐色材質堅而韌難割裂能耐水濕
榔榆	Ulmus parvifolia, Jacq.	分布於長江流域	南京老虎山	散生	114	三四	一三・四	一六・五	心材黃棕色邊材黃白色爲榆類中最堅硬而有韌力之材割裂難保存期長
朴樹	Celtis sinensis, Pers.	分布於山東江蘇浙江江西及廣東等省	南京北固山麓	散生	109	三〇	一四・五	二二・五	材黃白色年輪寬質軟且粗而富有韌力易腐朽保存期短
糙葉樹	Aphananthe aspera, Planch.	分布於中國中南部	浙江天目山	同上	96	四〇	一四・〇	三〇・五	邊材淡黃色心材黃褐色稍帶黑材質堅重强韌割裂難保存期短
桑樹	Morus alba, Linn.	分布於中國及日本尤以浙江出產最多	南京蟠龍山	孤立木	106	二五	九・八	二九・四	邊材黃白色心材黃棕色老材稍帶黑褐色肌理直而美鉋之則生美麗之光澤材質堅硬而重
玉蘭	Magnolia denudata, Desr.	爲中國原產分布浙江江蘇江西等省	浙江天目山	與其他闊葉樹混生	98	二八	一五・〇	四〇・〇	材色白而微帶淡褐色材質緻密而軟有光澤
木蘭	Magnolia liliflora, Desr.	分布於長江流域	同上	同上	89	二五	一四・七	二六・五	材白色有光澤材質與玉蘭同

中名	學名	分布	採集地	森林狀況	供試木 採集號目	樹齡	樹高(m.)	胸高直徑(cm.)	外觀之性質
樟樹	Cinnamomum camphora, Nees and Fberm.	爲中國之特產分布於浙閩粵桂等省	同上	散生	83	三二	一一・四	四〇・五	心材帶黃赭褐色邊材色稍淡材質堅實中庸鈍之有光澤且有香氣保存期長
圓葉樟	Litsea auriculata, Chien and Cheng.		同上	散生於雜木林中	65	二六	一二・七	一三・〇	邊材白色心材黃褐色材質堅軟中庸
楓香	Liquidambar formosana, Hance.	分布於中國南部中部及台灣等	同上	與其他落葉闊葉樹混生	94	二一	一〇・五	一四・五	材帶紅灰褐色心材色稍深年輪顯明肌理通直材質堅硬中庸
青皮梨	Pyrus serotina, Rehd.	分布於河南湖北四川浙江等省	同上	散生於雜木林中	5	一八	九・〇	一五・〇	材紫褐色邊心材之境界不明材質緻密
布狸（廣東）	Photinia beauverdiana, Schneid.	分布於中國中南部	同上	同上	20	四二	一〇・〇	一三・五	邊材淡黃色心材暗紅褐色材質甚堅硬
石楠	Photinia serrulata, Lindl.	同上	南京磨盤山	散生	110	三九	八・〇	一七・〇	木材淡黃白色至中心則呈暗紅褐色材質堅硬緻密劈裂難
猴楂子	Crataegus hupehensis, Sarg.	分布於浙江河南及湖北等省	浙江天目山	散生於雜木林中	49	二七	七・〇	一〇・五	木材帶紅黃白色心材色稍深材質堅硬

中名	學名	分布	採集地	森林狀況	供試木 採集號目	樹齡	樹高(m.)	胸高直徑(cm.)	外觀之性質
苦桃樹	Prunus brachypoda Var. pseudossiari, Koehne.	分布於浙江湖北四川及西藏	同上	同上	22	三〇	九・〇	一四・五	心邊材判明邊材赭黃白色心材黃棕色有絹光材質堅靭緻密
櫻桃	Prunus pseudo-cerasus, Lindl.	分布於長江流域	同上	同上	14	二六	八・五	一四・五	邊材淡褐色心材帶紅暗褐色木材縱斷面上常現無規則之綠色斑點材質堅密易劈裂
苦李	Prunus salicina, Lindl.	分布於江浙湖南湖北四川及雲南等省	同上	同上	7	三一	六・八	一三・五	邊心材之境界顯明邊材白色心材赭褐色髓綫細微材質緻密而硬
山槐	Albizzia kalkora, Prain.	分布於中國中南部	同上	同上	42	二六	一〇・五	一四・五	邊材帶黃白色心材黝灰褐色環孔顯明材質粗而軟
櫰槐	Maackia chinensis, Takeda.	分布於中國北部及中部	同上	同上	16	二九	一一・四	一七・〇	邊材帶黃白色甚狹心材棕色材質堅硬有粘力
黃檀	Dalbergia hupeana Hance	爲中國中部之重要樹材以浙江爲最多	同上	與櫟枹等樹混交	62	三四	一三・五	一八・五	材色淡黃心邊材之區別不明材質緻密硬重且富有彈性
臭椿	Ailanthus altissima, Swingle.	分布於中國北部及中部尤以黃河流域爲最多	同上	散生於雜木林中	72	一八	一二・〇	一五・〇	邊材黃白色心材黃色環孔大年輪界判明髓綫廣木理通直有光澤材質硬度中庸易劈裂

中名	學名	分布	採集地	森林狀況	供試木 採集號目	樹齡	樹高(m.)	胸高直徑(cm.)	外觀之性質
交讓木	Daphniphyllum macropodum, Mig.	分布於浙江湖北湖南及四川等省	同上	同上	11	三二	八・九	一〇・五	材灰色無心邊材之區別材質緻密而靭
山桐	Mallotus apelta, Muell.-arg.	分布於中國中南部	同上	同上	68	二七	九・七	一三・五	材淡黃褐色無心材年輪顯明材質輕軟中庸割裂易
油桐	Aleurites fordii, Hemsl.	分布區域甚廣以四川湖北及湖南出產最多	同上	與櫟山核桃等樹混生	93	一四	七・〇	一一・〇	材灰白色無邊心材之區別木理通直材質緻密而柔靭
烏桕	Sapium sebiferum, Roxb.	爲我國南方之原產現長江流域及黃河以南一帶多栽植之	同上	多生於山麓附近向南傾斜之處	95	二三	九・〇	一四・〇	材黝褐色材質堅靭有毒汁
鹽膚木	Rhus javanica, Linn.	分布於長江流域	同上	與其他落葉闊葉樹混生	56	二五	一〇・〇	一六・五	邊材汚白色幅狹心材帶淡褐黃色材質轉軟鉋削割裂均難
青榨槭	Acer davidii, Franch.	分布區域甚廣中國中南部多產之	同上	與櫟櫧等樹混生	64	二五	八・六	一四・〇	材黃白色帶微紅年輪界顯明材質堅密
槭樹	Acer palmatum, Thunb.	分布於江浙及江西等省	同上	同上	26	三四	一二・五	一六・五	材帶黃白色而微紅無邊心材之區別年輪界非正圓紋理甚美有光澤材質堅密易割裂

中名	學名	分布	採集地	森林狀況	供試木 採集號目	樹齡	樹高(m.)	胸高直徑(cm.)	外觀之性質
鷄爪槭	Acer Pictum, Thunb.	分布於東三省河北及四川	同上	同上	103	二八	一一・四	一五・〇	材赭白色髓綫細而有光年輪正圓材質堅密易割裂
椴樹	Tilia tuan, Szyszyl.	爲中國中部之樹材	同上	與其他落葉闊葉樹混生	75	三二	一二・八	二〇・五	材黃白色髓綫勻細有絹絲光澤材質輕軟粗鬆加工易抗濕力弱
梧桐	Firmiana simplex, Wight.	爲吾國原產分布於黃河及長江流域	南京北齒山	散生	108	一九	一二・〇	二一・〇	材黃白色年輪界環孔及髓綫均顯明頗似臭椿材木理粗鬆輕軟易割裂反張
油茶	Thea Oleosa, Lour.	爲我國中南部之樹種以浙江江西福建湖南等省出產最多	浙江天目山	多與胡桃科樹種混生	92	二九	七・〇	一〇・五	材棕色中心色稍濃材質堅硬而密難割裂
油金郎（湖北）	Stewartia gemmata, Chen&Cheng	產浙江江西湖北四川	同上	散生於雜木林中	41	三二	七・五	一一・〇	邊材赭白色心材紫褐色材質堅密細緻
椅樹	Idesia polycarpa, Maxim.	分布於浙江江西湖北及四川等省	同上	同上	9	二八	一四・〇	一六・〇	邊材黃白色心材帶赭灰白色木理通直有絹光材質輕軟易割裂
櫃木	Alangium Chinensis Rehd.	爲中國溫帶之樹材	同上	同上	21	二五	一一・五	一九・〇	材淡灰褐色無心邊材之區別材質堅而粗易割裂

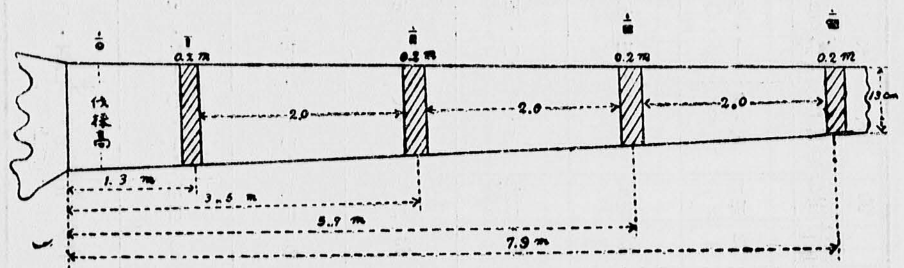
中名	學名	分布	採集地	森林狀況	供試木 採集號目	樹齡	樹高(m.)	胸高直徑(cm.)	外觀之性質
三葉刺楸	Acanthopanax evodiaefolius, Franch.	分布於浙江江西四川湖北及雲南等省	同上	同上	34	三一	九・五	一五・〇	心材赭黃色邊材白褐色木理通直有美麗絹光材質緻密易施工
刺楸	Acanthopanax ricinifolium, Seem.	產於東三省浙江福建四川湖北及雲貴等省	同上	與其他落葉闊葉樹混生	67	二七	一六・〇	二三・五	心材黃褐色邊材灰黃色木理通直而粗材質硬度中庸易施工鉋削之則生如桐材之光澤
楤木	Aralia Chinensis, Linn.	為中國中南部之樹材	同上	散生於雜木林中	76	二二	八・五	一二・五	邊材淡赭黑色心材黑褐色材質似刺楸而軟加工易
水木	Cornus Controversa, Hemsl.	分布於山東浙江江西四川湖北及湖南等省	同上	同上	12	三四	一一・三	一六・五	邊材黃白色心材淡褐色年輪界判明材質輕軟易施工
四照花	Cornus kousa, Buerg.	產浙江江西湖北四川	同上	同上	45	二〇	六・〇	九・五	邊材黃白色心材桃紅色材質堅硬緻密
胭脂紅	Rhododendron, mariesii Hemsl. & Wils.	分布於浙江江西福建湖北四川等省	同上	與其他闊葉樹混生	17	三六	七・五	一六・〇	木材深赭黃色心材色稍深材質硬重割裂難
白辛樹	Pterostyrax corymbosum, S. et Z.	分布於浙江江西及湖南等省	同上	同上	19	三一	九・七	一二・五	材白色無邊心材之區別有銀白色之光澤材質輕軟而韌

中名	學名	分布	採集地	森林狀況	供試木 採集號目	樹齡	樹高(m.)	胸高直徑(cm.)	外觀之性質
山茱葉灰木	Symplocos congesta, Benth.	產浙江廣東	同上	散生於雜木林中	32	三二	八・四	一一・五	材白色年輪稍判明髓線導管甚細微材質緻密堅實有韌力無反張折裂之虞
過冬青(浙江)	Symplocos crassifolia. Benth.	同上	同上	同上	33	三五	九・六	一三・五	材白色稍帶淡黃材質同前
白檀	Symplocos paniculata, Wall.		同上	同上	70	二九	七・八	一〇・五	材色白質較前種稍粗本種與前二種均可代黃楊之用為製造尺度及小工藝之良好材料
白臘樹	Fraxinus chinensis Roxb.	分布於中國北部及中部	同上	與櫟枹櫧等混生	53	二〇	八・〇	一一・五	邊材微黃白色心材色稍暗年輪判明材質剛勁有粘力并富有彈性保存期長
香果木	Emmenopteryx henryi, Oliv.	分布於浙江湖南四川雲南等省	同上	散生於雜木林中	29	三六	一〇・〇	一四・〇	邊材白色心材淡綠褐色斷面有銀白色之光澤材質輕軟而韌
風箱 獺狗耳(四川)	Cephalanthus occidentalis, Linn.	產浙江福建廣東廣西	同上	同上	86	二三	一一・〇	一六・五	邊材黃白色而寬心材黃色木理通直材質軟而韌易割裂初伐時有特殊之香氣
黃金樹	Catalpa speciosa, Warder.	為北美之原產吾國長江流域曾盛植此樹	南京		119	二五	七・六	二四・〇	邊材白色心材黃褐色材甚柔軟粗糙而富有彈力反撓割裂少材亦耐久

2. 供試材之採取

凡建築用材之供試材，選胸高直徑30cm.以上之健全木，各樹種選擇二株，離地高1.3m.(胸高)處伐採，如第一圖截取長2m.之圓材，并0.2m.圓盤，其數之多寡，隨樹高而定，但梢端之最小直徑，不得在13cm.以下，蓋

第 一 圖



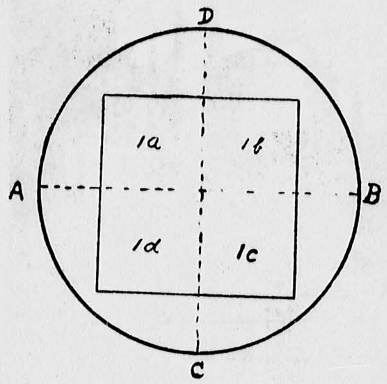
由是以下之樹材，已無建築用材之價值也。

唯其中大部樹材，尚未達伐期，其胸高直徑往往在30cm.以下者，況其材之應用於其他工藝者亦甚廣，茲爲便於比較計，亦同時採集，以資試驗。

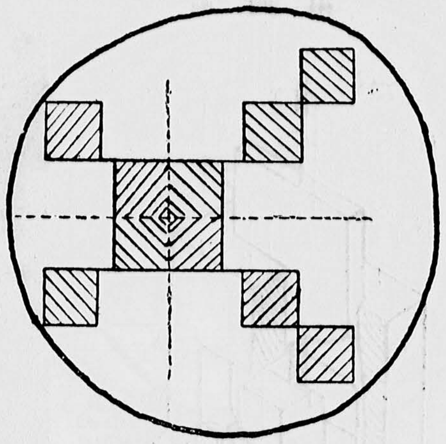
各供試木伐採之後，立即於原木根際斷面上，查定樹齡，各材附以採集號目及樹幹號目，又圓盤更由根部向梢頭，順次附以羅馬數字，而長2m之圓材，充抗拉抗彎試驗材料，圓盤作抗剪及硬度試驗材料，至於抗壓試材，則取抗彎試驗之殘材應用之。

3. 供試材之截取

截取方法，依材之直徑大小而異，直徑小之圓材，如第二圖，通過髓心，割爲四分，即以AB綫分木材爲腹背二部，次與AB交叉之CD綫兩斷腹背，而分爲ab腹部與cd背部之四割材，其直徑大者，如第三圖所示，得截取多數試體，各割材直接除去樹皮，放置室內通風良好之處，經一年以上



第二圖



第三圖

之自然乾燥後，施行試驗。

又各試材之有節者，或有其他瑕疵者，均避免使用。

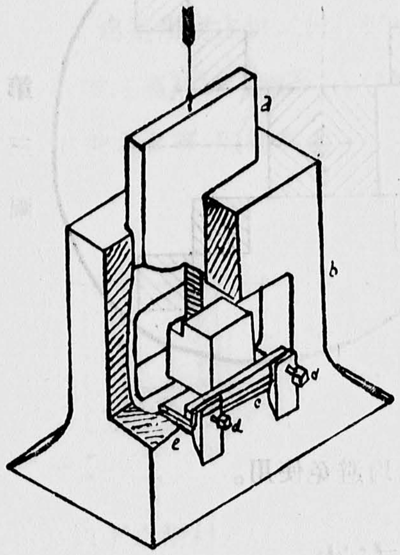
III. 試驗之方法

1. 試驗機及其補助裝置

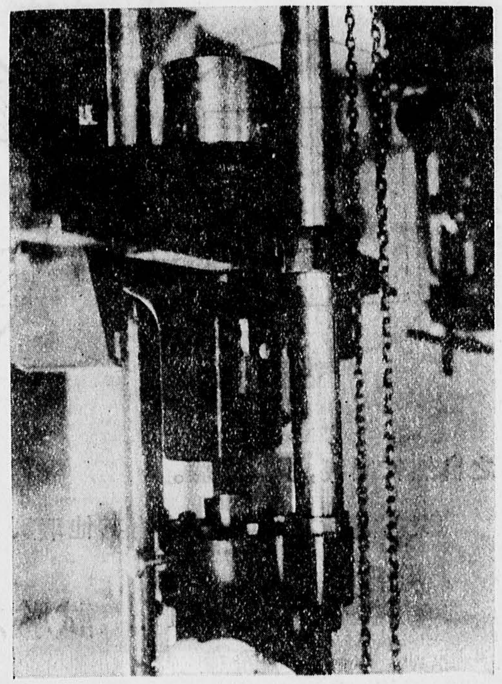
本試驗中所用試驗機除硬度試驗外均用瑞士製阿姆斯勒20噸試驗機(Amsler 20-ton universal Testing Machine)。該機具有20噸，10噸，5噸及2噸四種能力。本試驗中抗彎(Transverse)，橫向抗拉(Tension across the grain)及劈開性 (Cleavability)三種試驗，用其2噸能力。抗壓(Compression)，縱向抗拉(Tension along the grain)及抗剪(Shera)三種試驗用5噸能力，該機精密度在5噸能力時，抗壓試驗之5噸時誤差爲+0.44%，抗拉試驗之5噸誤差爲+0.56%。

試驗機以電動機運轉。各試驗中無荷重(Load)時試驗機之加力面運動速度爲一定。抗彎試驗時每分運動10mm.，其他諸試驗時每分5mm.。

第四圖



第五圖



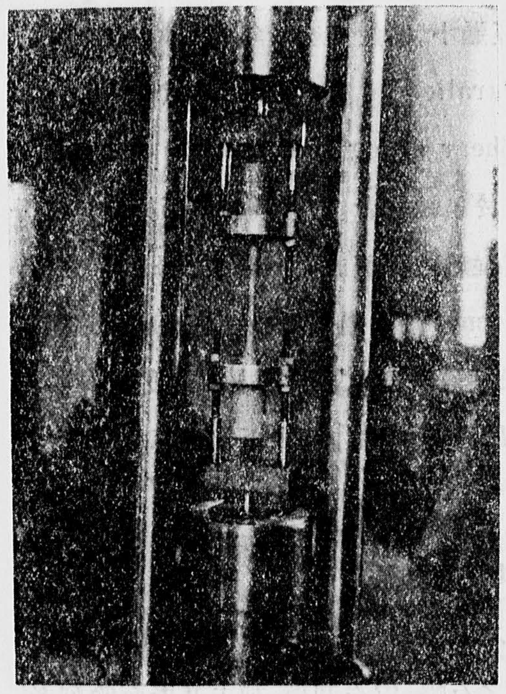
抗彎及抗壓試驗卽用該機原有裝置。抗剪試驗用第四圖及第五圖利雷（Riehle）剪斷裝置。置於試驗機之加壓面間。縱向抗拉用第六圖之裝置。橫向抗拉用第七圖之裝置。劈開性試驗用第八圖之裝置。均置於試驗機之加拉面間。

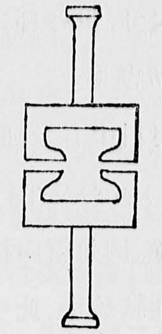
硬度試驗用白靈納(Brinell)硬度試驗機，球之直徑10mm.，加壓力對於硬材爲100kg.，對於軟材爲50kg.，加壓時間爲30秒。凹痕(Indentation)直徑用顯微鏡量之。

2. 試驗項目及其方法

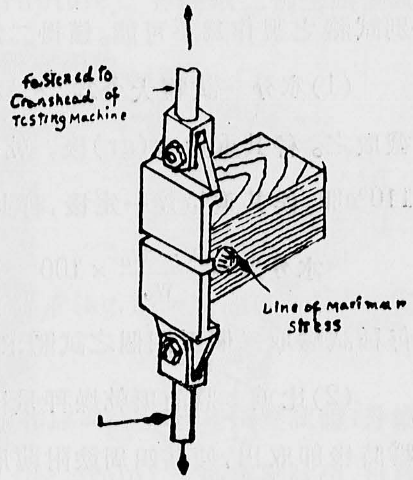
試驗項目分水分，比重，每公分年輪數，抗彎强度(Modulus of rupture,)抗壓强度(Compressive strength)，抗剪强度(Shear strength)

第六圖





第七圖



第八圖

抗拉强度(Tensile strength)劈開性(Cleavability)及硬度(Hardness)等九項。

木材强度因木材之年齡，生長狀況，水分，比重等而異。此外又因試體之大小與形狀及加力速度而其結果不同。故試體之尺寸與形狀須有一定標準。而加力速度則如前節所述保持一定。

本試驗中之供試材料因不能獲得充分大材，故所用試體之大小多不能依照標準尺寸，不得已而對於抗彎，抗壓兩種試體改用小形。其他試體

仍用標準尺寸。但各種木材對於同種試驗若用同一大小之試體，則對於比較上當無妨害也。

供試材料中有數種因幹身直徑過小，對於直交於年輪（Perpendicular to the ring）及平行於年輪(Paralled to the ring)之試體，分別製作至爲困難。例如縱向抗剪試驗(Shear along the grain)，橫向抗拉試驗及劈開性試驗中，此平行與直交於年輪二者，對於數種小形材料，其分別試體之製作爲不可能。僅得二者混雜之試體或斜向之試體。

(1)水分　試體大小爲2×2×4cm.，將經過抗彎或抗剪試驗後之試體截取之。秤其重量w(gr)後，乾燥於電气恆溫乾燥箱中，溫度在100°至110°c間。俟其重量達一定後，秤其最後重量w_0(gr)由下式計算水分。

$$水分\% = \frac{W - W_0}{W_0} \times 100$$

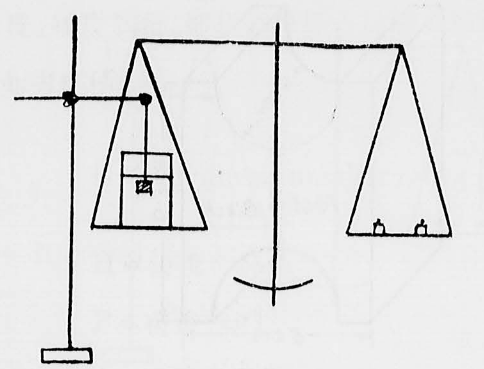
每種試驗取二個至四個之試體求其平均結果。

(2)比重　將前項乾燥秤量後之試體浸於熔融之石蠟（Paraffin)中，瞬時後卽取出，使其四周塗附薄層之石蠟，俟冷却後，刮去其表面餘剩者。浸入於第九圖之天秤盤內玻璃杯水中。此玻璃杯及水預以分銅平衡之。試體上插入細鐵針，將試體押入於水面稍下方，而細針固定於支架上。此時右方天秤盤內添加分銅復使平衡之。其所增加之重量(gr.)數，卽等於試體之體積c.c數。將試體全乾重量w_0(gr.)以試體體積v(cc.)除得之商卽爲全乾比重。每種試樣取二個至四個試體，求其平均結果。

$$全乾比重 = \frac{全乾重量W_0(gr)}{試體體積V(cc.)}$$

(3)每公分年輪數　就抗彎抗剪等試體斷面上與年輪成直角引一直線長1公分(cm)，數其年輪個數。就五個至十個試體求其平均。

第　九　圖



(4)抗彎强度　試體尺寸用2×2×33cm.之小形樑，支其兩端跨長(span)30cm.加力於中央。求其最終荷重(Ultimate load)，由下式計算抗彎强度(Modulus of rupture)。各種取二個至四個試體之平均

$$fr = \frac{1.5\,Pl}{bd^2}$$

或　fr＝5.625P

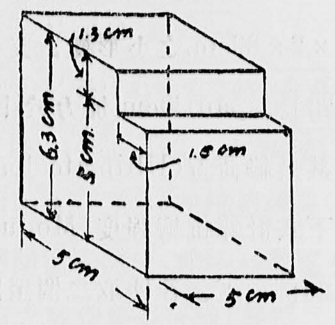
但fr＝抗彎强度(kglcm^2)，P＝最終荷重(kg.)，1＝跨距(cm.)，b＝寬(cm)，d＝深(cm.)

(5)抗壓强度　就抗彎試體後之試體作成2cm.立方之抗壓試體，分縱向(along the grain)及橫向(across the grain)二種抗壓試驗，每種木材取六個試體求其平均值。縱向壓縮時讀其最終荷重，以斷面積除之得縱向抗壓强度。橫向壓縮時讀其降伏點(Yield Point)荷重，以斷面積除之得橫向抗壓强度。

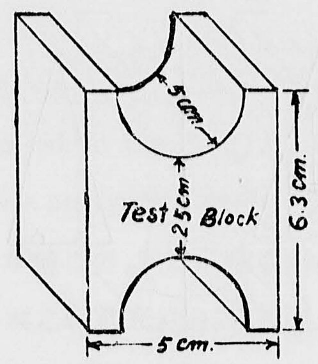
(6)抗剪强度　試體形狀與大小如第十圖。單剪(Single shear)面積爲5×5cm。抗剪面與木理(grain)平行。分平行於年輪及直交於年輪二者。各取二個至四個試體求其平均值。最終荷重以單剪面積除得之值爲抗剪强度。

(7)抗拉强度　分縱向與橫向二種。縱向試驗用之試體大小與形狀如

第十圖

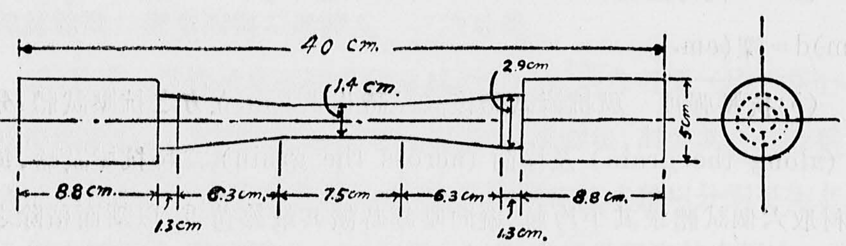


第十二圖



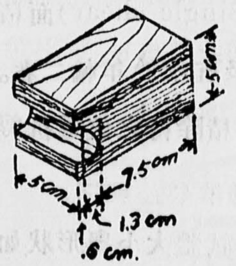
第十一圖。横向試驗之抗拉面又分平行及直交於年輪二者。其試體大小形狀如第十二圖。最終荷重以斷面積除得之值爲抗拉强度。各取二個試體求其平均值。

第十一圖



(8)劈開性　試體之大小形狀如第十三圖。其劈開面分直交及平行於年輪二者。其最後荷重以受劈部寛約(5cm.)除得之值爲示劈開性之值。

(9)硬度　硬度試驗之試體受壓面。分爲横斷面(end)徑斷面(radial)及弦斷面(tangential)三種。試體斷面積爲5cm.²厚2.5cm.－3cm。以1.5cm. 距離作三列三行之九個驗點。唯其中一部分材片。因受材料限制。故作成3cm.³以1.5cm.



第十三圖

作二列二行之四個試驗點。以其各點硬度之平均。爲供試材片一個之硬度。硬度數值。即以鋼球壓入材體之球面表面積(mm.²)除一定荷重(kg.)如次式所示。

$$H\ (\text{Hardness number})=\frac{P}{\pi d\left[\frac{d}{2}-\sqrt{\frac{d^2}{4}-\frac{D^2}{4}}\right]}$$

H＝硬度

P＝荷重(kg)

d＝鋼球之直徑(mm.)

若用球壓測深器。則可直接測定壓入凹部之深。由下列簡式求硬度。

$$H=\frac{P}{\pi.d.t}$$

t＝鋼球壓入凹部之深(mm.)

以上硬度數值。亦可直接由荷重直徑對照表或荷重深度對照表。讀取Brimell硬度。

IV. 試驗之結果

試驗之結果總括於A,B二表,表中括弧內之數字示平均值之試體個數。

A表內末附美松與俄松二種試驗結果。此二種試樣乃自市場上購得,同時試驗,并用同形同大之試體。以資與本國針葉樹類之强度比較。

茲將A,B二表附列於後。

Table A. Mechanical Properties of the Needle-leaved Trees grown in Central China.

Species of Wood			Moisture %	Specific gravity of dry wood	Rings per cm.	Modulus of rupture kg/cm²	Compressive Strength kg/cm²		Shearing Strength parallel to grain kg/cm²	Tensile Strength kg/cm²		Cleavability kg/cm	Hardness number (Brinell)		
Chinese Name	Scientific Name	Sample number					Parallel to grain	Perpendicular to grain		perpendicular to grain	parallel to grain		end	radial	tangential
銀杏	**Ginkgo biloba, Linn.**	78	18.44^{3}	0.456^{2}	7.7	647^{2}	357.4^{6}	49.5^{6}	81.2^{4}	52.7^{1}	933.2^{1}	40.1^{2}	2.67	0.97	0.99
三尖杉	**Cephalotaxus fortunei, Hook.**	97	12.61^{3}	0.590^{2}	5.5	692^{4}	338.9^{6}	96.9^{6}	97.0^{3}	54.6^{2}	702.2^{2}	73.7^{2}	3.95	1.87	1.90
榧樹	Torreya grandis, Fort.	83	15.76^{2}	0.542^{1}	3.3	788^{1}	429.1^{6}	91.9^{6}	—	—	949.1^{2}	—	3.71	1.80	1.50
馬尾松	Pinus massoniana Lamb.	104	18.05^{3}	0.456^{3}	5.4	804^{2}	303.9^{6}	44.2^{6}	72.0^{4}	26.7^{3}	1000.0^{2}	44.2^{2}	2.50	1.41	1.38
金錢松	Pseudolarix amabilis, Rehd.	6	13.92^{2}	0.528^{2}	7.4	647^{1}	355.0^{6}	64.4^{6}	89.9^{4}	—	—	45.2^{2}	2.83	1.53	1.46
杉木	Cunninghamia lanceolata, Hook.	82	17.68^{2}	0.290^{1}	1.5	377^{2}	229.1^{6}	22.8^{6}	55.9^{4}	19.5^{2}	597.2^{2}	25.1^{2}	2.05	1.17	1.07
柳杉	Cryptomeria japonica, D. Don.	81	16.10^{2}	0.339^{1}	3.0	336^{2}	224.2^{6}	20.8^{6}	59.8^{4}	3.4^{2}	406.4^{1}	27.5^{1}	1.86	1.03	1.08
扁柏	Thuja Orientalis, Linn.	105	20.96^{3}	0.532^{3}	8.0	872^{2}	392.8^{6}	100.2^{6}	111.4^{4}	16.8^{3}	1001.3^{2}	31.4^{3}	2.79	1.4	1.17
圓柏	Juniperus Chinensis, Linn.	113	15.80^{3}	0.602^{3}	6.6	1182^{1}	459.2^{6}	124.1^{6}	104.6^{4}	20.2^{2}	918.1^{1}	42.5^{2}	4.03	1.52	1.56
美松	Pseudotsuga taxifolia, Britl.	148	13.41^{5}	0.508^{5}	7.9	748^{12}	435.8^{12}	30.5^{12}	69.1^{12}	16.4^{12}	748.7^{5}	31.1^{12}	2.67	1.40	1.33
俄松	Abies Sachalinensis, Mast.	154	13.36^{5}	0.419^{5}	4.4	596^{12}	398.8^{12}	34.2^{12}	62.9^{9}	19.4^{11}	686.0^{6}	33.1^{12}	2.05	0.92	0.95

Table B. Mechanical Properties of the Broad-leaved Trees grown in Central China.

Species of Wood			Moisture%	Specific gravity of dry wood	Rings per cm.	Modulus of rupture kg/cm²	Compressive Strength kg/cm²		Shearing Strength parallel to grain kg/cm²	Tensile Strength kg/cm²		Cleavability kg/cm.	Hardness number (Brinell)		
Chinese Name	Scientific Name	Sample number					Parallel to grain	Perpendicular to grain		perpendicular to grain	parallel to grain		end	radial	tangential
響葉楊	Populus adenopoda, Maxim.	80	15.14^{2}	0.426^{1}	4.3	579^{2}	325.5^{6}	54.7^{6}	68.5^{4}	24.2^{2}	772.9^{2}	48.4^{2}	1.96	0.91	0.90
垂柳	Salix babylonica, Linn.	107	17.73^{3}	0.418^{3}	—	669^{2}	294.6^{6}	55.3^{6}	87.4^{4}	47.5^{2}	—	67.5^{2}	1.59	0.87	0.89
化香樹	Platycarya strobilacea. S. et z.	25	16.62^{3}	0.709^{3}	5.1	804^{1}	462.4^{6}	83.4^{6}	121.7^{2}	—	—	45.2^{2}	3.79	1.77	1.76
青錢李	Pterocarya Paliurus, Batal.	39	13.81^{5}	0.517^{5}	16.7	780^{4}	413.7^{12}	80.9^{12}	111.0^{4}	22.7^{1}	—	77.5^{2}	3.65	1.49	1.60
野核桃	Juglans cathayensis, Dode.	71	15.02^{3}	0.495^{3}	6.7	585^{3}	405.1^{6}	62.4^{6}	75.9^{4}	37.9^{1}	1143.5^{1}	52.0^{2}	3.02	1.12	1.13
山核桃	Carya cathayensis, Sarg.	79	18.17^{3}	0.738^{2}	4.3	900^{2}	349.2^{6}	91.7^{6}	127.1^{4}	74.2^{1}	1175.4^{2}	112.9^{2}	4.01	2.11	2.15
千筋楡	Carpinus fargesiana. Winkl.	10	14.14^{2}	0.652^{2}	13.0	782^{2}	363.3^{6}	101.1^{6}	126.6^{4}	197.6^{2}	—	87.7^{2}	4.13	2.11	2.13
錐栗	Castanea henryi, R. and W.	101	17.83^{1}	0.878^{1}	3.0	962^{1}	404.1^{6}	120.8^{6}	—	—	1546.8^{1}	—	5.42	2.29	2.22
板栗	Castanea mollissima, Bl.	1	23.41^{4}	0.718^{4}	5.5	726^{4}	408.4^{6}	64.2^{6}	92.2^{4}	13.3^{1}	652.9^{2}	42.9^{2}	4.46	4.47	2.28
茅栗	Castanea sequinii. Dode.	8	19.32^{2}	0.624^{2}	5.6	821^{2}	386.3^{6}	77.4^{6}	76.1^{4}	30.6^{1}	—	54.0^{1}	3.44	1.65	1.63
石櫟	Lithocarpus henryi, Rehd and Wils.	15	14.77^{3}	0.622^{2}	4.5	816^{2}	445.4^{6}	109.8^{6}	125.2^{4}	65.3^{2}	820.6^{2}	69.2^{2}	4.40	1.73	1.66
槲櫟	Quercus aliena, Bl.	59	15.68^{12}	0.754^{1}	3.2	743^{1}	363.5^{6}	112.3^{6}	111.0^{4}	64.9^{1}	—	94.0^{1}	3.87	1.53	1.59
枹樹	Quercus glandulifera, Bl.	18	20.32^{1}	—	—	—	—	—	132.6^{4}	56.3^{2}	—	108.9^{2}	4.28	2.39	2.39
青剛櫟	Quercus glauca Thunb.	100	15.06^{3}	0.527^{1}	3.0	596^{2}	305.1^{6}	55.4^{6}	121.2^{4}	76.4^{2}	922.8^{2}	115.5^{2}	5.21	2.28	2.20

Species of Wood			Moisture %	Specific gravity of dry Wood	Rings per cm.	Modulus of rupture kg/cm^2	Compressive Strength kg/cm^2		Shearing Strength parallel to grain kg/cm^2	Tensile Strength kg/cm^2		Cleavability kg/cm	Hardness number (Brinell)		
Chinese Name	Scientific Name	Sample number					parallel to grain	perpendicular to grain		perpendicular to grain	parallel to grain		end	radial	tangential
青 棡	Quercus myrsinaefolia, Bl.	4	15.83[3]	0.731[3]	7.5	962[3]	450.1[6]	139.2[6]	145.7[5]	77.5[2]	—	120.0[2]	4.96	2.13	2.12
櫟 樹	Quercus serrata Thunb.	111	12.89[2]	0.801[2]	2.0	1024[2]	526.6[6]	132.6[6]	156.1[2]	42.8[4]	1276.6[1]	105.9[2]	4.83	2.08	2.14
鑽天楡	Ulmus japonica, Sarg.	102	17.76[6]	0.783[6]	5.4	807[6]	358.2[12]	87.5[12]	117.8[8]	85.3[3]	1463.9[3]	91.5[4]	4.02	2.34	2.28
榔 楡	Ulmus parvifolia, Jacg.	114	18.15[3]	0.878[3]	2.3	1272[2]	545.4[6]	238.7[6]	176.5[4]	94.6[2]	1468.9[2]	100.1[2]	5.18	2.43	2.37
朴 樹	Celtis sinensis, Pers.	109	17.14[3]	8.886[3]	4.1	816[2]	427.1[6]	121.2[6]	125.0[4]	84.7[2]	1258.9[2]	118.8[2]	3.15	1.76	1.94
糙葉樹	Aphananthe aspera, Planch.	96	15.54[1]	0.753[2]	29.5	703[2]	416.0[6]	148.3[5]	118.1[4]	80.6[2]	—	95.0[2]	4.25	2.16	2.26
桑 樹	Morus alba, Linn.	106	12.91[2]	0.678[2]	2.0	1080[2]	550.0[6]	115.4[6]	155.0[4]	53.0[4]	1046.6[2]	—	4.31	1.91	2.18
玉 蘭	Magnolia denudata, Ders.	98	11.47[2]	0.408[2]	2.9	624[2]	326.8[6]	43.6[5]	64.4[3]	15.0[2]	—	30.2[2]	2.66	1.12	1.11
木 蘭	Magnolia liliflora, Ders.	89	14.13[4]	0.489[4]	5.8	743[4]	384.8[6]	64.4[6]	93.2[4]	32.2[2]	—	60.2[2]	3.59	1.24	1.31
樟 樹	Cinnamomum camphora, Nees, and Eberm	85	17.26[3]	0.540[3]	4.7	658[3]	319.5[6]	69.4[6]	90.2[4]	39.3[1]	644.5[2]	51.5[2]	2.44	1.30	1.39
圓葉樟	Litsea auriculata chien. and Cheng.	65	15.50[2]	0.649[2]	8.9	928[2]	424.3[6]	93.8[6]	106.2[3]	—	—	50.8[2]	4.43	1.42	1.44
楓 香	Liquidambar formosana, Hance.	94	14.58[2]	0.589[2]	4.3	753[3]	345.1[6]	83.7[6]	89.9[4]	50.2[2]	—	75.8[2]	3.58	1.31	1.26
青皮梨	Pyrus serotina, Rehd.	5	19.34[3]	0.677[3]	2.8	962[3]	470.4[6]	103.4[6]	96.2[4]	31.7[2]	955.4[2]	97.5[2]	5.36	2.01	2.17
布 狸 (廣東)	Photinia beauverdiana, Schneid.	20	12.05[2]	0.857[2]	12.4	1243[3]	539.8[6]	171.7[6]	149.4[4]	106.4[2]	—	135.2[1]	5.30	2.34	2.47
石 楠	Photinia Serrulata, Lindl.	110	16.32[3]	0.889[3]	4.3	1136[2]	532.0[6]	206.7[6]	147.7[4]	89.1[2]	1763.6[1]	169.4[2]	4.55	3.09	3.31
猴楂子	Crataegus hupehensis, Sarg.	49	17.52[2]	0.700[2]	6.2	839[2]	418.0[6]	146.3[6]	118.1[4]	64.9[2]	—	76.6[2]	4.75	2.22	2.17

Species of Wood			Moisture %	Specific gravity of dry wood	Rings per cm.	Modulus of rupture kg/cm^2	Compressive Strength kg/cm^2		Shearing Strength Parallel to grain kg/cm^2	Tensile Strength kg/cm^2		Gleavability kg/cm.	Hardness number (Brinell)		
Chinese Naem	Scientific Name	Sample number					parallel to grain	perpendicular to grain		perpendicular to grain	parallel to grain		end	radial	tangential
苦 桃	Prunus brachypoda var. pseudossiari, Koehne.	22	16.97[2]	0.692[3]	4.0	788[3]	448.6[12]	116.2[12]	118.2[8]	56.5[4]	1442.4[2]	73.0[4]	4.38	1.36	1.44
櫻 桃	Prunus pseudocerasus, Lindl.	14	18.21[2]	0.759[2]	7.3	838[2]	380.3[6]	114.8[6]	114.0[4]	87.1[1]	—	90.3[2]	4.35	1.56	1.68
苦 李	Prunus salicina, Lindl.	7	17.89[4]	0.742[4]	12.0	935[4]	553.9[12]	177.1[12]	119.7[5]	—	—	52.0[4]	6.41	3.02	3.05
山 槐	Albizzia kalkora, Prain.	42	19.32[2]	0.543[2]	9.9	698[2]	374.5[6]	82.5[6]	94.7[3]	—	1102.1[2]	42.0[2]	3.58	1.49	1.49
檴 槐	Maackia chinensis, Takeda.	16	16.85[2]	0.664[2]	6.6	990[2]	452.8[6]	85.7[6]	85.2[2]	20.4[2]	1642.7[2]	61.4[2]	5.39	2.13	2.25
黄 檀	Dalbergia hupeana, Hance.	62	19.49[2]	0.823[2]	8.0	911[1]	415.6[6]	159.2[6]	159.3[4]	82.5[2]	1610.9[2]	111.5[2]	5.26	3.00	3.05
臭 椿	Ailanthus altissima. Swingle.	72	16.52[2]	—	—	—	—	—	84.9[3]	28.5[2]	—	53.5[2]	2.09	1.04	1.06
交讓木	Daphniphyllum macropodum, Mig.	11	16.53[2]	0.626[2]	6.0	771[2]	323.3[6]	105.8[9]	110.8[4]	71.9[2]	—	66.7[2]	4.19	1.78	1.79
山 桐	Mallotus apelta, Muell -arg.	68	17.17[2]	0.619[2]	5.5	726[3]	359.0[6]	94.4[6]	108.7[3]	72.0[1]	—	87.8[2]	3.40	1.79	1.73
油 桐	Aleurits fordii, Hemsl.	93	17.03[1]	0.550[1]	3.5	703[3]	290.5[6]	105.6[6]	76.2[4]	45.3[2]	—	62.1[2]	3.33	1.28	1.3
烏 桕	Sapium sebiferum, Roxb.	95	15.27[2]	0.522[2]	7.0	608[3]	280.6[6]	108.6[6]	99.9[4]	50.3[2]	—	76.5[2]	2.62	1.16	1.25
鹽膚木	Rhus javanica, Linn	56	16.23[2]	—	—	—	—	—	73.3[4]	8.4[1]	—	49.5[1]	2.58	1.04	1.06
青榨槭	Acer davidii, Franch.	64	17.04[2]	0.521[3]	4.5	681[3]	337.4[6]	77.9[6]	—	—	1141.0[2]	—	3.66	1.26	1.26
槭 樹	Acer palmatum, Thunb	26	18.80[4]	0.757[4]	—	849[4]	403.7[6]	133.0[6]	131.4[3]	61.7[4]	1015.0[1]	79.1[2]	4.10	1.59	1.61
雞爪槭	Acer pictum, Thumb.	103	12.61[1]	0.780[2]	9.2	878[2]	410.1[6]	131.5[5]	91.7[3]	33.2[2]	—	31.7[1]	4.54	1.79	1.80
椴 樹	Tilia tuan Szyszy	75	12.74[2]	0.476[2]	6.6	597[1]	303.4[6]	42.1[6]	67.7[4]	33.8[2]	—	41.6[2]	2.27	0.85	0.92

Species of Wood			Moist-ure%	Specific gravity of dry Wood	Rings per cm.	Modulus of rupture kg/cm²	Compressive Strength kg/cm²		Shearing Strength parallel to grain kg/cm²	Tensile Strength kg/cm²		Cleavability kg/cm.	Hardness number Brinell		
Chinese Name	Scientific Name	Sample number					parallel to grain	perpendicular to grain		perpendicular to grain	parallel to grain		end	radial	tangential
梧桐	Firmiana Simplex Wight	108	17.87^{3}	0.681^{3}	3.7	816^{2}	384.6^{6}	90.9^{6}	109.9^{4}	74.2^{2}	1177.1^{2}	106.1^{2}	3.30	1.63	1.64
油茶	Thea oleosa,Lour.	92	16.32^{2}	0.874^{2}	7.0	934^{3}	429.6^{6}	163.5^{6}	148.6^{3}	97.7^{2}	——	$158.^{2}$	5.76	2.95	2.94
油金期(湖北)	Stewartia gemmata Chien. and Cheng.	41	17.10^{5}	0.683^{5}	10.4	732^{5}	338.2^{12}	89.0^{12}	128.1^{4}	69.7^{4}	1355.8^{3}	118.2^{4}	4.07	2.17	2.16
椅樹	Idesia polycarpa Maxim.	9	18.08^{2}	0.442^{2}	8.2	579^{2}	270.2^{6}	51.2^{6}	73.4^{4}	37.3^{2}	940.0^{2}	62.8^{1}	2.39	1.10	1.11
匯木	Alangium Chinensis, Rehd.	21	19.28^{2}	0.719^{2}	3.6	900^{3}	359.6^{6}	115.2^{6}	106.0^{5}	70.8^{2}	1723.1^{2}	90.8	5.21	1.95	1.95
三葉刺楸	Acanthopanax evodiaefolius,Franc.	34	16.96^{3}	0.485^{3}	7.5	484^{3}	252.0^{6}	41.2^{6}	94.0^{4}	46.7^{1}	1119.6^{2}	58.1^{1}	3.35	1.21	1.25
刺楸	Acanthopanax ricinifolium, Seem.	67	16.87^{4}	0.571^{4}	7.6	605^{4}	325.8^{12}	53.4^{12}	84.0^{3}	25.5^{2}	912.8^{3}	86.4^{1}	3.32	1.20	1.20
楤木	Aralia Chinensis, Linn.	76	15.20^{3}	0.548^{2}	4.2	630^{3}	285.8^{6}	47.8^{6}	82.1^{4}	32.4^{1}	——	53.0^{2}	3.44	1.12	1.12
水木	Cornus Controversa, Hemsl.	12	17.96^{2}	0.614^{2}	4.7	563^{1}	326.8^{6}	70.1^{6}	98.8^{4}	69.2^{3}	1368.9^{3}	94.1^{2}	4.33	1.50	1.58
四照花	Cornus Kousa, Buerg.	45	17.47^{4}	0.893^{4}	8.3	915^{5}	374.1^{12}	169.5^{12}	138.0^{8}	89.4^{4}	——	132.9^{4}	6.02	3.05	3.04
臙脂紅	Rhododendron mariesii,Hemsl and Wils.	17	17.06^{2}	——	——	——	——	——	107.0^{2}	85.1^{2}	——	132.5^{2}	5.17	2.23	2.20
白辛樹	Pterostyrax corymbosun S.ann Z.	19	15.58^{2}	0.539^{2}	6.8	838^{2}	359.9^{6}	78.0^{6}	97.1^{4}	46.5^{2}	——	51.9^{2}	3.41	1.28	1.32
山茶葉灰木	Symplocos Congesta, Benth.	32	16.75^{2}	0.703^{2}	10.8	945^{3}	412.5^{6}	112.1^{6}	121.9^{4}	74.0^{1}	——	116.9^{2}	4.42	2.01	1.97
過冬青(浙江)	Symplocos crassifolia, Benth.	33	——	——	——	——	469.4^{6}	140.4^{6}	124.8^{3}	56.0^{1}	——	85.0^{2}	4.92	2.09	2.14
白檀	Symplocos Paniculata, Wall.	70	16.83^{2}	0.809^{2}	——	883^{2}	405.8^{6}	149.3^{6}	147.7^{4}	95.3^{2}	——	91.6^{2}	5.27	2.16	2.20

Species of wood			Moist-ure %	Specific gravity of dry wood	Rings Per cm.	Modulus of rupture Kg/cm	Compressive Strength kg/cm		Shearing Strength Parallel to grain kg/cm	Tensile Strength kg/cm		Cleavability kg/cm	Hardness number Brinell		
Chinese Name	Scientific Name	Sample number					Parallel to grain	Perpendicular to grain		Perpendicular to grain	Parallel to grain		end	radial	tangential
白蠟樹	Fraxinus Chinensis, Roxb.	50	17.44^{3}	0.695^{3}	9.3	669^{2}	352.3^{6}	106.1^{6}	133.6^{3}	82.7^{2}	——	106.4^{2}	3.06	1.86	1.92
香果木	Emmenopteryx henryi Oliv.	29	18.50^{2}	0.507^{2}	10.5	624^{2}	284.3^{6}	64.1^{6}	91.5^{3}	59.8^{2}	1338.8^{1}	66.0^{2}	3.17	1.19	1.22
風箱(四川)	Cephalanthus occidentalis, Linn.	86	15.09^{2}	0.557^{2}	3.1	720^{3}	336.4^{6}	61.8^{6}	91.9^{4}	46.5^{2}	1020.0^{1}	69.8^{2}	3.64	1.61	1.66
黃金樹	Catalpa speciosa, Warder.	119	13.29^{2}	0.499^{2}	1.3	753^{3}	402.5^{6}	68.4^{6}	93.2^{4}	18.4^{4}	1116.6^{2}	51.0^{4}	2.26	1.15	1.10

V 結 論

由附表A,B得下列各項結論

(a) 强度

1.樹種對於强度之關係　觀表內結果各材種對於强度之關係，因强度種類而有參差。玆就最主要之抗彎，縱向抗壓，及縱向抗剪三種强度，將各材種比較其優劣，排列如下。其位於前方者較優於後者。

針葉樹

抗彎强度：　圓柏，扁柏，馬尾松，榧樹，美松，三尖形，銀杏，金錢松，俄松，杉木，柳杉。

縱向抗壓强度：　圓柏，美松，榧樹，俄松，扁柏，三尖杉，銀杏，金錢松，馬尾松，柳杉，杉木。

縱向抗剪强度：　扁柏，圓柏，三尖衫，金錢松，銀杏，馬尾松，美松，俄松，柳杉，杉木。

闊葉樹

抗彎强度：　榔榆，布䙖，石楠，櫟樹，桑樹，櫰槐，青栲，青皮梨，錐栗，山茶葉灰木，苦李，油茶，圓葉樟，四照花，黃檀，櫃木，山核桃，猴楂子，白檀，鷄爪械，械樹，櫻桃，白辛樹，茅栗，石櫟，朴樹，梧桐，鑽天榆，化香樹，苦桃，千筋榆，青錢李，交讓木，楓香，黃金樹，木蘭，槲櫟，油金朗，板栗，山桐，風箱，油桐，糙葉樹，山槐，青榨槭，白臘樹，垂柳，樟樹，橡木，玉蘭，香果木，烏桕，刺楸，椵樹，青剛櫟，野核桃，椅葉，響葉楊，水木，三葉刺楸。

縱向抗壓强度：　苦李，桑樹，榔榆，布䙖，石楠，櫟樹，青皮梨，過冬青

，化香樹，櫰槐，青栲，苦桃，石櫟，油茶，朴樹，圓葉樟，猴楂子，糙葉樹，黃檀，青錢李，山茶葉灰木，鷄爪械，板栗，白檀，野核桃，錐栗，械樹，黃金樹，茅栗，木蘭，梧桐，櫻桃，山槐，四照花，槲櫟，千筋榆，白辛樹，櫃木，山桐，鑽天榆，白臘樹，山核桃，楓香，油金朗，青榨槭，風箱，玉蘭，水木，刺楸，響葉楊，交讓木，樟樹，青剛櫟，椵樹，垂柳，油桐，橡木，香果木，烏桕，椅樹，三葉刺楸。

縱向抗剪强度：　榔榆，黃檀，櫟樹，桑樹，布䙖，油茶，石楠，白檀，青栲，四照花，白臘樹，枹樹，械樹，油金朗，山核桃，千筋榆，石櫟，朴樹，過冬青，山茶葉灰木，化香樹，青剛櫟，苦李，苦桃，猴楂子，糙葉樹，鑽天榆，櫻桃，青錢李，槲櫟，梧桐，山桐，胭脂紅，圓葉樟，櫃木，交讓木，烏桕，水木，白辛樹，青皮梨，山槐，三葉刺楸，黃金樹，木蘭，板栗，風箱，鷄爪械，香果木，樟樹，楓香，垂柳，櫰槐，臭椿，刺楸，橡木，油桐，茅栗，野核桃，椅樹，鹽膚木，響葉楊，椵樹，玉蘭。

2.比重對於强度之關係　觀試驗結果，木材强度與全乾比重共同增加。玆將抗彎强度及縱向抗壓强度對於比重之關係，示於第十四圖。此二種强度對於比重，均有直綫關係，而以抗彎强度對於比重之增加率爲大。玆將圖上二直綫之方程式求之如下。

抗彎强度對於比重：$f_r=1230S$

抗壓强度對於比重：$f_c=500^s+65$

但f_r爲抗彎强度(kg/cm^2)，f_c爲抗壓强度(kg/cm^2) S 爲全乾比重，f_c之方程式中僅包括比重之在0.25以上者。玆將各材種就比重之大小排列如下。其在前方者比重較大。

針葉樹　圓柏，三尖杉，榧樹，扁柏，金錢松，美松，馬尾松，銀杏，俄

2
0
0
3
4
2
5

0603

松，柳杉，杉木。

闊葉樹　四照花，石楠，椰楡，錐栗，油茶，布𧽚，青剛櫟，白檀，櫟樹，鑽天楡，鷄爪槭，櫻桃，槭樹，槲櫟，糙葉樹，苦李，山核桃，青栲，榧木，板栗，化香樹，山茶葉灰木，猴楂子，白臘樹，苦桃，朴樹，油金朗，梧桐，桑樹，青皮梨，欓槐，千筋楡，圓葉樟，交讓木，茅栗，石櫟。山洞，水木，楓香，刺楸，風箱，油桐，楤木，山槐，樟樹，白辛樹，烏桕，青榨槭，青錢李，香果木，黃金樹，野核桃，木蘭，三葉刺楸，椴樹，椅樹，響葉楊，垂柳，玉蘭。

(B) 硬度

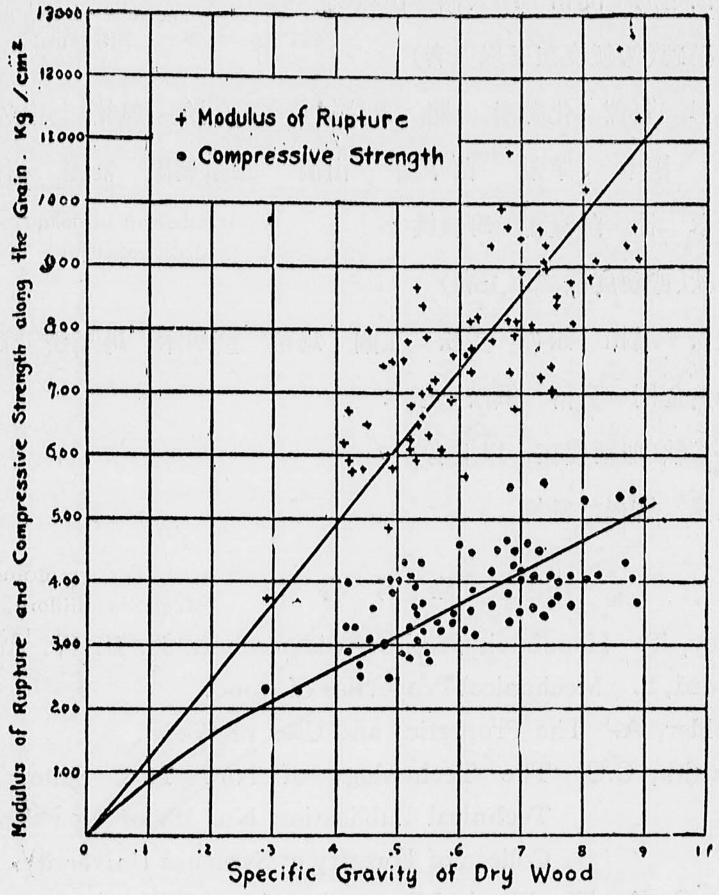
1，加壓面對於硬度之關係　木材硬度之高低。無論針葉樹材或闊葉樹材。恆隨試材之加壓面而異。然各加壓面中。硬度之最大者爲橫斷面。徑斷面與弦斷面兩者硬度之差甚微。試就本試驗之成績觀之。針葉樹材十一種中。弦斷面之硬度大於徑斷面者有六種。闊葉樹材六十五種。兩者硬度之高低殆相半。

2，材種對於硬度之關係　硬度之大小。各材不一。玆就各材橫斷面之硬度而論。針葉樹材十一種。硬度最大者爲圓柏。次之爲三尖形(杉)，榧。又次之爲金錢松，銀杏，扁柏，美松，馬尾松，俄松，杉木等。而最小者爲柳杉。

又闊葉樹材總數六十五種之中。硬度最大者爲苦李，次之爲油茶，四照花，欓槐，青皮梨，布𧽚，白檀，錐栗，黃檀，榧木，青剛櫟，椰楡，胭脂紅。又次之爲青栲，櫟，過冬青，猴楂子，石楠，圓葉樟，板栗，鷄爪槭，山茶葉灰木，苦桃，櫻桃，水木，石櫟，桑，枹，糙葉樹，交讓木，千筋楡，槭，油金朗，山核桃，鑽天楡　槲櫟，化香樹，青榨槭，青錢李，風箱，木蘭，山槐，楓香，楤木，茅栗，白辛樹，山桐，山(三)葉刺楸，油桐，梧桐，刺楸，香果木，朴，白臘樹，野核桃，玉蘭，烏桕，鹽膚木，樟，椅樹，椴，黃金樹，臭椿，響葉楊等。而以垂柳

爲最小。

第十四圖



3，硬度階級　今將實驗材種(橫斷面)之硬度。分硬度階級爲五。又各級所屬之樹種。按其硬度之大小而順序排列之如次。

第一級　甚硬(卽硬度在五以上者)

苦李　油茶　四照花　欓槐　青皮梨　布𧽚　白檀　錐栗　黃檀

榧木　青剛櫟　椰楡　胭脂紅

第二級　硬(卽硬度在四以上者)

青栲　櫟　過冬青　猴楂子　石楠　圓葉樟　板栗　鷄爪槭　山

茶葉灰木　苦桃　櫻桃　水木　石櫟　桑　枹　糙葉樹　交讓木　千筋楡

槭　油金朗　圓柏　鑽天楡　山核桃

第三級　稍硬(卽硬度在三以上者)

三尖杉　槲櫟　化香樹　梱　青榨槭　青錢李　風箱　木蘭　山槐

楓香　楤木　茅栗　白辛樹　山桐　三葉刺楸　油桐　梧桐　刺楸

香果木　朴　白臘樹　野核桃

第四級　軟(卽硬度在二以上者)

金錢松　扁柏　銀杏　美松　玉蘭　烏桕　鹽膚木　馬尾松　樟　椅樹

椵　黃金樹　臭椿　俄松　杉木

第五級　甚軟(卽硬度在一以上者)

響葉楊　柳杉　垂柳

參考書籍

1. Lorey, T. Handbuch der Forstwissenschaft. H. II. IV. Aufl.
2. Record, S. Mechanical Properties of wood.
3. Koehler, A. The Properties and Uses of Wood.
4. Forsaith, C.C. The Technology of New York State Timbers. Technical Publication No. 18. of New York State College of Forestry at Syracuse University.
5. Ivey, G. F. The Physical Properties of Lumber.
6. Hadeck, A. u. Janka, G. Untersuchungen über die Elastizität und Festigkeit der österreichischen Bauhölzer. Mitteilungen aus dem Forstlichen Versuchswesen Österreichs. H. XXV.
7. Janka, J. Die Härte der Hölzer. Mitteilungen aus dem Forstlichen Versuchswesen Österreichs H. XXXIX.
8. Bauschinger, J. Mitteilungen aus dem Mechanisch-Technischen Laboratorium der K. Technischen Hochschule in München H. IX.

Resume

Mechanical Strength of Woods growing in Central China

Weifong Tsu　　C. H. Loh

The various kinds of woods used in this experiment are those generally grown in Central China. The localities, the ages, the heights and the diameters, breast high, are shown in the following tables:-

Kind of Wood	No.	Locality	Age	Height (m)	Diam. B. H. (cm)
A. Needle-leaved Trees.					
Ginkgo biloba L.	78	Chekiang	31	16.4	19.5
Cephalotaxus fortunei Hook.	97	„	35	10.0	14.5
Torreya grandis Fort.	83	„	28	9.3	15.0
Pinus massoniana L.	104	Kiangsu	29	18.0	21.0
Pseudolarix amabilis Rehd.	6	Chekiang	32	14.3	15.0
Cunninghamia lanceolata Hook.	82	„	21	11.5	14.5
Cryptomeria japonica D. Don.	81	„	32	17.4	20.5
Thuja orientalis L.	105	Kiangsu	42	19.2	24.5
Juniperus chinensis Linn.	113	„	47	21.7	22.0
B. Broad-leaved Trees.					
Populus adenopoda Maxim.	80	Chekiang	26	13.0	19.0
Salix babylonica L.	107	Kiangsu	15	9.0	25.0
Platycarya strobilacea S. et Z.	25	Chekiang	29	12.5	17.0
Pterocarya paliurus Batal.	39	„	24	9.4	13.0
Juglans cathayensis Dode.	71	„	28	11.3	16.5
Carya cathayensis Sarg.	79	„	31	11.5	17.0
Carpinus fargesiana Winkl.	10	„	30	12.3	14.5
Castanea henryi Rehd. and Wils.	101	„	17	7.6	12.5
Castanea mollissima Bl.	1	„	38	13.0	28.0
Castanea sequinii Dode.	8	„	32	9.5	23.0
Lithocarpus henryi Rehd. and Wils.	15	„	24	8.5	13.0
Quercus aliena Bl.	59	„	25	12.5	16.0
Quercus glandulifera Bl.	18	„	29	10.5	15.0
Quercus glauca Thunb.	100	„	29	9.5	13.5
Quercus myrsinaefolia Bl.	4	„	24	8.0	11.5
Quercus serrata Thunb.	111	Kiangsu	15	8.0	17.0
Ulmus japonica Sarg.	102	Chekiang	26	11.0	15.0
Ulmus parvifolia Jacq.	114	Kiangsu	34	13.4	16.5
Celtis sinensis Pers.	109	„	30	14.5	22.5

Kind of Wood	No.	Locality	Age	Height (m)	Diam. B. H. (cm)
Aphananthe aspera Planch.	96	Chekiang	40	14.0	30.5
Morus alba Linn.	106	Kiangsu	25	9.8	29.4
Magnolia denudata Desr.	98	Chekiang	28	15.0	40.0
Magnolia liliflora Desr.	89	„	25	14.7	26.5
Cinnamomum camphora Nees and Eberm.	85	„	32	11.4	40.5
Litsea auriculata Chien and Cheng.	65	„	26	12.7	13.0
Liquidambar formosana Hance.	94	„	21	10.5	14.5
Pyrus serotina Rehd.	5	„	18	9.0	15.0
Photinia beauverdiana Schneid.	20	„	40	10.0	13.5
Photinia serrulata Lindl.	110	Kiangsu	39	8.0	17.0
Crataegus hupehensis Sarg.	49	Chekiang	27	7.0	10.5
Prunus brachypoda var. pseudossiori Koehne.	22	„	30	9.0	14.5
Prunus pseudo-cerasus Lindl.	14	„	26	8.5	14.5
Prunus salicina Lindl.	7	„	31	6.8	13.5
Albizzia kalkora Prain.	42	„	26	10.5	14.5
Maackia chinensis Takeda.	16	„	29	11.4	17.0
Dalbergia hupeana Hance.	62	„	34	13.5	18.5
Ailanthus altissima Swingle.	72	„	18	12.0	15.0
Daphniphyllum macropodum Miq.	11	„	32	8.9	10.5
Mallotus apelta Muell-Arg.	68	„	27	9.7	13.5
Aleurites fordii Hemsl.	93	„	14	7.0	11.0
Sapium sebiferum Roxb.	95	„	23	9.0	14.0
Rhus javanica Linn.	56	„	25	10.0	16.5
Acer davidii Franch.	64	„	25	8.6	14.0
Acer palmatum Thunb.	26	„	34	12.5	16.5
Acer pictum Thunb.	103	„	28	11.4	15.0
Tilia tuan Szyszyl.	75	„	32	12.8	20.5
Firmiana simplex Wight.	108	Kiangsu	19	12.0	21.0
Thea oleosa Lour.	92	Chekiang	29	7.0	10.5
Stewartia gemmata Chien and Cheng.	41	„	32	7.5	11.0
Idesia polycarpa Maxi n.	9	„	28	14.0	16.0
Alangium chinensis Rehd.	21	„	25	11.5	19.0
Acanthopanax evodiaefolius Franch.	34	„	31	9.5	15.0
Acanthopanax ricinifolium Seem.	67	„	27	16.0	23.5
Aralia chinensis L.	76	„	22	8.5	12.5
Cornus controversa Hemsl.	12	„	34	11.3	16.5
Cornus kousa Buerg.	45	„	20	6.0	9.5
Rhododendron mariesii Hemsl and Wils.	17	„	36	7.5	16.0

Kind of Wood	No.	Locality	Age	Height (m)	Diam. B. H. (cm)
Pterostyrax corymbosum S. et Z.	19	Chekiang	31	9.7	12.5
Symplocos congesta Benth.	32	„	32	8.4	11.5
Symplocos crassifolia Benth.	33	„	35	9.6	13.5
Symplocos paniculata Wall.	70	„	29	7.8	10.5
Fraxinus chinensis Roxb.	53	„	20	8.0	11.5
Emmenopterys henryi Oliv.	29	„	36	10.0	14.0
Cephalanthus occidentalis Linn.	86	„	23	11.0	16.5
Catalpa speciosa Warder.	119	Kiangsu	25	7.6	24.0

The samples used in this experiment were cut at breast height, about 1.3m. from the earth. Apiece of the trunk was then cut 2m. in length, and a (disc), 0.2m. in thickness, was taken which was used in the different experiments.

The instrument used for testing was an Amsler 20-ton Universal Testing Machine The following tests were made:

1. Moisture
2. Specific Gravity
3. Modulus of rupture
4. Compressive Strength
   a. Parallel to grain
   b. Perpendicular to grain.
5. Shearing Strength (Parallel to grain)
6. Tensile Strength
   a. Perpendicular to grain
   b. Parallel to grain
7. Cleavability
8. Hardness
   a. End
   b. Radial
   c. Tangential

The following results were secured:

1) The strength of the samples vary with different kinds of wood. Arranged according to strength, the samples are as follow:

A. Needle-leaved Trees:

a. Modulus of rupture:

Juniperus chinensis, Thuja orientalis, Pinus massoniana, Torreya grandis, Cephalotaxus fortunei, Ginkgo biloba, Pseudolarix amabilis, Cunninghamia lanceolata, Cryptomeria japonica

b. Compressive strength along the grain:

Juniperus chinensis, Torreya grandis, Thuja orientalis, Cephalotaxus fortunei, Ginkgo biloba, Pseudolarix amabilis, Pinus massoniana, Cryptomeria japonica, Cunninghamia lanceolata

c. Shearing strength along the grain:

Thuja orientalis, Juniperus chinensis, Cephalotaxus fortunei, Pseudolarix amabilis, Ginkgo biloba, Pinus massoniana Cryptomeria japonica, Cunninghamia lanceolata,

B. Broad-leaved Trees:

a. Modulus of rupture:

Ulmus parvifolia, Photinia beauverdiana, Photinia serrulata, Quercus serrata, Morus alba, Maackia chinensis, Quercus myrsinaefolia, Pyrus serotina, Castanea henryi, Symplocos congesta, Prunus salicina, Thea oleosa, Litsea auriculata, Cornus kousa, Dalbergia hupeana, Alangiun chinensis, Carya cathayensis, Crataegus hupehensis, Symplocos paniculata, Acer pictum, Acer palmatum, Prunus pseudo-cerasus, Pterostyrax corymbosum, Castanea sequinii, Lithocarpus henryi, Celtis sinensis, Firmiana simplex, Ulmus japonica, Platycarya strobilacea, Prunus brachypoda, Carpinus fargesiana, Pterocarya paliurus, Daphniphyllum macropodum, Liquidambar formosana, Magnolia liliflora, Quercus aliena, Stewartia gemmata, Castanea mollissima, Mallotus apelta, Cephalanthus occidentalis, Aleurites fordii, Aphananthe aspera, Albizzia kalkora, Acer davidii, Fraxinus chinensis, Salix babylonica, Cinnamomum camphora, Aralia chinensis, Magnolia denudata, Emmenopterys henryi, Sapium sebiferum, Acanthopanax ricinifolium, Tilia tuan, Quercus glauca, Juglans cathayensis, Idesia polycarpa, Populus adenopoda, Cornus controversa, Acanthopanax evodiaefolius,

b. Compressive strength along the grain:

Prunus salicina, Morus alba, Ulmus parvifolia, Photinia beauverdiana, Photinia serrulata, Quercus serrata, Pyrus serotina, Platycarya strobilacea, Maackia chinensis, Quercus myrsinaefolia, Prunus brachypoda, Lithocarpus henryi, Thea oleosa, Celtis sinensis, Litsea auriculata, Crataegus hupehensis, Aphananthe aspera, Dalbergia hupeana, Pterocarya paliurus, Symplocos congesta, Acer pictum, Castanea mollissima, Symplocos paniculata, Juglans cathayensis, Castanea henryi, Acer palmatum, Castanea sequinii, Magnolia liliflora, Firmiana simplex, Prunus pseudo-cerasus, Albizzia kalkora, Cornus kousa, Quercus aliena, Carpinus fargesiana, Pterostyrax corymbosum, Alangium chinensis, Mallotus apelta, Ulmus japonica, Fraxinus chinensis, Carya cathayensis, Liquidambar formosana, Stewartia gemmata, Acer davidii, Cephalanthus occidentalis, Magnolia denudata, Cornus controversa, Acanthopanax ricinifolium, Daphniphyllum macropodum, Populus adenopoda, Cinnamomum camphora, Quercus glauca, Tilia tuan, Salix babylonica, Aleurites fordii, Aralia chinensis, Emmenopterys henryi, Sapium sebiferum, Idesia polycarpa, Acanthopanax evodiaefolius

c. Shearing strength along the grain:

Ulmus parvifolia, Dalbergia hupeana, Quercus serrata, Morus alba, Photinia beauverdiana, Thea oleosa, Photinia serrulata, Symplocos paniculata, Quercus myrsinaefolia, Cornus kousa, Fraxinus chinensis, Quercus glandulifera, Acer palmatum, Stewartia gemmata, Carya cathayensis, Carpinus fargesiana, Lithocarpus henryi, Celtis sinensis, Symplocos crassifolia, Symplocos congesta, Platycarya strobilacea, Quercus glauca, Prunus salicina, Prunus brachypoda, Crataegus hupehensis, Aphananthe aspera, Ulmus japonica, Prunus pseudo-cerasus, Pterocarya paliurus, Quercus aliena, Firmiana simplex, Mallotus apelta,

Rhododendron mariesii, Litsea auriculata, Alangium chinensis, Daphniphyllum macropodum, Sapium sebiferum, Cornus controversa, Pterostyrax corymbosum, Pyrus serotina, Albizzia kalkora, Acanthopanax evodiaefolius, Catalpa speciosa, Magnolia liliflora, Castanea mollissima, Cephalanthus occidentalis, Acer pictum, Emmenopterys henryi, Cinnamomum camphora, Liquidambar formosana, Salix babylonica, Maackia chinensis, Ailanthus altissima, Acanthopanax ricinifolium, Aralia chinensis, Aleurites fordii, Castanea sequinii, Juglans cathayensis, Idesia polycarpa, Rhus javanica, Populus adenopoda, Tilia tuan, Magnolia denudata

2) The increase in specific gravity is directly proportional to that of the strength. The relationship of the modulus of rupture and the compressive strength along the grain to specific gravity is shown in graph 14 on page 31. The increased rate of the modulus of rupture to the specific gravity is especially great. We obtain the equations of two straight lines from the drawing:—

The modulus of rupture to the specific gravity: $Fr = 1230S$

The compressive strength to the specific gravity: $Fc = 500S + 65$

But Fr. is the modulus of rupture(Kg/cm^2),

Fc is the compressive strength (Kg/cm^2),

S is the specific gravity (based on O. D. Wt.).

The equation of Fc consists of only those specific gravities, which are above 0.25. The following samples are arranged according to their range of weight:

A. Needle-leaved Trees:

Juniperus chinensis, Cephalotaxus fortunei, Torreya grandis, Thuja orientalis Pseudolarix amabilis, Pinus massoniana, Ginkgo biloba, Cryptomeria japonica, Cunninghamia lanceolata

B. Broad-leaved Trees:

Cornus kousa, Photinia serrulata, Ulmus parvifolia, Castanea henryi, Thea oleosa, Photinia beauverdiana, Quercus glauca, Symplocos paniculata, Quercus serrata, Ulmus japonica, Acer pictum, Prunus pseudo-cerasus, Acer palmatum, Quercus aliena, Aphananthe aspera, Prunus salicina, Carya cathayensis, Quercus myrsinaefolia, Alangium chinensis, Castanea mollissima, Platycarya strobilacea, Symplocos congesta, Crataegus hupehensis, Fraxinus chinensis, Prunus brachypoda, Celtis sinensis, Stewartia gemmata, Firmiana simplex, Morus alba, Pyrus serotina, Maackia chinensis, Carpinus fargesiana, Litsea auriculata, Daphniphyllum macropodum, Castanea sequinii, Lithocarpus henryi, Mallotus apelta, Cornus controversa, Liquidambar formosana, Acanthopanax ricinifolium, Cephalanthus occidentalis, Aleurites fordii, Aralia chinensis, Albizzia kalkora, Cinnamomum camphora, Pterostyrax corymbosum, Sapium sebiferum, Acer davidii, Pterocarya paliurus, Emmenopterys henryi, Catalpa speciosa, Juglans cathayensis, Magnolia liliflora, Acanthopanax evodiaefolius, Tilia tuan, Idesia polycarpa, Populus adenopoda, Salix babylonica, Magnolia denudata

3) The degree of hardness of wood varies with the kind of section, the greatest difference being in cross sections. As for the radial and the tangential sections, the difference is very slight. The difference between the two sections of the coniferous and the broad-leaved trees is nearly fifty percent. Classifying the different cross section samples into five ranks according to degrees of hardness, they may be arranged as follows:

(1) Wood very hard (Hardness number above 5.0):

Prunus salicina, Thea oleosa, Cornus kousa, Maackia chinensis, Pyrus serotina, Photinia beauverdiana, Symplocos paniculata, Castanea henryi, Dalbergia hupeana, Alangium chinensnsis, Quercus glauca, Ulmus parvifolia, Rhododendron mariesii

(2) Wood hard (Hardness Number above 4.0):

Quercus myrsinaefolia, Quercus serrata, Symplocos crassifolia, Crataegus hupehensis, Photinia serrulata, Litsea auriculata, Castanea mollissima, Acer pictum, Symplocos congesta, Prunus brachypoda, Prunus pseudocerasus, Cornus controversa, Lithocarpus henryi, Morus alba, Quercus glandulifera, Aphananthe aspera, Daphniphyllum macropodum, Carpinus fargesiana, Acer palmatum, Stewartia gemmata, Juniperus chinensis, Ulmus japonica, Carya cathayensis

(3) Wood moderately hard (Hardness number above 3.0):

Cephalotaxus fortunei, Quercus aliena, Platycarya strobilacea, Torreya grandis, Acer davidii, Pterocarya paliurus, Cephalanthus occidentalis, Magnolia liliflora, Albizzia kalkora, Liquidambar formosana, Aralia chinensis, Castanea sequinii, Pterostyrax corymbosum, Mallotus apelta, Acanthopanax evodiaefolius, Aleurites fordii, Firmiana simplex, Acanthopanax ricinifolium, Emmenopterys henryi, Celtis sinensis, Fraxinus chinensis, Juglans cathayensis,

(4) Wood soft (Hardness number above 2.0):

Pseudolarix amabilis, Thuja orientalis, Ginkgo biloba, Pseudotsuga taxifolia, Magnolia denudata, Sapium sebiferum, Rhus javanica, Pinus massoniana, Cinnamomum camphora, Idesia polycarpa, Tilia tuan, Catalpa speciosa, Ailanthus altissima, Abies sachalinensis, Cunninghamia lanceolata

(5) Wood very soft (Hardness number above 1.0):

Populus adenopoda, Cryptomeria japonica, Salix babylonica

訂　正　表

頁	行　列	誤	正
6	第五横列第二行	Quercns	Quercus
,,	,, 八 ,, ,, ,, ,, ,,	serata	serrate
7	,, 二 ,, ,, ,, ,, ,,	sarg	Sarg
10	,, 二 ,, ,, ,, ,, ,,	mig	Miq
,,	,, 三 ,, ,, ,, ,, ,,	muell.-arg	Muell.-Arg
11	,, 六 ,, ,, ,, ,, ,,	Chen	Chien
12	,, 二 ,, ,, ,, ,, ,,	Acanthopanaxevodiaefolius	Acanthopanax evodiaefolius
,,	,, 八 ,, ,, ,, 一 ,,	自宰樹	自辛樹
13	,, 六 ,, ,, ,, 二 ,,	Emmenopteryx	Emmenopterys
15	,, ,, ,, ,,	universal	Universal
,,	,, 九 ,, ,,	Shera	Shear
18	,, 四 ,, ,,	ar	lar
,,	,, ,, ,, ,,	Paralled	Parallel
,,	,, 十 ,, ,,	110°c 間	110°C 間
,,	,, 十一 ,, ,,	每種試驗	每種試材
19	,, 三 ,, ,,	span	Span
,,	,, 九 ,, ,,	kg 1 cm^2	kg/cm^2
20	,, 六 ,, ,,	寬約(5 cm.)	寬(約 5cm.)
21	,, 一 ,, ,,	四個試驗點	四個驗點
,,	,, 十二 ,, ,,	Brimell 硬度	Brinell 硬度
22	,, 一 ,, ,, 第六行	per-cm	per cm (以下各表均準此)
,,	,, 八 ,, ,, ,, 七 ,,	336^2	366^2
,,	,, ,, ,, ,, ,, 八 ,,	$224,2^6$	234.2^6
,,	,, 九 ,, ,, ,, 十五 ,,	1.4	1.14
23	,, 十 ,, ,, ,, 十五 ,,	4.47	2.47
24	,, 五 ,, ,, ,, 二 ,,	Jacg	Jacq
,,	,, 六 ,, ,, ,, 五 ,,	8.686^3	0.686^3
,,	,, 七 ,, ,, ,, 十五 ,,	2.16	2.19
,,	,, 十 ,, ,, ,, 十 ,,	93.2^4	93.1^4
,,	,, ,, ,, ,, ,, 十三 ,,	60.2^2	50.2^2
25	,, 一 ,, ,, ,, 一 ,,	Naem	Name
,,	,, ,, ,, ,, ,, 十三 ,,	Cleavadility	Cleavability
,,	,, 七 ,, ,, ,, 十三 ,,	111.5^2	112.5^2
,,	,, 九 ,, ,, ,, 二 ,,	Mig	Miq
,,	,, ,, ,, ,, ,, 四 ,,	16.53^2	19.53^2
,,	,, ,, ,, ,, ,, 十 ,,	110.8^4	100.8^4
,,	,, 十 ,, ,, ,, 二 ,,	Muell.-arg	Muell.-Arg
,,	,, 十一 ,, ,, ,, 二 ,,	Aleurits	Aleurites
,,	,, ,, ,, ,, ,, ,, 十六 ,,	1.3	1.30
,,	,, 十五 ,, ,, ,, 十二 ,,	61.7^4	64.7^4
,,	,, 十六 ,, ,, ,, 二 ,,	Acerpictum Thumb.	Acer pictum Thunb.
,,	,, 十七 ,, ,, ,, ,, ,,	Szyszy	Szyszyl
26	,, 三 ,, ,, ,, 十三 ,,	$158.^2$	158.8^2
,,	,, 七 ,, ,, ,, 二 ,,	ev odiaefolius, Franc	evodiaefolius Franch.
,,	,, 十三 ,, ,, ,, ,, ,,	S. ann £.	S. and Z.
,,	,, ,, ,, ,, ,, ,, 十三 ,,	51.9^2	55.9^2
27	,, 一 ,, ,, ,, 八 ,,	kg/cm	kg/cm^2
,,	,, ,, ,, ,, ,, 十 ,,	,,	,,
,,	,, ,, ,, ,, ,, 十一 ,,	,,	,,
,,	,, 三 ,, ,, ,, 二 ,,	Emmenopteryx	Emmenopterys
29	,, 十九 ,, ,,	fc = 500s + 65	fc = 500 S + 65
30	,, 五 ,, ,,	山洞	山桐
38	,, 十 ,, ,,	chinensnsis	chinensis

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外國大麥品種條紋病抗病性之試驗
(英　文)

Varietal Resistance and Susceptibility of Foreign Barleys to HELMINTHOSPORIUM GRAMINEUM Rabh.

(IN ENGLISH)

俞大紱　黃　亮
YU TA-FUH AND HWANG LIANG

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外國大麥品種條紋病抗病性之試驗

Varietal Resistance and Susceptibility of Foreign Barleys to HELMINTHOSPORIUM GRAMINEUM Rabh.*

YU TA-FUH AND HWANG LIANG.

Covered smut and stripe are two important diseases of barley in Kiangsu Province as well as in other barley growing regions in China. One phase of the study made in connection with their control, was to test the disease resistance of a great number of barleys secured from foreign countries. The results of the covered smut resistance test was given in a previous publication**; and that of the stripe resistance test is presented in this paper.

The barleys used for this investigation came from the same sources as those used for the covered smut study**. Inoculation was made in the field about sunset by spraying the heads with a spore suspension two to three times when the grain was between the milky and green mature stage. Immediately after inoculation, the heads were wrapped in oil paper sacks in order to maintain a high moisture content. The inoculum was a heavy spore suspension, prepared four to eight hours prior to the inoculation, by washing the spore-bearing plants in the field with tap water. The spore suspension so obtained was then drained through several thicknesses of cheese cloth to remove any foreign materials that might have been present.

The inoculated grains were sown 4-inch apart in 8-feet rows with 10 replications. Readings were made twice in the next spring before the plants had turned yellow. The results of three years test are given in the following table.

The writers are indebted to Mr. C. T. Tsiang for his help in taking records and in harvesting the barleys in the spring of 1935.

*Paper No. 38, from Plant Pathology Laboratory, Botany Department, The University of Nanking.

**T. F. Yu, H. K. Chen, and L. Hwang, Varietal Resistance and Susceptibility of Foreign Barleys to Covered Smut (*Ustilago hordei*). (Pers.) K. & S.-I Agricultural Sinica Vol. 1 No. 3 pp. 83-90, 1934.

Table. Results of three years test on the resistance and susceptibility of foreign barleys to **Helminthosporium gramineum** Rabh.

Name	Accession No.	University of Nanking No.	Per cent of Diseased plants		
			1932-33	1933-34	1934-35
Abyssinian	*C. I. 946	60	1.6	0.0	6.2
Abyssinian	C. I. 949	61	*Trace	0.0	0.0
Abyssinian	C. I. 951	62	0.9	0.0	0.0
Alaska	C. I. 4106	307	2.1	1.7	3.6
Alexis	C. I. 968	71	0.0	Trace	0.0
Arlington Sel. 12	C. I. 3534	304	2.1	5.4	4.3
52	C. I. 3543	305	9.6	27.2	3.3
66	C. I. 3546	306	42.9	52.7	25.0
Baker	C. I. 975	77	5.1	0.0	7.3
Beldi giant	Washington 967	328	0.0	0.0	0.4
Bema	C. I. 1100	145	1.5	0.0	0.0
Black Egyptian	C. I. 1246	174	0.0	0.0	0.0
Blarney	C. I. 1303	188	7.1	0.0	9.6
Blue	Washington 973	326	0.0	0.0	0.8
Blue Ribbon	C. I. 611	18	0.0	0.9	0.0
Bohemian	C. I. 933	56	0.0	0.0	0.0
Bohemian	C. I. 1148	159	0.7	0.0	0.0
Bolton	C. I. 922	50	0.0	0.0	0.0
Caballew	C. I. 1006	94	0.0	0.0	0.0
Cape	C. I. 1386	227	0.0	0.0	0.0
Cape	C. I. 1387	228	5.5	12.2	7.4
Cape	C. I. 1431	244	0.0	0.0	0.0
Catts	C. I. 1283	180	0.0	0.0	0.0
Cheddar	C. I. 1307	192	0.0	0.0	0.0
Chevallier	Japan	355	0.0	Trace	0.0
Chevron	C. I. 1111	148	0.0	0.0	0.0
Chikurin	Japan	343	40.0	14.7	24.9
Chinese	Ottawa 60	310	6.5	6.9	1.9
Claudia	C. I. 1297	185	35.4	19.0	11.6
Club Mariout	C. I. 932	55	0.0	0.0	0.0
Corbel	C. I. 1113	149	14.3	5.1	3.4
Crypt	C. I. 1090	138	0.0	1.2	7.1
Cusada	C. I. 895	38	0.0	0.0	4.1
Daniels	C. I. 971	73	0.0	1.4	11.5
Duck Bill	C. I. 1420	239	0.0	0.0	0.0
Eckendorfer Mommoth	Germany 21	332	0.0	0.0	0.8
Egel finger	Germany 22	333	0.0	0.0	0.0
Entresot	C. I. 1261	176	36.2	17.9	21.4

*C. I. Refers to U. S. D. A. accession number. *Trace—Diseased plants less than 0.1%

Name	Accession No.	University of Nanking No.	Per cent of Diseased plants		
			1932-33	1933-34	1934-35
Featherston	C. I. 1120	152	31.6	7.1	23.5
Feline	C. I. 1284	181	0.0	0.0	0.0
Finland	C. I. 581	15	1.1	0.0	0.0
Flynn	C. I. 1311	194	0.0	0.0	0.0
Frankish	C. I. 958	65	11.0	6.4	0.7
Freideishswerth Berg Elite	Germany 20	331	0.0	0.0	0.0
Gold Foil	C. I. 928	54	0.0	0.7	0.0
Golden Grain	C. I. 1423	240	0.0	0.0	0.0
Golden Melon	Japan	354	0.0	0.0	0.0
Gose Shikoku	Japan	347	0.0	18.3	8.0
Goud Gerst	C. I. 1393	232	0.0	0.0	0.0
Han River	C. I. 2163	249	2.2	0.0	0.0
Hanna	C. I. 203	5	0.0	0.6	0.0
Hanna	C. I. 906	42	0.0	0.0	0.0
Harem	C. I. 1019	100	0.3	0.0	0.0
Hazoroi	Japan	351	0.0	0.0	0.0
Heron	C. I. 1299	186	0.0	0.0	0.0
Hidalgo	C. I. 1020	101	7.6	0.0	0.6
Hodge	C. I. 982	79	0.0	Trace	0.0
Horn	C. I. 926	52	0.0	2.3	7.8
Horsfard	C. I. 877	308	10.3	2.8	3.3
India	C. I. 2319	254	0.0	10.4	6.5
Khayyam	C. I. 1117	151	23.1	7.4	18.4
Khorsela	C. I. 733	33	60.2	51.8	28.5
Kintama	Japan	349	0.9	11.1	4.3
Kiryzlau	C. I. 1346	206	0.0	0.0	Trace
Kopeck	C. I. 869	36	0.0	5.9	0.0
Kwan	C. I. 1016	99	0.0	0.0	0.0
Lake City	C. I. 1126	155	0.0	0.0	0.0
Leader	C. I. 1282	179	0.0	0.0	0.0
Louden	C. I. 1308	193	0.0	0.0	0.0
Luth	C. I. 972	74	1.1	3.7	4.0
Manchuria	C. I. 956	63	0.0	1.6	0.0
Manchuria	Minnesota 184	317	0.0	1.4	0.0
Mansury	C. I. 617	19	0.0	5.8	7.6
Mariout	Oregon 261	324	0.0	0.0	1.3
Mariout	Nebraska	319	33.3	28.1	17.2
Mecknos Meroe	C. I. 1379	225	0.0	0.0	0.0
Meloy Selection	Oregon 3	323	5.1	0.0	0.0
Morcuran	C. I. 965	69	3.8	11.2	0.6
Nakano Wase	Japan	338	0.0	0.0	0.0
Napal	C. I. 595	16	0.0	0.0	Trace
Oder Brucker	C. I. 957	64	11.3	5.2	12.3

Name	Accession No.	University of Nanking No.	Per cent of Diseased plants		
			1932-33	1933-34	1934-35
Oder Brucker	C. I. 969	72	0.0	14.0	11.5
Oder Brucker	C. I. 1174	162	0.0	0.0	0.0
Oder Brucker	Nebraska	320	25.0	14.9	12.5
Oder Brucker	C. I. 1137	157	0.0	4.1	0.8
Odessa	C. I. 916	45	0.0	0.0	0.0
Odessa	C. I. 961	68	0.0	0.0	0.0
Odessa	Nebraska	321	0.0	0.0	0.0
Omar	C. I. 898	40	0.0	Trace	0.0
Orel	C. I. 351	9	0.0	0.0	0.0
Orel	C. I. 351	336	0.0	0.0	0.0
Pasha	C. I. 984	80	Trace	0.0	Trace
Persia	C. I. 1372	222	33.3	0.0	21.4
Peru	C. I. 653	23	71.3	46.3	31.2
Peruvian	C. I. 935	57	0.0	2.1	6.4
Peruvian	C. I. 935	325	0.0	8.5	4.7
Phoebe	C. I. 1305	190	0.0	0.0	0.0
Pidor	C. I. 901	41	0.0	0.0	0.0
Poda	C. I. 652	22	50.1	18.3	11.5
Pryor	C. I. 1429	243	0.0	0.0	0.0
Purple Nepal	C. I. 1373	223	9.6	25.4	14.3
Quinn	C. I. 1024	104	7.1	4.2	6.5
Rex	C. I. 1388	229	0.0	1.5	8.1
Russia	C. I. 1371	221	0.0	0.3	0.0
Saitama-aohadaka	Japan	368	0.0	0.0	0.0
Sandrel	C. I. 937	59	0.0	0.0	Trace
Santaku	Japan	344	11.5	39.2	10.0
Sekitori	Japan	342	31.3	14.5	24.4
Sekitoriden	Japan	345	17.6	21.1	12.5
Short Head	C. I. 1441	245	0.0	0.9	2.1
Square Head	C. I. 1417	238	0.0	0.0	0.8
Strengs	Germany 23	334	0.0	0.0	0.0
Success	C. I. 1375	224	0.0	0.0	0.0
Sulu	C. I. 1022	103	0.0	4.8	1.5
*Szechwan No. 21	No. 21	369	50.8	5.1	19.6
23	23	370	0.0	0.0	0.0
29	29	371	0.0	8.1	4.6
32	32	373	0.0	0.6	5.1
35	35	374	35.3	14.7	5.1
Tenkau	C. I. 646	21	48.2	9.8	12.7
Tennessee Winter	C. I. 257	7	0.0	0.0	0.0
Trebi	C. I. 936	58	0.0	4.8	1.5
Tripoli	C. I. 1115	150	0.0	11.2	6.3

*Szechwan Nos. 21, 23, 29, 32 and 35 are Chinese barleys.

Name	Accession No.	University of Nanking No.	Per cent of Diseased plants		
			1932-33	1933-34	1934-35
Torano	Japan	352	0.0	0.0	1.1
Vitz	C. I. 1306	191	0.0	0.0	0.0
White Abyssinian	C. I. 676	27	0.0	0.0	0.0
White Smyruna	C. I. 195	4	0.0	0.0	0.0
White Smyruna	C. I. 658	24	0.0	0.0	0.0
Winter Arlington	C. I. 351	10	0.0	0.0	0.0
Winter Club	Washington 957	327	0.0	0.0	0.5
Wisconsin Winter	C I. 2159	250	0.0	1.5	12.4
Wisconsin Winter	C. I. 2167	339	17.6	3.1	8.4
Usuhawa	Japan	256	0.0	0.0	0.0
Zond	C. I. 1138	160	11.1	7.6	14.8
Unnamed	Mich. 04113	312	0.0	0.0	0.0
	Neb. Bearded 2-row	318	0.0	0.0	0.0
	New York 2(9)-20-367	322	0.0	0.0	0.0
	Wisconsin p-6	330	0.0	21.8	12.0
	C. I. 497	11	0.0	0.0	0.5
	C. I. 730	31	72.1	80.9	18.5
	C. I. 731	32	0.0	0.0	0.2
	C. I. 985B	82	37.4	0.0	4.3
	C. I. 999	90	0.0	0.0	0.0
	C. I. 1012	97	0.0	3.0	0.0
	C. I. 1015	98	0.0	0.0	0.0
	C. I. 1021	102	—	0.0	0.0
	C. I. 1025	105	0.0	0.0	0.0
	C. I. 1028	106	0.0	2.5	0.0
	C. I. 1037	107	73.1	22.5	21.9
	C. I. 1042	111	7.5	16.1	5.3
	C. I. 1074	130	0.0	0.0	0.0
	C. I. 1078	132	4.0	9.1	3.8
	C. I. 1091	139	0.0	0.0	0.0
	C. I. 1093	141	0.0	0.0	0.0
	C. I. 1099	144	0.0	5.7	8.9
	C. I. 1103	146	11.7	0.0	0.0
	C. I. 1229	169	0.0	0.0	0.0
	C. I. 1342	204	0.0	0.0	0.7
	C. I. 1344	205	0.0	0.0	0.0
	C. I. 1357	211	0.0	Trace	0.6
	C. I. 1358	212	16.5	0.0	0.0
	C. I. 1359	213	0.0	0.0	0.0
	C. I. 1360	214	Trace	Trace	0.0
	C. I. 1363	216	0.0	0.0	0.0
	C. I. 1364	217	0.0	1.5	0.0
	C. I. 1383	226	0.0	0.0	0.4

Name	Accession No.	University of Nanking No.	Per cent of Diseased plants		
			1932-33	1933-34	1934-35
Unnamed	C. I. 1390	230	0.0	1.9	0.0
	C. I. 1395	233	47.6	8.5	19.1
	C. I. 1404	235	0.0	2.3	0.0
	C. I. 1443	246	0.0	1.6	0.0
	C I. 2318	253	0.0	2.6	1.9
	C. I. 2327	258	50.0	25.6	18.3
	C. I. 2332	259	0.0	0.0	0.4
	C. I. 2333	260	0.0	5.3	0.8
	C. I. 2336	261	0.0	1.2	3.5
	C. I. 2346	263	0.0	0.0	0.0
	C. I. 2353	266	0.9	0.0	0.0
	C. I. 2355	267	0.0	0.0	0.0
	C. I. 2361	269	0.0	0.0	0.0
	C. I. 2364	270	0.0	Trace	Trace
	C. I. 2367	271	11.1	7.6	12.4
	C. I. 2374	273	0.0	2.9	0.0
	C. I. 2412	280	0.0	0.0	0.0
	C. I. 2412	282	12.7	0.0	0.0
	C. I. 2431	284	0.0	5.6	8.5
	C. I. 2433	286	0.0	1.0	0.0
	C. I. 2430	287	0.0	1.6	0.6
	C. I. 2434	288	16.5	5.2	15.6
	C. I. 2435	289	42.9	63.1	40.1
Check (Local susceptible barley)			45.1	29.4	37.9

As seen in the table above, the reactions of these barleys to the stripe organism are in many cases variable from year to year, but in general, the results obtained from different years are quite consistent. Thus, the varieties such as Arlington Sel. 66, Chikurin, Khorsela, Peru, C. I. 730, C. I. 1037, C. I. 2327 and C. I. 2435 were heavily infected; while on the other hand, Alaska, Arlington Sel. 12, Chinese, Luth, Quinn were only slightly infected with the disease each year.

The same variety coming from different sources may give different reactions to the disease. This is especially noticeable in the cases of Abyssinian, Cape, Mariout and Oder Brucker.

For inoculation, different methods were tried out. The simplest and most effective was to spray the heads any time between the milky and

the green mature stage with fresh spore suspension which usually brought about a high percentage of infection. The high percentage of the diseased plants in the check barley, a local susceptible strain, indicated that the method of inoculation was efficient and also that the fungus was virulent.

Among these 184 foreign barleys 62 were disease free throughout the experiment. They are :

Black Egyptian (N 174)*
Bohemian (N 56)
Bolton (N 50)
Caballew (N 94)
Cape (N 227)
Cape (N 244)
Catts (N 180)
Cheddar (N 192)
Chevron (N 148)
Club Mariout (N 55)
Duck Bill (N 239)
Egel finger (N 333)
Feline (N 181)
Flynn (N 194)
Freideishswerth Berg Elite (N 331)
Golden Grain (N 240)
Golden Melon (N 354)
Goud Gerst (N 232)
Hanna (N 42)
Hazoroi (N 351)
Heron (N 186)
Kwan (N 99)
Lake City (N 155)
Leader (N 179)
Louden (N 193)
Mecknos Meroe (N 225)
Nakano Wase (N 338)
Oder Brucker (N 162)
Odessa (N 45)
Odessa (N 68)
Odessa (N 321)
Orel (N 9)
Orel (N 336)
Phoebe (N 190)
Pidor (N 41)
Pryor (N 243)
Saitama-aohadaka (N 368)
Strengs (N 334)
Success (N 224)
Szechwan No. 23 (N 370)
Tennessee winter (N 7)
Vitz (N 191)
White Abyssinian (N 27)
White Smyruna (N 4)
White Smyruna (N 24)
White Arlington (N 10)
Usukawa (N 256)
Mich. 04113 (N 312)
Nebraska Bearded 2-row (N 318)
New York 2(9) 20-367 (N 322)
C. I. 999 (N 90)
C. I. 1015 (N 98)
C. I. 1025 (N 105)
C. I. 1074 (N 130)
C. I. 1091 (N 139)
C. I. 1093 (N 141)
C. I. 1229 (N 169)
C. I. 1344 (N 205)
C. I. 1363 (N 216)
C. I. 2346 (N 263)
C. I. 2355 (N 267)
C. I. 2361 (N 269)
C. I. 2364 (N 270)

According to the results of previous study(**), and of the present investigation of the 39 barleys tested, none contracted the covered smut or the stripe. These barleys, which will serve as good materials for breeding work, are enumerated as follows:

Black Egyptian (N 174)
Bohemian (N 56)
Bolton (N 50)
Caballew (N 94)
Cape (N 227)
Catts (N 180)
Cheddar (N 192)
Duck Bill (N 239)
Egel finger (N 333)
Feline (N 181)
Freideishswerth Berg Elite (N 331)
Golden Grain (N 240)
Hanna (N 42)
Heron (N 186)
Lake City (N 155)
Leader (N 179)
Mecknos Meroe (N 225)

*N = University of Nanking number

Oder Brucker (N 162)	Tennessee Winter (N 7)	C. I. 1074 (N 130)
Odessa (N 45)	Vitz. (N 191)	C. I. 1091 (N 139)
Orel (N 9)	Winter Arlington (N 10)	C. I. 1344 (N 205)
Orel (N 336)	Min. 04113 (N 312)	C. I. 1363 (N 216)
Phoebe (N 190)	Nebraska Bearded 2-row (N 318)	C. I. 2346 (N 263)
Pidor (N 41)		C. I. 2361 (N 269)
Saitama-aohadaka (N 368)	New York 2(9) 20-367 (N 322	C. I. 2364 (N 270)
Strengs (N 334)	C. I. 999 (N 90)	

外國大麥品種條紋病抗病性之試驗

（提　　要）

俞大紱　　黃　　亮

大麥重要之病害，有堅黑粉病及條紋病，其防除方法，爲種子消毒或培養能抵抗病害之品種，金陵大學植物病理研究室，曾搜集國內外大麥，作抵抗上述病害之實驗，關于外國大麥抵抗黑粉病試驗之結果，詳見上次報告，本文專述外國大麥對于條紋病之抵抗性。

試驗麥種，來自美國，加拿大，德國並日本，凡一八四種此外尚有我國四川產大麥五種，接種方法，于春末在田中施行，俟麥粒青熟時期，噴以二或三次胞子接種水，接種後，納麥穗于臘紙袋中，以維持相當濕度，所用胞子接種水，係在接種前四至八小時取田中受病大麥，滌以清水，用紗布漏過，此漏過之水，含有多量胞子，用以接種。

已經接種之種子，俟其成熟後，分別收穫，至秋間每種大麥，播植于長八尺之行中，行距離爲一尺，種子距離爲四英寸，每種大麥重復十次，紀錄兩次，三年試驗之結果，詳見上表。

所試驗之外國大麥，凡一八四種，其中有六十二種，經過三年試驗，從未感受病害，又根據前次所作堅黑粉病抵病試驗，則此六十二種大麥中，有三十九種，非徒能抵抗堅黑粉病，並能抵抗條紋病，此項麥種名稱，詳見本文。

金陵大學

植物病理研究室

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SILVER
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CHINESE PRICE LEVEL

BY

ARDRON B. LEWIS AND CHANG LU-LUAN
Department of Agricultural Economics
The University of Nanking

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SILVER AND THE CHINESE PRICE LEVEL[1]

ARDRON B. LEWIS AND CHANG LU-LUAN[2]

IT is a matter of common knowledge that farmers in the interior of China are receiving unusually low prices for their products, and are having unusual difficulty in paying their debts and taxes. Declining prices are not confined to farm products but are also affecting the products of city industries. The average of wholesale prices in China has been declining since the middle of 1931 (figures 2 and 3). Widespread economic distress such as that which was experienced in gold standard countries because of falling prices after 1920 and 1929 is beginning to be felt in China.

Statistical research into price relationships extending over long periods of years has shown that the price level in gold standard countries has depended primarily upon the supply of and demand for gold.[3] The rapid increase in the purchasing power of gold that began in 1929 was expressed in a rapid increase in the purchasing power of gold standard currencies and in declining commodity prices in gold standard countries. Falling prices caused the undesirable conditions that are known as "the economic depression."

It is the purpose of this article to show the relationship between the purchasing power of silver and the price level in China. The data indicate (1) that declining prices in China are due primarily to the increasing purchasing power of silver, and (2) that the purchasing power of silver is very likely to continue to increase. If the price level in China continues to decline, in consequence of a rising purchasing power of silver, economic distress will be intensified.

The gold standard countries have tried in many ways to avoid the economic consequences of the rising purchasing power of gold. As a last resort, most of these countries have abandoned the fixed gold standard. A change in the basis of the currency is the only

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1.—Study made by the Department of Agricultural Economics, University of Nanking, Nanking, China.

2.—Ardron B. Lewis is Agricultural Statistician and Chang Lu-luan is Instructor, Department of Agricultural Economics, University of Nanking, Nanking, China.

3.—Kitchin, J., "The Supply of Gold Compared with the Prices of Commodities," Interim Report of the Gold Delegation of the Financial Committee of the League of Nations, Document C. 375 M. 161, Sept., 1930.
Cassel, G., The Theory of Social Economy, p. 447, 1924.
Woytinsky, W., "Das Ratsel der langen Wellen," Smollers Jahrbuch, 55 Jahrgang, Viertes Heft, p. 30, 1931.
Warren, G. F. and Pearson, F. A., Prices, pp. 74-125, 1933.

way in which a gold standard country can avoid declining prices when the supply of and demand for gold is such as to increase its value in terms of other commodities.

The experience of China will probably be similar to that of foreign countries. As long as China is on a fixed silver standard, declining prices cannot be avoided if silver continues to rise in purchasing power. The present is the best time for China to consider the problem of a modification in the silver standard, before declining prices have done further damage to the economic life of the country.

Purchasing Power of Silver

The purchasing power of silver is the amount of other commodities that a given amount of silver will buy. Since China is on the silver standard and silver is the basis of important payments and prices, the purchasing power of silver determines the level of prices in China. When the purchasing power of silver rises, fewer silver dollars and other forms of silver are required to buy a given amount of commodities, and wholesale prices decline. Conversely, when the purchasing power of silver declines, more silver dollars are required to buy a given amount of other commodities, and wholesale prices rise. The purchasing power of silver in China is therefore measured as the reciprocal of the index of wholesale prices of commodities.

In countries that are not on the silver standard, silver is not the basis of commodity prices, and the money price of silver is not fixed. Nevertheless, the price of silver in terms of money cannot be used as a direct measurement of the purchasing power of silver in terms of other commodities. If the price of silver rises, and average wholesale prices also rise at the same rate, the purchasing power of silver in terms of commodities has not changed. Neither has the purchasing power of silver changed if the price of silver declines and average wholesale prices also decline at the same rate. Therefore, in countries that are not on a silver standard, the purchasing power of silver is measured as the percentage that the index of the price of silver is of the index of wholesale prices.

Longtime Changes in the Purchasing Power of Silver in China and in England

An index of the purchasing power of silver in China was calculated as a reciprocal of an index of prices of Chinese import and export commodities.[1] According to this index, the purchasing power of silver in China has been declining rapidly for many years. After 1887, except during the world war, this decline closely paralleled the decline in the purchasing power of silver in England (figure 1).

1.—The index of the price of Chinese import and export commodities was compiled by Nankai Institute of Economics, Nankai University, Tientsin, China.

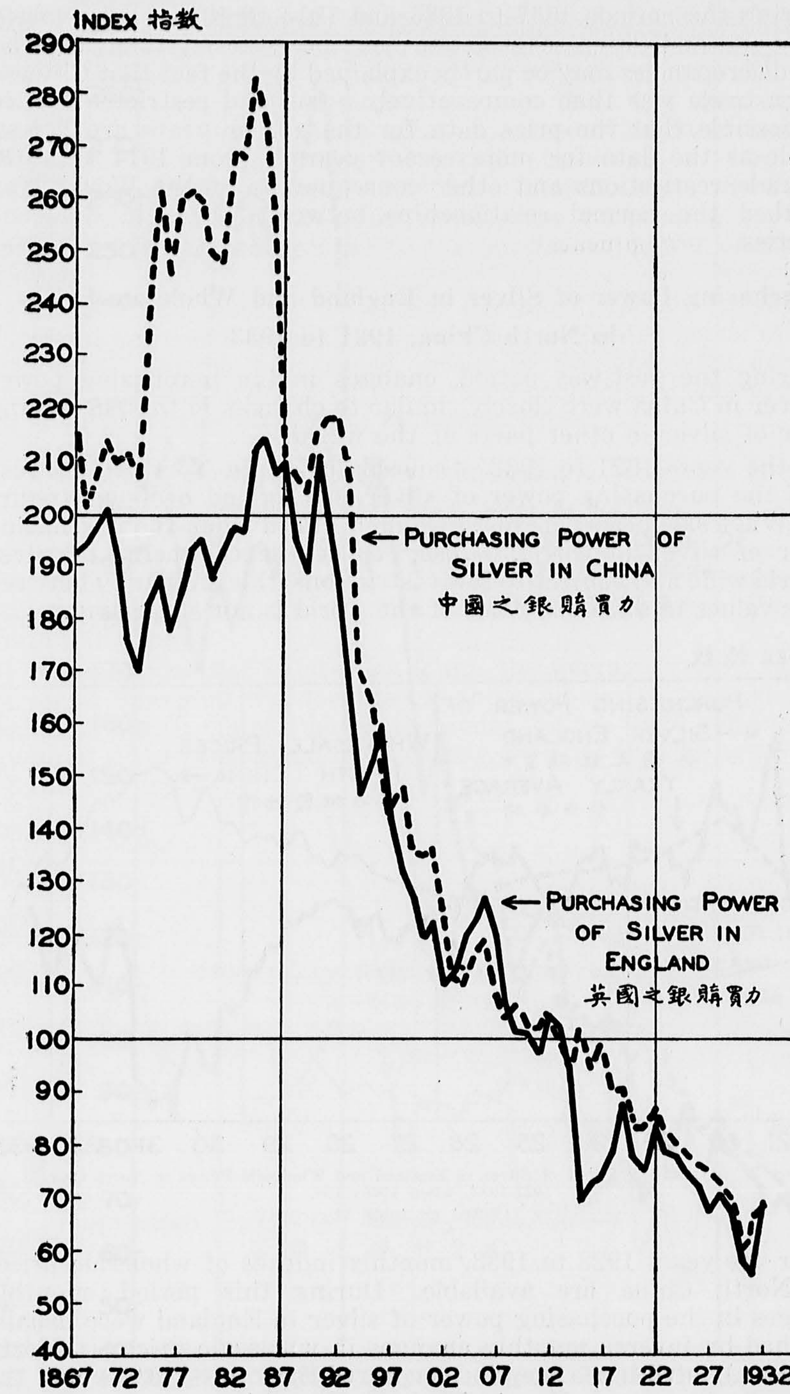


Figure 1. Index of Purchasing Power of Silver in China and Purchasing Power of Silver in England, 1910-1914=100.
(Based on table 3)

During the periods 1867 to 1886 and 1914 to 1918, silver values in England and China seem not to have been closely related. The early discrepancies may be partly explained by the fact that Chinese foreign trade was then comparatively small and restricted. It is also possible that the price data for the earlier years are not so reliable as the data for more recent years. From 1914 to 1918, the trade restrictions and other consequences of the World War disturbed the normal relationships between prices in different countries.

Purchasing Power of Silver in England and Wholesale Prices in North China, 1921 to 1933

During the post-war period, changes in the purchasing power of silver in China were closely similar to changes in the purchasing power of silver in other parts of the world.

In the years 1921 to 1933, wholesale prices in North China rose when the purchasing power of silver in England declined (figure 2). Wholesale prices in North China declined when the purchasing power of silver in England rose. Since the commerce in silver is world wide and subject to few restrictions, this similarity between silver values in different parts of the world is not surprising.

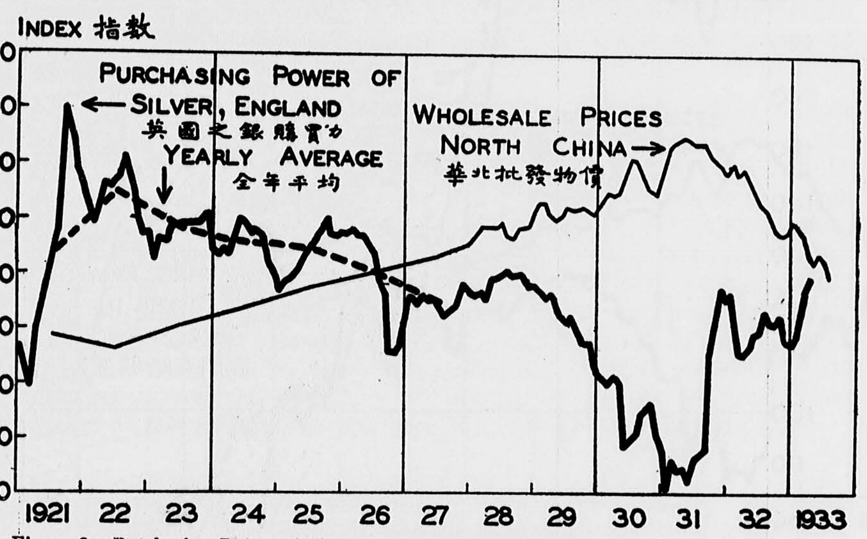


Figure 2. Purchasing Power of Silver in England and Wholesale Prices in North China, 1921-1933, when 1926=100.
(Based on table 4)

For the years 1928 to 1933, monthly indexes of wholesale prices for North China are available. During this period, monthly changes in the purchasing power of silver in England were usually matched by inverse monthly changes in wholesale prices in North China. A striking exception occurred late in 1931 when the purchasing power of silver in England rose without any corresponding fluctuation in the wholesale price level in China. At that time,

Great Britain abandoned the gold standard and wholesale prices in England rose. When prices rise, the prices of basic commodities (silver, wheat, pig iron, coal, cotton and others) tend to rise faster than the average of wholesale prices. This fact explains the sudden rise in the purchasing power of silver in England just after England left the gold standard. This rise went too far, and a reaction occurred. Later in 1932 and in 1933, when the English price level was comparatively stable, the purchasing power of silver in England was similar to the purchasing power of silver in China.

In 1930 and most of 1931, the purchasing power of silver in England was considerably lower than the purchasing power of silver in China. During this period, prices in England were declining rapidly, and the price of silver, a basic commodity, was declining in advance of the average of wholesale prices.

Purchasing Power of Silver in England and Wholesale Prices at Shanghai, China, 1921 to 1933

During the period 1921 to 1933, month-to-month changes in the purchasing power of silver in England were usually matched by inverse month-to-month changes in wholesale prices in Shanghai, China (figure 3).

These similarities existed although the average yearly value of silver at Shanghai was not always the same as its average yearly value in North China, where the index before 1926 reflected the value of silver in England more closely than did the Shanghai index (figures 2 and 3).

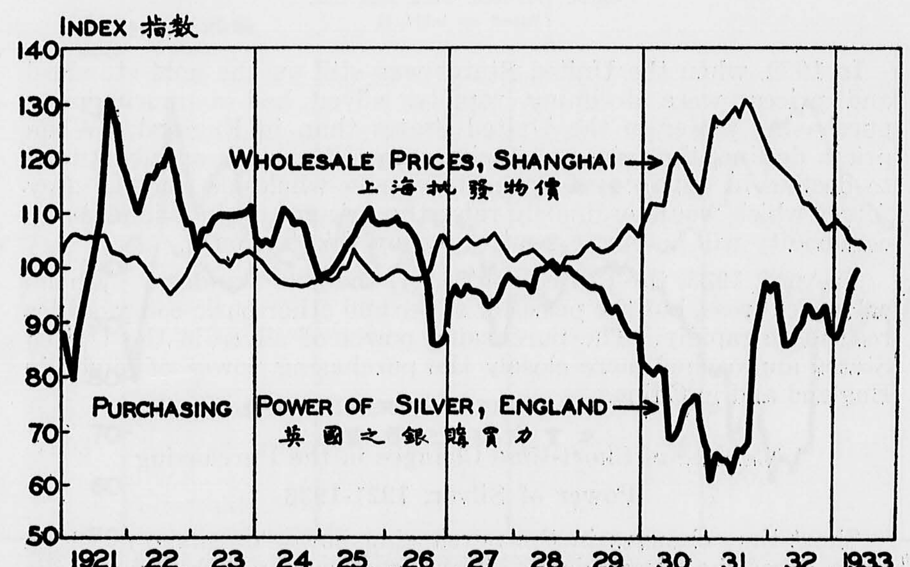


Figure 3. Purchasing Power of Silver in England and Wholesale Prices in Shanghai. 1921-1933, when 1926=100.
(Based on table 4)

Purchasing Power of Silver in the United States and Wholesale Prices in China, 1921 to 1933

During the years 1921 to 1931, the purchasing power of silver in the United States moved in close relation to the purchasing power of silver in England (figures 3 and 4). Changes in the purchasing power of silver in the United States were usually matched by inverse changes in wholesale prices in China (figure 4).

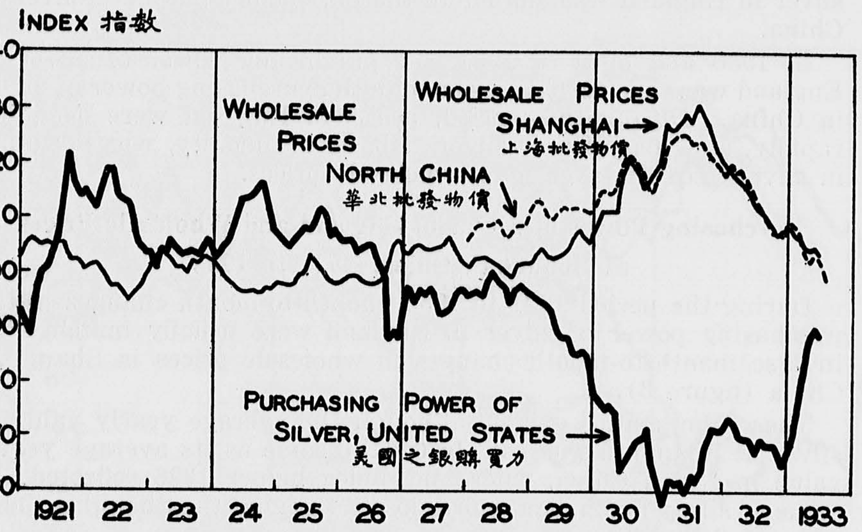


Figure 4. Purchasing Power of Silver in the United States and Wholesale Prices in China, 1921-1933, when 1926=100.
(Based on table 4)

In 1932, when the United States was still on the gold standard and prices were declining rapidly, silver had a much lower purchasing power in the United States than in England. When prices decline, the prices of basic commodities such as silver tend to decline in advance of general average wholesale prices. Any forces which would ordinarily raise the price of an individual basic commodity will be partly neutralized by this tendency.

In April, 1933, the United States left the gold standard. Wholesale prices rose, but the prices of silver and other basic commodities rose more rapidly. The purchasing power of silver in the United States approached more closely the purchasing power of silver in England and in China.

Violence of Short-time Changes in the Purchasing Power of Silver, 1921-1933

Short-time changes in the purchasing power of silver in China were somewhat less violent than corresponding changes in the purchasing power of silver in foreign countries (figures 2, 3 and 4). This relationship is to be expected, since there is always a

certain amount of resistance to a change in the price of a commodity, and a change in the purchasing power of silver in China can be expressed only by a change in the price of many commodities. In countries where silver is not the monetary standard, changes in the purchasing power of silver must overcome the resistance to a change in the price of only one commodity, namely, silver.

Factors Responsible for Long-Time Changes in the Purchasing Power of Silver

The precipitious decline in the purchasing power of silver in the world from about the year 1885 to the middle of 1931 was due to the rapid demonetization of silver during that period (table 1). While the market for monetary silver was being rapidly narrowed, the demonetized silver was continually being sold. This demonetized silver increased the supply available for other uses and for monetary uses in a decreasing number of countries. During the period, 1920 to 1932, 541.5 millions of fine ounces of demonetized silver were sold by various governments and central banks (table 2).

TABLE 1

Dates of Adoption of the Gold Standard by Different Countries and of Other Acts Unfavorable to Use of Silver as Money*

Year	
1816	England
1854	Portugal
1871	Germany
1873	United States, Denmark, Sweden and Norway began to adopt the gold standard. Belgium stopped using silver to mint 5-Franc pieces. France prohibited the free coinage of silver 5-Franc pieces.
1874	The Latin League limited the minting of silver currency.
1875	Italy began to limit the free coinage of silver currency. The Dutch Settlements stopped minting silver currency. Holland adopted bimetalism, and stopped minting silver currency.
1876	Finland adopted the gold standard. France stopped minting silver 5-Franc pieces.
1880	Haitie
1881	Agentina
1885	Egypt
1893	The free coinage of Indian silver currency and French trade silver were stopped. The United States repealed the "Sherman Act".
1897	Japan and Russia
1899	India adopted the gold exchange standard.

*Wu Ta-yeh, "A Statistical Analysis of Fluctuations in the Silver Price, 1833-1931", Quarterly Journal of Economics and Statistics, Nankai University, Vol. 1, No. 1, p. 24 (Chinese).

TABLE 1—*(Continued)*

1900	Uruguay
1903	The Philippine Islands adopted the gold exchange standard.
1905	Bolivia adopted the gold standard. Mexico adopted the gold exchange standard.
1906	Straits of Malacca
1907	Colombia
1908	Siam
1910	Canada
1925	India
1930	French Indo-China

TABLE 2

Demonetized Silver Sold by Various Governments or Central Banks during the Period 1920-1932**

Year	United Kingdom	Other European countries	British India	Indo-China	Other countries	Total, all countries
1920	—	27.0	—	—	—	27.0
1921	6.5	30.0	—	—	—	36.5
1922	24.0	19.0	—	—	—	43.0
1923	25.0	20.0	—	—	—	45.0
1924	2.0	18.0	—	—	—	20.0
1925	7.0	23.0	—	—	—	30.0
1926	0.7	7.0	—	—	—	7.7
1927	1.2	8.0	9.2	—	—	18.4
1928	5.5	32.0	22.5	—	—	60.0
1929	10.0	10.0	35.0	12.0	—	67.0
1930	—*	22.0*	29.5	20.0	—	71.5
1931	—*	—	35.0	6.4	27.4	68.8
1932	—	11.6	24.0	10.0	1.0	46.6
Total	81.9	227.6	155.2	48.4	28.4	541.5

*During 1930 and 1931, additional supplies came to London from Europe and from the debasement of British coinage. These were used for the manufacture of coin in other countries and are not included in this table.

**Figures quoted from the publications of Messrs. Handy and Harmon, New York, by E. Kann, "The Exchange and Financial Markets", Finance and Commerce, Shanghai, July 19, 1933.

During the period 1902 to 1922, the price level in China rose at about the same rate as the world stocks of silver increased (figure 5). The demonetization of silver during this period was therefore just sufficient to prevent any net increase in the demand for silver, since changes in the purchasing power of silver corresponded to changes in the supply.

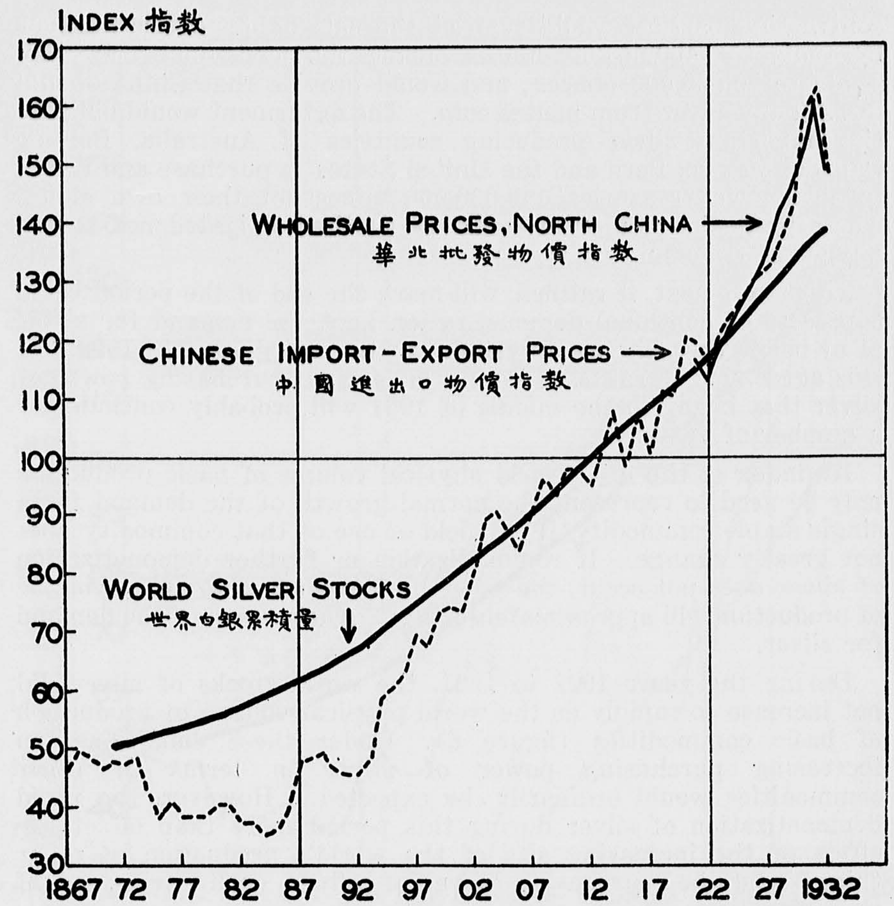


Figure 5. Estimated World Silver Stocks and Wholesale Prices in China, 1867-1932, when 1910-1914=100.
(Based on tables 3, 5 and 6)

From 1923 to 1931, prices in China rose faster than did the world stocks of silver. During this period, sales of demonetized silver were apparently sufficient to reduce the demand for silver, and its value in terms of commodities declined faster than the total stocks increased.

Prospects for higher purchasing power of silver in the future

The source of supply of demonetized silver has been considerably reduced by past demonetization. It is inevitable that this source of silver will be exhausted. Unless China goes off the silver standard, the demand for new silver for monetary uses cannot be reduced nearly so extensively in the future as it has been in the past.

On July 22, 1933, the agreement relative to the control of silver was signed in London.[1] This agreement, if ratified by the

1.—Kann, E., "The Exchange and Financial Markets", Finance and Commerce, Shanghai, Vol. 22, No. 4, July 26, 1933.

contracting parties, would restrict the sale of demonetized silver by India to 140,000,000 ounces during the next four years; by Spain to 20,000,000 ounces; and would provide that China should not sell any silver from melted coin. The agreement would obligate the important silver producing countries of Australia, Bolivia, Canada, Mexico, Peru and the United States to purchase and retain in their own treasuries 140,000,000 ounces of their own silver. These producing countries would be further obligated not to sell any silver from surplus stocks.

This agreement, if ratified, will mark the end of the period when a process of continual demonetization kept the demand for silver at or below the demand prevailing in the period 1902 to 1922. If this agreement is ratified, the increase in the purchasing power of silver that began in the middle of 1931 will probably continue for a number of years.

An index of the total world physical volume of basic production may be used to represent the normal growth of the demand for a single staple commodity, if the field of use of that commodity does not greatly change. If remonetization or further demonetization of silver does not occur, the growth of the world physical volume of production will approximately measure the growth of the demand for silver.

During the years 1922 to 1931, the world stocks of silver did not increase so rapidly as the world physical volume of production of basic commodities (figure 6). Under these conditions, an increasing purchasing power of silver in terms of other commodities would ordinarily be expected. However, the rapid demonetization of silver during this period more than offset the effect of the increasing size of the world's production of other things, and the purchasing power of silver declined instead of rising.

Total world physical production has been greatly reduced by the post war depression and unemployment in gold-standard countries. As recovery in these countries progresses, the world's physical volume of production will probably resume its usual rate of increase, as it had begun to do after the serious decrease in production caused by the World War. From 1865 to 1914, the world's physical volume of production normally increased at the rate of 3.15 per cent per year.[1] It is probable that, if there is no remonetization or further demonetization of silver, the world stocks of silver should increase at about 3.15 per cent per year in order to maintain a stable purchasing power of silver. The estimated world stocks of silver in 1932 were 15,222,112,000 ounces (table 5). Silver production in 1933 would have to be about 479,000,000 ounces in order to equal 3.15 per cent of stocks for the preceding year. The highest annual silver production known was 260,900,000 ounces, produced in 1929. Warren and Pearson estimate that only about 155,000,000 ounces

1.—Carl Snyder's index of world physical volume of production, as quoted from Warren, G. F. and Pearson, F. A., Prices, p. 47.

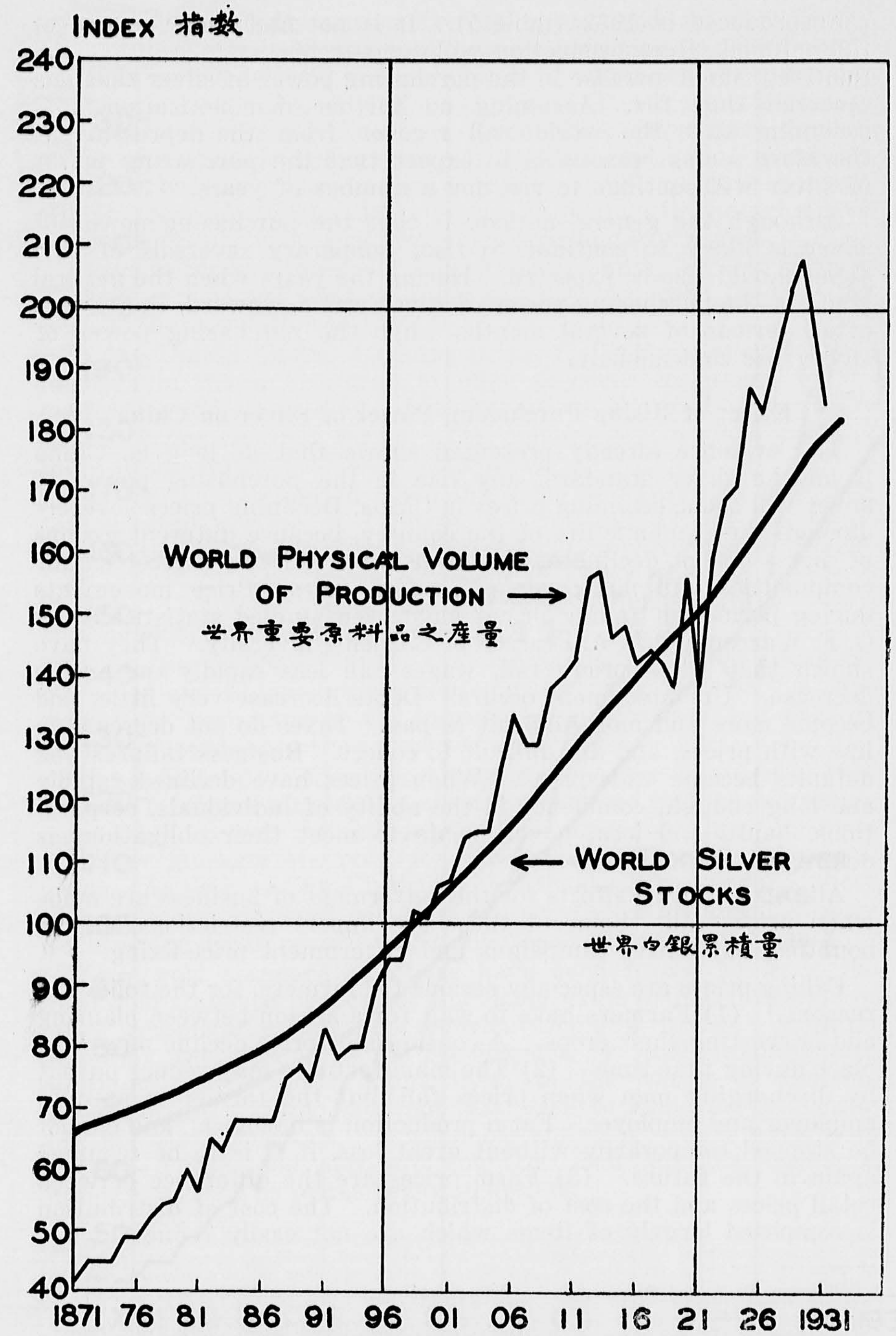


Figure 6. Index of World Physical Volume of Production of Basic Commodities and Index of World Silver Stocks, 1871-1931, when 1880-1914=100.

(Based on table 5)

were produced in 1932 (table 5). It is not reasonable to expect that annual silver production will soon treble as a result of the relatively small increase in the purchasing power of silver that has occurred thus far. Assuming no further demonetization, and assuming that the world will recover from the depression, it therefore seems reasonable to expect that the purchasing power of silver will continue to rise for a number of years.

Although the general outlook is that the purchasing power of silver is likely to continue to rise, temporary reversals of this trend should also be expected. During the years when the general trend in the purchasing power of silver was downward, there were often periods of several months when the purchasing power of silver rose continuously.

Effect of Rising Purchasing Power of Silver on China

The evidence already presented shows that as long as China is on the silver standard, any rise in the purchasing power of silver will cause declining prices in China. Declining prices severely damage the economic life of the country, because different groups of prices do not decline at the same rate, and prices received for commodities will not cover production costs. Price movements during periods of falling prices have been studied statistically by G. F. Warren and F. A. Pearson of Cornell University.[1] They have shown that when prices fall, wages fall less rapidly and profits decrease. Unemployment occurs. Debts decrease very little, and become more and more difficult to pay. Taxes do not decrease in line with prices, and are difficult to collect. Business failures and defaults become widespread. When prices have declined rapidly and long enough, confidence in the ability of individuals, corporations, banks and local governments to meet their obligations is destroyed.

All sorts of blind efforts for the betterment of business are made when prices fall. Some of these are import restrictions, export bounties, buy-native campaigns and government price-fixing.[2]

Falling prices are especially serious for farmers, for the following reasons.[3] (1) Farmers have to wait for a season between planting and harvesting their crops. A considerable price decline may take place during that time. (2) The manufacturer may reduce output by discharging men when prices fall, but the farmer is at once employer and employee. Farm production is biological, and cannot be stopped temporarily without great loss, if it is to be resumed again in the future. (3) Farm prices are the difference between retail prices and the cost of distribution. The cost of distribution is composed largely of items which are not easily reduced when

1.—Warren, G. F. and Pearson, F. A., Prices, 1933.

2.—Ibid. pp. 303-310.

3.—Warren, G. F. and Pearson, F. A., "Interrelationships of Supply and Price", Cornell University, Agr. Exp. Stat. Bul. 406, 1928.
Warren, G. F. and Pearson, F. A., Prices, 1933, pp. 183-193.
Chang Lu-luan, "Farm Prices in Wuchin, Kiangsu" (Chinese), Nanking Journal, Vol. 3: 153-216. May, 1933. Reprinted.

prices fall, such as wages, freight rates, and internal tariffs. Therefore, most of the amount of any reduction in retail prices tends to be passed back to farm prices, of which it will be a much larger percentage than it is of retail prices. Therefore, when prices decline, farm prices decline by a much larger percentage than do retail or wholesale prices. In China, this fact is of great importance, because transportation is relatively difficult and expensive, and the cost of distribution is high.[1] A change in the price level in China results in a very violent change in farm prices.

Farm prices are especially important in China, because Chinese farmers sell 54 per cent of their products for cash, and 80 per cent of the population is rural.[2]

In the United States, declining prices for farm products caused farmers in many instances to offer physical resistance to the marketing of farm products at the low prices, and to the foreclosure of mortgages on their farms. Tax delinquency in rural areas of the United States has been widespread.[3]

During the long period when the value of silver was declining, the physical volume of Chinese imports and exports increased rapidly (figure 7). In the years 1922-1930, imports were especially high, although the purchasing power of silver was the lowest in history. Chinese exports also increased during these years, although not so rapidly as imports.

Since the middle of 1931, the purchasing power of silver has increased and Chinese prices consequently have declined. At the same time, both exports and imports have decreased, but imports have decreased more than exports.

These facts do not support the view, often expressed, that Chinese foreign trade would necessarily increase with an increasing purchasing power of silver. When prices decline, business shrinks. Markets are poor for foreign as well as for domestic goods. As long as China remains on a fixed silver standard, those who advocate and work for higher silver values are unconsciously working for declining prices and business depression in China.

Many gold standard countries have been forced to leave the fixed gold standard because of the rising value of gold in terms of other commodities, and consequent declining prices. Without exception, these countries did not abandon the gold standard until declining prices had brought them to the verge of complete economic ruin. Many have not been able to avoid serious social and political upheavals. Incalculable suffering would have been avoided if the gold standard countries had left the fixed gold standard as soon as prices began to decline.

1.—Much of the transportation in China is furnished by pack animals, carts and wheelbarrows. In 16 localities in the North China plain the cost of transportation of agricultural products per ton-mile was 38 cents by mule and donkey, 23 cents by cart, and 11 cents by wheelbarrow. Transportation by boat was only 5 cents per ton mile; and by railroad, only 7 cents per ton-mile. (Unpublished data from an economic study of land utilization in China, Department of Agricultural Economics, College of Agriculture and Forestry, University of Nanking, Nanking, China.)

2.—Buck, J. L., Chinese Farm Economy.

3.—Hibbard, B. H., "Taxes a Cause of Agricultural Distress," Journal of Farm Economics, Vol. XV, No. 1: 1-10, Jan., 1933.

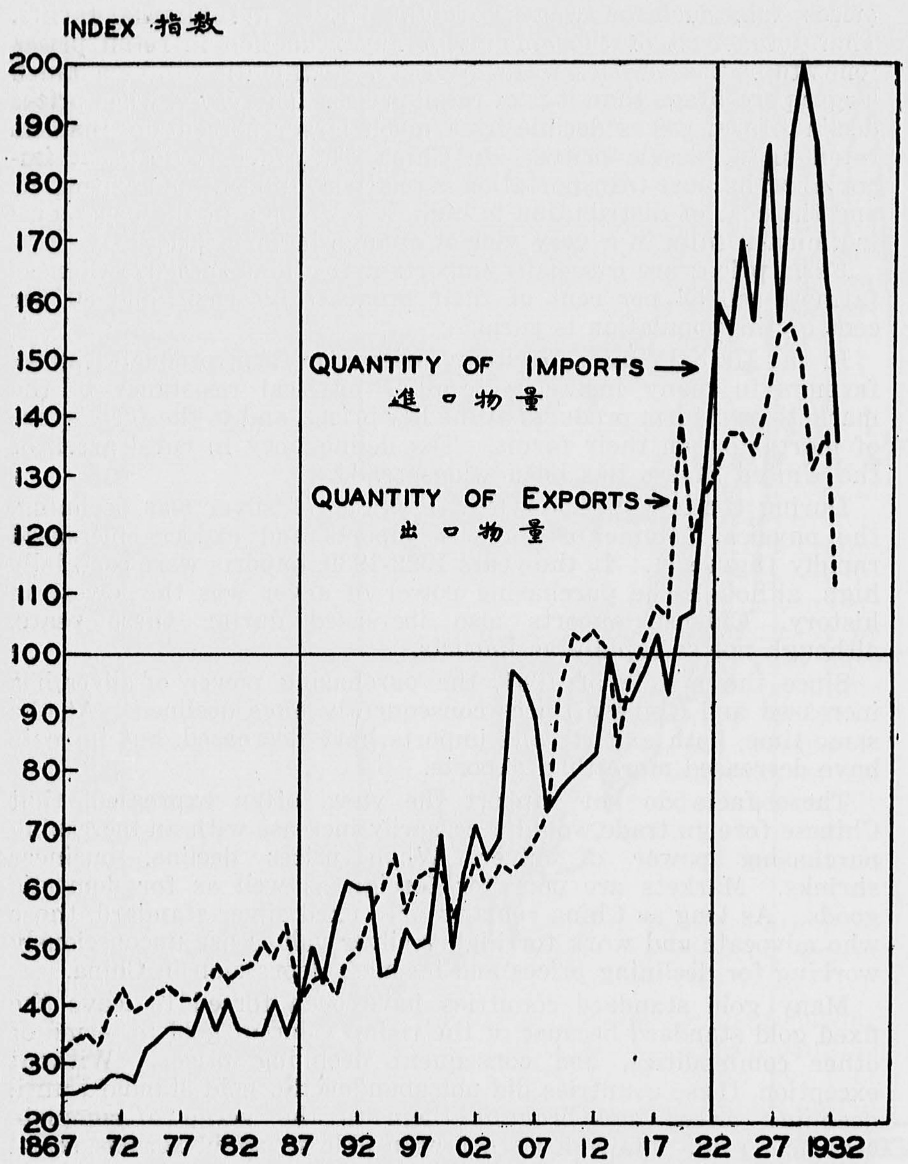


Figure 7. Index of Quantity of Exports and Index of Qualitity of Imports in China, 1867-1932, when 1913=100.

(Based on table 7)

The strongest lesson that the terrific economic chaos of the past few years has taught is that when money is exchangeable for a fixed amount of any one commodity, the general price level will change whenever a change occurs in the supply of and demand for that commodity. This is true, whether the commodity is gold or silver.

AVOIDING ECONOMIC DEPRESSION

If measures were taken to raise the wholesale price level in China to the point from which it began to fall in 1931, most of the unusual economic distress now being felt by farmers and other producers in China would be alleviated. If wholesale prices were raised, farm prices would rise by a much greater percentage, just as they have fallen much further than wholesale prices have fallen. If commodity prices were raised, relatively immovable items such as debts, wages, and taxes, which have remained up while commodity prices have declined, would be little affected, and could then be paid with the proceeds of the sale of no more than the usual amount of commodities.

The present low commodity prices are due primarily to the increased purchasing power of silver. Much less silver can be obtained from the sale of other commodities than was obtained in 1931. Since the Chinese dollar exchanges for a fixed weight of silver, fewer Chinese dollars are now obtained when commodities are sold, than were obtained in 1931.

The purchasing power of the Chinese dollar may change either because of a change in the purchasing power of silver, or because of a change in the weight of silver represented by the dollar. The purchasing power of silver is determined in a world market, and there is little that one country can do to control this factor as long as free trade in silver is permitted. There remains one way in which the purchasing power of the Chinese dollar can be changed, and that is by changing the weight of silver exchanging for the dollar.

If the weight of silver exchanging for the Chinese dollar were reduced, the purchasing power of the Chinese dollar would fall, and wholesale prices in China would rise.

A reduction in the weight of silver exchanging for the Chinese dollar is the same as an increase in the price of silver in terms of Chinese dollars. A given percentage rise in the price of silver in terms of Chinese dollars would eventually produce a similar rise in wholesale prices in China.

Restoring the Wholesale Price Level

At the beginning of 1932, the wholesale price level in China had not yet fallen disastrously. At that time, the index of wholesale prices in North China, compiled by the Nankai Institute of Economics, was about 118, when 1926=100. By November 1, 1933, this index had dropped to 94. To restore prices from an index of 94 to an index of 118, a rise of about 25 per cent would be necessary.

The accomplishment of the following objects would raise the price level 25 per cent, thus raising commodity prices toward the point from which they have fallen:

(1) The central banks of China, that are now permitted to issue notes exchangeable at par for the silver Yuan dollar, would issue new notes redeemable in a smaller weight of silver per dollar than are present notes, and the old notes would be

retired. If it were desired to raise the price level 25 per cent, the number of new dollar notes exchanging for a given number of silver Yuan dollars or for a given weight of silver would be increased 25 per cent.

(a) All persons holding silver coin or bullion could exchange these at banks or at exchange offices for new notes, obtaining 25 per cent more dollars than before.

(b) All persons holding Yuan dollar bank notes could exchange these notes for new notes, receiving 25 per cent more dollars than the face value of the old notes. The banks of issue would be required to destroy all old notes received in exchange for new notes.

(c) After the application of item (7), all demand deposits in banks, subject to be drawn upon by check, would be increased in number of dollars 25 per cent; but the depositor would be entitled to withdraw a correspondingly smaller amount of silver or of silver coin per dollar; and if he withdraw notes, he would receive the new notes.

(2) All written or unwritten obligations payable in terms of Yuan dollars, including taxes, wages, debt principle, interest, and all other public and private obligations except the obligations of banks to demand depositors, would henceforth be payable, dollar for dollar, in terms of the new notes.

A person who owed 100 dollars could pay the obligation in full with 100 dollars in new notes.

(3) All obligations payable in terms of uncoined silver, or in terms of silver coins other than the Yuan dollar, would henceforth be payable in terms of as many new notes as the Yuan dollar value of the obligation.

A person who owed 100 ounces of silver in uncoined form would first determine the number of silver Yuan dollars for which 100 ounces of the uncoined silver would exchange. He could then pay this debt, when due, in this number of dollars in new notes.

(4) Any persons or agencies requiring the payment of obligations in actual coin or silver would be required to accept as full payment the amount of coin or silver exchangeable for the number of new notes in which the obligation, according to item (3), could otherwise be paid.

(5) All old notes outstanding after a certain date would be received at banks in exchange for only the amount of silver represented by the new notes; or would be received in exchange for new notes dollar for dollar.

This provision would clear the markets of an issue of notes having a greater silver exchange weight than the new, legal tender notes.

(6) Note exchange offices would be made available in every hsien city.

Such offices would be necessary in order to furnish exchange facilities to all the people. These offices might be branches of the central banks, departments of the hsien government, or local banking or trade organizations authorized to act in this capacity.

(7) It is stated under item (1) (c) that demand deposits in banks would be treated as if they were current cash in the hands of the depositor, and would therefore be increased in number of dollars by 25 per cent. Before applying this provision, however, it would be necessary to divide the present demand deposits of banks into time and demand divisions. Only the demand division of the present demand deposits would then be increased 25 per cent. The reasons for this reservation are as follows:

A demand deposit in a bank is a liability of the bank to the depositor. The assets which cover this liability may at present consist partly of cash and partly of other assets, such as loans. The decrease in the silver exchange weight of the dollar would automatically increase the dollar value of the bank's cash on hand by 25 per cent. The bank can therefore increase by 25 per cent the dollar value of demand deposits that are covered by cash. It is not desirable, however, that the bank increase the dollar value of its outstanding loans, and therefore the bank cannot increase the dollar value of that proportion of its demand deposits which is covered by loans.

Furthermore, to the extent that demand deposits have served in the past as the basis for bank loans, and have been subject to the payment of interest, they have been, in effect, time investments rather than current cash deposits.

Therefore, all banks that have demand deposits subject to check would be required, before increasing the number of dollars in demand deposits by 25 per cent (item (1) (c)), to divide their present demand deposits into time and demand divisions, according to the following rules:

(a) Of each different account, a certain amount (for instance, 200 dollars) would be reserved as a demand deposit. This provision would insure that the funds of small depositors would remain accessible and be treated as current cash.

(b) The total value of loans outstanding against demand deposits would be determined. After reserving 200 dollars from each account (item (7) (a)), the percentage that total loans were of total remaining demand deposits would be determined. This percentage of the value of each account (not counting the 200 dollars reserved) would be transferred to time deposits. The rest or each account, plus the 200 dollars first reserved (item (1) (a)), would remain as a demand deposit.

The operation of item (7) is illustrated by the following simple balance sheets:

Original Balance Sheet of Demand Deposit Department of Bank

	Assets of the bank against demand deposits	Demand deposits of the bank	
Cash	$ 5,000	Account A	$ 200
		Account B	1,000
Loans	5,000	Account C	800
		Account D	2,000
		Account E	100
		Account F	900
		Account G	5,000
Total	$10,000		$10,000

From Each Account, 200 Dollars is Reserved for the Demand Division of Deposits (Item (7) (a))

	Original demand accounts	First part of demand division of deposits	Remainder of account
Account A	$ 200	$200	$ 0
„ B	1,000	200	800
„ C	800	200	600
„ D	2,000	200	1,800
„ E	100	100	0
„ F	900	200	700
„ G	5,000	200	4,800
Total	$10,000	$1,300	$8,700

The Proportion of Remaining Deposits that is Covered by Loans is Transferred to Time Deposits (Item (7) (b))

The $5,000 of notes outstanding are 57.47 per cent of the remainder of $8,700.

	Remainder (after subtracting 200 dollars)	Transferred to time deposits (57.47 per cent of remainder)	Second part of demand division of deposits (remainder less 57.47 per cent)
Account A	$ 0	$ 0	$ 0
„ B	800	460	340
„ C	600	345	255
„ D	1,800	1,034	766
„ E	0	0	0
„ F	700	402	298
„ G	4,800	2,759	2,041
Total	$8,700	$5,000	$3,700

Final Demand Deposit Balance Sheet of Bank

Assets		Demand division of deposits (Sum of first and second parts of demand division of deposits)	
Cash	$5,000	Account A	$ 200
		„ B	540
		„ C	455
		„ D	966
		„ E	100
		„ F	498
		„ G	2,241
Total	$5,000		$5,000

Final Time Deposit Balance Sheet of Bank

Assets		Time division of deposits	
Loans	$5,000	Account A	$ 0
		„ B	460
		„ C	345
		„ D	1,034
		„ E	0
		„ F	402
		„ G	2,759
Total	$5,000		$5,000

The dollar value of the bank's cash on hand against the final demand division of deposits would be increased 25 per cent, and the dollar value of each separate depositor's account would also be increased 25 per cent (item (1). The weight of silver exchanging for each of these dollars would, of course, be 20 per cent smaller than before.

No change would take place in the dollar valuation of the time division of deposits or loans against time deposits. The bank would be obligated to pay withdrawals in new notes or in silver enough to purchase the new notes; and would accept new notes or their silver equivalent from debtors.

In subsequent revaluations of the currency, if these should occur, no change would take place in the dollar value of time deposits or in bank loans, but collections and payments would both be made in the revalued dollars. The number of dollars in checking accounts would be changed by the percentage of the revaluation.

(8) All amounts transferred by banks to time deposits would not be withdrawable, except with the consent of the bank, within three months after the date of revaluation of the currency;

and after the expiration of this three months' period, such deposits would be withdrawable, in new notes or their silver equivalent, upon one month's notice to the bank. During this four months' period, the maturity of loans would bring the bank a cash balance with which to meet demands for the withdrawal of time deposits. After any subsequent revaluations of the currency, time deposits would be withdrawable on one month's, not three months' notice. Banks would also encourage the making of deposits to be withdrawn or extended at a prearranged time, such as 3-month, 6-month, or 12-month time deposits.

(9) After the date of revaluation, no bank would be permitted in future to pay any interest on demand deposits subject to check. Banks could charge a small fee for the use of checking accounts.

Any person desiring to receive interest on bank deposits would deposit his money in a time deposit, subject to withdrawal on one month's notice to the bank, or subject to withdrawal or extension at a prearranged time.

(10) After the date of revaluation, no bank would be permitted in future to make, on the basis of demand deposits, any loans other than demand loans; and the percentage of such demand loans against demand deposits would be strictly limited. This provision would not limit the power of banks to make loans against time deposits.

(11) Under present rules, banknotes issued by the central banks must be backed by silver up to 60 per cent of the face value. After the application of item 1 (b), the bank would have outstanding 125 dollars in new notes for each 100 dollars of notes previously issued. Cash on hand of 60 Yuan dollars silver would be worth 75 new dollars. If all other assets behind the note issue were loans of 40 dollars, these would remain 40 dollars, collectible in new notes. The bank would have outstanding $125 in notes against only $115 of assets ($75 in silver+$40 in loans=$115).

The expense of a revaluation large enough to raise the price level 25 per cent would thus be a severe burden to the banks. Since the restoration of the price level would be attempted for the benefit of the state rather than for the benefit of the banks, it would seem fair for the government to transfer to the banks sufficient government bonds to replace any loss in net worth that would otherwise be suffered as a result of the operation of revaluing the currency.

(12) In areas where large amounts of copper coins are used to pay debts or other obligations the value of which is set in silver it might be found desirable to issue notes in exchange for copper coins. In issuing such notes, the amount of silver for which the copper coins would exchange at the market rate would first be determined. As many new dollar notes would then be issued as would have been issued in exchange for

that amount of silver. A note issued would be redeemable in copper at the rate of exchange prevailing between the silver face value of the note and copper at the time the note is presented for redemption.

In some areas, the issue of these copper notes might help greatly in relieving the people from the effects of the increased purchasing power of silver. In other areas, the small importance of copper coins would not justify this provision. If there were areas where the copper mints could not be controlled, and rapid depreciation of copper coins might result, no copper notes would be issued in those areas.

Establishing an Approximately Stable Price Level

In China, silver serves primarily as a medium of exchange and not primarily as a material for purposes of manufacture and consumption. Promises to pay a certain amount of silver in the future are therefore really promises to pay a certain purchasing power in terms of other commodities. When the value of silver increases greatly, injustice results if debtors are forced to pay the full weight of silver borrowed, because in order to do this they must surrender an unusually large proportion of the commodities which they produce. If prices fall fast and far enough, creditors also lose, because they are not repaid at all. When the value of silver decreases rapidly, injustice results if debtors pay back no more than the weight of silver borrowed, because the lender cannot buy as much goods with the silver when it is paid back as he could when he lent it. Many other injustices result from fluctuations in the value of money. In order to accomplish the purposes for which it is intended, a currency should remain approximately stable in purchasing power in terms of commodities.

The outlook is that the purchasing power of silver in the world may continue to increase, with occasional periods of temporary decrease, for a number of years. After the first revaluation of the Chinese currency, commodity prices might not remain at the level to which the revaluation would raise them, but might begin to decline again from that point. In order to hold the price level up, the process of raising the price level could be repeated whenever indices of wholesale prices had fallen a certain percentage below the level established by the first revaluation. It would not be desirable that such revaluations be frequent, and therefore the wholesale price level might be allowed to fall 5 per cent before a revaluation were made. The price of silver in terms of dollars would then be raised 5 per cent, by reducing the silver exchange weight of the currency.

After the first revaluation of 25 per cent, small decreases in the silver exchange weight of the currency could be made with comparative ease, since no further change in the banking system would be required. It would not be necessary for banks to subdivide their demand deposits before increasing the number of dollars in such deposits. It would not even be necessary to replace all old notes outstanding with new notes, since old notes might be received, identified by an indelible stamp or by punching, and reissued together with the necessary additional number of similarly identified new notes.

Preventing Inflation

When 1910-14 is taken as 100, wholesale prices in China rose from an index of 46 in 1892 to an index of 162 in 1931 (table 3). During this 39 year period, prices rose 252 per cent of the level existing in 1892.

When prices rise, creditors are penalized, because the money which they receive in repayment of loans has less purchasing power than the money which was lent. Persons engaged in productive enterprise are favored by rising prices, because prices received for finished products tend to be higher than prices paid for the materials, credit and labor which are the costs of production. Periods of gradually rising prices therefore stimulate productive enterprise.

Since productive enterprise is profitable, there is a steady demand for the use of money, and rates of interest are high when the general price level is rising. These higher interest rates partly compensate the creditor for the loss that he sustains from the decrease in the purchasing power of repayments of principle.

The high interest rates prevailing in China are partly the result of the fact that the price level has increased 252 per cent in 39 years. The practice of paying interest on demand deposits and of issuing demand obligations on relatively non-liquid security are also due, in part, to the rapidly and continuously rising price level of the past two generations. The present banking practices in China are adjusted to a rising, not to a stable price level. This fact increases the severity of the effects of the present declining prices in China. High interest rates cannot be paid when prices decline, and the issue of demand obligations based on non-liquid security is extremely risky.

A gradual rise in the price level, if that should occur, would not be undesirable, since it would encourage productive enterprise and thus help in the development of China. As stated before, it is not very likely that the purchasing power of silver will soon decline markedly, and therefore not likely that the price level in China will soon rise on account of such a decline.

At some time in the future, however, the country may be faced with the danger of rapid inflation due to a rapid decrease in the purchasing power of silver. If, after the expiration of the London silver agreement, India should decide to sell its silver stocks quickly, such a sudden decrease in silver values might occur. If, after a period of remonetization of silver, many foreign nations should quickly demonetize silver, a sudden decrease in silver values might also occur. A resulting rapid rise in prices in China, from the stable level to which they had been held for some years, could then

quickly be offset by an increase in the silver exchange weight of the currency. This object could be attained by methods that are the opposite of those used in raising the price level. If a real danger of inflation due to rapidly decreasing silver purchasing power should exist, these measures would have to be applied immediately if at all, since business soon adjusts itself to higher prices. As soon as business is adjusted to a given price level, it is hazardous to attempt to lower prices, since only through bankruptcy and unemployment does business finally become adjusted to a lower price level.

The following procedure would counteract rapidly rising prices due to rapidly declining purchasing power of silver:

(1) Persons presenting silver and old notes to banks would receive a definite percentage smaller number of dollars in new notes, exchanging for a correspondingly greater weight of silver per dollar. Existing demand bank deposits would be reduced by a definite percentage, but be made payable in new notes, each exchanging for a greater weight of silver.

(2) Obligations payable in silver and old notes would be legally discharged only by the presentation of new notes or by the presentation of a correspondingly greater amount in old notes or in silver.

(3) When copper were presented to be exchanged for notes, in areas where copper notes were used, an amount of copper equalling in value the silver exchangeable for the new notes would be required. These notes would be redeemable in copper, at the rate prevailing between copper and the face value of the note in silver at the time redemption were desired by the note holder.

(4) After a set date, all old notes not redeemed in a smaller number of new notes or in silver would be declared worthless, and would not be received at banks or exchange offices in return for silver.

This provision would clear the markets of the old banknotes.

Prohibiting the Export of Silver

It is impossible to predict in advance the net effect that an embargo on the export of silver from China might have on the Chinese price level. During the war period, Great Britain placed an embargo on the export of silver, and the purchasing power of silver in Great Britain fell rapidly to a point far below its purchasing power in China (figure 1). When the embargo was lifted, the purchasing power of silver in Great Britain rose, and was again similar to the purchasing power of silver in China.

From this example it should not be concluded that the purchasing power of silver in China would necessarily fall markedly, and the Chinese price level necessarily rise considerably, if the export of silver were prohibited. In China, there is a large demand for silver for currency purposes, which is not duplicated in Great Britain, and the growth of trade in China will therefore require increasing amounts of silver. Although an embargo on the export of silver from China might partly release the purchasing power of silver in China from foreign influences, it is not at all certain that domestic influences might not be sufficient to hold the purchasing power of silver up and commodity prices down to the present level.

Over a period of years, even if no silver were exported from China, Chinese commodity prices would decline if silver increased in purchasing power abroad, because the silver prices received for export commodities would decline. It would therefore be impossible to increase the supply of Chinese money fast enough to maintain stable internal prices, unless the silver exchange weight of the dollar were reduced.

If the exchange weight of the Chinese dollar were reduced, an embargo on silver exports would not be necessary in restoring prices, nor later in maintaining a stable price level. Furthermore, it would contribute to the international strain resulting from the currency restrictions now imposed by many foreign countries.

Foreign Cooperation

Foreign cooperation would not be helpful in restoring or controlling the Chinese price level. Until 1931, the Chinese price level had risen steadily for many years. The fluctuations in the purchasing power of gold standard currencies that came during and after the World War had no effect on the Chinese price level. These fluctuations were observed in China only as fluctuations in foreign exchange rates. These fluctuations in foreign exchange rates had no corresponding effect on Chinese foreign trade, which increased rapidly under a variety of foreign exchange rate situations.

If the silver exchange weight of the Chinese dollar were reduced so as to restore the Chinese price level to the point where producers' costs would again be paid, the resulting change in foreign exchange rates would have no permanent effect, either good or bad, on Chinese prosperity. Temporarily it might encourage Chinese exports of manufactured commodities, the prices of which would be comparatively slow in rising to the full extent of a devaluation of the currency.

Adequacy of Present Indexes of Wholesale Prices in China

Available indexes of wholesale prices in various cities in China agree closely in showing the decline in prices that has occurred in recent years. If it were decided to restore the wholesale price level, these indexes are sufficient evidence as to the amount of the necessary revaluation. If the price level is raised, the exact amount of the rise is not important if the rise is sufficient to relieve the distress occasioned by the previous fall in prices.

If it were decided to make subsequent revaluations of the currency, if necessary, in order to maintain a stable price level in future, an official index of wholesale prices would be desirable. This index should be based on data from many wholesale markets in various parts of China.

Conclusion

When the internal price level has fallen suddenly, a rise in internal prices is the only way in which the resulting depression can be avoided. Efforts to raise the price of individual commodities by tariffs, export bounties, buying campaigns, and restriction of production, though often tried in other countries, have not been effective in curing the fundamental situation. Expansion of credit, when prices are declining on account of increasing silver purchasing power, only involves debtors and creditors in further losses. There are various ways in which the internal price level could be raised and later stabilized, but all of them would involve changes in the relation of the currency to silver.[1]

The method that is outlined in principle in this bulletin could be modified and extended in various ways. Advantages of following such a procedure, in establishing a stable price level, would be

(1) No motives to speculate in or against silver, banknotes, or demand checking deposits would be furnished by any revaluation, since all these forms of currency would be treated alike.

(2) No change would take place in the ratio of number of dollars of banknotes and checking accounts to number of dollars' worth of silver as a result of a revaluation, except as more notes based 100 per cent on silver might be issued.

(3) Credit customs adjusted to a rapidly rising price level would be adjusted to the conditions prevailing under a stable price level.

(4) International complications would not be involved.

1.—Warren, G. F. and Pearson, F. A., Prices, 1933: 150-177.
Fisher, I., Stabilizing the Dollar, 1920.

TABLE 3
Value of Silver in China and in England 1867-1932, when 1910-14=100

Year	Index of import and export prices in China, 1867-1871 =100*	Index of import and export prices in China 1910-1914 =100**	Index of purchasing power of silver in China, 1910-1914=100†	Price of bar silver in London (pence per fine ounce)‡	Index of price of bar silver in London 1910-1914 =100	Index of wholesale prices in England, 1910-1914 =100††	Index of purchasing power of silver in England, 1910-1914 =100‡‡
1867	97.1	46.4	215.5	60.56	232.7	121	192.3
1868	104.1	49.8	200.8	60.50	232.5	120	193.8
1869	101.0	48.3	207.0	60.44	232.3	118	196.9
1870	97.9	46.8	213.7	60.56	232.7	116	200.6
1871	99.8	47.7	209.6	60.50	232.5	121	192.1
1872	99.1	47.4	211.0	60.31	231.8	132	175.6
1873	101.2	48.4	206.6	59.19	227.5	134	169.8
1874	89.1	42.6	234.7	58.31	224.1	123	182.2
1875	80.1	38.3	261.1	56.69	217.9	116	187.8
1876	85.4	40.8	245.1	53.13	204.2	115	177.6
1877	80.5	38.5	259.7	54.81	210.6	114	184.7
1878	80.1	38.3	261.1	52.63	202.3	105	192.7
1879	80.7	38.6	259.1	51.25	197.0	101	195.0
1880	83.8	40.1	249.4	52.25	200.8	107	187.7
1881	84.5	40.4	247.5	51.63	198.4	103	192.6
1882	77.9	37.2	268.8	51.81	199.1	101	197.1
1883	78.0	37.3	268.1	50.56	194.3	99	196.3
1884	73.9	35.3	283.3	50.69	194.8	92	211.7
1885	76.0	36.3	275.5	48.56	186.6	87	214.5
1886	82.9	39.6	252.5	45.38	174.4	84	207.6
1887	100.0	47.8	209.2	44.69	171.8	82	209.5
1888	101.3	48.4	206.6	42.88	164.8	85	193.9
1889	103.0	49.2	203.3	42.69	164.1	87	188.6
1890	97.3	46.5	215.1	47.75	183.5	87	210.9
1891	96.0	45.9	217.9	45.06	173.2	87	199.1
1892	96.0	45.9	217.9	39.75	152.8	82	186.3
1893	100.8	48.2	207.5	35.56	136.7	82	166.7
1894	122.0	58.3	171.5	28.94	111.2	76	146.3
1895	126.2	60.3	165.8	29.81	114.6	75	152.8
1896	131.7	63.0	158.7	30.81	118.4	74	160.0
1897	145.5	69.5	143.9	27.56	105.9	75	141.2
1898	141.6	67.7	147.7	26.94	103.5	78	132.7
1899	153.3	73.3	136.4	27.44	105.5	82	128.7
1900	155.0	74.1	135.0	28.31	108.8	91	119.6
1901	154.0	73.6	135.9	27.19	104.5	85	122.9
1902	168.6	80.6	124.1	24.06	92.5	84	110.1
1903	187.1	89.4	111.9	24.75	95.1	84	113.2
1904	189.9	90.8	110.1	26.38	101.4	85	119.3
1905	181.1	86.6	115.5	27.81	106.9	87	122.9
1906	175.2	83.7	119.5	30.88	118.7	93	127.6

TABLE 3—*(Continued)*

Year	Index of import and export prices in China, 1867-1871 =100*	Index of import and export prices in China 1910-1914 =100**	Index of purchasing power of silver in China, 1910-1914=100†	Price of bar silver in London (pence per fine ounce)‡	Index of price of bar silver in London 1910-1914 =100	Index of wholesale prices in England, 1910-1914 =100††	Index of purchasing power of silver in England, 1910-1914 =100‡‡
1907	189.9	90.8	110.1	30.19	116.0	97	119.6
1908	200.0	95.6	104.6	24.38	93.7	88	106.5
1909	195.9	93.6	106.8	23.69	91.0	90	101.1
1910	205.1	98.0	102.0	24.63	94.7	94	100.7
1911	204.5	97.8	102.2	24.56	94.4	97	97.3
1912	199.1	95.2	105.0	28.03	107.7	103	104.6
1913	211.1	100.9	99.1	27.56	105.9	103	102.8
1914	226.2	108.1	92.5	25.31	97.3	103	94.5
1915	205.0	98.0	102.0	23.69	91.0	131	69.5
1916	222.3	106.3	94.1	31.31	120.3	165	72.9
1917	210.2	100.5	99.5	40.88	157.1	212	74.1
1918	231.6	110.7	90.3	47.56	182.8	232	78.8
1919	231.4	110.6	90.4	57.06	219.3	249	88.1
1920	251.5	120.2	83.2	61.50	236.4	304	77.8
1921	250.3	119.6	83.6	36.88	141.7	188	75.4
1922	241.8	115.6	86.5	34.44	132.4	159	83.3
1923	254.4	121.6	82.2	31.94	122.8	156	78.7
1924	259.7	124.1	80.6	34.00	130.7	168	77.8
1925	266.3	127.3	78.6	32.08	123.3	165	74.7
1926	273.5	130.7	76.5	28.69	110.3	153	72.1
1927	277.4	132.6	75.4	26.04	100.1	148	67.6
1928	285.5	136.5	73.3	26.74	102.8	145	70.9
1929	296.8	141.9	70.5	24.48	94.1	139	67.7
1930	330.3	157.9	60.3	17.65	67.8	117	57.9
1931	339.8	162.4	61.6	14.46	55.6	101	55.0
1932	——	148.2	67.5	17.81	68.4	99	69.1

*Compiled by Nankai Institute of Economics, Nankai University, Tientsin, China, and Published in Nankai Weekly Statistical Service, Vol. V, No. 15, April 11, 1932.

**For the years 1867 to 1931, these indexes were obtained by coverting the indexes in column 1 to the base of 1910-14=100. For the year 1932, the index is the North China index of wholesale prices compiled by Nankai Institute of Economics. This was made comparable with the import-export index by converting it from a base of 1926=100 to a base of 1926=130.7, which was the import-export index for 1926 (Table 6).

†Reciprocals of indexes in column 2.

‡For the years 1867 to 1924, from Kann, Eduard. The Currencies of China, 1926, p. 161. For the years 1925 to 1932, average of monthly quotations found in The Shanghai Market Prices Report published by National Tariff Commission, Shanghai, China.

††Warren, G. F. and Pearson, F. A., Prices, 1933, p. 75.

‡‡Percentage that the index of silver prices is of the index of wholesale prices in England.

TABLE 4

Purchasing Power of Silver in the United States, England, and China from 1921 to 1933, 1926=100[11]

Year and month	Price of silver in New York[1] (cents per fine ounce)	Index of price of silver in New York, 1926=100	Index of wholesale prices in the United States, 1926=100[2]	Index of purchasing power of silver in the United States, 1926=100[3]	Price of Silver in London[4] (pence per fine ounce)	Index of price of silver in London, 1926=100	Index of wholesale prices in England, Board of Trade, 1926=100[5]	Index of wholesale price in England, Statist, 1926=100[6]	Index of purchasing power of silver in England, based on Board of Trade index of wholesale prices, 1926=100[7]	Index of purchasing power of silver in England, based on Statist index of wholesale prices, 1926=100[8]	Index of wholesale prices in North China, 1926=100[9]	Index of wholesale prices in Shanghai, China, 1926=100[10]
1921	—	—	—	—	—	—	—	—	—	103.0	88.9	—
January	65.95	106.1	114.0	93.1	39.63	138.1	—	156.1	—	88.5	—	102.9
February ...	59.32	95.5	104.9	91.0	34.56	120.5	—	145.0	—	83.1	—	105.5
March	56.03	90.2	102.4	88.1	31.81	110.9	—	140.4	—	79.0	—	106.2
April	59.34	95.5	98.9	96.6	33.94	118.3	—	134.5	—	88.0	—	105.9
May	59.85	96.3	96.2	100.1	34.31	119.6	—	128.0	—	93.4	—	105.2
June	58.51	94.2	93.4	100.9	34.63	120.7	—	123.4	—	97.8	—	105.4
July	60.26	97.0	93.4	103.9	37.38	130.3	—	125.4	—	103.9	—	105.0
August	61.60	99.1	93.5	106.0	37.69	131.4	—	122.1	—	107.6	—	105.8
September ..	66.15	106.5	93.4	114.0	40.56	141.4	—	118.2	—	119.6	—	105.5
October	70.97	114.2	94.1	121.4	41.00	142.9	—	109.7	—	130.3	—	102.6
November ..	68.23	109.8	94.2	116.6	39.19	136.6	—	108.4	—	126.0	—	102.5
December ..	65.76	105.8	92.9	113.9	36.13	125.9	—	105.8	—	119.0	—	102.1
1922	—	—	—	—	—	—	—	—	—	115.0	86.4	—
January	65.45	105.3	91.4	115.2	35.00	122.0	—	104.5	—	116.7	—	100.9
February ...	65.31	105.1	92.9	113.1	33.81	117.8	—	104.5	—	112.7	—	101.6
March	64.38	103.6	92.8	111.6	33.00	115.0	—	105.1	—	109.4	—	101.8
April	66.57	107.1	93.2	114.9	34.56	120.5	—	106.4	—	113.3	—	100.6
May	71.15	114.5	96.1	119.1	35.88	125.1	—	107.1	—	116.8	—	99.2
June	71.15	114.5	96.3	118.9	35.88	125.1	—	107.1	—	116.8	—	97.2
July	70.24	113.1	99.4	113.8	35.81	124.8	—	105.8	—	118.0	—	97.6
August	69.40	111.7	98.6	113.3	34.88	121.6	—	102.5	—	118.6	—	96.1
September ..	69.50	111.9	99.3	112.7	35.38	123.3	—	101.2	—	121.8	—	95.0
October	68.01	109.5	99.6	109.9	34.56	120.5	—	103.2	—	116.8	—	96.2
November ..	65.18	104.9	100.5	104.4	32.94	114.8	—	103.2	—	111.2	—	97.5
December ..	64.62	104.0	100.7	103.3	31.38	109.4	—	101.9	—	107.4	—	99.5
1923	—	—	—	—	—	—	—	—	—	108.3	90.4	—
January	65.71	105.8	102.0	103.7	31.94	111.3	—	103.2	—	107.8	—	100.9
February ...	64.34	103.6	103.3	100.3	30.75	107.2	—	104.5	—	102.6	—	103.3
March	67.53	108.7	104.5	104.0	32.25	112.4	—	105.1	—	106.9	—	104.1
April	66.85	107.6	103.9	103.6	32.31	112.6	—	105.8	—	106.4	—	103.2
May	67.07	108.0	101.9	106.0	32.63	113.7	—	104.5	—	108.8	—	102.0
June	64.84	104.4	100.3	104.1	31.69	110.5	—	101.2	—	109.2	—	100.8
July	63.01	101.4	98.4	103.0	30.88	107.6	—	98.6	—	109.1	—	100.8
August	62.78	101.0	97.8	103.3	30.94	107.8	—	98.6	—	109.3	—	99.9
September ..	64.22	103.4	99.7	103.7	31.69	110.5	—	101.2	—	109.2	—	102.1
October	63.65	102.4	99.4	103.0	31.75	110.7	—	101.2	—	109.4	—	101.7
November ..	63.82	102.7	98.4	104.4	32.94	114.8	—	104.5	—	109.9	—	102.8
December ..	64.70	104.1	98.1	106.1	33.44	116.6	—	105.1	—	110.9	—	102.6
1924	—	—	—	—	—	—	—	—	105.8	—	93.6	—
January	63.44	102.1	99.6	102.5	33.56	117.0	111.6	108.4	104.8	107.9	—	101.6
February ...	64.36	103.6	99.7	103.9	33.56	117.0	112.7	109.7	103.8	106.7	—	100.8
March	63.96	102.9	98.5	104.5	33.50	116.8	111.6	108.4	104.7	107.7	—	99.1
April	64.14	103.2	97.3	106.1	33.06	115.2	111.2	108.4	103.6	106.3	—	98.6
May	65.52	105.5	95.9	110.0	33.75	117.6	110.5	107.7	106.4	109.2	—	97.2
June	66.69	107.3	94.9	113.1	34.88	121.6	109.8	107.7	110.7	112.9	—	96.9
July	67.16	108.1	95.6	113.1	34.50	120.3	109.8	109.7	109.6	109.7	—	96.4
August	68.52	110.3	97.0	113.7	34.31	119.6	111.5	109.1	107.3	109.6	—	96.7
September ..	69.35	111.6	97.1	114.9	34.94	121.8	112.7	111.7	108.1	109.0	—	96.4
October	70.87	114.1	98.2	116.2	35.44	123.5	114.8	115.6	107.6	106.8	—	96.5
November ..	69.30	111.5	99.1	112.5	33.69	117.4	114.6	114.9	102.4	102.2	—	97.2
December ..	68.10	109.6	101.5	108.0	32.94	114.8	114.8	116.9	100.0	98.2	—	96.9
1925	—	—	—	—	—	—	—	—	103.9	—	97.3	—
January	68.45	110.2	102.9	107.1	32.13	112.0	115.5	114.3	97.0	98.0	—	98.2
February ...	68.47	110.2	104.0	106.0	32.25	112.4	114.0	113.0	98.6	99.5	—	97.9

SILVER AND THE CHINESE PRICE LEVEL

TABLE 4—(Continued)

Year and month	Price of silver in New York[1] (cents per fine ounce)	Index of price of silver in New York, 1926=100	Index of wholesale prices in the United States, 1926=100[2]	Index of purchasing power of silver in the United States, 1926=100[3]	Price of Silver in London[4] (pence per fine ounce)	Index of price of silver in London, 1926=100	Index of wholesale prices in England, Board of Trade, 1926=100[5]	Index of wholesale price in England, Statist, 1926=100[6]	Index of purchasing power of silver in England, based on Board of Trade index of wholesale prices, 1926=100[7]	Index of purchasing power of silver in England, based on Statist index of wholesale prices, 1926=100[8]	Index of wholesale prices in North China, 1926=100[9]	Index of wholesale prices in Shanghai, China, 1926=100[10]
March	67.79	109.1	104.2	104.7	31.88	111.1	112.3	111.0	98.9	100.1	—	97.6
April	66.90	107.7	101.9	105.7	31.44	109.6	109.7	108.4	99.9	101.1	—	97.9
May	67.58	108.8	101.6	107.1	31.31	109.1	107.3	107.1	101.7	101.9	—	99.9
June	69.12	111.3	103.0	108.1	31.69	110.5	106.4	103.8	103.9	106.5	—	99.6
July	69.44	111.8	104.3	107.2	32.00	111.5	106.3	106.4	104.9	104.8	—	103.2
August	70.26	113.1	103.9	108.9	32.44	113.1	106.0	106.4	106.7	106.3	—	101.7
September ..	71.61	115.3	103.4	111.5	32.88	114.6	105.3	105.1	108.8	109.0	—	100.5
October	71.11	114.5	103.6	110.5	33.00	115.0	104.0	103.2	110.6	111.4	—	99.4
November ..	69.22	111.4	104.5	106.6	32.13	112.0	103.7	105.1	108.0	106.6	—	98.3
December ..	68.89	110.9	103.4	107.3	31.81	110.9	103.4	103.2	107.3	107.5	—	97.6
1926	—	—	—	—	—	—	—	—	100.1	—	100.0	—
January	67.75	109.0	103.2	105.6	31.31	109.1	101.3	102.5	107.7	106.4	—	97.9
February ...	66.88	107.6	102.0	105.5	30.75	107.2	99.6	101.2	107.6	105.9	—	99.0
March	65.88	106.0	100.6	105.4	30.31	105.6	97.3	99.9	108.5	105.7	—	99.2
April	64.38	103.6	100.3	103.3	29.75	103.7	96.9	99.3	107.0	104.4	—	99.4
May	65.00	104.6	100.5	104.1	30.06	104.8	97.8	99.3	107.2	105.5	—	98.1
June	65.44	105.3	100.4	104.9	30.19	105.2	99.2	98.6	106.0	106.7	—	97.9
July	64.88	104.4	99.5	104.9	30.00	104.6	100.6	99.9	104.0	104.7	—	98.0
August	62.31	100.3	99.1	101.2	28.69	100.0	101.1	100.6	98.9	99.4	—	97.9
September ..	61.25	98.6	99.7	98.9	28.25	98.5	101.9	101.2	96.7	97.3	—	99.2
October	54.00	86.9	99.4	87.4	25.13	87.6	102.7	103.8	85.3	84.4	—	103.0
November ..	54.38	87.5	98.4	88.9	25.25	88.0	102.9	103.2	85.5	85.3	—	105.3
December ..	53.50	86.1	97.9	87.9	24.56	85.6	98.6	98.0	86.8	87.3	—	105.5

Year and month	Price of silver in New York[1] (cents per fine ounce)	Index of price of silver in New York, 1926=100	Index of wholesale prices in the United States, 1926=100[2]	Index of purchasing power of silver in the United States, 1926=100[3]	Price of Silver in London[4] (pence per fine ounce)	Index of price of silver in London, 1926=100	Index of wholesale prices in England, Board of Trade, 1926=100[5]	Index of wholesale price in England, Statist, 1926=100[6]	Index of purchasing power of silver in England, based on Board of Trade index of wholesale prices, 1926=100[7]	Index of purchasing power of silver in England, based on Statist index of wholesale prices, 1926=100[8]	Index of wholesale prices in North China, 1926=100[9]	Index of wholesale prices in Shanghai, China, 1926=100[10]
1927	—	—	—	—	—	—	—	—	95.1	—	103.0	—
January	55.88	89.9	96.5	93.2	25.88	90.2	96.9	97.3	93.1	92.7	—	103.2
February ...	57.75	93.0	95.8	97.1	26.63	92.8	96.3	98.0	96.4	94.7	—	103.1
March	55.38	89.1	94.7	94.1	25 69	89.5	94.9	98.0	94.3	91.3	—	104.7
April	56.50	90.9	94.1	96.6	26.19	91.3	94.4	97.3	96.7	93.8	—	105.2
May	56.13	90.3	94.2	95.9	26.00	90.6	95.2	98.0	95.2	92.4	—	104.1
June	56.75	91.3	94.1	97.0	26.25	91.5	95.9	97.3	95.4	94.0	—	103.9
July	56.25	90.5	94.3	96.0	25.94	90.4	95.2	96.6	95.0	93.6	—	104.5
August	54.50	87.7	95.2	92.1	25.19	87.8	95.1	97.3	92.3	90.2	—	104.8
September ..	55.50	89.3	96.3	92.7	25.63	89.3	95.9	96.0	93.1	93.0	—	106.2
October	56.13	90.3	96.6	93.5	25.75	89.8	95.4	95.3	94.1	94.2	—	104.9
November ..	57.50	92.5	96.3	96.1	26.50	92.4	95.2	96.0	97.1	96.3	—	103.1
December ..	58.06	93.4	96.4	96.9	26.81	93.4	94.8	96.0	98.5	97.3	—	101.7
1928	—	—	—	—	—	—	—	—	—	—	—	—
January	57.13	92.0	96.4	95.4	26.44	92.2	95.2	95.3	96.8	96.7	105.6	101.0
February ...	57.13	92.0	95.8	96.0	26.19	91.3	94.7	96.0	96.4	95.1	107.1	102.2
March	57.25	92.1	95.5	96.4	26.38	92.0	94.9	98.0	96.9	93.9	108.3	102.4
April	57.38	92.4	96.6	95.7	26.31	91.7	96.6	99.3	94.9	92.3	108.6	102.9
May	59.75	96.2	97.5	98.7	27.56	96.1	96.9	99.9	99.2	96.2	108.3	103.0
June	59.94	96.5	96.7	99.8	27.44	95.6	96.3	96.6	99.3	99.0	108.6	101.7
July	59.25	95.4	97.4	97.9	27.28	95.1	95.2	95.3	99.9	99.8	109.6	100.8
August	58.88	94.8	97.6	97.1	27.13	94.6	94.0	93.4	100.6	101.3	106.8	99.8
September ..	57.63	92.8	98.6	94.1	26.50	92.4	92.9	92.1	99.5	100.3	106.3	98.9
October	58.00	93.4	96.7	96.6	26.69	93.0	93.2	92.1	99.8	101.0	108.0	101.2
November ..	58.00	93.4	95.8	97.5	26.69	93.0	93.1	93.4	99.9	99.6	108.5	101.4
December ..	57.38	92.4	95.8	96.5	26.31	91.7	93.4	93.4	98.2	98.2	108.6	101.6
1929	—	—	—	—	—	—	—	—	—	—	—	—
January	57.00	91.7	95.9	95.6	26.25	91.5	93.4	92.7	98.0	98.7	111.4	101.7
February ...	56.25	90.5	95.4	94.9	25.88	90.2	93.4	94.7	96.6	95.2	112.9	103.2
March	56.38	90.7	96.1	94.4	26.00	90.6	94.6	95.3	95.8	95.1	112.7	104.1
April	55.75	89.7	95.5	93.9	25.81	90.0	93.7	92.1	96.1	97.7	110.6	103.1
May	54.38	87.5	94.7	92.4	25.19	87.8	91.7	89.5	95.7	98.1	109.8	102.6
June	52.44	84.4	95.2	88.7	24.25	84.5	91.5	89.5	92.3	94.4	110.4	103.0
July	52.63	84.7	96.5	87.8	24.28	84.6	92.7	90.8	91.3	93.2	111.9	103.4

TABLE 4—(Continued)

Year and month	Price of silver in New York[1] (cents per fine ounce)	Index of price of silver in New York, 1926=100	Index of wholesale prices in the United States, 1926=100[2]	Index of purchasing power of silver in the United States, 1926=100[3]	Price of silver in London[4] (pence per fine ounce)	Index of price of silver in London, 1926=100	Index of wholesale prices in England, Board of Trade, 1926=100[5]	Index of wholesale prices in England, Statist, 1926=100[6]	Index of purchasing power of silver in England, based on Board of Trade index of wholesale prices, 1926=100[7]	Index of purchasing power of silver in England, based on Statist index of wholesale prices, 1926=100[8]	Index of wholesale prices in North China, 1926=100[9]	Index of wholesale prices in Shanghai, China, 1926=100[10]
August	52.63	84.7	96.3	88.0	24.31	84.7	91.7	90.1	92.4	94.0	111.7	104.8
September ..	50.75	81.7	96.1	85.0	23.63	82.4	91.7	88.8	89.9	92.8	111.8	106.6
October	50.00	80.5	95.1	84.6	23.03	80.3	91.9	88.2	87.4	91.0	111.9	107.4
November ..	49.63	79.9	93.5	85.5	22.69	79.1	90.5	85.5	87.4	92.5	111.1	106.1
December ..	49.00	78.9	93.3	84.6	22.44	78.2	89.4	86.2	87.5	90.7	110.7	105.5
1930	—	—	—	—	—	—	—	—	—	—	—	—
January	44.81	72.1	92.5	77.9	20.81	72.5	88.4	84.2	82.0	86.1	111.3	108.3
February ...	43.56	70.1	91.4	76.7	20.00	69.7	86.3	82.9	80.8	84.1	114.5	111.3
March	41.81	67.3	90.2	74.6	19.25	67.1	84.0	81.6	79.9	82.2	114.9	111.3
April	42.50	68.4	90.0	76.0	19.56	68.2	83.5	80.3	81.7	84.9	114.1	111.2
May	40.94	65.9	88.8	74.2	19.00	66.2	82.4	78.4	80.3	75.5	114.8	111.0
June	34.13	54.9	86.8	63.2	15.91	55.5	81.5	75.7	68.1	73.3	118.6	117.5
July	34.38	55.3	84.4	65.5	15.94	55.6	80.5	74.4	69.1	74.7	120.5	120.4
August	35.25	56.7	84.3	67.3	16.19	56.4	79.5	73.1	70.9	77.2	120.2	119.6
September ..	36.25	58.3	84.4	69.1	16.75	58.4	78.3	71.8	74.6	81.3	118.3	118.4
October	35.81	57.6	83.0	69.4	16.56	57.7	76.3	71.2	75.6	81.0	116.0	115.4
November ..	36.00	57.9	81.3	71.2	16.63	58.0	75.6	69.9	76.7	83.0	115.0	114.1
December ..	32.38	52.1	79.6	65.5	15.19	52.9	73.5	68.6	72.0	77.1	114.5	113.6
1931	—	—	—	—	—	—	—	—	—	—	—	—
January	29.38	47.3	78.2	60.5	13.88	48.4	72.2	67.9	67.0	71.3	118.2	119.7
February ...	26.88	43.3	76.8	56.4	12.44	43.4	71.7	67.9	60.5	63.9	122.2	127.4
March	29.25	47.1	76.0	62.0	13.53	47.2	71.5	67.9	66.0	69.5	124.0	126.1
April	28.38	45.7	74.8	61.1	13.19	46.0	71.3	66.6	64.5	69.1	124.5	126.2

Year and month	Price of silver in New York[1] (cents per fine ounce)	Index of price of silver in New York, 1926=100	Index of wholesale prices in the United States, 1926=100[2]	Index of purchasing power of silver in the United States, 1926=100[3]	Price of silver in London[4] (pence per fine ounce)	Index of price of silver in London, 1926=100	Index of wholesale prices in England, Board of Trade, 1926=100[5]	Index of wholesale prices in England, Statist, 1926=100[6]	Index of purchasing power of silver in England, based on Board of Trade index of wholesale prices, 1926=100[7]	Index of purchasing power of silver in England, based on Statist index of wholesale prices, 1926=100[8]	Index of wholesale prices in North China, 1926=100[9]	Index of wholesale prices in Shanghai, China, 1926=100[10]
May	28.00	45.1	73.2	61.6	13.00	45.3	70.5	65.3	64.3	69.4	125.0	127.5
June	26.63	42.9	72.1	59.5	12.38	43.2	69.7	65.3	62.0	66.2	124.8	129.2
July	28.00	45.1	72.0	62.6	13.13	45.8	69.0	63.3	66.4	72.4	123.3	127.4
August	27.50	44.3	72.1	61.4	12.81	44.6	67.2	62.7	66.4	71.1	123.8	130.3
September ..	27.88	44.9	71.2	63.1	13.00	45.3	67.0	64.0	67.6	70.8	123.5	129.2
October	29.75	47.9	70.3	68.1	17.25	60.1	70.2	65.3	85.6	92.0	121.3	126.9
November ..	31.13	50.1	70.2	71.4	18.88	65.8	71.6	65.3	91.9	100.8	120.5	124.8
December ..	30.25	48.7	68.6	71.0	20.00	69.7	71.6	67.3	97.3	103.6	119.4	121.8
1932	—	—	—	—	—	—	—	—	—	—	—	—
January	29.81	48.0	67.3	71.3	19.63	68.4	71.6	67.3	95.5	101.6	117.7	119.3
February ...	30.13	48.5	66.3	73.2	19.63	68.4	70.9	68.6	96.5	99.7	119.9	—
March	29.75	47.9	66.0	72.6	18.09	63.1	70.6	66.6	89.4	94.7	118.0	—
April	28.25	45.5	65.5	69.5	16.88	58.8	69.1	65.3	85.1	90.0	118.8	116.7
May	27.75	44.7	64.4	69.4	16.81	58.6	68.0	63.3	86.2	92.6	117.0	115.7
June	27.63	44.5	63.9	69.6	16.88	58.8	66.2	60.7	88.8	96.9	115.0	113.6
July	26.75	43.1	64.5	66.8	16.91	58.9	65.9	62.7	89.4	93.9	112.4	111.8
August	28.00	45.1	65.2	69.2	17.93	62.5	67.2	64.0	93.0	97.7	111.3	111.3
September ..	27.63	44.5	65.3	68.1	18.00	62.7	68.9	63.3	91.0	99.1	109.5	109.8
October	27.38	44.1	64.4	68.5	17.78	62.0	68.2	61.4	90.9	101.0	107.5	108.7
November ..	27.00	43.5	63.9	68.1	18.07	63.0	68.2	61.4	92.4	102.6	106.9	106.9
December ..	25.13	40.4	62.6	64.5	17.10	59.6	68.2	61.4	87.4	97.1	107.1	107.5
1933	—	—	—	—	—	—	—	—	—	—	—	—
January	25.64	41.3	61.0	67.7	16.85	58.7	67.5	—	87.0	—	109.1	108.6
February ...	26.43	42.5	59.8	71.1	16.91	58.9	66.8	—	88.2	—	108.5	107.6
March	28.15	45.3	60.2	75.2	17.63	61.4	66.2	—	92.7	—	106.7	106.7
April	30.58	49.2	60.4	81.5	18.22	63.5	65.5	—	96.9	—	103.0	104.6
May	34.51	55.5	62.7	88.5	19.12	66.6	66.8	—	99.7	—	101.8	104.2
June	36.19	58.2	65.0	89.5	19.12	66.6	—	—	—	—	103.1	104.5
July	37.94	61.1	68.9	88.7	18.39	64.1	—	—	—	—	101.9	103.4
August	—	—	69.5	—	17.90	62.4	—	—	—	—	98.5	—

1.—For 1921-1925, Sun, C., Chinese translation of Bratter, Herbert, M., "The Price of Silver," The Statistical Monthly, Vol. 2, No. 6, June, 1930.
For 1926-1932, National Tariff Commission, "The Shanghai Market Prices Report," April-June and October-December Issues, 1932.
For 1933, Nankai Weekly Statistical Service, Nankai Institute of Economics, Nankai University, Tientsin.

2.—United States Bureau of Labor Statistics Index of Wholesale Prices in the United States.

3.—Percentage that the index of the price of silver is of the index of wholesale prices in the United States.

4.—For 1921-1932, National Tariff Commission, "The Shanghai Market Prices Report" Oct.-Dec. Issues, 1932.
For 1933, Nankai Weekly Statistical Service, Nankai Institute of Economics, Nankai University, Tientsin.

5.—Board of Trade Index of Wholesale Prices in England, converted from the base of 1913=100 to the base of 1926=100. Original Found in Ministry of Industries, China, "Price Indexes in China and Foreign Countries," and in Federal Reserve Board, Washington, D. C. "Federal Reserve Bulletin," July, 1933.

6.—Statist-Sauerbeck Index of Wholesale Prices in England, converted from a base of 1910-14 to a base of 1926=100. Original found in Warren, G. F. and Pearson, F. A. "Wholesale Prices for 213 years, 1720 to 1932," Cornell University Agr. Exp. Stat. Mem. 142, Nov., 1932, p. 14.

7.—Percentage that the index of the price of silver in London is of the Board of Trade index of wholesale prices in England.

8.—Percentage that the index of the price of silver in London is of the Statist index of wholesale prices in England.

9.—Ministry of Industries, "Price Indexes in China and Foreign Countries" and Nankai Weekly Statistical Service, Nankai Institute of Economics, Nankai University, Tientsin, China.

10.—Sheng, T., "The Revision of the Price Index Numbers" Stat. Series No. VI, Bul. of the National Tariff Commission, China.
"Wholesale Prices", U. S. Dept. of Labor, July, 1933.

11.—In figures 2 and 3, which are based on this table, the purchasing power of silver in England for the years 1921 to 1923 is in terms of the Statist index of wholesale prices in England; and, for the years 1924 to 1933, is in terms of the Board of Trade index of wholesale prices in England.

TABLE 5

World Silver Stocks and World Physical Volume of Production of Basic Commodities

Year	Annual world production of silver* (Thousands of fine ounces)	Estimated world stocks of silver at the end of the year** (Thousands of fine ounces)	Index of world stocks of silver, 1910-1914 =100	Index of world stocks of silver, 1880-1914 =100	Index of world physical volume of production of basic commodities*** 1880-1914=100
1871	63,317	5,560,000	50.6	66.3	42
1872	63.317	5,623,639	51.2	67.0	45
1873	63,267	5,686,906	51.8	67.8	45
1874	55,301	5,742,207	52.3	68.4	45
1875	62,262	5,804,469	52.8	69.2	49
1876	67,753	5,872,222	53.4	70.0	49
1877	62,680	5,934,902	54.0	70.7	52
1878	73,385	6,008,287	54.7	71.6	54
1879	74,383	6,082,670	55.4	72.5	55
1880	74,795	6,157,465	56.0	73.4	60
1881	79,021	6,236,586	56.8	74.3	56
1882	86,472	6,322,958	57.5	75.3	65
1883	89,175	6,412,133	58.3	76.4	63
1884	81,568	6,493,701	59.1	77.4	68
1885	91,610	6,585,311	59.9	78.5	68
1886	93,297	6,678,608	60.8	79.6	68
1887	96,124	6,774,732	61.6	80.7	68
1888	108,828	6,883,560	62.6	82.0	75
1889	120,214	7,003,774	63.8	83.5	77
1890	126,095	7,129,869	64.9	85.0	74
1891	137,170	7,267,039	66.1	86.6	83
1892	135,152	7,402,191	67.3	88.2	78
1893	165,473	7,567,664	68.9	90.2	80
1894	164,610	7,732,274	70.4	92.1	80
1895	167,501	7,899,775	71.9	94.1	90
1896	157,061	8,056,836	73.3	96.0	94
1897	160,421	8,217,257	74.8	97.9	94
1898	169,055	8,386,312	76.3	99.9	102
1899	168,337	8,554,649	77.8	101.9	101
1900	173,591	8,728,240	79.4	104.0	106
1901	173,011	8,901,251	81.0	106.1	107
1902	162,763	9,064,014	82.5	108.0	114
1903	167,689	9,231,703	84.0	110.0	115
1904	164,165	9,395,898	85.5	112.0	115
1905	172,318	9,568,216	87.1	114.0	125
1906	165,054	9,733,270	88.6	116.0	134
1907	184,207	9,917,477	90.3	118.2	129
1908	203,131	10,120,608	92.1	120.6	129
1909	212,149	10,332,757	94.0	123.1	138
1910	221,716	10,554,473	96.0	125.8	140

TABLE 5—*(Continued)*

1911	226,193	10,780,666	98.1	128.5	143
1912	230,904	11,011,570	100.2	131.2	156
1913	210,013	11,221,583	102.1	133.7	157
1914	172,264	11,393,847	103.7	135.8	146
1915	173,001	11,566,848	105.2	137.8	148
1916	180,802	11,747,650	106.9	140.0	142
1917	186,125	11,933,775	108.6	142.2	144
1918	203,159	12,136,934	110.5	144.6	142
1919	179,850	12,316,784	112.1	146.8	138
1920	173.296	12,490,080	113.6	148.8	156
1921	171,286	12,661,366	115.2	150.9	138
1922	209,815	12,871,181	117.1	153.4	159
1923	246,010	13,117,191	119.4	156.3	169
1924	239,484	13,356,675	121.5	159.2	171
1925	245,213	13,601,888	123.8	162.1	187
1926	253,795	13,855,683	126.1	165.1	183
1927	253,981	14,109,664	128.4	168.1	192
1928	252,273	14,366,937	130.8	171.2	202
1929	260,900	14,627,837	133.1	174.3	208
1930	243,700	14,871,537	135.4	177.2	198
1931	195,575	15,067,112	137.1	179.5	184
1932	155,000	15,222,112	138.5	181.4	——

*Wu Ta-yeh, "A Statistical Analysis of Fluctuations in the Silver Price, 1833-1931" Quarterly Journal of Economics and Statistics, Nankai University, Vol. 1, No. 1, p. 24 (Chinese). For 1931 and 1932, estimates made by Warren, G. F. and Pearson, F. A. in "Prices," p. 139.
**Ibid. These figures make no allowance for annual losses due to such causes as chemical combination, shipwreck, and forgotten hoards.
***Warren, G. F. and Pearson, F. A., Prices, pp. 85-86.
This index was originally prepared by Carl Snyder of the Federal Reserve Bank of New York.

TABLE 6
Index of Import and Export Prices in China and Index of Wholesale Prices in North China, 1921-1932

Year	Index of import and export prices in China,* when 1910-14=100	Index of wholesale prices in North China,** when 1926=100	Index of wholesale prices in N. China when 1926=130.7
1921	119.6	88.91	116.2
1922	115.6	86.40	112.9
1923	121.6	90.35	118.1
1924	124.1	93.61	122.3
1925	127.3	97.28	127.1
1926	130.7	100.00	130.7
1927	132.6	103.02	134.6
1928	136.5	107.98	141.1
1929	141.9	111.08	145.2
1930	157.9	115.84	151.4
1931	162.4	122.55	160.2
1932	——	113.40	148.2

*Nankai Weekly Statistical Service, Nankai Institute of Economics, Nankai University. Tientsin. Vol. V, No. 15, April 11, 1932. Converted from a base of 1867-1871=100.
**Ibid, and Ministry of Industries "Price Indexes in China and Foreign Countries."

TABLE 7
Indexes of Quantities of Exports and Imports in China, 1867-1932, when 1913=100

Year	Index of quantity of Chinese exports, 1913=100*	Index of quantity of Chinese imports, 1913=100*	Year	Index of quantity of Chinese exports, 1913=100*	Index of quantity of Chinese exports, 1913=100*
1867	31.9	24.7	1900	54.9	49.5
1868	33.7	25.4	1901	59.8	62.5
1869	35.4	26.4	1902	65.1	70.9
1870	33.3	25.9	1903	59.8	65.1
1871	39.4	28.1	1904	64.0	69.2
1872	43.3	27.9	1905	62.5	96.6
1873	39.1	27.3	1906	64.6	95.3
1874	40.1	31.5	1907	67.1	88.7
1875	42.2	33.8	1908	73.0	72.7
1876	42.8	36.3	1909	92.9	77.1
1877	40.8	36.1	1910	102.9	79.2
1878	41.4	34.9	1911	102.1	80.9
1879	43.2	40.8	1912	103.8	82.8
1880	47.2	36.2	1913	100.0	100.0
1881	43.5	40.8	1914	83.8	91.6
1882	45.9	36.4	1915	96.5	92.1
1883	47.2	35.0	1916	102.3	96.6
1884	50.6	34.5	1917	108.3	103.0
1885	47.6	40.5	1918	105.5	92.7
1886	54.2	35.3	1919	140.0	105.8
1887	41.2	41.6	1920	119.3	106.5
1888	43.6	50.3	1921	126.9	132.9
1889	45.2	44.0	1922	130.5	158.5
1890	42.0	54.8	1923	137.3	154.4
1891	47.9	60.8	1924	136.6	170.1
1892	49.8	59.9	1925	132.9	156.3
1893	57.2	59.4	1926	141.1	185.9
1894	60.1	45.3	1927	154.1	156.5
1895	66.3	45.8	1928	156.1	187.5
1896	56.4	53.2	1929	148.9	199.5
1897	61.6	49.7	1930	130.8	186.8
1898	63.4	51.3	1931	137.4	160.8
1899	62.5	69.2	1932	111.4	136.0

*Indexes for the years 1867 to 1930 were compiled by Nankai Institute of Economics, Nankai University, Tientsin, and found in Ministry of Industries "Price Indexes in China and Foreign Countries" 1932: 51-52.
Indexes for the years 1931 and 1932 were estimated on the basis of the value of Chinese imports and exports in 1913, 1931 and 1932 (Ho Ping-Yin, "China's Foreign Trade for the Second Half-Year, 1932", Chinese Economic Journal, Vol. XII, No. 5: 537), index numbers of export and import prices in Shanghai (The Shanghai Market Prices Report, January-March, 1933, published by National Tariff Commission, Shanghai, China) and index numbers of Chinese import prices and export prices compiled by Nankai Institute of Economics, and found in Ministry of Industries "Price Indexes in China and Foreign Countries" 1932: 51-52. Index numbers of the value in Haikwan Taels of Chinese imports and exports in 1931 and 1932 when 1913=100 were deflated by indexes of the import prices and export prices in Shanghai, when the average of these indexes for 1926 to 1930=the average of the Nankai import and export price indexes, respectively, for the years 1926-1930. The Shanghai index of export prices in 1932 was not complete, but an average of the five available monthly indexes was used.
The indexes for 1932 include estimates of the exports and imports for Manchuria, as made by Ho Ping-Yin, which are not included in official figures.

貯藏及市場中菓實之病害(其三)

金陵大學

俞大紱，葉和才

NOTES ON THE STORAGE AND MARKET DISEASES OF FRUITS - III.

Bitter Rot of Pear (Glumerella cingulata Spould. et Schr.*)

T. F. Yu and H. T. Yih.

In the fall of 1933, our attention was called by Professor S. H. Chen to a serious rot appearing on the pears in his storeroom. These pears, consisting of two foreign varieties, namely Kieffer and Bartlett, had been grown in the University orchard for variety tests. They were harvested on September 7th without any sign of disease on the fruit surface. Immediately after harvesting they had been stored in wooden boxes under laboratory conditions. Only five days later, many of the fruits showed brownish spots or discolorations which increased very rapidly and soon resulted in the complete decay of the fruits. Actual counts of five hundred Kieffer fruits during a period of 33

*Contribution No. 30 from Plant Pathology Laboratory, Botany Department, University of Nanking.

days showed the following percent of rotten fruit: September 15th., 8%; Sept. 18th., 12%; Sept. 23 rd., 36.4%; Oct. 4th., 73.6%; Oct. 7th., 85.3%. The pinkish spore pustules, together with the black perithecia on the diseased area, gave unmistakable evidence that the bitter rot organism (Glumerella cingulata Spould. et Schr.) was chiefly responsible for the rot under investigation.

Distribution. Bitter rot is primarily a disease of apple, but it laso affects other hosts, e. g., pear, orange, grape and peach. It is distributed throughout the world and seriously affects the apple crop, particularly in the Eastern part of the United States*. As far as the writers are aware, its existence on pears in China has never been reported. Investigation of the rot in the market conducted during the last two years did not reveal its presence on pears, while on the otherhand, apples frequently showed the bitter rot infection. The disease occurs, however, on the foreign pears in storage here at Nanking.

Isolation. Pure cultures of the bitter rot fungus can be readily obtained by plating, on agar plate, a bit of diseased tissue taken from the inside of a rotten fruit. Direct transfers of the conidia or perithecia also yield pure cultures of the organism.

Symptoms. The disease seldom appears on the fruit in the orchard.

*Schrenk, H. von, and Spaulding, P. The Bitter Rot of Apples. U. S. D. A. Plant Ind. Bul. 44 P. 12-14, 1903.

Only on a few occasions, the fruits developed small, brownish, circular spots while still hanging on the trees. Upon isolation, cultures of bitter rot fungus were obtained.

Under storage conditions, the disease manifests itself at first by small, circular, brownish discolorations on the fruit or at the stem end of the fruit. There were from one to as many as fifteen spots recorded on a single fruit. The diseased area enlarges rapidly retaining a circular outline. The spots are brown at first and later turn to deep reddish brown or even black. Frequently, concentric zones of light and dark color of more or less uniform width appear about the center of the diseased area. As the disease advances, the infected area becomes sunken and sharply defined with black dots arranged concentrically or scattered throughout. (Plate I, Fig. I). The diseased areas soon break through the epidermis, exposing the pinkish spore mass at the top. At the same time, perithecia are produced in great abundance on the diseased areas.

Under conditions of high temperature and humidity, the fruits rot rapidly and usually do not produce the characteristic concentrical zones on the diseased areas. In many instances, there occurs in the center of the diseased area, a heavy whitish mycelial growth which soon turns greenish in color. (Plate 1, Fig. 2) The fruits become soft, shriveled and deep brown to black in color. Eventually they dry up and shrivel into dark mummies on which the acervuli and perithecia are distinctly seen.

Causal organism. Both the Gleosporium and Glumerella stages of the fungus are produced on the naturally and artificially infected fruits. Acervuli,(Plate II, Fig. 1) are black, erumpent, measuring 91.8-161.1, u. and arranged concentrically or scattered on the diseased area. Conidia are oblong to elliptical, straight or slightly curved, round-ended and measure 6.8-32.6 x 3. 4-6.8 μ (Plate II, Fig. 5)

Mature conidia are filled with finely granular protoplasm with a clear area situated near the middle of the spore and are almost indistinguishable from the ascospores. During germination, they become 1-septated and produce 1 to 2, rarely 3, germ tubes from each end of the spore. At the tip of the germ tubes or the branches of young mycelia, there are produced dark reddish appresoria of various shapes and sizes (Plate II, Fig.4).

Perithecia are few and distinct or abundant and crowded; dark brown to black; globose or pyriform; not beaked; and measure 102.7-248.6 μ in diameter(Plate II, Fig. 2). Asci are numerous and clavate, containing 8 spores and measure 47.6-73.7 x 6.8-11.4 μ (Plate II, Fig. 3). Ascospores are single celled, hyaline, elliptical or slightly curved, and measure 11.9-25.5 x 3.4-6.8 μ.

Inoculation experiments. Thirty healthy pears (P. ussuriensis, Maxim.) (鵝梨) after being surface disinfected with 95% alcohol, were treated as follows.

Lot 1 - 10 fruits, not wounded and inoculated with conidia suspension.

Lot 2 - 10 fruits, artificially wounded by means of sterile needles and sprayed with conidia suspension.

Lot 3 - 10 fruits neither wounded nor sprayed with conidia suspension.

Immediately after the treatment, the fruits were wrapped in sterile paper and stored in a box under a temperature ranging from 21-23°c. Six days later, none of the fruit in Lots 1 and 3 showed any sign of disease, while that in Lot 2 produced soft, pale yellow areas about 1-1$\frac{1}{2}$ cm. in diameter on the surface. Two days after the first reading, two fruits in Lot 1 showed circular spots measuring about 1 cm. in diameter, while all those in Lot 2 became badly rotted. Whitish mycelial growth came from the needle holes, and soft, light brownish areas varying from 3-5$\frac{1}{2}$ cm. in diameter with pinkish spore masses were seen at the center of the diseased areas. No symptom of disease appeared on the fruits in Lot.3

Nine healthy pears (P. ussuriensis Maxim.) (子母梨) three of them wounded, were all inoculated by spraying with conidia suspension and put in a moist chamber at 23°C. Seven days later, all the wounded fruits became infected with the disease, producing the characteristic spots and sporulations. None of the unwounded fruits showed the signs of disease.

Twenty four pears (鵝梨) were treated and inoculated as in the previous experiments, 5 of them being wounded by sterile needles. After eight days incubation under a temperature of 23°C, only those which had been wounded and inoculated were rotted.

On the surface of 36 ehalthy pears (P. ussuriensis Maxim.)(官瓶梨) normal and uninjured places were marked with pencil circles. On 18 of them, the centers of the circles were injured by means of sterile needles; while for the rest, the surface remained uninjured. A drop of conidia suspension was put on the center of each circle and then covered with Van Teighum cells and cover slips sealed with vaseline in order to maintain a relatively high moisture content. The first symptom of the disease appeared on the wounded fruits three days after the inoculation. Fourteen days later, all the wounded fruits were rotted badly while only 2 out of the 18 uninjured fruits produced the characteristic diseased spots with pinkish conidia pustules.

Experiments of the same nature were conducted from time to time on various kinds of pears. The results obtained indicate that the bitter rot organism infects the normal fruits with difficulty but enters the injured fruit readily through the wounds.

Eight apples (Malus pumila Mill. var. domestica) (烟台苹菓) were inoculated on October 5th with conidia suspension through needle punctures, and 4 uninoculated fruits were held as checks. Small discolorations appeared around the needle punctures three days after inoculation. They enlarged, in two more days, into light yellowish to brownish circular areas measuring from 3-5 cm. in diameter. The center of the spots were darker in color with abundant pinkish sporulations; while the outer portions were water-soaked in appearance without the presence of fungus fructification. On October 25th, about four fifths of the fruit surface produced big spots with the characteristic rings and black acervuli. The fruits became sunken andsoft.

Healthy grapes were divided into 4 lots and received varying treatments as follows, on October 25th:

1. Unwounded and not inoculated.
2. Wounded and not inoculated.
3. Wounded and dipped in a conidia suspension for 10 minutes.
4. Unwounded and dipped in a conidia suspension for 10 minutes.

The fruits were all disinfected with 95% alcohol and wounded by means of sterile needles before the inoculation.

Three days after inoculation, fruits of Lots 1, 2 and 4, kept in a moist chamber under a temperature of 15°C, remained healthy, while those of Lot 3 showed tiny brownish discolored areas around the needle holes. This symptom was, however, not seen on the fruits of Lot 2. On November 4th, 9 out of 16 of the grapes of Lot 4 produced brown spots with or without the dark margins. The pinkish spore mass was present. Before the experiment was discarded, fruits of Lots 3 and 4 had shown the Gleosporium fructification, while 2 fruits of Lot 1, and 5 fruits of Lot 2 had become blackened and decayed but without the presence of the bitter rot organism being detected. The experiment indicates that the fungus enters the grape readily through wounds although normal fruits may also be infected.

Cultural studies. From 28 isolations, 6 were grown in various kinds of cultural media for comparison. As a result of a preliminary study, they could be represented by two cultures labelled respectively C-1 and C-2. Both of them originated from single ascus isolations. Artificial cultural media were made of the following compositions:

1. Potato dextrose agar

Potato, 30%; dextrose, 1%; agar, 1.5% and distilled water, 1000cc.

2. Quaker oat agar

Quaker oats, 3%; dextrose, 1%; agar, 1.5% and distilled water, 1000cc.

3. Corn meal agar

Corn meal, 3%; dextrose, 1%; agar, 1.5% and distilled water. 1000cc.

4. Apple decoction agar

Apple flesh, 30%; agar, 1.5% and distilled water, 1000cc.

5. Pear decoction agar

Pear flesh, 30%; agar 1.5%; and distilled water 1000cc.

The differences in the cultural characteristics of C-1 and C-2 grown for 14 days (25-28°C) in plates containing the above listed media, are tabulated in Table I.

While growing in the agar plates, C-1 differes from C-2 by its production of greenish sectors in which perithecia are produced. (Plate II, Fig. 3) The production of the sectors may be due to sexual phenomena involved*. C-2 does not produce the perithecia except on the infected fruits.

In general, apple and pear decoction agars are good for the vegetative growth of the fungus, while the rest of the media are favorable for spore production. The best media for perithecia production of C-1 is corn meal agar and that for Gleosporium pustule formation of C-2 is Quaker oat meal agar. On all of the cultural media, C-2 produced only the conidia pustules (Plate I, Fig. 4).

*Leonian, L. H, Attempts to Induce "Mixochimaera" in Fusarium moniliforme. Phytopath. 20: 895-901, 1930.

Table I. A Comparison of the Cultural Characteristics of Cultures No. 1 and 2 of Glumerella cingulata Spould et Schr.

Culture medium	Growth characteristics	
	Culture No. 1	Culture No. 2
Potato dextrose	Growth fair. Gleosporium pustules spare. Perithecia produced in greenish sectors.	Growth fair. Gleosporium pustules spare. Perithecia and sectors absent.
Corn Mela agar	Growth fair, white. Gleosporium pustules few. Perithciae produced in great abundance in greenish sectors.	Growth good, white. Gleosporium pustules many. Perithecia and sectors absent.
Quaker Oat agar	Growth fair, white. Gleosporium pustules present. Perithecia in greenish sectors.	Growth thin, white. Gleosporium pustules produced in great abundance. Perithecia and sectors absent.
Apple decoction agar.	Growth vigorous. Aerial mycelia rich. Gleosporium pustules, perithecia and sectors absent.	Growth vigorous. Aerial mycelia rich. Gleosporium pustules rare. Perithecia and sectors absent.
Pear decoction agar.	Growth vigorous. Gleosporium pustules absent. Perithecia few in greenish sectors.	Growth vigorous. Gleosporium pustues few. Perithecia and sectors absent.

Temperature relation: The development of bitter rot of pear in storage depends principally on a relatively high temperature and humidity. Twenty four surface disinfected pears (鵝梨) were wounded by sterile needles and were then sprayed with conidia suspension of

the bitter rot organism. They were then divided into four parts and kept in four moist chambers under different temperature conditions, viz. 30°, 25-26°, 14-16° and 8-11°C. The size of the diseased spots on the fruits was noted daily as shown in the following table.

Table II. Temperature in Relation to the Development of Bitter Rot on Pear Fruits (Pyrus ussuriensis Maxim.)

	Days after Inoculation					
Temperature	4	5	6	7	9	11
30°C	mm.* 6.4X6.5	mm. 10.8X10.9	mm. 15.6X15.8	mm. 20.4X21.6	mm. 28.3X30.5	mm. 39.1X40.2
25-26°C	7.0X7.2	10.2X11.2	15.7X16.8	21.6X22.6	30.4X31.1	39.8X43.7
14-16°C	(—)	Tiny brownish area around needle holes	3.2X3.7	4.1X4.9	7.7X7.7	9.3X10.2
8-11°C	(—)	(—)	(—)	(—)	(—)	(—)

*Average size of spots of six fruits. (—)No symptoms of the disease

A temperature ranging from 25 to 30 degrees Centigrade is favorable for the development of bitter rot on pears in storage. Throughout the experiment, fruits kept under a temperature between 8 to 11° Centigrade showed no sign of the disease.

Humidity. Healthy pears (Pyrus ussuriensis Maxim.)(鵝梨) were surface disinfected with 95 percent alcohol and 60 holes were punctured in each fruit by means of a sterile needle. After being sprayed with conidia suspension, the fruits were kept under a temperature of

26–28° C. in a series of sealed glass jars in which the relative humidity was controlled by sulfuric acid of various concentrations These jars are 8 inches in diameter and 10 inches in height with glass covers, each cover with two holes containing rubber stoppers. Through these holes, thermometers may be inserted for humidity readings. On the bottom of each jar, there is a glass supporter on which the inoculated pears were placed. The distance from the pears to the surface of the sulfuric acid was exactly 6 cm. In making the humidity readings, thermometers were inserted into each jar so that both the dry and wet bulbs were at the same level as the inoculated fruits. The humidity of each jar was recorded at both the beginning and termination of the experiment. The results are presented in table III.

Table III. Relative Humidity in Relation to the Development of Bitter Rot (Glumerella cingulata Spould. et Schr.) on Pear Fruits.

Treatment	Four days after inoculation				
	Relative humidity	No. of needle holes infected	Percent of infection	Size of spot	
				Range	Average
	%	*	%	mm.	mm.
Water	96–100	30.5	50.83	2–9	4.2
H_4SO_2 Sp. Gr.					
1.1	91–95	26.8	44.66	2–7	4.1
1.2	86–89	15.4	25.66	2–9	3.0
1.3	79–82	7.5	12.50	tiny	tiny
1.5	58–66	(—)	(—)	(—)	(—)

(—) No symptons of the disease

*Average of 5 fruits.

Fruits kept under conditions of 91 percent relative humidity or higher, produced dark brown, slightly depressed spots with sharp margins. Under 86 to 89 percent of relative humidity, only a few needle holes on the fruits produced the diseased spots, while the rest showed merely small discolorations. When kept under a relative humidity of 82 percent or less, the development of the rot was inhibited. The experiment indicates that the optimum humidity for the development of the bitter rot of pear is 91 percent or above.

SUMMARY

1. Bitter rot of pear caused by Glumerella cingulata Spould. et Schr. was noted as a serious storage disease on foreign pears grown in Nanking.
2. Both Bartlett and Kieffer pears are very susceptible.
3. The fungus enters the pear fruits readily through wounds.
4. Artificial inoculation of apples and grapes resulted in the development of bitter rot.
5. Five varieties of Chinese pears (Pyrus ussuriensis Maxim.)(鵝梨，官瓶梨，碭山梨，蜜梨，子母梨) were infected artificially.
6. The development of bitter rot of pear in storage depends largely on temperature and humidity. The optimum temperature for the development of the disease is 25–30°, Centigrade or higher, and the optimum humidity is 91 percent and above.

Plant Pathology Laboratory
University of Nanking,
Nanking, China
May 28,1934

貯藏中及市場上水菓之病害(其三)

俞大紱 葉和才

撮要

(一)南京所植之西洋梨在貯藏中發生劇烈之苦腐病其病原菌為Glumerella cingulata Spould. et Schr.

(二)西洋梨品種Bartlett與Kieffer皆極易感病

(三)病原菌多由傷口侵入梨實

(四)苹菓與葡萄皆能感受此病

(五)用人工接種於五種中國梨(鵝梨，官瓶梨，碭山梨，蜜梨，子母梨)俱發生苦腐病

(六)在貯藏中，溫濕度之高低直接影響此病之滋長，最適宜之溫度為攝氏二十五至三十度或較高，最適宜之濕度為百分之九十一或以上

金陵大學植物病理研究室

EXPLANATION OF PLATES

Plate I.

Fig. 1. A diseased pear fruit.

2. Same as Fig. 1 under moist conditions.
3. A pure culture of Glumerella cingulata Spould. et Schr. (Culture C-1) on corn meal agar, showing the sector and perithecia.
4. A pure culture of Glumerella cingulata Spould. et Schr. (Culture C-2) on Quaker Oat agar showing the conidia pustules.

Plate II.

Fig. 1. A cross section of acervulus on infected pear.

2. A perithecium from corn meal agar.
3. Asci.
4. Germinating conidia with appresoria.
5. Conidia.

Plate I.

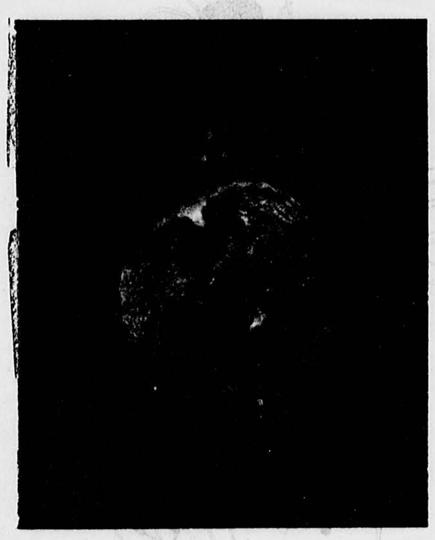


Fig. 1

Fig. 2

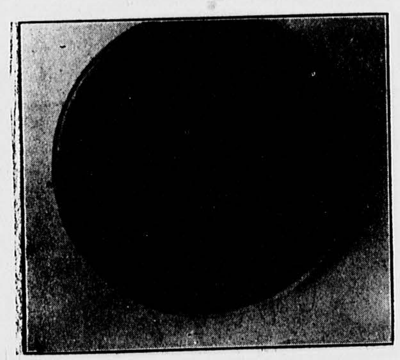


Fig. 3

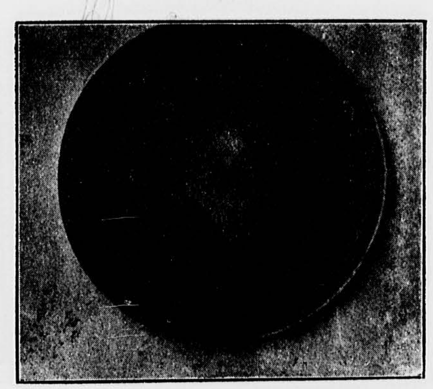
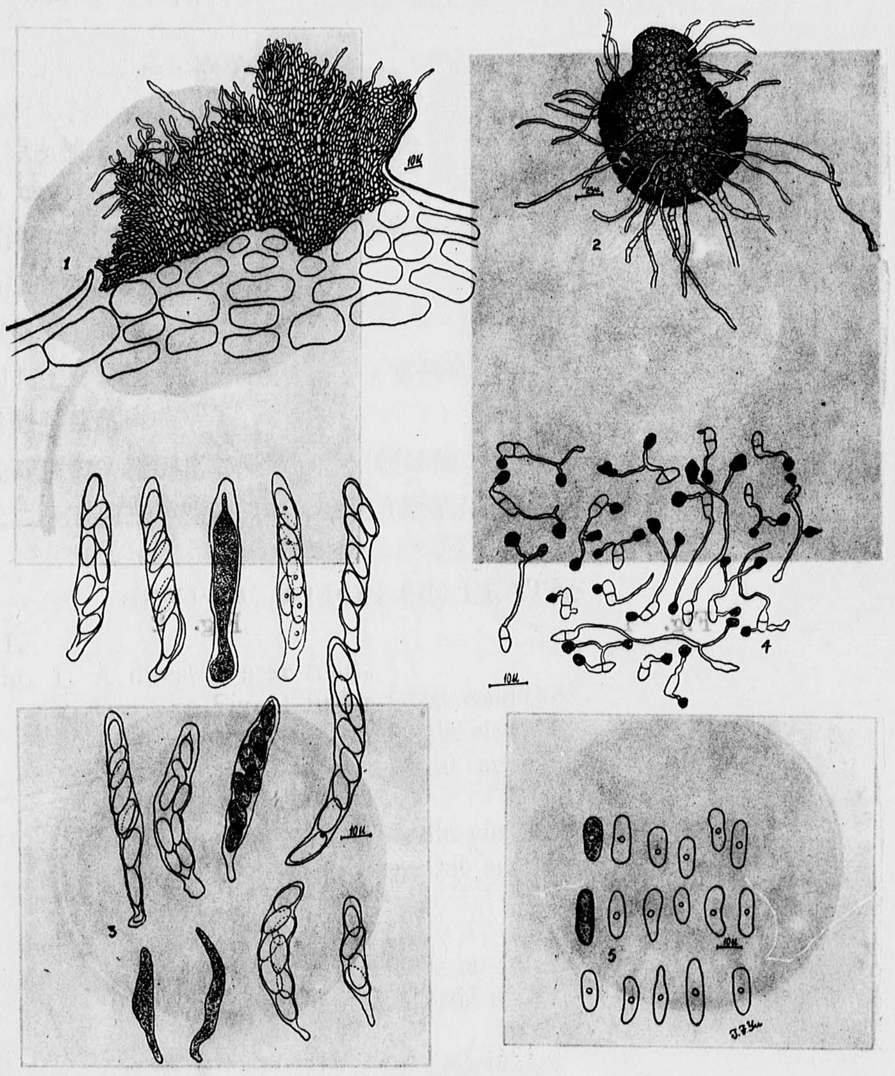


Fig. 4



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貝德士先生

A PRELIMINARY STUDY OF FARM CROPS AND LIVESTOCK ON 497 FARMS IN HWA-YANG COUNTY, SZECHUAN, CHINA, FOR THE YEAR 1940

RUH-TSUIN TSUI

The University of Nanking

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A PRELIMINARY STUDY OF FARM CROPS AND LIVESTOCK ON 497 FARMS IN HWA-YANG COUNTY, SZECHUAN, CHINA, FOR THE YEAR 1940

I. INTRODUCTION

1. Source of the data.

In the early spring of 1941, the Department of Agricultural Economics of the University of Nanking, Chengtu, China, set up a type of farming survey in Szechwan Province, West China. Several areas were studied, namely: rice area, tobacco area, fruit area, hemp area, tea area and general farming area. In each area, five hundred farmers were interviewed first to get the general information such as size of farm area, size of family, kinds of crops grown and yield, livestock, and so forth. After a preliminary analysis of these five hundred farms, at least 100 farms were chosen for detailed study. This is the preliminary study of Hwa-yang which is considered to represent the wheat-corn-sweet potato area.

2. Location of the study.

Studies were made on farms around Kao-tien-tze, the largest market town in the northern part of Hwa-yang County. Kao-tien-tze is located about six miles southeast of Chengtu, the capital city of Szechwan Province. The Chengtu-Chungking highway is only a mile north of this market town. Five hundred records were enumerated at first, but three records were discarded, and so there are 497 records in this study.

3. General description of local conditions.

(A) An open rural community.

In China as a whole, the farmers usually live in a village and farm their distant fields or plots in various directions from the village. But this is not true ot the Szechwan farmers, because their farm-steads are built on their own farm land. This arrangement saves a lot of time in travelling to and fro between farm-stead and fields.

There are four market days in every ten days in Kao-tien-tze. Farmers usually go to the market tow nevery market day, except planting and harvesting time, to sell farm products and buy necessities, but mostly to visit the tea house of the market town for social and recreational purposes.

(B) Japanese bombers help to make the rural community progress:

As a result of the constant bombing of the large cities like Chengtu by Japanese bombers, many city families have moved to the rural areas. Radios, telephones, and school boys and girls are all scattered in this area. You can find an elementary school within an area of one hunddred families and a large central school in every market town. A farmer told me, when we were taking records, that it would be very difficult to ask questions among farmers three years ago, but not now.

(C) Climate.

The Chengtu Plain has a mild climate, 43°-48° F. being the typi al mean of January temperatures. It is almost frostless. There is light frost in winter time, but there is no killing frost. The mean temperature of the hottest month is most frequently 79° F.

The annual rainfall is about 38 inches, but sometimes droughts occur. The atmosphere is exceptionally still and a rather high humidity prevails.

(D) Soils.

The soils in the region where this study was made are not so fertile as the soils in the plain. Kao-tien-tze is located on the foot-slopes of Lung-chuan-I mountain. Brown podsolic soils are dominant in Kao-tien-tze. The soil texture is either loamy clay or clay loam. The soils are difficult to work, but their water holding capacities are high. Whenever possible or where water is available, the farmers use the land for rice planting.

II. SIZE OF FARM AREA AND SIZE OF FARM FAMILY

1. Size of farm area.

The average size of farm business in this study, measured in terms of farm area, is 10.3 mow, which equals 1.7 acres (see table I). It equals about 1.6 percent of the size of a 106-acre New York farm. In other words, one New York farm could be operated by Chinese farmers of West China as 62 units. Among the 497 farms studied, 344 farms or 69.3 percent of the total farms had an area of less than 10 mow, averaging 4.7 mow or 0.78 acres. More than 85 percent of the farms had an area below 20 mow or 3.3 acres.

Table 1
SIZE OF FARM AREA
497 Farms, Hwayang, Szechwan, China, 1940

Farm Area (mow)* Range	Farm Area (mow)* Average	Number of Farms	Percent of Farms
Under 10	4.7	344	69.3
10-19.9	13.0	80	16.1
20-29.9	23.7	32	6.4
30-39.9	33.7	20	4.0
40 and over	52.9	21	4.2
Average	10.3	497	100.0

*One mow = 1/6 of an acre.

Because of the small area in the farm about 95 percent of the farm area is in crops. Farmers try to utilize the farm area as completely as possible. The unproductive area is occupied by the farmstead, roads, and ponds.

2. Size of farm family.

The size of farm family is widely spread from an average of 4.6 persons in the small size farm group to 11.6 persons in the large size farm group (see table 2). There is a very good relationship between the size of farm and the size of family, that is, the larger the farm area, the larger the farm family. In a subsistence agriculture such as that in Hwayang county in China, a large farm area does not necessarily mean an economic unit for farming, but may simply mean a

Table 2
SIZE OF FARM FAMILY
497 Farms, Hwayang, Szechwan, China, 1940

Farm Area (mow)	Number of Farms	Number of Persons Per Family: Male	Female	Total
Under 10	344	2.3	2.3	4.6
10-19.9	80	3.3	3.2	6.5
20-29.9	32	4.0	3.6	7.6
30-39.9	20	5.0	4.3	9.3
40 and over	21	6.8	4.8	11.6
Average	497	3.0	2.7	5.7

larger size of family. In order to keep the large family living together, they have to work on a large farm area.

The average size of family is 5.7 persons per family, consisting of 3.0 males and 2.7 females. In a farm family in this region, all members of the family, both male and female, young and old, if they can work, are all working on the farm. One day in the spring of 1941 when I was taking records on a farm in the afternoon, I saw a boy and a girl who had just come back from school hurry with a big basket to go to a pea field to pick fresh pea pods for their father to sell on the market next morning. An old lady, the mother of the operator, who could not walk very well sat down on the ground in the pea field to pick the pea pods.

Income from land being limited, farmers were obliged to do some other work or maintain side-lines to support the family. Cotton weaving, and retail sales of oranges and baked potatoes are the main side-lines of the farmers in this area. The total average receipts was about $2,200 Chinese money or $122 U. S. money per farm per year, of which about 21 percent was received from other sources than the farm.

III UTILIZATION OF CROP LAND

1. Intensity of land use

Intensity of land use may be measured by an index of double cropping. The higher the index of double cropping, the more intensive

Table 3

INTENSITY OF LAND USE

497 Farms, Hwayang, Szechwan, China, 1940

Size of Farm Area (mow)	Percentage of Crop area in the Following				Index of Double Cropping
	Perennial Crops	Winter Crops	Spring Crops	Summer Crops	
Under 10	8.0	87.7	4.2	87.7	187.7
10-19.9	4.3	82.1	13.5	82.1	182.1
20-29.9	4.6	67.0	28.4	67.0	167.0
30-39.9	4.9	68.4	26.7	68.4	168.4
40 and over	4.8	60.9	34.3	60.5	160.5
Average	6.5	73.8	19.7	73.8	173.8

the use of land. The average index of double cropping for that area was 173.8 that means on a 100-acre piece of land, 173.8 acres of crops were planted in one year; or we may say that among the 100 acres, 73.8 acres had two crops a year while the rest of the area had only one crop a year.

The small size farm had a double-cropping index of 187.7 (see table 3) while the larger the size of farm the smaller the index. In other words, the land on the small farms is the more intensively used. On the small sized farms the farmers have to work more on the land than on that of large sized farms.

2. Crops grown.

(a) Perennial crops.

Orange trees and jasmine were the two kinds of perennial crops in this region. The average percent of crop area in orange was 4.7 and in jasmine 1.89 (see table 4). The quality of oranges produced in this region is not so good as of those produced in other orange regions but due to the nearness of the market, it brought back to the farmer the largest income. Jasmine flowers were used to flavor the tea. They had a high value, and the cultivation of jasmine required lots of labor, so the small sized farms tried their best to grow it. Under orange trees, especially in winter time, farmers usually grow wheat, peas, or beans. This helps the intensive use of the land.

The percentage of crop area for orange and jasmiue were higher on small sized farms than on larger farms.

Table 4

PERCENTAGE OF CROP AREA FOR VARIOUS KINDS OF PERENNIAL CROPS

497 Farms, Hwayang, Szechwan, China, 1940

Size of Farm Area (mow)	Orange, Percent	Jasmine, Percent	Total, Percent
Under 10	5.0	3.0	8.0
10-19.9	2.0	2.3	4.8
20-29.9	4.0	.6	4.6
30-39.9	3.3	1.6	4.9
40 and over	4.5	.3	4.8
Average	4.7	1.8	6.5

(b) Winter crops.

Winter crops were very important in this region. The term winter crops is given to crops which were planted in late fall or early winter and harvested in the spring time. About 73.8 percent of the crop area was in winter crops, with wheat occupying 34.3 percent, vegetables 17.1 percent and barley 12.8 percent, (see table 5). The less important winter crops were field peas, vetch, broadbeans, and rapeseed. Vegetables in winter were mostly radishes, cabbage, onions, and so forth. Vegetables, field peas and broadbeans were three crops which utilize most of the farmers' labor in winter and spring time. The large percent of vegetable area on small sized farms provided the more intensive use of land and more efficient use of labor in winter time.

Table 5

PERCENTAGE OF CROP AREAS FOR WINTER CROPS

497 Farms, Hwayang, Szechwan, China, 1940

Size of Farm Area (mow)	Wheat %	Vegetables %	Barley %	Field Peas %	Vetch %	Broadbeans %	Rapeseeds %	Total %
Under 10	43.1	29.2	7.3	4.4	0.6	2.8	0.3	87.7
10-19.9	29.0	14.8	13.7	18.9	1.6	2.2	1.9	82.1
20-29.9	32.0	12.7	13.2	2.9	4.7	1.0	0.5	67.0
30-39.9	31.1	11.4	15.7	1.2	3.9	2.7	2.4	68.4
40-and over	26.6	8.6	16.3	3.2	4.0	.9	1.4	61.0
Average	34.3	17.1	12.8	5.7	2.6	2.1	1.2	73.8

Vetch was grown for feed, and some of the vetch grown on the best land which can be cut two or three times in the winter. After the second or third cutting, when the vetch had grown up to half a foot high, it was plowed under the ground as green manure.

(c) Spring crops.

Spring crops were the crops planted in spring on the ground where there is no crop grown in winter time. In most cases, either the land is so poor that it can grow only one crop in that year, or the previous crop grown required such a long season that the land was unable to grow a second crop in that year.

Rice, ginger, sugar cane, flowers, tomatoes, and watermelons were the kinds of spring crops. Among these, rice was the most important one. Land for spring rice was in the low areas and it was covered by water all through the year. If farms have a high percent of land in spring rice, that shows they have much land area covered by water all through the year. Farms umder 10 mow had no land area covered by water through the year, so they grew no spring rice. (See table 6).

Table 6

PERCENTAGE OF CROP AREA FOR VARIOUS KINDS OF SPRING CROPS

497 Farms, Hwayang Szechwan, China, 1940

Size of Farm Area (mow)	Rice %	Ginger %	Sugar Cane %	Flowers %	Tomato %	Watermelon %	Total %
Under 10	—	.1	.3	3.0	.3	.5	4.2
10-19.9	10.4	.5	.1	2.3	.2	—	13.5
20-29.9	27.2	1.1	—	.1	—	—	28.4
30-39.9	23.3	1.5	.4	1.5	—	—	26.7
40 and over	32.5	1.0	—	.5	.3	—	34.3
Average	16.7	.7	.2	1.7	.2	0.2	19.7

(d) Summer crops.

Summer crops refer to the crops planted on the land where winter crops have been harvested. They were usually planted in summer and harvested in late fall or early winter.

As land is scarce, farmers try their best to plant as many summer

Table 7

PERCENTAGE OF CROP AREA FOR SUMMER CROPS

497 Farms, Hwayang, Szechwan, China, 1940

Size of Farm Area (mow)	Rice %	Corn %	Sweet Potato %	Vegetable %	Cotton and Hot-pepper %	Kao-liang %	Pepper %	Taro %	Corn and soybean %	Total %
Under 10	6.4	27.0	16.0	19.7	10.4	5.1	1.4	.7	1.0	87.7
10-19.9	17.7	21.9	16.1	12.0	7.0	5.4	1.0	.9	.1	82.1
20-29.9	20.5	13.4	15.1	8.0	4.6	4.0	—	.3	1.1	67.0
30-39.9	24.8	12.2	13.5	7.0	2.9	3.4	.2	1.1	3.3	68.4
40 and over	16.0	12.2	15.2	5.8	2.1	4.4	.9	1.0	1.9	59.5
Average	14.8	18.6	15.2	11.2	6.4	4.4	1.0	.8	1.4	73.8

crops as they can. The total percentage of crop area for all summer crops equals that of winter crops, which is a good indication that the farmers planted as many summer crops as they could.

Corn, sweet potatoes, rice, vegetables, cotton and hot-peppers, kaoliang hot-peppers, taro, and corn and soybeans were the summer crops grown. The first four were the most important ones.

Corn was the most important summer crop, and had 18.6 percent of the crop area (see table 7). In most cases, farmers plant soybeans in the corn rows, but the soybeans are neglected. In reality, soybeans under the corn usually had a yield of two to three tow. Rice was grown on land which is better than the spring rice land, because summer rice land can be drained in late fall to grow winter crops, while spring rice land cannot. Sweet potatoes, and cotton and hot-peppers are usually grown on sloping land, while hot peppers alone are grown on good level areas.

IV CROP YIELDS

1. Crop yields of perennial crops.

Oranges had an average yield of 573 chin per mow (table 8), or 4,573 pounds per acre. There was a wide range among the different sized farms. Farms with an area of 30 to 39.9 mow had a yield of 1,525 chin per mow, while those with an area of 40 mow and over had a yield of only 307 chin, and the farms with an area of 10 to 19.9 mow had a yield of 234 chin. This wide range was due to varieties of orange, percent of orange trees in bearing age, fertility of the land and the disease and insect control measures.

Jasmine is a shrub which produces flowers to be used in flavoring the tea. The average dry flower yield per mow was 40 chin. The highest average yield was 72 chin and the lowest yield was 26 chin. The most important factor affecting the yield of jasmine was the time of picking the flowers. The earlier the time of picking the flower, the less the yield.

2. Spring crops.

The average spring rice yield was 8.3 tow (tabe 9). There was no exceptional high yield nor low yield for spring rice. The reason was that the land for growing spring rice was all the same kind - that which was covered with water all through the year.

Ginger had an average yield of 1,058 chin per mow. Sugar cane had an average yield of 2,451 chin per mow, and had a wide range of

Table 8

CROP YIELD PER MOW OF PERENNIAL CROPS

497 Farms, Hwayang, Szechwan, China.

1940

Farm Area, mow*	Orange, chin**	Jasmine, chin
Under 10	513	38
10-19.9	234	26
20-29.9	789	32
30-39.9	1,525	70
40 and over	307	72
Average	573	40

*One mow = 1/6 of one acre. **One chin = 1.33 pounds.

yield in different groups of farms according to size. The varieties of sugar cane probably can explain the differences of the sugar cane yield.

Table 9

CROP YIELD PER MOW OF SPRING CROPS

497 Farms, Hwayang, Szechwan, China, 1940

Farm Area (mow)	Rice towA	Ginger chin	Sugar Cane chin	Flower(return) YuanB
Under 10	....	1,225	2,250	60
10-19.9	8.3	1,008	2,250	63
20-29.9	8.4	1,000	....	30
30-39.9	8.3	1,122	2,780	50
40 and over	8.3	1,016	3,300	120
Average	8.3	1,058	2,451	64

A One tow = 20.7092 litres. B One yuan=1/18 of U.S.dollar (1940 official exchange rate).

The flower yield was measured by the return in terms of yuan. The average return per mow of flowers was 64 yuan or 21.6 U.S. dollars per acre. The return was not high, but it gave the farmers a good distribution of income through the year.

3. Winter crops.

Winter wheat had an average yield of 6.3 tow per mow (table 10), or 22 bushels per acre. The amount is exactly the same as the 1930-1936 average yield of wheat for New York State. It is not high, but one should remember that farmers in Hwayang usually get at least two crops a year from one piece of ground. The barley yield was 7.4 tow, that of vetch was 321 chin, that of both broadbeans and field peas was 4.5 tow, and that of rapeseed was 3.7 tow.*

The yield of broadbeans and field peas really were residues, because before harvesting, farmers usually pick the fresh bean or pea pods for sale, especially on small sized farms, and nobody can tell how many of the bean and pea pods have been picked off. As estimated by the farmers, it is about one-fifth on the small farms and one-tenth on the large farms.

For both the important crops of wheat and barley, the yields were higher on the larger-sized farms, and there was no indication that the small sized farms had a higher yield.

4. Summer crops.

The corn yield was about 7.6 tow per mow. In most cases, farmers planted soybeans in the corn rows, and these soybeans had an average yield of 2 to 3 tow. According to the farmers' experience, the soybean crop would not cause any reduction of the corn yield, but so far there is no scientific data on this point.

Table 10

CROP YIELD PER MOW OF WINTER CROPS

497 Farms, Hwayang, Szechwan, China, 1940

Farm Area mow A	Wheat tow B	Barley tow B	Vetch chin C	Broadbeans tow B	Field Peas tow B	Rapeseed tow B
Under 10	6.3	7.4	235	4.6	4.3	4.6
10-19.9	6.2	7.3	404	4.8	5.0	3.6
20-29.9	6.1	7.2	360	4.1	4.0	3.0
30-39.9	6.2	7.4	184	4.5	4.0	3.7
40 and over	6.5	7.6	345	4.0	6.2	3.7
Average	6.3	7.4	321	4.5	4.5	3.7

A One mow = 1/6 of one acre. B One tow = 20.7092 litres.
C One chin = 1.33 pounds.

Table 11

CROP YIELD PER MOW OF SUMMER CROPS

497 Farms, Hwayang, Szechwan, China, 1940

Farm Area mow	Corn A tow	Sweet Potato chin	Kaoliang tow	Taro tow	Cotton B (seed cotton) chin	Pepper chin
Under 10	7.5	810	12.7	960	310	319
10-19.9	7.6	826	12.6	1,000	305	299
20-29.9	7.8	792	12.3	975	327	...
30-39.9	7.6	883	13.0	995	342	300
40 and over	7.8	836	13.2	977	343	300
Average	7.6	817	12.8	977	310	313

A. Corn usually planted with soybeans, this is the yield of corn only. In addition to this amount, about 2-3 tow of soybeans are harvested.

B. Cotton usually planted with pepper. In addition to cotton yield, about 7 chin of dry pepper can be harvested.

C. Usually has cotton in pepper field.

Sweet potatoes had a yield of 817 chin per mow; kaoliang, 12.8 tow; taro, 977 chin; cotton, 310 chin; and peppers, 313 chin. For most of the above mentioned crops, the high yields were on the large sized farms.

1. Productive livestock.

Chickens, pigs, goats, geese, ducks and rappits were productive livestock raised on farms in Kao-tien-tze. In general, 92 percent of the farms raised chickens, 60 percent raised pigs, 22 percent raised goats, 12.1 percent raised ducks, 6.2 percent raised geese and 2.8 percent raised rabbits (table 12). Livestock is not an important enterprise in Chinese agriculture, especially on small sized farms like those of Kao-tien-tze. Even though farmers raised several kinds of livestock on the farm, no one farm had a commercial enterprise of any one kind.

The chicken was the most important kind of livestock. Even of the small sized farms under 10 mow, 90 percent had chickens. Of the larger farms, nearly all had chickens. The number of chickens per farm varied from 2.6 chickens on the group of farms under 10 mow to 11.5 chickens on the farms of 80 mow and over. The size of farm area and the number of chickens per farm have a very good relationship. The larger the size of farm area, the greater the number of chickens raised.

Pigs were next in importance to chickens. The percentage of the farms having pigs, and number of pigs per farm having pigs, were closely related to the size of farm area. The larger the farm, the higher percentage of the farms having pigs and the more pigs were kept. On the farms under 10 mow, 1.8 pigs were kept on farms, while 5.7 pigs were kept on farms having 40 mow or more.

Goats, geese, ducks and rabbits were less important on the farms. Only a small percentage of farms kept them, and also a small number for each of them was kept per farm. The average number per farm having each kind of animal was only 1.4 goats, 1.2 geese, 2.1 ducks, and 3.7 rabbits.

The raising of so many kinds and so few of each kind of livestock was due to the small size of farm and the different purposes for which various kinds of animal were kept. As the size of farm was so small, there was not enough feed for a large number of animals. However, since the farmers wished to clean their barnyards and fields after harvesting, they kept several chickens, ducks and geese as scavengers, and also for the eggs or meat for cash. Pigs were kept not only for meat but also for the pig manure to fertilize the land. Goats and rabbits were kept for the purpose of utilizing the roughages and also to give some work to the boys and girls. In general, the labor was well used in taking care of hese livestocks, even though it was few in number.

2. Labor animals.

There was only one kind of labor animal kept on farms in this locality, namely the water buffalo. Most farms having water buffalo only had one per farm. The percent of small-sized farms having water buffalo was small. In the group of farms under 10 mow, only fourtenths percent of the farms had water buffalo, that is to say, only 1.4 farms out of the 344 farms in this group (table 13). Farm work was mostly done by hand, and sometimes by labor animals rented just for plowing and planting.

In the group of 10 to 19.9 mow sized farms, the percent of farms having water buffalo was 17.5 percent, and in the group of 20 to 29.9 mow sized farms, 59.4 percent of farms had water buffalo. The larger the size of farm, the higher was the percentage of farms having water buffalo. On 40 mow and over farms, more than 90 percent of farms had an average of 1.1 water buffalo.

Table 12

KIND OF LIVESTOCK KEPT ON FARM

497 Farms, Hwayang, Szechuan, china. 1940

Farm Area	Chickens: % of Farms Having Chickens	Chickens: No. of Chi-ckens per Farm	Pigs: % of Farms Having pigs	Pigs: No. of Pigs per Farm	Goats: % of Farms Having Goats	Goats: No. of Goats per Farm	Geese: % of Farms Having Geese	Geese: No. of Geese per Farm	Ducks: % of Farms Having Ducks	Ducks: No. of Ducks per Farm	Rabbits: % of Farms Having Rabbits	Rabbits: No. of Rabbits per Farm
Under 10	90.1	2.6	47.8	1.8	17.4	1.4	2.6	1.0	6.4	2.0	4.1	2.9
10-19.9	93.7	4.0	80.0	2.4	28.8	1.4	15.0	1.2	20.0	2.1	2.5	3.5
20-29.9	100.0	4.6	90.6	3.7	40.6	1.4	12.5	2.0	28.1	2.2	3.1	3.0
30-39.9	100.0	7.5	90.0	4.7	30.0	1.7	15.0	1.0	35.0	2.2	—	—
40 and over	92.8	7.3	95.2	5.7	52.9	1.7	20.0	1.3	40.0	2.3	11.1	1.0
Average	91.8	3.4	59.6	2.5	22.3	1.4	6.2	1.2	12.1	2.1	2.8	3.7

Table 13

LABOR ANIMALS ON FARM

497 Farms, Hwayang, Szechwan, China, 1940

Size of Farm mow	Number of Farms	Percentage of Farms Having Water Buffalo	Number of Buffalo Per Farm
Under 10	344	.4	1.0
10-19.9	80	17.5	.9
20-29.9	32	59.4	1.0
30-39.9	20	80.0	.9
40 and over	21	90.5	1.1
Average	497	14.3	1.0

VI Summary

This was a preliminary study of 497 farms in West China in 1940, giving a general picture of the size of farm business, land use, kinds and yield of crops, and kind fo livestock.

The average size of farm area was 10.3 mow which equals 1.7 acres. About 69.3 percent of farms included in this study had an average size of 4.7 persons for the local average. On some of the larger farms there were larger numbers of persons per farm. This does not necessarily mean that they had an economic size of business, but may have indicated that the large families had to have a large size of farm to keep them alive.

Land was more intensively used on small farms than on large farms. The index of double cropping for the area was 173.8 Perennial crops were orange trees and jasmine. Winter crops were wheat, barley, vegetables, field peas, broadbeans, vetch and rapeseed. Among these, wheat was the most important winter crop. Spring crops were not important but thert were several kinds which increased the income to farmers, such as ginger, sugar cane, and flowers. Summer crops were numerous. Corn, sweet potatoes and rice were the most important ones.

Crop yields varied on different sizes of farms. On the average for the important crops. yields were higher on large farms than on small farms.

The only labor animal was the water bnffalo. The small farms could not afford to own a water buffalo, so they were obliged to rent a buffalo in plowing time

On the 12 percent of the farms having chic kens, the average number of chickens per farm was 3.4. On the 60 percent of the farms having pigs, each farm had only 2.5 pigs.

Goats, geese, ducks and rabbits were very few in number and also only a few farms raised them.

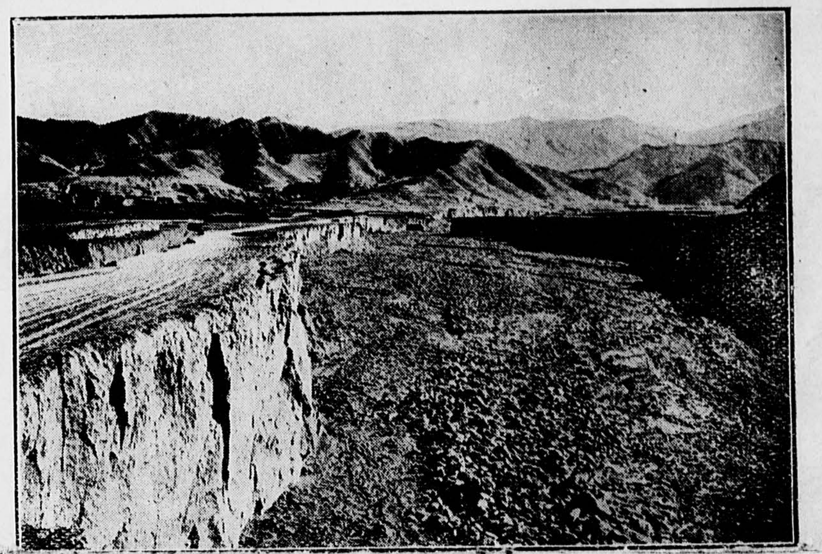
The income from the farm could not furnish a living for the whole farm family, so most farmers had an additional income, from non-farm sources.

[*Reprinted from the "Far Eastern Review," December, 1918*]

The Relation of Forests to Floods

By D. Y. Lin, M. F., Author of "Elements of Forestry," "China and Forestry," etc., and Professor of Forestry, University of Nanking

SAVING WHAT IS LEFT WHEN THE FORESTS ARE GONE. ARTIFICIAL TERRACING, AT WUTAISHAN, SHANSI PROVINCE.



DEFORESTED MOUNTAINS, SHOWING ARTIFICIAL TERRACING. WASH IN FOREGROUND. SHANSI PROVINCE.

Nowadays no excuse is needed for treating on the subject of floods. China, the Celestial land, may well be called the land of floods. Just at this time we have floods in Hunan, where the Governor superstitiously gave out orders to stop the killing of pigs and cows in order to stop the rise of flood waters; floods in Kwangtung, where the Central Government made a grant of $100,000; and floods in Honan, Shantung and Manchuria, where enormous sums of money have been spent in relieving the sufferers. The great Anhwei flood of 1911 resulted in the organization of the China Famine Relief Committee and the Colonization Association; the Canton flood of 1915 gave rise to the establishment of the Bureau of Conservancy Works, with Admiral Tang Hsia-heng as Director; and the so-called phenomenal flood we had in Chihli last year resulted in the organization of the General Flood Relief Committee, with Ex-Premier Hsiung Hsi-ling as Director-General. In Shanghai, Tientsin, and other important cities more than half-a-dozen "hui," or societies, were started as the result of these big floods, and it is the duty of these "hui" just to raise money for the sufferers and no more.

When we come to think of all these committees, bureaus, "hui," and what not, organized as results of the various floods, we cannot but infer that something *has* been done to try to solve the problem of floods in China. We read of the wonderful reports published by different committees about the flooded areas, and of the vast amount of money and food distributed among the homeless and starving people; but outside of these well-written reports and distribution of alms has there been anything *actually* done by these organizations to solve the flood problem? The answer to this question is: Yes, but very little. This, however, is to be expected because of the unsettled state of affairs in China, and, also, because of the lack of some form of concerted public action on the part of foreign and Chinese workers who have labored so assiduously to improve the hydraulic conditions of this country.

The Flood Problem

The problem of floods in China has been quite thoroughly analyzed and discussed during the last few years by engineers. Popular opinion has been that the flood problem is entirely an engineering one. I wish, however, to bring out in the following paragraphs the forestry side of the question, which, in the opinion of a few, has not been given proper emphasis in the discussions hitherto published. I wish to say at the outset that in a country like China, where there are hundreds of millions of acres of mountainous land, afforestation and reforestation cannot but exert an enormous influence on the control of floods.

Forest Influence

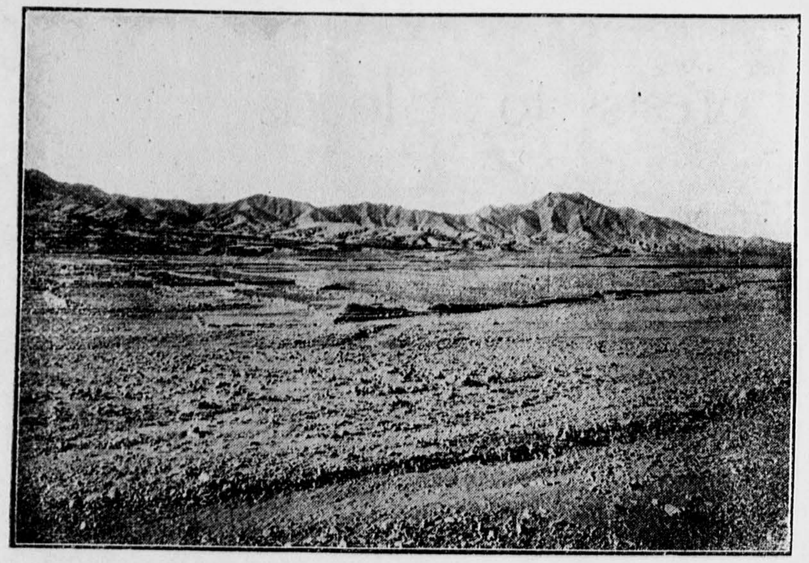
In order to understand exactly the relation of forests to floods, it is important that we first consider the influence of forests on watersheds and the conditions they create with regard to surface run-off, evaporation, soil erosion, absorptive capacity of soil cover, underground seepage, and streamflow.

Surface run-off.—In the mountains the greatest loss of rain water is through surface run-off, and a forest cover has the most important influence in reducing this. According to investigations made by the United States Forest Service, the amount of water which the forest cover saves to the soil by reducing the surface run-off and changing it to underground seepage is as follows: For forests at low altitudes, where the rains are not heavy and the soil is less subject to freezing, twenty per cent; for forests of moderate altitudes, thirty-five per cent., and for mountain forests, fifty per cent. of the precipitation.

The reasons why the forest is able to check surface run-off are: (1) the trunks and the underbrush in the forest offer mechanical obstruction; (2) the litter of the forest floor checks rapid surface drainage of the water and also acts as a sponge;

and (3) the network of deeply penetrating roots, living and decayed, make the forest soil more porous and permeable, hence the water sinks into it more readily.

So it is evident that the ability of the forest to check surface run-off is greatest when the forest is dense and when the ground beneath it is covered with an unbroken leaf litter.



FARMING IN THE PATH OF THE FLOOD. WUTAISHAN, SHANSI PROVINCE.

Mechanical action of tree-crowns.—It will be remembered that when water is precipitated from the clouds a portion of it is prevented from reaching the ground through interception by the leaves, branches and trunks of the trees. The intercepted portion varies according to tree species and the density of the woods. The various measurements made in Europe have given the following results:

Stations	Quantity of rainfall which reached the ground in well-stacked woods in per cent. of total rainfall.			
	Beech Woods	Spruce Woods	Scotch Pine Woods	Larch Woods
Prussian Stations	76	78	73	—
Swiss ,, ...	90	77	—	85
Bavarian ,, ...	78	73	66	—

The table shows that the intercepted portion of rainfall varies anywhere from 10 per cent. to 34 per cent., depending on species. This explains why after a rain, water continues to drop from the leaves and twigs for hours.

Evaporation.—It must be remembered that when water is precipitated from the clouds, a great portion of it, after a longer or shorter period and after serving one purpose or another in nature's economy, goes back to the air again through evaporation. Zikawei records show that the average annual evaporation in the shade is a little over 32 inches. This is enormous when we come to think that the average annual rainfall for nearly forty years is only about 57 inches. Evaporation then has a great influence in determining the amount of run-off of the streams.

It must be borne in mind, however, that there is a great difference between evaporation from soil in the open and from forest soil. Investigations show that evaporation in the forest is only two-fifths of that in the open country. On the other hand we must remember that the evaporation from the crowns of the trees is enormous. Trees like all other living things require water for growth. It is said that for every pound of dry substance produced, corn evaporates 233-lbs. of water, and turnips 910-lbs. Forest trees are the most highly developed form of vegetable life and as such they require for growth and development a much greater supply of water, and it simply means that evaporation from the crowns of trees must be enormous. The reason why in wooded regions the level of the ground water is lower than that in the wooded regions may be easily explained by this process of evaporation, botanically known as the process of transpiration, and to keep this process going, the forest must draw and consume heavily the water stored up in the earth.

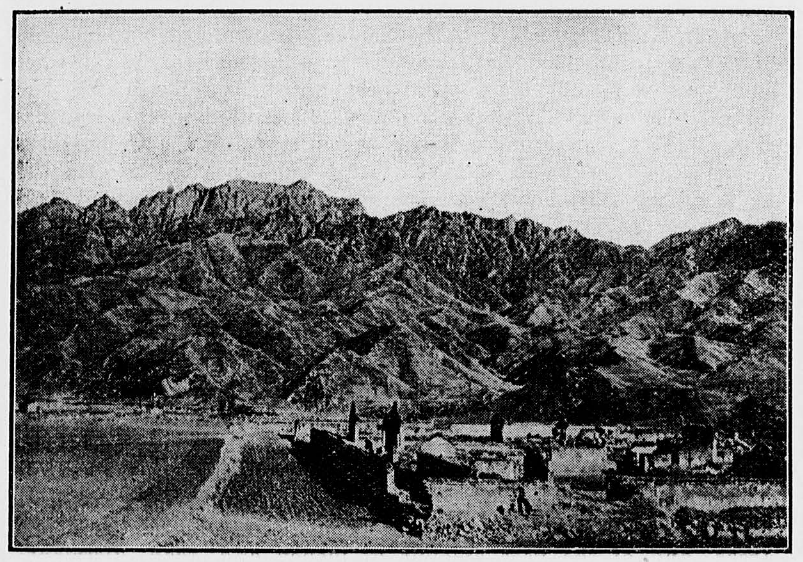
Soil erosion.—When water rushes down a bare slope it possesses great mechanical power. It loosens the soil and carries it downhill. It makes gullies and ravines and often causes landslides. The soil brought down not only renders the fertile land below valueless, but also goes to the silting up of streams.

It is generally admitted that of all the vegetable covers forests are most efficient in protecting slopes from the erosive action of running water. This is because (1) the roots of the trees hold the soil firmly in place and so increase its resistance to erosive action; (2) the crowns of the trees protect the earth from the violence of beating rain, and, as brought out in the preceding paragraph, intercept a considerable portion of it; and (3) the velocity of the moving water is checked because of the reduced amount of the run-off, hence the erosive force of the run-off itself is minimized. On the whole we may say that on a forested slope, a series of obstacles is always present to oppose the movement of the water, and reduce its velocity and force, and, consequently, its erosive action.

Depth of soil.—In forested regions the soil is not only protected from erosive action of water, but also made deeper. The depth of soil has a great bearing upon the amount of water which it can retain. A thin soil cannot retain much water, no matter what its character may be. The way in which the forest is able to increase the depth of soil is (1) by adding leaves and twigs which when decayed become a constituent part of the soil; and (2) by causing the underlying rock to disintegrate—this is on account of the mechanical action of the penetrating roots. When soil increases in depth it increases also in absorptive capacity, thus creating greater reservoirs for water.

Stream flow.—So in fostered regions rain water is conserved in such a way that it is allowed to drip slowly down; hence we find in such regions streams do not rise high immediately after rains, and do not dry up where there is no rain, and there is always a great abundance of springs which go to feed such streams.

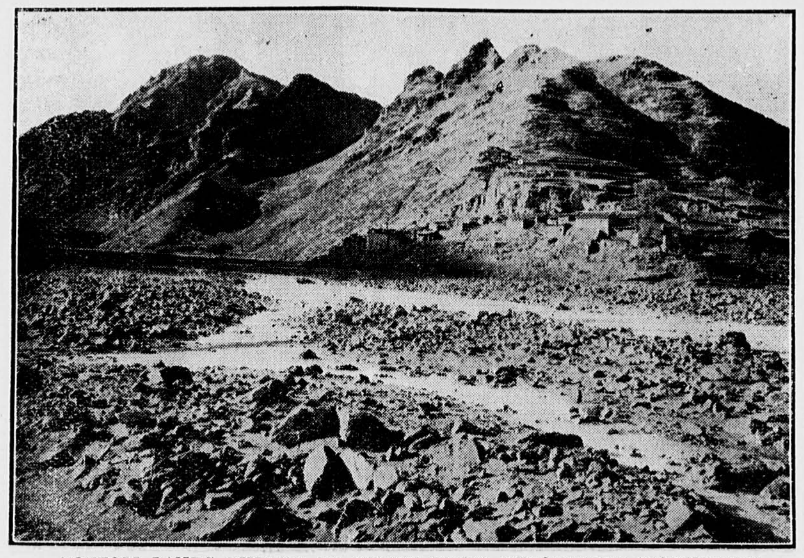
Forests regulate stream flow by conserving not only water but also snow. The influence of forests in retarding the melting of snow has been demonstrated with precision in a ten years' series of observations carried on at Moscow. Results show that the period of snow melting within forests is from twenty-six to fifty-seven days, while snow in the open disappears within six or seven days. The ability of the forest to retard the melting of snow is due chiefly to the shade and protection of the trees and of the leaf litter, and such gradual thawing will render it possible for streams to be slowly fed—hence a more even stream flow.



ORIGINALLY WOODED; SETTLED, CLEARED AND RUINED SINCE 1725. FOUPING, CHIHLI PROVINCE.

Closely connected with the gradual thawing of snow in cold climates is another important fact which must not be overlooked, especially in North China where so often we hear of spring floods. Spring floods are caused by rapid thawing of snow, together with the bursting out of ground water accumulated behind the icy dams formed at the battoms of slopes. The bursting out of ground water is explained this way: Forest soil is not only cooler than

bare soil in summer time on account of protection and shade, but also warmer in winter months on account of protection from radiation by trees and the protection given by leaf litter. The leaf litter is a poor conductor of heat and it prevents the soil from cooling off and keeps it from freezing in winter, and in the processes of fermentation and decay contributes the heat which these evolve; and then there is the snow which protects it still further. Now if the soil of watersheds is thus kept soft and unfrozen, or only slightly frozen, the condition of the ground beneath will be such that percolation continues during winter and there is still that normal flow of ground water which goes to feed the streams. If, however, the soil is frozen and the flow of ground water ceases during winter (which, no doubt will be the case if the watersheds are forestless), then in the spring the ground water which has accumulated behind the icy dams will enter the rivers in large quantities, which the main channel is generally unable to discharge.



BOTTOM LANDS BURIED IN WASTE FROM DEFORESTED MOUNTAINS. WUTAISHAN, SHANSI PROVINCE.

Summary of forest influence.—The influence of forests on mountainous watersheds of streams, then, may be briefly summarized as follows:

(1) They protect the ground from the violence of beating rain and intercept a considerable portion of it.
(2) They reduce the amount of surface run-off by 20 per cent. to 35 per cent. of the precipitation, and often more with higher altitudes.
(3) They increase soil depth and hence the absorptive capacity of soil cover.
(4) They prevent soil erosion and check surface run-off in general.
(5) They increase underground seepage as shown by the abundance of springs in mountain forests.
(6) They retard the melting of snow.
(7) They give out vast amounts of moisture to the air by process of transpiration and yet tend to reduce surface evaporation.
(8) They save a greater amount of precipitation for stream flow and for their own growth than any other vegetation similarly situated.
(9) They create the most favorable conditions for a steady flow of water in streams.

Forests and Floods

With a knowledge of the facts summarized above we are in a position now to appreciate the relation of forests to floods. A mountainous watershed with trees growing on it will have a regulated system of checking and storing the rainfall, and such a condition is not likely to cause floods, unless there are unusual meteorological circumstances. While on the other hand, if the mountains are devoid of tree growth, it requires very little imagination to picture to ourselves how after a heavy rain the slopes will be thoroughly drained by a system of gullies and the water will sweep down through them in a fraction of the time that would be required if it had trickled down in a thin sheet or amidst vegetative obstacles. Now if the rain channel is unable to discharge the influx of water as fast as it rushed down, the result is a flood.

The high rate of run-off which is characteristic of streams arising from denuded hills and mountains enables them to carry an enormous amount of silt and boulders of extraordinary size. The transporting power of water varies as the sixth power of its velocity, so that if the velocity of a stream is increased ten times, for instance, its transporting power is increased 1,000,000 times. This is why, in the case of many rivers in China, they speak of stones and boulders of large size carried down to the foot of mountains, and of the enormous quantity of silt brought down to raise the beds that have already been silted up.

Flood Records

The records of floods for the different rivers in China are not kept, yet it is safe to say that floods in China are increasing in frequency, in severity and in duration in the many rivers. The reason for this increase is not far to seek. China has been allowing deforestation to go on unchecked for centuries, and, sad to say, this process of deforestation is still going on at an increased rate. The gradual decrease of forested watersheds with the gradual increase of denuded forestless watersheds can bring but one result, and that is the increase of favorable conditions for floods. In this connection it might be well for us to turn to some of the United States' records of floods which have been kept long enough on some rivers to show changes in the conditions of flow. The following table* taken from the United States Department of Agriculture Circular 176 gives records regarding the flow of ten important rivers of the United States on which careful records have been kept from periods ranging from sixteen to thirty-four years:

CLASS I.—FLOODS INCREASED.

Name of Stream	Years	No. of floods	Days of floods	No. of Low-water stages	Days of Low-water stages	Precipitation (inches)
Potomac	1890-1898	19	33	54	1,351	36
	1898-1907	26	57	76	1,693	37
Monongahela ...	1886-1896	30	55	66	912	42
	1897-1907	52	100	90	979	41
Ohio	1882-1894	46	143	79	1,333	41
	1895-1907	59	188	110	1,609	39
Cumberland	1890-1898	32	89	61	1,261	46
	1899-1907	43	102	65	1,576	41
Wateree	1892-1899	46	147	115	1,164	45
	1900-1907	70	187	64	508	47
Savanah	1890-1898	47	116	70	566	48
	1899-1907	58	170	41	292	46
Tennessee	1874-1890	32	173	71	902	53
	1891-1907	33	137	55	982	46
Allegheny	1874-1890	39	92	99	1,747	41
	1891-1907	53	131	91	1,136	36

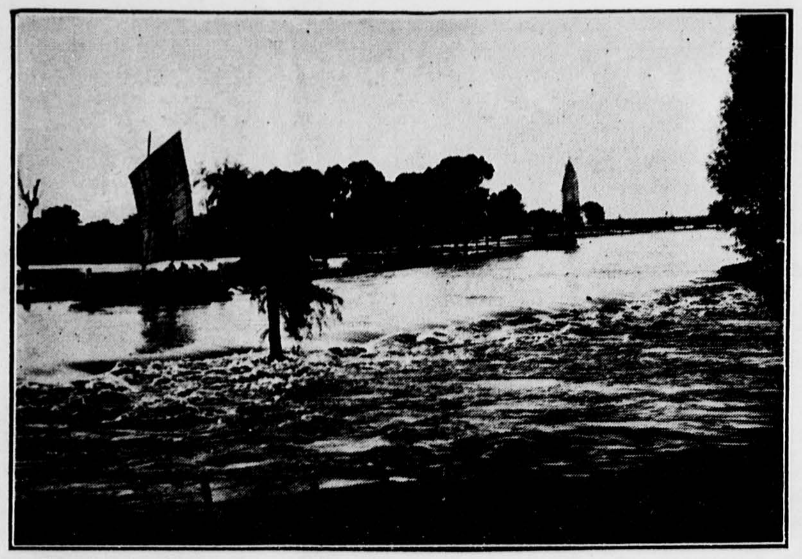
* For greater detail see Circular 176, pp. 4-6.

CLASS II.—FLOODS DECREASED.

Name of Stream	Years	No. of floods	Days of floods	No. of Low-water stages	Days of Low-water stages	Precipitation (inches)
Wabash	1890-1898	21	351	38	1,365	39
	1899-1907	19	279	44	1,160	35
Red	1892-1899	19	87	49	826	31
	1900-1907	16	60	8	208	29

The authors of the circular (Hall and Maxwell), after discussing thoroughly the different factors known to have an important influence upon the flow of those streams, observed:

"The Cumberland River is a good example of how conditions have changed for the worse on some of the watersheds. The drainage area of the Cumberland River above Burnside, Ky., comprises 3,739 square miles and lies in the heart of the Cumberland mountains. The figures given in the table show that floods have increased in the Cumberland River at Burnside, Ky., in number from thirty-two in the first half to forty three in the second half, and in duration from eighty-nine days in the first half to one hundred and two days in the second half, while low-waters have increased in times from sixty-one in the first half to sixty-five in the second half, and in days from 1,261 in the first half to 1,576 in the second half.



THE FLOODS OF 1917, BREAKING THE GRAND CANAL DYKE NEAR TIENTSIN.

"The removal of the forest on this watershed is progressing from three causes: (1) Clearing for agriculture; (2) lumber operations; (3) fires. In 1890 when these measurements were begun, 21 per cent. of the watershed above Burnside was cleared; in 1908 the cleared area had grown to 32 per cent. . . . Then at intervals fires ran through the woods on the hills and mountains where the Cumberland River has its source. Though the fires are slow and small, they burn the leaf cover and the upper layers of humus at each visitation. This removes or injures the porous surface, one of whose essential functions is to arrest the storm water falling upon the slopes and afford it an opportunity to sink into the ground."

"The behavior of the Cumberland River," the authors said in conclusion, "shows a direct and positive relation between the run-off and the changed condition of the surface. The changes due to agriculture and lumbering can be definitely stated, but the extent and effect of forest fires are not subject to exact calculation. Yet undoubtedly all of these influences are active in producing the results as shown in the flood and low-water records at Burnside. It is impossible that these results should be due to rainfall, because the rainfall was approximately ten per cent. less in the second half of the period. Since no other influences could have produced the result, there is no conclusion possible other than that the progressive floods and low-waters have been due to the changes accomplished on the surface of the watershed."

To give an example of a watershed where conditions have improved, the authors wrote as follows:

"The stream which shows this tendency in an unmistakable way is the Red River, which forms the boundary for many miles between Texas and Oklahoma. In this river the geology and topography have not changed. The precipitation has changed in the direction of lessened rainfall, but not enough to account for the record. But in soil conditions, and especially in the condition of the surface, the change has been marked. So the results which have appeared in the form of change of the flow in the Red River are precisely what ought to be expected from changes in surface conditions. In 1908 the Red River basin in Oklahoma had 10,200 square miles of improved land, instead of 3,284 square miles in 1900. Statistics are not complete for the Texas portion of this basin, but the Texas has developed at about the same rate as the Oklahoma part. The river's behavior has become better as the area of wild land has decreased. Wild and barren land being the worst condition for the protection of watershed, and cultivated farm lands being next to forests the best condition, the change of a large part of the watershed from the worst condition to the next to the best condition has brought about this result in the Red River. It is probable that the whole Red River basin above Arthur City in Oklahoma and Texas had 40 per cent. of its land under improvement in 1908 instead of 14 per cent. eight years earlier."

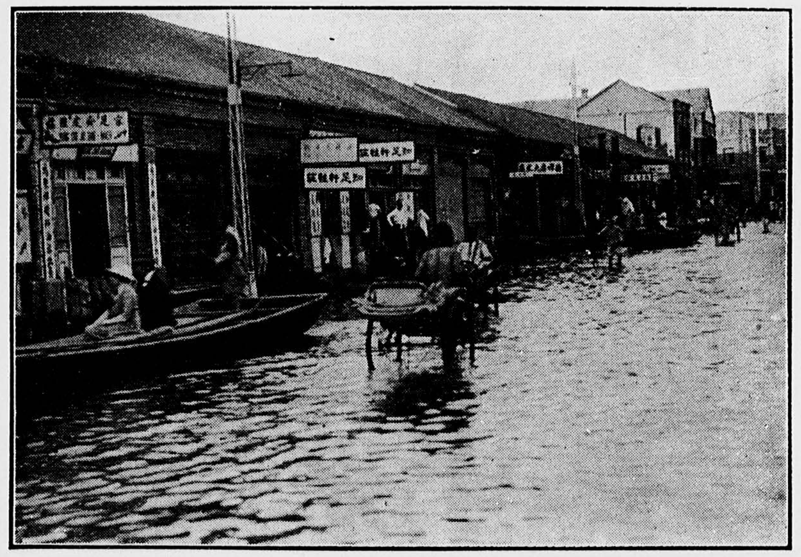
The conclusions gotten after so many years of investigation cannot but show that there is a close relationship between forests and floods. From such conclusions we wonder why floods in China have not been more frequent and severe, especially when there has been such an alarming increase in area of forestless watersheds.

Some Observations on China's Floods

That flood intensity and frequency have been on an increase in China is universally admitted. The so-called "phenomenal" floods or floods which China has not experienced for the last 170 years are no longer phenomenal for they seem to come around almost every year with greater severity. The Tientsin flood last year, which rendered more than 5,611,000 people homeless, and as many as 17,646 villages partly or wholly under water, was a terrific thing. It was caused by the simultaneous rise of water of the five rivers in Chihli, the chief of which is the Yungting Ho. These five rivers have their upland collecting basins in the mountains of Chihli, Shansi, and Honan provinces—covering a mountainous area of about 60,000 square miles. These five rivers have, as a matter of fact, only one outlet, i.e., the Hai Ho. The maximum capacity of the Hai Ho is 30,000 to 35,000 cubic feet of water per second, but the Yungting Ho alone carries down as much as 200,000 cubic feet per second during summer freshets. It is evident then that all the water that comes down in excess of the volume disposed of by the Hai Ho must necessarily overflow and become flood water on every side. We need only to recall some of the facts discussed under Forest Influence in the preceding paragraphs and then imagine for ourselves the enormous amount of water that the 60,000 square miles of deforested mountains and hills must shed during torrential rains, and then think further how the water rushes down the hillsides unhindered by vegetation, making gullies and carrying with it enormous amounts of silt. Those of us who have seen the flow of the Hai Ho cannot help comparing it to the flow of liquid mud. Since the Hai Ho cannot discharge such an influx of heavily laden water, the only alternative will be for the water to break through the embankments and overflow the surrounding country.

Remarks of some Engineers

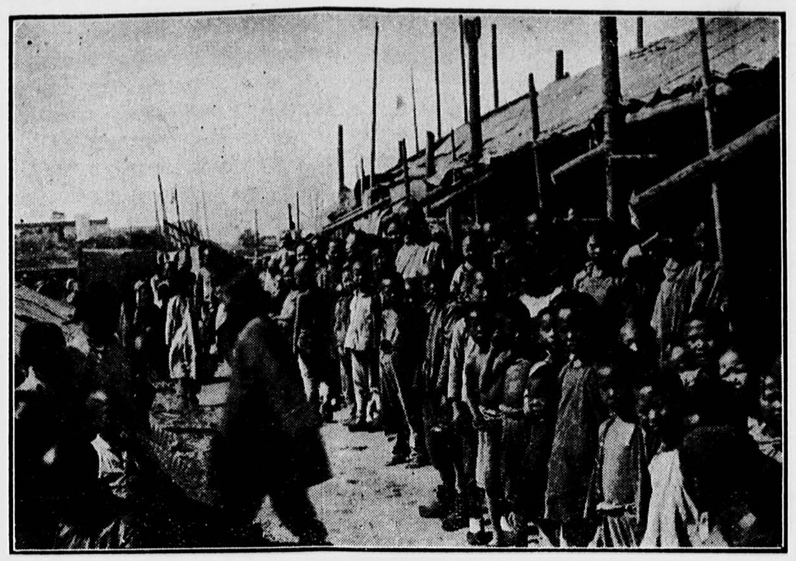
One leading engineer who has been working to improve the river system of Chihli for many years and with whom the writer had an interesting conference, said: "The Chihli rivers during freshets have a discharge of from 150 to 200 times the discharge during dry seasons. For instance, the Yungting Ho in dry seasons discharges scarcely 1,500 cubic feet of water per second, but during freshets its flow rises to 200,000 cubic feet per second. It is evident that if a channel is prepared for this large discharge, it will dry up during dry seasons on account of the meagre supply of water. On the other hand, if the channel is good for 1,500 cubic feet, it cannot carry down to the sea 200,000 cubic feet during rainy seasons." Then he want on and frankly said: "Only reforestation on the upland collecting basins in the mountains is able to prevent this great difference of discharge, holding on nearly one-half of the rainfall during heavy rains, and giving it subsequently to the channel. Therefore, forests can be compared to a sponge for retaining rainfall and giving it up gradually."



HOW CITIES SUFFER IN CHINA. FLOODS AT TIENTSIN (FRENCH CONCESSION) IN 1917.

Another leading engineer, who after deploring the present condition of the different rivers in China, wrote at the conclusion of one of his reports as follows:

"The only way to diminish this evil (meaning floods) is to diminish the amount of soil brought down from the mountains. And the reason for this enormous quantity of silt coming down from mountains is that those mountains are bare so that during a heavy rain nothing prevents the water from rushing downward practically immediately after it has fallen, taking with it large quantities of soil. Now if those mountains were planted with trees, not only would the water then be unable to take away so much soil, but it would also reach the river gradually in a regular flow divided over a longer period and not within a few hours in fierce torrents. . . . The deterioration of the various rivers in China and especially of those in the province of Chihli would never have reached its present stage if deforestation had not taken place. . . . To build reservoirs in the hills in order to regulate the flow of water, as has sometimes been suggested, is not only far too expensive, but moreover wrong, as it does not do away with the problem of silt. Sooner or later these reservoirs will be filled, consequently new ones would have to be built, a process which would have to be carried on into eternity. . . ."



A FEW OF THE THOUSANDS OF FLOOD SUFFERERS AT TIENTSIN IN 1917.

These remarks of the engineers are too evident and too conclusive to need further explanation. The problem of floods in Chihli, nay in all China, cannot be *permanently* taken care of by engineering works alone, no matter how much money is expended on it. The barrages, the reservoirs, the outlets, etc., will be silted up again after a few years of usefulness, just as the different streams have been silted up. We have heard that at some places the bed of the Yungting Ho is 20-ft. higher than the adjacent country. So it is evident that the problem of floods is not a problem of unrestrained run-off of rainfall alone, but also a problem of silt, which cannot be taken care of unless soil erosion on the mountain slopes is checked and stopped.

Side by side with these Chihli rivers we might mention two more rivers in the United States, the Queen's Creek in Arizona and the Cedar Creek in Washington, whose behavior seems to bear out what the engineers said of the Yungting Ho and the Hai Ho.

Queen's Creek has a drainage area of 143 miles where the annual rainfall is only 15-in. It flows over unforested watersheds and is subject to violent floods. It is said that the maximum discharge in 1896 was 9,000 cubic feet per second; whereas the mean discharge was only 15 cubic feet per second, and during a large part of the year the stream was dry. On the other hand, the Cedar Creek in Washington, with a well-wooded watershed, behaved entirely differently, although having a drainage area of equal size and a precipitation of from 93-in. to 150-in. The stream in 1907 had a maximum flood discharge of 3,600 cubic feet per second, and a mean discharge of over 1,000 cubic feet. In the opinion of leading scientists, "this radical difference in the behavior of the two streams can be explained only by the difference in the soil cover of the two basins." *

Uncontrollable Meteorological Conditions

We have often heard it said that floods in China are produced by exceptional meteorological conditions and that as such they cannot be prevented by either forests or engineering works. No doubt this is true. No forests, no reservoirs, no dykes and no outlets of any kind will ever be able to check floods, if these floods are produced by exceptional meteorological conditions, chief of which is excessive rainfall. But we are not concerned, however, with "exceptional" things but with things that occur with increased intensity and frequency every year and every month throughout China.

In this connection it might be mentioned that ordinarily countries with a forest area of less than 20 per cent. of the total area of the country show bad climate conditions with prolonged droughts, frosts, and alternating floods and low water. Portugal, with a forest area of only 3½ per cent. of the total area; Spain, with 16 per cent.; Greece, with 13 per cent.; Italy, with 14 per cent.; Turkey, with less than 20 per cent., are good examples of this. China, the horrible example of forest neglect, the only civilized country which has allowed deforestation to go on unchecked, with a forest area certainly too small to be considered, surely cannot escape this rule. The calamities she is experiencing now are but natural results of her long-continued forest denudation.

Conclusion

The object of writing this article is not to minimize in any way the importance of engineering works as a remedial measure for the control of floods. As a matter of fact, the deterioration of all the rivers in China to-day has reached such a stage that engineering works are absolutely indispensable in order to give temporary relief to the constantly inundated districts in the different provinces. But it must be remembered, however, that engineering works cannot have a *permanent* effect unless they are supplemented by a system of tree-planting on the different watersheds. Recently so much has been said about the need of some form of mechanism for co-ordinated and persistent public action to improve the hydraulic conditions of this country, and I can think of no better mechanism than that in which the forester and the engineer plan to work together—one on the upper and one on the lower collecting basins—and no doubt it is only through *such co-operation* that China can be given a *permanent solution* of her flood problem. The words of Professor Van Hise are indeed worth our consideration when he says: *"The best protection against flood is provided by a combination of forests and reservoirs."*

* "The Conservation of Natural Resources in the United States," by Charles R. Van Hise.