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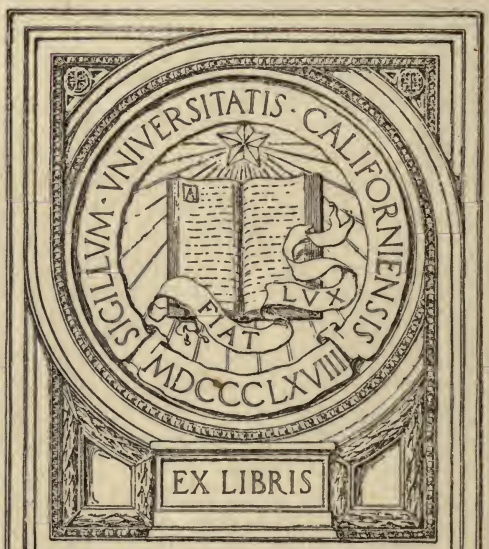

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INDIAN TRADE ENQUIRY

Special Committee on Food Grains

Sir MARSHALL F. REID, C.I.E. (*Chairman*).
Sir CHARLES H. ARMSTRONG.
Sir John P. HEWETT, G.C.S.I., K.B.E., C.I.E.
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PREFATORY NOTE

In August 1916 the Secretary of State for India invited the Imperial Institute Committee for India to conduct an enquiry into the possibilities of further commercial usage in the United Kingdom of the principal Indian raw materials. It was also proposed that the enquiry should include the possibility of the usage of these materials in other parts of the Empire.

The invitation was accepted by the Committee for India, and a number of Special Committees were formed to deal with the principal groups of materials selected for inclusion in the Indian Trade Enquiry.

The groundwork for the consideration of the various Committees has been supplied from the information as to the raw materials concerned which has been systematically collected at the Imperial Institute, chiefly in the Scientific and Technical Department and in the Technical Information Bureau.

The Committee have also had at their disposal the numerous reports made by the Scientific and Technical Department of the Institute during recent years on the composition and commercial uses and value of Indian raw materials, and have also utilised the collection of raw materials of India derived partly from Technical Departments in India and partly from commercial sources which are included in the Indian Section of the Public Galleries and in the Reference Sample Rooms of the Institute.

It has now been decided by the Secretary of State that, subject to certain reservations, the reports of these various Committees which have been forwarded by the India Office to the Government of India shall be published.

The reservations referred to are that at the request of the Government of India paragraphs in certain of the

reports as presented should be omitted, such paragraphs being indicated by asterisks, and that it should be stated that the reports represent the personal opinions of the members of the Committees, and that the Secretary of State is in no way committed to accept these opinions.

C. C. McLeod,
Chairman, Committee for India.

November 1919.

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THE TRADE IN INDIAN RICE

Introduction

The Special Committee appointed to investigate the possibility of increasing the trade of the United Kingdom and other parts of the Empire with India in food grains consisted of Sir Marshall F. Reid, C.I.E. (Chairman), Sir John P. Hewett, G.C.S.I., C.I.E., Sir Charles H. Armstrong, and the late Mr. George Allen, with Dr. T. A. Henry, of the Imperial Institute Staff, as Secretary. At its first meeting the Special Committee decided to invite Mr. R. E. Prothero, M.P. (now President of the Board of Agriculture and Fisheries), and Mr. A. E. Humphries (President of the National Association of British and Irish Millers), to join the Committee, and these gentlemen consented to serve. On his assumption of the office of President of the Board of Agriculture and Fisheries, Mr. Prothero was unable to continue his work on the Committee.

The work of the Committee has been much facilitated by the fact that many of the firms interested in the sale and milling of rice kindly consented to make statements and to give their evidence jointly. Among the firms and associations consulted are the following:

(1) *Rangoon Rice Shipping Firms:* Messrs. Steel Brothers & Co., Ltd., Messrs. The Arracan Co., Ltd., Messrs. Bulloch Brothers & Co., Ltd., and Messrs. The Ellerman Rice Mills, Burma, Ltd.

(2) *The London Rice Brokers' Association.*

(3) *The Committee of the Rice, Rice Bran, and Kindred Trades of Liverpool.*

(4) *Starch Manufacturers:* Messrs. Reckitt & Sons, Ltd., and Messrs. J. & J. Colman, Ltd.

(5) *Feeding-cake Manufacturers:* Messrs. The British Oil & Cake Mills, Ltd., Messrs. J. Bibby & Sons, Ltd., and Messrs. R. Silcock & Sons, Ltd.

The Special Committee are greatly indebted to these and other firms and associations for the generous way in which they placed at the Committee's disposal full information regarding those aspects of the rice trade in which they are specially interested, and for the care they took in giving full and frank replies to the questions they were asked.

I. The Quality of Indian Rice

At an early stage of the enquiry it became necessary to ascertain the position of Indian rice as regards quality, in comparison with other commercial rices, especially those of Siam and Indo-China, which are India's chief competitors.

The rice trade of the world falls naturally into two great branches: the Far Eastern branch, requiring a cheap rice for feeding the native population; and the Western branch, requiring large quantities of a medium-quality rice and much smaller quantities of high-quality rice. The Far Eastern branch is catered for to a very large extent by Siam "field" and Indo-China rices, both poor, cheap qualities, and to a less extent by Rangoon rice. The Western branch is supplied mainly by Rangoon and Siam "garden" rices, both medium qualities, and for the special qualities by imports from Bengal (Patna rice), Java, Japan, United States, Italy and elsewhere. For this trade also highly milled and polished rices are produced in European mills, mainly from rice imported originally from Burma and Siam. The general opinion expressed by witnesses was that Rangoon rice was an all-round useful quality, and that on the whole it was unwise to try to modify it. There is, however, always the possibility that one of India's competitors may seriously take in hand its rice industry, and by improving the yield per acre and the quality of the grain threaten the dominant

position which India at present occupies. It is understood that investigations in this connection are already being made in Burma and elsewhere in India, and the Committee therefore feel that they need only express their satisfaction that these important questions are being dealt with, and record their opinion that all the British firms interested in the rice trade would welcome the production in India of all types of rice required for the home and export trade of the United Kingdom, if that proves to be technically and commercially possible.

II. Statistics of the Trade in Rice

The preparation of rice for the market involves three main operations after the grain has been actually threshed to yield paddy. These are :

(1) Removal of the husk, yielding "cargo rice."

(2) Cleaning to remove the outer layers of the edible grain, producing white rice, with rice meal or bran as a by-product.

(3) Polishing and glazing to produce the appearance required especially by European and American consumers, "polisher meal" being obtained as a by-product.

The whole tendency of the trade in recent years has been to conduct the first two operations entirely, and the third in part in the East, and the statistics of trade for Siam and Indo-China (Appendix I, Tables IV and V) show that far more white rice (*i.e.* cleaned and perhaps polished rice) is now exported than "cargo rice" (*i.e.* partially cleaned rice), and that exports of rice in the husk (paddy) are small and practically confined to the Far East where the natives in some cases apparently still prefer to husk their own grain. In the case of the Indian statistics it is not possible to trace this tendency so clearly, because these statistics are compiled under two headings only, "rice in the husk" (paddy) and "rice not in the husk," which includes "cargo rice and white rice, whole and broken." The British Trade Returns give statistics of rice grain under three headings, viz. "Rice, whole and cleaned," "Rice, other than whole and cleaned," and "Rice, mixtures of whole and broken (cleaned)."

The first may include "whole rice cleaned" and "whole rice cleaned and polished"; the second and third may include everything else except rice flour, rice starch and rice meal and dust, which are shown separately.

The Committee have ascertained that it would be useful to the trade in India and the United Kingdom to have more detailed statistics of exports and imports of rice, and a number of new headings are suggested (see page 26).

Detailed trade returns are published by most countries for the calendar year, whereas those of India are for the year April 1 to March 31. A useful abstract return of Indian trade for the calendar year is, however, published and the Committee think it desirable that this should be more generally known.

III. The World's Trade in Rice and India's Share in it

Table I annexed shows, as far as figures are available, the world's exported surplus of rice. The figures are for the year 1913, but comparison of these figures with those for earlier years shows that 1913 may be taken as fairly representing the trade in recent years, apart from such accidental circumstances as failure in the harvest, affecting certain countries in certain years, and, since the war, freight difficulties. It will be seen that the chief countries of the world which produce enough rice to export on a large scale are India (chiefly Burma), Siam, and Indo-China, which in 1913 together exported 94 per cent. of the world's exported surplus. Siam and Indo-China, therefore, are the only serious competitors with India in the export of rice. Japan, Italy, Spain, the United States and Java all export special kinds of rice in comparatively small quantities, and the evidence placed before the Committee confirms the conclusion arrived at from the statistics available that at present serious competition with Rangoon rice need not be expected from these quarters, though Japan and the United States have both increased their production and exports since the war.

The quantities and values of the exports of rice (including paddy, but excluding rice-meal and dust) from India, Siam and Indo-China in the last year before the war, and their group destinations, were as follows :

Rice in the Husk (Paddy)

Exporting country.	Total exports.		Exports to : British Empire.	Allied Countries.	Enemy Countries.	[1] Other Countries.
	Tons.	£	*Tons.*	*Tons.*	*Tons.*	*Tons.*
India (1913–14)	30,486	138,053	29,671	804	—	10
Siam (1913–14)	28,657	159,726	28,609	—	—	48
Indo-China (1913) . .	5,839	21,021	1,002	2,879	—	1,954
Total of paddy . . .			59,282	3,683	—	2,012

Rice Not in the Husk

	Tons.	£	*Tons.*	*Tons.*	*Tons.*	*Tons.*
India (1913–14)	2,419,863	17,599,582	1,031,163	274,671	621,919	492,110
Siam (1913–14)	1,014,249	7,142,129	809,724	31,977	82,243	90,305
Indo-China (1913) . .	1,128,781	6,607,555	498,911	485,888	6	143,962
Total of rice . . .			2,339,798	792,536	704,168	726,377
Grand total (paddy and rice).			2,399,080	796,219	704,168	728,389

[1] *The countries included in this group are shown in the detailed Tables II, IV, and V, Appendix I. Some of them have joined the Allies since these tables were compiled.*

From the above it appears that out of the total exported surplus of rice of all kinds, but excluding rice meal and rice dust, from the three chief producing countries, India contributed 53 per cent. (2,450,349 tons), which is just about equivalent to the apparent total requirements of the British Empire from these three countries (2,399,080 tons).

From the point of view of a self-supporting Empire, therefore, it would appear possible for India to become the sole source of supply of rice to the Empire. Reference to the detailed tables of exports of rice from India (Table II annexed) shows, however, that the three chief importing countries of the Empire for Indian rice are Ceylon, Straits Settlements, and the United Kingdom. Ceylon re-exports very little, but the Straits Settlements (see Table III) and the United Kingdom (see Table XIV) re-export

large quantities of rice to foreign countries. The actual consumption of rice within the Empire is therefore less than the apparent consumption shown in the tabular statement on the previous page, and is probably below the total Indian export of rice. It is clear, therefore, that India for the present, at all events, cannot restrict her market for rice to the Empire alone.

For convenience of comparison with the trade of India, statistics of the rice trade of Siam and Indo-China are given in Tables IV and V annexed. It will be seen that Siam exports chiefly whole and broken white rice, and that her most important customers are Singapore, Hong Kong, and the United Kingdom. In the case of Indo-China also the exports are chiefly in the form of whole and broken white rice, and the chief destinations of export are Hong Kong, Singapore, France, the Philippines, and Japan. The Netherlands Indies was a large purchaser in 1913, probably because Indo-China in that year had an unusually large exportable surplus.

IV. Rice Trade of India with the Empire

In Table VI annexed is given a statement of the imports of rice into all the countries of the Empire, so far as figures can be obtained. The imports from India are also shown as far as possible. It will be seen that India's position as a source of supply is already satisfactory, but that there is room for additional imports from India in the cases of the United Kingdom and the Straits Settlements, and possibly also Ceylon. India's position as a direct source of supply of rice in these three countries is indicated in the following summary :

	Total imports of rice per annum.	Imports from India per annum.	Percentage of Imports from India per annum.
	Average of years 1911–14. *Tons.*	Average of years 1911–14. *Tons.*	Average of years. 1911–14.
United Kingdom .	244,062	153,215	62
Ceylon . . .	343,173	304,655	88[1]
Straits Settlements .	758,260	328,645	43

[1] *In* 1914 *the imports into Ceylon from India were below the average, viz.* 79 *per cent. In* 1915 *they decreased to* 78 *per cent.*

In these cases Siam is India's chief competitor, although Indo-China also supplies considerable quantities of rice to the Straits Settlements. Hong Kong is also a large importer of rice from Siam and Indo-China (see Tables IV and V), but statistics for that Colony are not available. The exports of Siam rice to these British Territories, and especially to the United Kingdom, are no doubt in part due to the operations of British firms in Siam. The explanation of the large share taken in the rice trade of the Straits Settlements and Hong Kong by Siam and Indo-China given to the Committee by the Rangoon rice-shipping firms is as follows :

"The geographical position of Siam and Indo-China, and to some extent the better shipping facilities and relatively cheaper costs, are the main reasons for the predominant positions taken by Siam and Indo-China in the Far Eastern trade. In Siam the rice mills are all owned by Chinese or natives with Eastern connections. The bulk of the rice crop is known as 'garden' rice, the remainder as 'field' rice. The better qualities of 'garden' rice were shipped to Europe by British and German firms, who bought it from the native millers.

"Similar conditions obtain in Indo-China, but the grain being of an inferior type is normally purchaseable at a relatively low figure, and is quite suitable for the feeding of coolies and the poorer classes of natives in the Far East. The Eastern rice consumer is notoriously conservative. Accustomed to a certain quality of rice he will have that, if obtainable, and no other.

"As regards shipping facilities, large fleets of Chinese and Japanese-owned steamers ply regularly between Siam and Saigon to Singapore and Hong Kong. India is dependent, to all intents and purposes, on one or two lines of steamers which are British-owned, and probably charge proportionally higher freights. Opportunities for shipment are fewer, but these would, no doubt, have been increased had there been an urgent demand for them."

The question of improving shipping facilities between Rangoon and Singapore in order to take advantage of the latter port as a distributing centre for rice to the Far East might well receive attention from the Government of India.

V. Rice Trade of India with the United Kingdom and the Continent

Table VII shows the exports of rice from India to the chief European countries and to Egypt in each of the years 1900–1 to 1914–15 as given in the Indian Trade Returns. Up to and including 1902–3 these returns are incomplete, because the exports credited to Egypt probably included shipments "to await orders" at Port Said, but they show a large increase on the whole to Continental countries, whilst exports to the United Kingdom remained almost stationary. Figures supplied to the Committee by the rice-shipping firms in Rangoon show that the tendency of the trade has not been quite so disadvantageous to the United Kingdom as appears from the Indian Trade Returns, but even these figures show a remarkable increase in exports of Indian rice to the Continent, whilst exports to the United Kingdom slightly decreased.

These figures are as follows:

Exports of Rice from India to the United Kingdom and Continent.

	From Burma. *Tons.*	From Bengal. *Tons.*	Total from India. *Tons.*
United Kingdom—			
1900	101,054	50,977	152,031
1913	117,848	10,955	128,803
Germany—			
1900	197,562	14,367	211,929
1913	320,919	18,503	339,422
Holland—			
1900	103,169	—	103,169
1913	255,264	17,643	272,907
Austria-Hungary—			
1900	115,697	—	115,697
1913	178,937	2,697	181,634

	1900	1913
Total to United Kingdom	152,031	128,803
Total to 3 Continental countries	430,795	793,963

These figures are also not quite complete becauce they include only British imports of Indian rice which appear in the London and Liverpool bills of entry. For comparison with them it is not possible to quote official figures prior to 1902, as that was the first year in which the British Trade Returns gave separate figures for rice, rice flour and rice meal. The official figures for 1902 were abnormally low, and 1903 is the first year for which normal figures can be quoted. The imports of rice in that year amounted to 231,007 tons, of which 169,216 tons came from India. Between 1903 and 1913 the largest imports were received in 1910, viz. 301,156 tons, of which 170,274 tons came from India; and the lowest in 1913, when 214,885 tons were received, of which 126,442 tons came from India.

Consideration of all these figures leaves no doubt that the exports of Indian rice to the Continent, and especially to Holland and Germany, have increased far more rapidly than to the United Kingdom, and that the latter has come to depend more and more on rice cleaned and polished in Continental mills.

The Committee have carefully investigated the reasons for this change in trade, and the information obtained may best be given in the form of an analysis of the conditions obtaining in each of the chief rice-importing countries.

VI. Imports, Exports and Home Consumption of Rice in European Countries and the United States

Germany.—Figures for the rice trade of Germany for the period 1910 to 1913 are shown in Table VIII. The trade was as follows for 1913:

Imports	477,589 *metric tons.*
Exports	184,340 „ „
Retained for consumption	293,249 „ „

The principal exports were to:

	Metric tons.		*Metric tons.*
Cuba	43,736	Dominican Republic	11,496
Russia	16,128	Portugal	10,578
Colombia	12,073	United Kingdom	9,758

It is noticeable that the amount of rice retained by Germany for home consumption was much larger than that retained by the United Kingdom (125,557 tons in 1913), and the exports from Germany were 184,340 metric tons as against 89,328 tons from the United Kingdom.

So far as geographical position is concerned, Germany is advantageously situated for the export trade to Russia and Scandinavia, but the United Kingdom should, under equal conditions, be able to control the export trade from Europe to Germany's other chief customers in an article produced within the Empire. It is important to note that the imports of cleaned rice into Germany were increasing before the war, this change being probably a result of the growing German interest in the rice-milling trade in the East.

* * * * * *

Most of the rice imported into Germany is shipped to Hamburg, and consequently the low charges at that port give the German rice miller a further advantage over his British competitor receiving his raw material via a dear port such as Liverpool or London (see p. 17, and Appendix II).

* * * * * *

Holland.—The figures for the rice trade of Holland for the period 1911 to 1915 are given in Table IX: the trade was as follows for 1913:

Imports	415,972	*metric tons.*
Exports	234,484	„ „
Retained for consumption . .	161,488	„ „

The principal exports were to:

Germany	62,205	*metric tons.*
United Kingdom	37,447	„ „
Belgium	36,024	„ „

It will be seen that the Dutch home market for rice is larger than the British, and that the exports are much larger than those of the United Kingdom and somewhat larger than those of Germany. The export trade, however, differs materially from that of Germany and the United Kingdom in being mostly to contiguous countries. Owing to cheaper handling and quick discharge of cargoes at

Dutch ports, shipowners usually conceded one shilling per ton on cargoes of rice to these ports. Lighterage on the Scheldt was so cheap that Dutch importers gave rice shippers the option of discharging at Antwerp for a concession of 10*d.* per ton, *i.e.* lighterage from Antwerp to Amsterdam did not cost more than 10*d.* per ton. Shippers therefore naturally preferred these ports.

No duty is charged on imports of rice to Holland.

Austria-Hungary.—The figures for the rice trade of Austria-Hungary for the period 1910 to 1913 are shown in Table X : the trade was as follows for 1913 :

Imports	107,669	*metric tons.*
Exports	113	„ „
Retained for consumption	107,756	„ „

The exports are trifling, and all to contiguous countries.

The duty on white rice imported for consumption was 1*s.* 6½*d.* ; on paddy, 2*s.* 6½*d.* per cwt.

Paddy, cargo rice and cleaned rice were, however, allowed to be imported under control, for cleaning and for the manufacture of starch, at a special duty of 4½*d.* per cwt. (see Appendix III).

France.—The figures for the rice trade of France for each of the last five years are given in Table XI : the trade was as follows for 1913 :

Imports	273,205	*metric tons.*
Exports	38,631	„ „
Retained for consumption	234,574	„ „

The principal exports were to :

Senegal	13,398	*metric tons.*
Algeria	7,221	„ „
Switzerland	6,193	„ „

The home trade is large, and the export trade is chiefly to the French Colonies of Algeria and Senegal.

Indo-China practically controls the French market for rice, supplying about 79 per cent., as against about 9 per cent. from India. Exports of rice from French Indo-China to Europe go almost entirely to France, owing to the existence of an additional export duty on rice shipped from Saigon, which is rebated in the case of

shipments to France or French Colonies (see Appendix IV).

The rates of this export duty are as follows :

On paddy and cargo rice, including more than 33 per cent. of paddy .	5*s.* 11*d.* *per metric ton.*
On cargo rice, including less than 33 per cent. of paddy . .	3*s.* 4*d.* „ „
On white rice	2*s.* 6¼*d.* „ „
On dust and broken rice . .	2·85*d.* „ „

(For details of other charges levied on rice exported from Saigon to *all* destinations, see Appendix IV.)

The import duties per cwt. on rice in France are as follows : Rice in the husk, 1*s.* 2¾*d.* ; broken rice, 2*s.* 5¼*d.* ; whole rice, flour or grits, 3*s.* 3*d.*, in each case with a surtaxe d'entrepôt of 1*s.* 5½*d.* per cwt. if in transit from European countries. Rice imported into France direct from Indo-China is admitted free of duty.

Belgium.—The figures for the rice trade of Belgium are given in Table XII : the trade was as follows for 1913 :

Imports	82,793 *metric tons.*
Exports	42,540 „ „
Retained for consumption . .	40,253 „ „

The principal exports were to :

Netherlands	21,929 *metric tons.*
Germany	4,575 „ „

India is the chief direct source of supply, followed by Siam, and the trade is largely in transit, the Netherlands being the chief customer.

No import duty was charged on rice in Belgium.

United States.—The figures for the rice trade of the United States for the periods 1912–13 to 1915–16 are given in Table XIII : the trade was as follows for 1913–14 :

Imports	67,093 *tons.*
Re-exports	7,926 *tons* (excluding 8,142 *tons* of home produce).
Imported rice retained for consumption	59,167 *tons.*

The re-exports of foreign rice were chiefly to other American countries in 1913–14:

Panama	2,801 *tons.*
Nicaragua	1,016 „
Mexico	1,984 „

The trade increased considerably in 1914–15.

The United States produces about 1 per cent. of the world's output of rice and supplies the bulk of its own requirements. The home production in 1913 amounted to 319,200 tons of cleaned rice, and by 1916 had increased to 520,000 tons. This home-grown rice is of exceptionally high quality, and it is not likely that any considerable market for Indian rice could be found in the United States, unless the cultivation of the home-grown high-quality rice becomes unprofitable.

The duties per cwt. on rice imported to the United States are as follows: Cleaned rice, 4*s.* 6*d.*; uncleaned rice, 2*s.* 11*d.*; paddy, 1*s.* 9*d.*; rice flour, rice meal and broken rice, 1*s.* 2*d.*

United Kingdom.—The figures for the rice trade of the United Kingdom for the period 1911 to 1915 are given in Table XIV: the trade was as follows in 1913:

Imports	214,685 *tons.*
Re-exports	59,168 „
Retained for consumption and working	155,717 „
Exports	30,160 „
Retained for consumption	125,557 „

The principal re-exports and exports in 1913 were:

	Re-exports. *Tons.*	Exports. *Tons.*	Total. *Tons.*
Cuba	34,183	7,051	41,234
British W. Africa	3,429	10,624	14,053
British W. Indies	8,332	1,044	9,376
Canada	1,488	2,284	3,772
Brazil	1,241	1,211	2,452
United States	1,131	1,338	2,469
Portugal	1,701	834	2,535

Table XIV shows that the imports of whole and cleaned rice from India have fluctuated a good deal in

the last thirteen years (1903–15), but on the whole have increased slightly. Imports from Siam have increased much more rapidly in proportion than the imports from India. This is stated to be due to the failure of Bengal supplies of rice, Siam rice being now prepared by millers in such a way that it resembles Patna rice, though it is inferior in quality; but it is more likely to be due to the increasing British interest in the Siamese trade.

The principal European sources of supply of fully milled rice to the United Kingdom in the three years before the war were Holland, about 34,000 tons annually, and Germany, about 11,000 tons annually; it is noticeable that imports from Germany were declining a little before the war, having fallen to about 9,500 tons in 1912 and 1913. The imports of ground rice, rice flour and rice starch are all from European countries, with the exception of small imports of rice flour from Canada.

There is no reason to suppose that any large proportion of rice milled on the Continent is re-exported from the United Kingdom, and it may be assumed that it is practically all consumed in this country. The figures show that the actual home market for whole and broken rice in the United Kingdom before the war averaged about 136,000 tons a year. In addition, there was an annual import of about 7,000 tons of rice flour, and about 12,000 tons of rice starch, making a total home market of about 155,000 tons for rice and rice products. Of this, about 49,000 tons of rice, and 19,000 tons of flour and starch, were imported from the Continent, chiefly from Holland and Germany, making in all about 68,000 tons of rice, rice starch and flour, which was the amount of the home trade of the United Kingdom done by Continental countries.

Since the war the home trade in rice has increased largely. The quantity actually retained in the United Kingdom has increased from an average of 136,000 tons in the years 1911–13 to 292,786 tons in 1915, and 268,554 in 1916. Part of the two last-named quantities, however, is believed to have been held for the Belgium Relief Commission. These totals do not include rice milled in the United Kingdom and subsequently exported, the

figures for which were 33,193 tons average for 1911–13, and 51,358 tons in 1915, but only 24,892 tons in 1916.

In addition to recovering the portion of the home trade held by German and Dutch rice millers before the war, the United Kingdom ought to be able to secure a proportion of the German export trade in milled rice, if British rice-millers were able to compete on even terms with the Continental millers.

VII. Comparative Cost of Handling, Milling and Transporting Rice in the United Kingdom and on the Continent

The Committee were greatly impressed by the fact that out of about 136,000 tons of whole and broken rice used in the United Kingdom before the war, no less than about 49,000 tons were imported from the Continent, and if rice flour and rice starch are included, the Continent's share in the home trade of the United Kingdom was about 68,000 tons out of 155,000 tons. The Committee therefore gave much attention to the various stages by which Burma rice reached the British consumer through British, Dutch or German hands.

There is every reason to suppose that the c.i.f. cost of rice from Burma to the United Kingdom and Dutch and German ports was about the same, and that Continental importers obtained no direct or indirect advantages over their competitors either in the country of export or in connection with shipping facilities or rates, apart from the concession of one shilling per ton on rice shipped to Dutch ports (see p. 11). From this stage onwards it was clear from all the evidence that conditions were in several respects more favourable in Holland and Germany than in this country.

(*a*) *Situation of Mills.*—Liverpool is the chief centre of the rice-milling trade in the United Kingdom. The port has excellent shipping facilities both for the import of rice from the Far East and for the export and re-export of rice to some of the more important rice-consuming countries, such as West Africa and the West Indies, and, as would be expected from this circumstance, British

exports and re-exports of rice are chiefly to these areas. Liverpool is also well situated for the supply of rice starch and rice flour for use in the textile industries in Lancashire and Yorkshire. Its chief drawback is that port charges are very high, and this is enhanced, so far as the rice-milling trade is concerned, by the bad situation of the rice mills. The latter when built were for the most part situated near the points at which rice-carrying steamers loaded and unloaded, but with the development of the port and increase in the size of steamers conditions have changed, and the loading and unloading of rice now take place away from the mills, and the grain has to be carted to and from the mills and in transit from the import to the export steamer. The cost of cartage amounts to 1*s.* per ton on rice loaded for milling and consumption, and 2*s.* per ton for rice in transit or to be milled and re-exported.

In Germany, on the contrary, most of the mills are in or near Hamburg and Bremen, and are situated on the waterside. In many cases the rice can be taken straight from the steamer into the mill or *vice versâ*, and in others it merely has to be lightered to the mill.

Hamburg and Bremen have good shipping facilities to West Africa and the West Indies, and they are exceptionally favourably situated for the export and re-export of rice to Russia. It is not surprising, therefore, that some of the best foreign customers for the German-milled rice were West Africa, West Indies, Central and South America and Russia. It is noticeable, however (compare Tables VIII and XIV), that the German export trade in rice is not only larger than that of the United Kingdom, but is much more widely distributed.

The Dutch rice mills are situated in Amsterdam, Rotterdam and Zaandam, and are believed to be all waterside mills, conveniently placed for the receipt and discharge of rice. As would be expected, the Dutch export trade in rice is largely to Germany and Belgium, for which the country has special advantages in its position and in its highly developed canal system. This special transit trade accounted for at least 40 per cent. of the exports in 1913 (see Table IX).

(*b*) *Port, Lighterage and Transport Charges.*—All the evidence taken showed that the cost of landing and exporting rice was higher in Liverpool than in Continental, and especially German, ports, and the figures for actual costs in Liverpool and Hamburg respectively were obtained from British firms operating independently in the two ports. These figures are given in detail in Appendix II, and may be summarised as follows :

Rice Re-exported without Treatment.

Liverpool.	*Hamburg.*
Charges for dues, porterage, cartage and handling, 3*s.* 5*d.* per ton.	Cost of transport from ship to ship 10*d.* to 1*s.* 8*d.* per ton.
Amsterdam.	*Rotterdam.*
Charges for discharging, sampling, etc., lighterage and loading, 3*s.* 6*d.* per ton.	Cost of transhipment, 2*s.* 8½*d.* per ton.

Rice Exported after Treatment in Mills.

Liverpool.	*Hamburg.*
Dues, porterage, cartage (2*s.* 0*d.*) and handling, 5*s.* 6*d.* per ton.	10*d.* to 1*s.* 8*d.* per ton each way where lighterage to and from mill and storage on lighters are incurred, making 1*s.* 8*d.* per ton minimum and 3*s.* 4*d.* per ton maximum charge.
Amsterdam.	
Charges for port dues, discharging cargo, receiving, etc., storage, lighterage, loading, 4*s.* 6*d.* per ton.	
Rotterdam.	
Discharging, storage, lighterage and loading, 3*s.* 5*d.* per ton.	

It must be pointed out that these charges are not strictly comparable, owing to the different customs of each port and to differences in the items included ; but it appears that, as compared with Hamburg, Liverpool is handicapped to the extent of approximately 1*s.* 9*d.* to 2*s.* 7*d.* per ton for transit trade in rice, and from 2*s.* 2*d.* to 4*s.* 8*d.* per ton if the rice is cleaned in the Liverpool mills and then exported. The charges at the Dutch ports are higher than at Hamburg, but are still appreciably lower than those at Liverpool. The charges for transit trade at Amsterdam are as high as those at Liverpool, but there is practically no sea-going transit trade in rice at Amsterdam and, as pointed out on page 11, a

rebate of 1*s.* per ton was allowed at Dutch ports on rice cargoes for quick discharge.

In a further attempt to arrive at strictly comparable figures for costs at Hamburg and Liverpool, the Committee obtained an estimate of the cost of landing and milling rice from firms at Liverpool and an independent estimate from a firm who, before the war, were interested in mills at Hamburg. The difference between the two estimates was 3*s.* 6*d.* per ton in favour of Hamburg, although the cost of milling was almost the same in the two estimates.

(*c*) *Equipment.*—It would appear that in some respects the machinery and equipment of English mills were, before the war, not quite equal to those of their competitors on the Continent, but there is no doubt that since the outbreak of war many improvements have been effected in these respects.

Cost of Milling.—It is admitted that the British mills are older and smaller than most of the German mills, and it was generally stated in evidence that labour in Germany was cheaper and more efficient than in the United Kingdom. It was to be expected therefore that the cost of milling rice would prove to be higher in British than in German mills.

In view of this it was with some surprise that the Committee ascertained, by comparison of actual figures of costs, that the cost of milling rice before the war in mills in Hamburg and Liverpool operated independently by British mills was practically the same.

(*d*) *Through Transport Rates from Continental Ports to British Towns.*—It was frequently stated in evidence that the export of rice from Germany and Holland to the United Kingdom was greatly facilitated by low through rates to British towns from German and Dutch ports. The Committee therefore made careful enquiries on this point, and have ascertained that while it is true that shipping rates from Hamburg to towns on or near the East Coast were lower than either railway or shipping rates from Liverpool to the same towns, it is not true that the rates are lower to towns at any distance inland. The following typical examples of rates may be quoted :

	From Liverpool to—		*From Hamburg to—*	
	Lots of 4 tons.	Lots of 2 tons.	Lots of 4 tons.	Lots of 2 tons.
	s. d.	*s. d.*	*s. d.*	*s. d.*
Manchester . .	6 6	7 0	18 0	20 6
York . . .	12 2	14 0	13 11	14 4
Sheffield . . .	9 2	10 9	15 9	16 7
Leeds . . .	9 2	10 8	14 6	14 9
Lincoln . . .	12 10	14 9	11 11	13 3
Birmingham . .	10 8	12 0	18 0	19 9
Leicester . . .	12 5	14 0	14 9	15 11
Nottingham . .	11 1	12 9	15 6	17 0
Derby . . .	10 3	12 7	18 3	20 6

	Rates by Sea.	*Rates by Sea.*
	s. d.	*s. d.*
London (by sea) .	10 0	7 6
Plymouth ,, .	9 1	10 0
Southampton ,, .	9 1	—
Bristol ,, .	7 10	10 0
Hull ,, .	—	7 6

The rates are per ton, and in all cases are those in force before the war.

It is clear from these figures that, except as regards East Coast towns, Liverpool is at no disadvantage as regards transport rates compared with Hamburg or Bremen, but it is certainly an unsatisfactory position that rice can be sent from Bremen or Hamburg to Lincoln or London at lower rates than from Liverpool. This state of things might be remedied by the development of rice-milling on the East Coast at such ports as Leith and Hull, where port dues are relatively low, or by the railway companies conceding special rates for British milled rice to towns on the East Coast where competition from German and Dutch milled rice is keen.

(*e*) *Trading Facilities.*—The German millers are also stated to have had certain other advantages which are less obvious than those discussed above, but were no doubt of substantial value to them. The great German trading banks are alleged to have given substantial financial assistance to at least one of the largest German rice-milling concerns, and it is now generally admitted that the financial backing afforded by such banks was of material assistance in promoting German industries. Further, it was also no doubt due to the assistance afforded by these banks that the German rice millers were able to

give long credits to their customers in the West Indies, Central America, and elsewhere, and this was a factor of considerable importance in enabling them to secure such a strong position in this trade.

Finally, it has been alleged that German firms received assistance from their Consuls abroad in collecting debts and in ascertaining the financial status of their export customers.

(*f*) *Estimate of Value of Advantages secured by Continental Mills.*—It has been shown that the British rice millers were seriously handicapped in their competition with the Continental millers before the war, not only in the world's export trade in polished rice, but even in the home market. Their most serious competitors in the export trade were the Germans, and in the home trade the Dutch and to a less extent the Germans. The causes which enabled foreign competitors to secure this position in the British home market, in respect of a commodity produced within the Empire, have been discussed and may be summarised as follows :

(1) Bad situation of mills.

(2) High charges in British ports as compared with those in German and Dutch ports.

(3) Railway rates so high as to render the British East Coast towns more accessible, as regards cost, to German and Dutch millers than to British millers.

(4) Less assistance from banks, etc., in conducting trading operations than are available to the German millers.

The last three of these adverse factors cannot be remedied by the British millers themselves, and they have strongly represented to the Committee that until they have been remedied some assistance should be given to the industry, especially as they anticipate still greater difficulties after the war in (1) increased milling costs ; (2) increased import and shipping charges ; (3) increased taxation, and (4) special efforts on the part of German and Dutch millers to recover the trade lost during the war.

* * * * * *

Industrial Uses of Rice

Rice is chiefly employed the world over as food, but a certain amount is used for industrial purposes, either merely ground for use as a size in the textile industry or converted into starch. Considerable quantities are also used in brewing, especially in Germany and Austria.

Starch Manufacture

With regard to the use of rice for the manufacture of starch, it appears that for this purpose Burma rice is preferred to other kinds which come on this market, because it is softer and easier to treat. Broken rice being cheaper than whole rice, and equally good for starch manufacture, is generally preferred, and is usually imported direct from Burma, though some broken rice was imported for this purpose from Germany. Rice starch is principally used for the manufacture of laundry starch, and for this purpose it is not easily replaced, though maize starch is said to have been substituted for it to some extent in recent years.

Before the war there was considerable competition in the British market from Continental rice starch manufacturers, who, it is stated, were able to deliver starch in this country at prices below those at which British makers could offer their produce.

The figures of imports of rice starch from the Continent since 1909 have been as follows :

Imports of Starch to the United Kingdom.

	Tons.		Tons.
1909	11,175	1913	11,105
1910	12,316	1914	8,815
1911	13,541	1915	3,329
1912	11,267	1916	2,463

Up to 1913 the average import was therefore nearly 12,000 tons, which, allowing for loss in manufacture, is equivalent to about 16,000 tons of broken rice.

Rice as a Brewing Material

The evidence placed before the Committee by rice shippers and brokers indicated that in Germany and Austria a good deal of rice was used in brewing light beers of the type now generally consumed on the Continent, but that such use was unusual in this country.

No certain information could be obtained as to the quantity of rice used in brewing in the United Kingdom, though one estimate placed the amount at 2,500 tons per annum. It appears clear that British brewers as a rule do not like it, as it is believed to yield a dry " characterless " beer, and to cause rapid deterioration of the yeast. Brewers who regularly use rice as a brewing material, however, say that both these objections are groundless. Of the commercial rices, Patna is preferred for brewing as it contains least oil, but any good-quality rice can be used successfully provided that it is delivered free from dirt, husk and germ, and in " grits " of uniform size. Rice grits can only be utilised in breweries which possess converting plant for gelatinising the rice ; where such equipment is not available the rice must be used in the form of flakes.

The factor which will chiefly determine the possibility of extending the use of rice for brewing and distilling in the United Kingdom is its price in relation to that of other starchy and saccharine materials suitable for brewing, such as maize. Taking the range of prices prevailing over the last twenty years, maize has generally been cheaper than rice. The popularisation of rice as a brewing material is a subject to which those interested in the rice trade might well give attention.

By-products of Rice-milling

The first operation in the preparation of rice for the market is the removal of the husks from the paddy, leaving " cargo rice," which usually contains about 20 per cent. of unhusked grains. The husks thus removed are of no food value, and in Burma they are as a rule

utilised as fuel in the mills. In Holland and Germany they are used to some extent as a packing material. Many suggestions have been made and experiments carried out with a view to finding better methods of utilising them, but so far without success.

In the subsequent operations the remaining husks are removed and the inner skin of the rice rubbed off with a certain amount of the outer part of the rice grain itself, yielding " white rice," and a by-product known as rice-meal or rice-bran. The latter is obtained in large quantities in the rice mills, and is used as a feeding stuff. Finally, in the polishing of rice a further quantity of the outer layer of the rice-grain is removed, forming " polisher meal."

Large quantities of rice-meal are exported, Germany and the United Kingdom being the chief buyers in Europe ; a good deal also goes to the Straits Settlements and Hong Kong. The exports of rice-meal from the three chief exporting countries in 1913 were as follows :

	Quantity.	Value.
India (1913–14) . . .	221,994 *tons*	£478,780
Siam (1913–14) . . .	131,073 ,,	£342,605
Indo-China (1913) . . .	152,183 *metric tons*	£426,112

The chief destinations of the exports in the last years before the war were as follows :

Exported to	From India, 1913–14. Quantity [1] *Tons.*	From Siam, 1913–14. Quantity *Tons.*	From Indo-China, 1913. Quantity 1913. *Metric tons.*
United Kingdom . . .	121,383	2,512	43,111
Straits Settlements . . .	44,443	53,871	361
Germany	44,978	13,198	50,416
Sweden	3,145	—	—
Ceylon	3,291	—	—
Hong Kong	1,095	61,134	57,557
Mauritius	1,670	—	—
Other Countries . . .	1,989	358	738
Total	221,994	131,073	152,183

[1] *Given under the heading " bran and pollards " ; it is probably mainly rice meal.*

It will be seen that the United Kingdom took the bulk of the Indian exports. During the war the course of

trade has altered somewhat, and the principal destinations in 1915 and 1916 were as follows :

Exported to	India. Quantity. 1915–16. *Tons.*	1916–17. *Tons.*	Siam. Quantity.[1] 1915–16. *Tons.*	Indo-China. Quantity. 1915. *Metric tons.*
United Kingdom	170,169	112,277	—	35,045
Straits Settlements	33,505	30,937	72,011	5,857
Ceylon	3,351			
Hong Kong	1,491		35,702	80,554
Aden	1,190	7,421		
Mauritius	1,184	Denmark	4,217	
Australia	1,902	China	232	
Other Countries	436	Other Countries		1,108
Total	213,228	150,635	112,162	122,564

[1] " *White rice meal,*" 94,626 *tons, and* " *Cargo rice meal,*" 17,537 *tons.*

Practically all the rice-meal imported into Europe is consumed in the importing countries, very little being re-exported.

Rice-meal is used in the United Kingdom solely as a feeding stuff, chiefly in the form of compound cakes or compound feeds, though a little is used as meal for feeding pigs. In Germany the meal seems to be chiefly used for feeding along with exhausted beet slices or ground barley.

It appears that in recent years there has been a steady increase in the use of rice-meal in this country, and it is estimated that from 90 to 95 per cent. of the imports are used in the form of compound cakes.

There is considerable difference of opinion as to the relative qualities of Burma, Siam and Indo-China meals, but it appears to be generally agreed that the Burma meal is the most uniform in quality. Siam meal is sometimes of better colour, and for that reason is preferred for direct feeding, but on the other hand it is stated by one firm that Siam meal frequently contains excess of " sand " (really silica due to the presence of an excess of rice husks). Some years ago adulteration of this kind is alleged to have taken place in rice-meal from Burma ; but, owing to the introduction of the " sand clause " in the British form of contract by which buyers are entitled to allowances if more than the standard amount (2·5 per cent.) of sand is present, the practice has largely disappeared so far as

Burma rice-meal is concerned, though some firms have had recent experience of meal so adulterated.

The importers regard it as of great importance that this practice should be stopped, as British traders in feeding stuffs are liable to prosecution if they sell material containing more than a certain percentage of " sand."

It is alleged that in recent years Germany had become a much more serious competitor with the United Kingdom for rice-meal, and the supplies to this country were hardly enough to keep pace with the increasing demand. So far as can be ascertained, Germany had no advantage over the United Kingdom in competing for rice-meal, with the exception that in Germany rice-meal appears to be sold on a guarantee of 24 per cent. oil and albuminoids and without reference to " sand." It is stated that, owing to this practice, it is possible to adulterate meal for export to Germany with rice husks and still meet this guarantee. The British contract, on the contrary, ensures the absence of an excess of rice husks by the so-called " sand clause."

VIII. General Conclusions

In dealing with the rice trade it is important to remember that the grain is principally used for food, and that the process of preparing it is a comparatively simple one, viz. the removal of the husk yielding " cargo rice," the cleaning away of the inner skin furnishing " white rice," and lastly the polishing, glazing, etc., of the grain yielding the polished rice of European commerce. The whole of this work can be, and is in fact, done in Burma, and large quantities of polished rice are exported from Rangoon. It is found in practice, however, that rice polished in the East loses its appearance to a certain extent during the long voyage to Europe, and it has become customary to repolish it and glaze it in Europe, and it is with this final preparation of the grain for European consumption that the European rice mills are chiefly occupied, though they also treat a good deal of cargo rice, *i.e.* rice from which the husk has been largely removed.

The final preparation done in Europe merely improves

the appearance of the grain and actually diminishes its nutritive value. Colouring matter and glazing materials such as French chalk, which though inert are not desirable additions, are added in the process. The polishing of rice was investigated some years ago for the Local Government Board by Dr. J. H. Hamill, who found that Continental polished rice might contain up to 2 per cent. of added mineral matter of the nature of French chalk. After a thorough investigation of the whole subject he suggested that the amount of mineral matter admissible in fully polished rice should be fixed at 0·5 per cent., which British millers find sufficient to produce the appearance desired.

It seems desirable that if a maximum amount of 0·5 per cent. of added mineral matter is accepted as a legal standard for polished rice in this country, the importation of polished rice containing more than that amount should not be permitted.

It is clear from the statistics of German trade in rice that even in Germany, with a protected home market, imports of cleaned rice (described as polished rice in the German Trade Returns) from the East were increasing before the war.

It is a matter of considerable importance to ascertain how the rice-milling industry in India is developing, and the Committee therefore suggest that, in future, exports of rice from India should be recorded in the Indian Trade Returns under the following headings : [1]

1. Cargo rice.
2. Broken cargo rice.
3. Cleaned rice.
4. Broken cleaned rice.
5. Other sorts.
6. Paddy.
7. Rice flour and ground rice.
8. Rice meal.

[1] NOTE.—This report was submitted in May 1918 to the India Office, by whom copies were transmitted to the Government of India. In November 1918 the Director of Statistics notified the Collectors of Customs in India that from April 1st, 1919, Rice is to be classified in the Sea-borne Trade Returns of British India as follows :

I. Paddy (rice in the husk). II. Rice not in the husk. (1) Cleaned rice, (2) Broken cleaned rice, (3) Other sorts. III. Rice flour and ground rice. IV. Rice meal.

Similar information is also needed regarding the trade in rice in the United Kingdom, and it is therefore suggested that the imports, re-exports and exports should be shown under the following headings in the Annual Statement of Trade of the United Kingdom :

1. Cargo rice.
2. Eastern cleaned rice.
3. Other cleaned rice.
4. Broken rice.
5. Other sorts, including paddy.
6. Rice meal.
7. Rice flour and ground rice.
8. Rice starch.

Apart from its direct use as human food, rice is also used (in the form of " rice cones ") in making bread, and as a poultry food. Its industrial uses include brewing, the manufacture of vinegar, the sizing of textiles and the manufacture of laundry starch.

According to one estimate supplied to the Committee, the utilisation of the British imports of rice for consumption is approximately as follows: Whole rice, 66,000 tons ; ground rice or rice flour, 45,000 tons ; rice flakes, 4,000 tons ; poultry food, 3,000 tons ; brewing, 2,500 tons ; manufacture of vinegar, 1,000 tons ; preparation of starch, 40,000 tons. The bulk of the rice imported is therefore used in the form of whole or ground rice as food.

On the whole, rice is in a different position from raw materials such as oil-seeds, which form the basis of a wide range of industries, some of them very complex. Rice can, in fact, be placed on the European markets from India as a finished product ready for consumption.

In view of this it seems clear that such control of this trade as may be considered desirable can best be secured by action in India. The evidence placed before the Committee shows that although enemy firms had a considerable share of the rice trade in Burma before the war, they did not secure effective control, nor did they, as far as can be ascertained, receive special assistance to this end from their Governments. It was strongly urged on the Committee that the rice trade of India should be definitely secured to British and Indian interests. The Committee do not think it feasible to accept this suggestion

in its entirety, but they are of opinion that steps should be taken to render impossible penetration or control of the trade by firms or individuals not members of the British Empire.

They further recommend that as long as the war lasts, and until a complete policy based on the conclusions of the Paris Conference has been formulated and put into force, special care should be taken to conserve the interests of the Empire in this as well as in other trades and industries in India. Employers have undertaken that those who have answered their country's call shall not suffer thereby, and it is strongly urged that Governments should be guided by the same principle, and should take steps to ensure that mercantile and industrial organisations, which have been weakened through enlistment and other war causes, shall not find themselves permanently injured in any degree by the intrusion of new competitors or the increased influence of old ones.

The suggestion has been made that the London Rice Brokers' Association form of contract should be used for all sales of Indian rice and rice products, including rice-meal to European and American countries; but this is a matter which may be left to the merchants themselves.

It has been shown that Continental countries are important markets for Indian rice for their own consumption, and most of the evidence placed before the Committee was strongly against any proposals for limiting the market by any form of restriction or prohibition of export, since such action would merely lead to the countries affected by such restrictions meeting their requirements elsewhere, to the ultimate disadvantage of the Indian producers.

In this connection the fact that India has not a monopoly of rice production is of first-rate importance.

* * * * *

It was recognised that, although increased consumption of Indian rice within the Empire would render India less dependent on foreign countries than was the case before the war, there is no certain indication at present that British countries can use much more Indian rice. Since the war the United Kingdom has taken more rice, but this is apparently largely due to temporary causes,

such as failure of supplies of other foodstuffs, and this increase in demand cannot be depended upon.

A material and permanent increase in the use of rice in the United Kingdom is unlikely, unless steps are taken to popularise it for use as food, and particularly as a vegetable course, by improved methods of cooking. There are considerable possibilities of development in the use of rice for brewing and distilling. These are matters to which those interested in the rice trade might well give attention.

The witnesses examined were unanimously of opinion that steps should be taken to render it impossible for the Continent to participate in the rice trade in the British home market and in the re-export and export trade in Indian rice from Europe. It is most unsatisfactory that the Continent, which obtained its supplies of rice from India largely through British shipping firms and brokers, should have been able to compete with such success in the home market as to supply about 40 per cent. of the British consumption of polished rice, rice starch, etc.

It has been shown already (pp. 16–20) that owing to convenient location of rice mills, low port charges, cheap lighterage and canal and river transport, the import, re-export and export of rice can be effected more cheaply in Continental ports than in Liverpool, where the chief British rice mills are situated. This forces the Committee to the conclusion that the unsuitable location of the British rice mills is a fundamental obstacle to their successful operation. Further, it is believed that the German rice millers, with a protected home market, penalised their home consumers for the sake of encouraging their export trade, and that through the ready assistance of their trading banks they were enabled to give long credits to their customers abroad and, in addition, received special assistance from their Consuls. The Committee are satisfied that these various factors give the Continental rice millers a substantial advantage over their British competitors, and account for their success in the British home market and in the export and re-export trade.

The Committee cannot but recognise the justice of the contention that unless British rice millers are placed in a better position by receiving some assistance to counter-

balance the advantages enjoyed by their Continental competitors, the trade they have in part now recovered will be lost after the war, and the developments in rice-milling now in prospect in this country will not take place. As already stated, the British rice millers estimate their economic disadvantage, after the war, owing to the factors mentioned above and to new ones which will then become operative, at 10¼*d.* per cwt. of rice milled.

* * * * *

The Committee are of opinion that a more certain and a more complete remedy lies in depriving competing countries of their advantages by the removal of the disabilities which handicap the trade in this country. These disabilities include bad situation of the chief British rice mills, whereby heavy cartage charges are incurred, but the position would be materially improved if charges at the ports at which rice is chiefly handled were reduced to the same level as those in Continental ports, and if steps were taken to cheapen transport in the United Kingdom so that it would no longer be possible for rice to be transported from German and Dutch ports to towns on or near the British East Coast at rates lower than are available from a rice-milling centre in the United Kingdom to the same towns.

In determining port charges and railway rates the fundamental principle should be to charge only what the goods concerned will bear, due regard being paid to special competition in the industry concerned. The most striking difference between British and German methods in relation to trade appears to be that, in Germany, banks, port authorities, railways and steamship companies are at one with manufacturers and merchants in encouraging trade and industry as a whole, whilst in this country these various organisations are often indifferent to each other's interests.

While it is desirable that any re-export trade in Indian rice that may be necessary should be carried on *viâ* British rather than foreign countries, the Committee recognise that the natural tendency is for this trade to be done direct from India, and there have been considerable developments in this direction during the war. The

Committee suggest that it is desirable that this direct trade should be encouraged as far as possible by the provision of further British and Indian shipping facilities. Arising out of this suggestion, it may be pointed out that India should be able to secure a larger share of the export trade in rice to Singapore and Hong Kong. These important distributing centres, and especially Hong Kong, now take their supplies largely from Siam and Indo-China. This is due in part to the cheap shipping facilities from Bangkok and Saigon to Singapore and Hong Kong, and it would appear to be worth enquiry by the Government of India whether, with a view to encouraging export of rice from Rangoon to Singapore, better facilities should not be provided between these two ports.

The Committee are also of opinion that in order to encourage the shipments of rice in British or Indian vessels, and as part of a general scheme for the development of British and Indian shipping, there should be discrimination in favour of such shipping at all ports in the Empire according to the following rules :

(1) That a lower scale of tonnage dues and port charges should apply in all ports in the Empire to ships owned within the Empire.

(2) That privileges in the ports of the Empire should be accorded to shipping owned in Allied or Neutral countries, equivalent only to the corresponding privileges accorded to shipping owned within the Empire, in the ports of Allied or Neutral countries.

(3) That shipping owned in enemy countries should pay, in ports in the Empire, dues at least twice as large as those paid by any other shipping.

Summary of Suggestions for Action

The Committee desire to make the following suggestions for action in India :

(1) *Statistics of the Rice Trade.*—(*a*) It should be made more widely known that a return of Indian trade for the calendar year is published, in addition to the detailed trade returns for the financial year, March 31 to April 1 (see p. 4).

(*b*) In order that more complete information should in

future be available as to the progress of the rice-milling industry in India, exports of rice and rice products should be recorded under a greater number of headings, designed chiefly to distinguish between exports of partly milled and fully milled rice (see p. 26).

(2) *Control of Foreign Trading.*—That steps should be taken (*a*) to prevent the possibility of penetration and control of the rice trade by firms or individuals not members of the British Empire (see p. 28).

(*b*) To protect the interests of British (including Indian) organisations which are handicapped through enlistment and other war causes against permanent injury through the encroachment of new competitors and the increased influence of existing ones (see p. 28).

(*c*) To encourage as far as possible the development of British and Indian shipping by discrimination in favour of such shipping as regards dues and charges in ports within the Empire (see p. 31); and to enquire into the desirability of providing further shipping facilities from Rangoon with a view to the development of rice exports to the Far East.

(3) *Form of Contract.*—It is desirable that sales of rice and rice products, including rice meal, to Europe and America, should be made in accordance with the London Rice Brokers' Association form of contract.

The Committee also desire to place on record the following conclusions which they have arrived at regarding the rice trade in the United Kingdom.

(4) *Statistics of the Rice Trade.*—It would be to the advantage of those interested in this trade if in the Annual Statement of the trade of the United Kingdom figures for the trade in rice were recorded under a greater number of headings (see p. 27).

(5) *Condition of Rice-milling Trade in the United Kingdom.*—This trade is severely handicapped in competing with the Continental rice mills, owing chiefly to the unfavourable situation of the British rice mills, to the heavy charges at the port of Liverpool where most of these mills are situated, and, to a less extent, by high railway rates.

* * * * *

The Committee believe a more certain and a more complete remedy would be found in the adjustment of port charges and railway rates as suggested in paragraphs (6) and (7). A well-equipped mill, conveniently situated at a cheap port, would possess several important advantages.

Any restriction of the amount of mineral matter admissible in fully polished rice, prepared in the United Kingdom, should also be applicable to rice imported from the Continent (see p. 26).

(6) *Port Charges.*—It is desirable, in the interests both of the rice-milling trade and of the rice transit and export trade of the United Kingdom, that charges in British ports should be reduced to at least the same level as those prevailing in the cheapest Continental ports.

(7) *Railway Rates.*—It is desirable that attention should be given to railway rates in the United Kingdom with a view to enabling British rice millers to compete on favourable terms with rice sent from the Continent at low through rates to towns on or near the East Coast of the United Kingdom.

With regard to these suggestions regarding port charges and railway rates, the Committee are of opinion that in fixing such charges and rates, port, shipping and railway authorities should recognise the principle that the charges and rates should be such as the goods concerned can carry without handicapping British trade and industry in competition with the Continent.

The Committee desire to express their appreciation of the great assistance they have received from Dr. T. A. Henry, who has proved such an able and efficient secretary in spite of the many other calls upon him. They also wish to acknowledge the services rendered by Dr. Henry and the Staff of the Imperial Institute in the preparation of the numerous statistical tables attached to the Report.

MARSHALL REID (*Chairman*).
C. H. ARMSTRONG.
A. E. HUMPHRIES.
THOMAS A. HENRY (*Secretary*).

IMPERIAL INSTITUTE, S.W.7.
December 12th, 1917.

APPENDICES TO THE REPORT ON THE TRADE IN INDIAN RICE

LIST OF TABLES

APPENDIX I

STATISTICS OF TRADE

NOTE

The trade returns of Continental countries in some cases give statistics of imports and exports under two heads, GENERAL COMMERCE and SPECIAL COMMERCE. The former as a rule includes total imports and total exports, but in the case of Germany direct transit trade is excluded.

Special commerce as a rule includes (1) imports for consumption or manufacture or which have become nationalised by the payment of duty, and (2) exports of (*a*) domestic produce, (*b*) foreign produce nationalised by payment of duty, or (*c*) foreign produce which has been

subjected to some process of improvement or manufacture in the importing country.

In Tables VIII to XII, dealing with the trade of Continental countries, footnotes are added stating whether the figures relate to " General " or " Special " Commerce.

TABLE I

World's Exported Surplus of Rice : Chief Countries which Produce and Export Rice, 1913

	Tons.	Tons.
India : Rice	2,548,363	2,578,921
Paddy	30,558	
British Guiana		7,704
[1]Egypt		23,546
[1]Italy		66,386
[1]Spain		19,987
Indo-China		1,134,620
[1]Japan		28,887[2]
Siam		1,042,906
[1]Persia		64,126
Mesopotamia (average of recent years)		6,000[3]
Madagascar		10,500
[1]United States		12,521
[1]Netherlands East Indies		66,755
Total		5,062,859

[1] *These figures are taken from the " Annuaire International de Statistique Agricole," published by the International Institute of Agriculture, Rome.*

[2] *In* 1915 *exports rose to* 93,000 *tons, and in* 1916 *to* 97,000 *tons, the increase being chiefly due to exports of cleaned rice to the United Kingdom, United States, Hawaii, Canada and Asiatic Russia.*

[3] *The exports vary greatly, depending on the crop and the transport available.*

TABLE II

Indian Trade in Rice : (a) Exports

(1) *Rice in Husk (Paddy)*

	1910–11.	1911–12.	1912–13.	1913–14.	1914–15.
Total Exports	£141,090	242,600	225,165	138,035	99,518
	tons 34,694	55,263	46,944	30,486	23,588
To British Countries.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
United Kingdom	12	5	75	—	—
Ceylon	34,537	33,901	32,458	29,666	23,482
Straits Settlements (including Labuan)	20	20,843	13,107	3	1
Other British Possessions	3	1	9	2	66
Total	34,572	54,750	45,649	29,671	23,549
To Allied Countries.					
Russia	—	500	1,098	300	—
Japan	—	—	100	504	—
Total	—	500	1,198	804	—
To Other Foreign Countries.	121	11	94	10	37

(2) *Exports of Rice not in Husk*

	1910–11.	1911–12.	1912–13.	1913–14.	1914–15.
Total Exports	£15,346,685	19,124,081	21,478,765	17,599,582	11,339,322
	tons 2,365,142	2,568,608	2,716,220	2,419,863	1,538,290
To British Countries.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
United Kingdom	175,698	137,015	175,976	161,409	211,793
Malta . .	—	—	—	—	7,010
Aden . . .	16,202	23,234	19,517	18,113	11,132
Bahrein Is. .	17,976	18,707	17,023	20,343	8,288
Maldive Is. .	786	703	841	588	418
Ceylon . .	327,272	347,077	348,960	335,058	278,880
Straits Settlements	291,716	365,699	396,272	284,589	232,846
Federated Malay States . .	404	967	2,531	1,364	799
Hong Kong .	14,599	9,771	19,469	15,902	4,227
Cape Province .	3,581	5,722	6,511	4,583	4,001
Natal . .	16,503	19,008	21,823	19,168	20,368
Mauritius . .	57,326	67,615	57,525	51,344	69,069
Zanzibar . .	18,863	21,580	13,279	19,106	12,655
East Africa Prot.	6,858	8,814	7,448	7,298	8,130
Seychelles . .	2,335	2,398	2,151	2,253	1,767
Somaliland . .	3,112	4,834	3,865	2,082	1,614
Canada . .	15	6,020	826	8,150	5,499
British West Indies	8,764	12,014	11,483	4,512	6,196
Australia . .	20,900	24,214	33,496	20,713	27,128
Fiji . . .	541	3,378	1,143	403	202
Egypt . .	72,270	29,769	35,866	53,884	42,310
Other Countries .	521	127	151	301	40
Total . .	1,056,242	1,108,666	1,176,156	1,031,163	954,372
To Allied Countries.					
Russia . .	—	9,645	3,937	6,427	4,262
Belgium . .	43,263	38,963	64,226	21,618	5,510
France . .	11,111	10,132	17,244	23,679	15,824
Portugal . .	—	—	—	—	7,830
Italy . . .	6	110	112	900	942
Roumania . .	21,297	14,249	20,368	32,076	5,360
Japan . .	61,617	140,922	241,232	160,646	8,104
Portuguese W. Africa	412	886	—	1,748	464
French West Africa	—	4	517	—	—
Portuguese E. Africa	8,092	10,935	13,911	9,853	5,862
Madagascar .	15	32	341	148	—
Réunion . .	130	18,804	8,517	2,927	23
Italian East Africa (Somaliland and Eritrea) . .	1,810	1,713	2,843	1,945	1,042
French Somaliland	57	57	76	159	206
United States of America . .	262	186	1,162	399	922
French West Indies	1,533	3,533	4,405	2,998	2,604
Cuba . . .	1,127	4,599	1,574	9,148	32,355
Philippines . .	9,000	19,015	26,068	—	2,852
Total . .	159,732	273,805	406,433	274,671	94,162

To Enemy Countries.	1910–11. Tons.	1911–12. Tons.	1912–13. Tons.	1913–14. Tons.	1914–15. Tons.
Germany . .	328,475	330,954	414,250	315,895	115,020
Austria-Hungary	169,652	161,554	177,449	211,442	98,724
Turkey, European	575	353	—	—	—
Turkey, Asiatic .	32,689	79,156	79,565	81,057	42,625
German East Africa	10,429	24,809	13,782	13,525	4,272
Total . .	541,820	596,826	685,046	621,919	260,641
To Other Countries.[1]					
Sweden . .	17,054	3,835	17,124	25,098	12,254
Norway . .	—	900	1,000	1,410	2,265
Denmark . .	4,970	—	—	—	5,900
Holland . .	226,050	228,467	206,281	333,732	66,016
Greece . .	—	—	—	—	7,437
Arabia: Maskat .	24,557	20,269	10,402	30,984	16,805
Other States	815	1,754	3,085	10,406	8,319
Persia . .	5,731	5,491	8,525	12,845	6,305
Sumatra . .	13,000	9,467	5,351	5,645	16,767
Java . . .	258,109	277,839	159,928	39,412	68,925
Celebes . .	4,112	5,638	7,346	5,641	5,845
China . .	23,659	20,424	12,630	4,592	2,158
Brazil . .	5,755	—	—	—	—
Argentina . .	14,759	13,328	10,951	17,456	6,096
Chile . . .	8,682	1,579	5,553	4,375	3,761
Countries not specified . .	95	320	409	514	262
Total . .	607,348	589,311	448,585	492,110	229,115

Note.—*Figures taken from the Annual Statement of the Sea-borne Trade of British India.*

[1] *In this and succeeding tables this heading includes some countries which have joined the Allies since the tables were compiled.*

(*b*) *Imports*

(1) *Imports of Rice (including Paddy)*

Total . . .	*tons* 6,266	353	337	11,389	16,408
Value . . .	£52,408	2,503	3,533	119,291	155,329
From British Countries.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons*
Straits Settlements	6,174	57	132	11,196	15,986
Ceylon . .	50	33	39	16	267
Other Countries .	26	39	34	59	42
Total . .	6,250	129	205	11,271	16,295
From Foreign Countries.					
Persian Gulf .	—	92	—	2	60
Persia . .	—	100	—	—	—
China . .	—	—	100	79	2
Japan . .	10	13	13	15	23
Other Countries .	5	18	18	21	29
Total . .	15	223	131	117	114

(c) *Summary of Indian Trade in Rice*

	1910–11. *Tons.*	1911–12. *Tons.*	1912–13. *Tons.*	1913–14. *Tons.*	1914–15. *Tons.*
Exports: Paddy .	34,695	55,263	46,944	30,486	23,588
Rice .	2,365,142	2,568,608	2,716,220	2,419,863	1,538,290
Total . .	2,399,837	2,623,871	2,763,164	2,450,349	1,561,878
Imports: Paddy .	24	218	37	97	15
Rice .	6,242	135	300	11,292	16,393
Total . .	6,266	353	337	11,389	16,408
Excess of Exports over Imports .	2,393,571	2,623,518	2,762,827	2,438,960	1,545,470

TABLE III

Trade in Rice in Straits Settlements: (a) Imports

(1) *Paddy*

	1911.	1912.	1913.	1914.	1915.
Total	£286,188	400,253	324,237	503,843	530,026
Total . . .	*tons* 59,238	60,530	62,113	104,914	109,559
FROM BRITISH COUNTRIES:	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
India . . .	4,663	25,740	1,441	2	—
Malay States . .	39,205	24,477	26,550	32,784	38,439
Total . . .	43,868	50,217	27,991	32,786	38,439
FROM ALLIED COUNTRIES:					
French Indo-China .	83	43	648	14,131	9,542
FROM OTHER COUNTRIES:					
Borneo . . .	125	169	708	1,248	26
Sumatra . . .	1,309	1,927	3,715	14,694	3,515
Siam . . .	13,773	7,784	28,593	41,579	57,908
Countries not specified	80	390	458	476	129
Total . . .	15,287	10,270	33,474	57,997	61,578

(2) *Rice*

Total . . .	£5,454,357	7,106,733	6,573,704	6,140,004	6,192,216
Total . . .	*tons* 595,156	670,972	733,501	746,615	759,177
FROM BRITISH COUNTRIES:	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
India . . .	316,408	421,326	303,427	240,692	174,479
Hong Kong . .	7,081	1,661	902	965	1,655
Malay Peninsula. .	12,848	8,810	13,798	12,426	16,874
Total . . .	336,337	431,797	318,127	254,083	193,008

	1911.	1912.	1913.	1914.	1915.
FROM ALLIED COUNTRIES:	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
French India . .	1,936	2,003	2,359	3,732	1,231
French Indo-China .	39,270	55,140	119,690	141,254	161,429
Total . . .	41,206	57,143	122,049	144,986	162,660
FROM OTHER COUNTRIES:					
Java	4,697	3,465	144	127	162
Sumatra East Coast .	25	42	20	20	71
Siam	212,303	177,112	291,521	346,534	401,984
Countries not specified	588	1,413	1,640	585	1,292
Total . . .	217,613	182,032	293,325	347,366	403,509

(*b*) *Exports and Re-exports*

(1) *Paddy*

Total	£40,991	22,859	21,515	19,471	15,727
Total . . .	*tons* 7,435	3,612	3,539	3,469	2,891
TO BRITISH COUNTRIES:	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Borneo . . .	97	141	80	28	43
India. . . .	—	1	88	5	529
Malay Peninsula. .	6,913	3,141	2,527	2,235	1,753
Total . . .	7,010	3,283	2,695	2,268	2,325
TO FOREIGN COUNTRIES:					
German New Guinea .	7	10	10	3	—
Dutch Indies. . .	381	295	653	1,184	501
Siam	37	22	122	7	—
Countries not specified	—	2	59	7	65
Total . . .	425	329	844	1,201	566

NOTE.—*In the statistics of exports, foreign merchandise is not differentiated from produce of the Straits Settlements.*

(2) *Rice*

Total . . .	£4,442,919	5,429,977	5,502,305	5,124,377	5,740,006
Total . . . *tons*	472,702	477,202	571,587	564,757	664,093
TO BRITISH COUNTRIES:	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Borneo . . .	23,316	25,335	24,592	20,008	12,178
India . . .	378	210	8,673	16,379	44,987
Ceylon . . .	12,016	10,126	40,697	75,663	80,132
Hong Kong . .	5,617	2,611	3,130	278	749
Malay Peninsula. .	186,139	210,612	219,652	215,068	223,970
Australia . . .	562	309	438	334	216
New Zealand . .	275	418	389	182	232
Total . . .	228,303	249,621	297,571	327,912	362,464

	1911. Tons.	1912. Tons.	1913. Tons.	1914. Tons.	1915. Tons.
To Allied Countries:					
French India	5	7	185	10	23
French Indo-China	15	2	31	3	—
Philippine Is. and Sulu Archipelago	4,315	5,746	4,603	2,731	5,376
Japan	203	5,235	81	—	—
Total	4,538	10,990	4,900	2,744	5,399
To Enemy Countries:					
German New Guinea	821	1,086	1,417	880	—
To Other Countries:					
China	693	551	578	48	89
Dutch Indies	227,438	201,834	249,804	217,115	283,939
Siam	10,729	12,433	17,087	10,394	11,829
Countries not specified	180	687	230	5,664	373
Total	239,040	215,505	267,699	233,221	296,230

Note.—*Table III. Figures taken from the Return of Imports and Exports issued by the Government of the Straits Settlements. See also foot-note on previous page.*

Table IV

Trade of Siam in Rice

(*a*) *Exports of All Classes of Rice*

	1911–12. Tons.	1912–13. Tons.	1913–14. Tons.	1914–15. Tons.	1915–16. Tons.
Cargo rice, whole	38,708	19,702	76,062	57,727	47,857
,, broken	4,864	3,306	9,505	6,413	6,857
White rice, whole	302,222	299,841	514,329	470,727	511,088
,, broken	204,077	193,026	414,353	410,329	404,355
Paddy	3,295	928	28,657	36,458	35,894
Total	553,166	516,803	1,042,906	981,654	1,006,051

(*b*) *Destination of Exports of Various Classes of Rice*, 1914–16

(1) *Cargo Rice and Paddy*

	British Countries.			Other Countries.		Total.
	Hong Kong.	Straits Settlements.	United Kingdom.	Dutch East Indies.	China.	
Cargo rice, whole—	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
1914–15	36,198	20,572	600	357	—	57,727
1915–16	30,036	13,942	—	800	3,078	47,856
Cargo rice, broken						
1914–15	6,056	357	—	—	—	6,413
1915–16	6,545	308	—	—	4	6,857
Paddy—						
1914–15	—	36,459	—	—	—	36,459
1915–16	21	35,761	—	—	111	35,893

(2) *Whole White Rice*

	1914–15.	1915–16.
Total Exports	£3,648,528	3,892,330
	tons 470,727	511,088
To British Countries.	*Tons.*	*Tons.*
Singapore	294,018	340,350
Hong Kong	67,771	85,241
United Kingdom	61,881	51,219
India	—	500
Egypt	3,062	—
Port Said (for orders)	—	2,850
Union of South Africa	2,629	2,900
Ceylon	371	1,906
Papua	209	742
Total	429,941	485,708
To Allied Countries.		
Japan	250	—
Portugal	—	2,250
Cuba	—	4,603
Total	250	6,853
To Enemy Countries.		
Germany	12,961	—
To Other Countries.		
Denmark	500	1,697
Holland	21,099	—
Netherlands Indies	5,628	5,963
China	—	1,661
Chile	—	1,001
Norway	—	1,231
Sweden	—	5,700
Countries not specified	348	1,274
Total	27,575	18,527

(3) *Broken White Rice*

Total Exports	£2,146,072	2,159,256
	tons 410,329	404,355
To British Countries.	*Tons.*	*Tons.*
Singapore	88,412	99,361
Hong Kong	204,894	217,676
United Kingdom	70,454	62,358
Union of South Africa	—	25
British North Borneo	—	101
Ceylon	5,572	2,755
Total	369,333	382,276
To Allied Countries.		
Belgium	11,227	—
Japan	6,751	—
Total	17,979	—

	1914–15. Tons.	1915–16. Tons.
To Enemy Countries.		
Germany	5,876	—
To Other Countries.		
Norway	—	5
Netherlands Indies	15,418	16,282
Denmark	1,722	3,881
China	—	1,910
Total	17,140	22,078

Note.—*Table IV. Figures taken from the Trade Returns of the Port of Bangkok.*

Table V

Trade of French Indo-China in Rice

(*a*) *Exports of All Classes of Rice*

	1911. Metric tons.	1912. Metric tons.	1913. Metric tons.
Whole Cleaned Rice	647,899	635,545	991,170
Broken Rice	39,329	30,634	86,087
Cargo Rice	58,792	64,138	51,524
Paddy	32,003	10,393	5,839
Total	778,023	740,710	1,134,620

(*b*) *Destination of Exports of Various Classes of Rice*

(1) *Whole Cleaned Rice*

Total Exports	647,899	635,545	991,170
To British Countries.			
United Kingdom	—	—	1,996
Singapore	41,574	60,421	119,223
Hong Kong	229,253	271,795	338,895
Total	270,827	332,216	460,114
To Allied Countries.			
France	129,764	109,869	174,127
French Colonies	12,234	3,774	36,262
Japan	81,966	41,445	106,490
Philippines	112,952	140,509	57,501
United States	—	—	12,885
Total	336,916	295,597	387,265
To Enemy Countries.			
Germany	—	5	6
	—	—	—
To Other Countries.			
China	9,745	771	10,635
Netherlands Indies	30,108	5,881	133,140
Total	39,853	6,652	143,775

(2) *Broken Cleaned Rice*

	1911. Metric tons.	1912. Metric tons.	1913. Metric tons.
Total Exports . . .	39,329	30,634	86,087
To British Countries.			
Hong Kong . . .	4,632	6,203	14,957
Singapore	—	1,755	1,627
Total . . .	4,632	7,958	16,584
To Allied Countries.			
France	34,505	22,675	69,400
French Colonies . .	50	—	—
Japan	142	—	101
Total . . .	34,697	22,675	69,501

(3) *Cargo Rice*

Total Exports . . .	58,792	64,138	51,524
To British Countries.			
Hong Kong . . .	29,896	23,933	21,863
Singapore . . .	171	278	350
Total . . .	30,067	24,211	22,213
To Allied Countries.			
France	21,187	37,652	29,122
Japan	6,989	914	—
Philippines . . .	—	1,148	—
Total . . .	28,176	39,714	29,122
To Other Countries.			
China	549	209	187

(4) *Paddy*

Total Exports . . .	32,003	10,393	5,839
To British Countries.			
Hong Kong . . .	21,216	9,047	520
Singapore . . .	83	259	482
Total . . .	21,299	9,306	1,002
To Allied Countries.			
France	7,006	1,057	1,725
French Colonies . .	—	—	14
Japan	—	—	1,140
Total . . .	7,006	1,057	2,879
To Other Countries.			
China	185	30	137
Siam	—	—	19
Countries not specified .	3,511	—	1,798
Total . . .	3,696	30	1,954

Note.—*Table V. Figures taken from the Official Statistics of the Trade of the French Colonies.*

TABLE VI

Imports of Rice by Countries of the British Empire

Country.	Year.	Total Tons.	From India. Tons.	Other chief sources of supply.
Australia	1914–15	26,630	Paddy 18,4.. / Rice 3,452	China, Java, Siam, Japan.
			Total 21,888	
Barbados	1915	6,177	652	United Kingdom, British Guiana.
Brit. Guiana[1]	1915	2	—	
Canada	1913–14	27,662	Paddy 7,492 / Rice 40	Hong Kong, Japan, Siam, United States (paddy).
			Total 7,532	United Kingdom, Hong Kong, United States (rice).
Ceylon	1915	358,688	281,153	Straits Settlements, Siam.
East Africa	1915–16	8,179	8,072	German East Africa (107).
Egypt	1915	24,861	22,086	—
Fiji	1914	1,317	341	New South Wales, Hong Kong.
Gambia	1915	2,162	114	1,328 tons from France.
Gold Coast	1914	7,217	—	5,563 tons from U. Kingdom, 1,127 from Germany.
Grenada	1915	482	196	283 tons from Brit. Guiana.
Hong Kong	No statistics for imports or exports available.			
Jamaica	1914	4,835	84	4,749 tons from U. Kingdom.
Leeward Is.	1914–15	921	22	561 tons from U. Kingdom.
Mauritius	1915	58,463	50,789	Indo-China (in normal years) and Madagascar.
Malay States, Federated	1914	7,026	—	No information as to sources of supply.
Malay States, Unfederated	1915	461	—	No information as to sources of supply.
Nigeria	1915	5,441	—	5,175 tons from U. Kingdom.
Rhodesia (South)	1915	706	479	Siam and Madagascar.
Rhodesia (North)	1915	31	—	Siam and Nyasaland.
	Total	737	479	
St. Lucia	1914–15	222	171	38 tons from British Guiana.
St. Vincent	1915	217	145	72 tons from other B.W.I.
Sierre Leone	1915	475	—	193 tons from U. Kingdom, 213 tons from Germany.
Somaliland	1914	5,626	—	No details as to sources.
Straits Settlements[2]	1915	868,736	174,479	(For details see Table III.)
Sudan	1915	925	673	No details as to sources.
Trinidad, Tobago	1914	11,790		British Guiana and United Kingdom.
Uganda	1915–16	533	531	—
Union of South Africa	1915	36,449	25,409	Siam, China, Madagascar.
United Kingdom	1915	(See Table XIV for details.)		
Zanzibar	1915	quantity not given, value £146,668	quantity not given, value £135,033	Madagascar.

NOTE.—*Table VI. Figures taken from the Official Trade Statistics of the respective countries.*

[1] *Grows and exports rice.*

[2] *Mainly transit trade.*

Table VII

Showing Gradual Change in Importance of Certain Countries as Markets for Indian Rice (other than Paddy and Rice Meal) in the last 15 Years

The figures are 1,000 cwts. in each case, and are taken from the Official Indian Export Returns

Rice not in husk:	1900–1901.	1901–1902.	1902–1903.	1903–1904.	1904–1905.	1905–1906.	1906–1907.	1907–1908.	1908–1909.	1909–1910.	1910–1911.	1911–1912.	1912–1913.	1913–1914.	1914–1915.
United Kingdom	3,261	3,523	2,957	3,780	4,378	3,474	2,650	3,057	2,554	2,862	3,514	2,740	3,520	3,228	4,236
Germany	240	817	321	5,074	5,546	4,969	6,665	6,189	4,489	6,670	6,569	6,619	8,285	6,318	2,300
Holland	6	173	56	2,511	3,394	2,513	3,744	3,713	3,190	4,125	4,521	4,569	4,126	6,674	1,320
Austria-Hungary	63	302	958	2,558	3,965	2,443	3,158	3,399	2,482	3,709	3,393	3,231	3,549	4,229	1,974
Italy	—	20	133	28	116	56	33	40	56	402	—	2	2	18	19
Belgium	—	75	32	535	859	725	641	825	1,030	740	865	779	1,285	432	110
France	1	53	79	198	437	219	233	324	121	217	222	203	345	474	316
Roumania	58	10	—	58	203	172	145	291	184	310	426	285	407	642	107
Egypt	10,326	9,750	15,870[1]	675	550	1,318	1,667	1,181	1,834	1,580	1,445	595	717	1,078	846

[1] *Up to and including 1902–3 the official export figures to Egypt are believed to include shipments "to await orders at Port Said." Much of the rice eventually went to the United Kingdom and the Continent. For actual comparison of markets the figures are only useful after 1902–3.*

TABLE VIII

Trade of Germany in Rice

(*a*) *Imports*

Unpolished Rice. From:	1910. Metric tons.	1911. Metric tons.	1912. Metric tons.	1913. Metric tons.
India, etc.	243,622	133,209	87,258	154,354
Siam	30,300	8,540	4,421	3,341
Netherlands Indies	1,911	4,144	5,733	3,214
French Indies	22,018	45	—	
Netherlands	3,720	1,305	478	
Japan	2,278	1,971	28	
Belgium	1,350	808	381	2,534
France	749	740	197	
Egypt	—	150	829	
Other Countries	457	2,243	1,125	
Total	306,405	153,155	100,450	163,443

Polished Rice. From:	1910. Metric tons.	1911. Metric tons.	1912. Metric tons.	1913. Metric tons.
India, etc.	66,755	184,936	252,724	215,464
Siam	28,283	26,701	20,864	53,066
Netherlands Indies	9,891	11,295	10,152	12,007
Netherlands	34,903	34,090	30,728	28,807
Belgium	295	948	964	773
France	331	287	35	—
Italy	194	734	863	432
Austria-Hungary	786	2,342	1,027	434
Roumania	—	82	575	582
Sweden	315	1,729	290	
French India	47	1,138	—	2,491
Japan	545	461	89	
Other Countries	241	1,166	587	
Total	142,586	265,909	318,898	314,146

(*b*) *Exports*

Unpolished Rice:	1910. Metric tons.	1911. Metric tons.	1912. Metric tons.
Total	800	228	25

Polished Rice. To:	1910. *Metric tons.*	1911. *Metric tons.*	1912. *Metric tons.*	1913. *Metric tons.*
Cuba	42,092	43,802	35,165	43,736
Great Britain	11,269	12,466	8,625	9,758
Russia	10,189	13,588	13,267	16,128
Portugal	9,058	13,081	8,467	10,578
Brazil	9,367	6,476	5,110	3,503
Dominican Republic	8,780	9,138	12,278	11,496
Colombia	5,631	9,051	9,450	12,073
Chile	5,844	5,327	4,870	5,602
Panama	3,196	5,318	5,500	3,569
British West Africa	3,960	5,949	6,340	5,720
Cameroons	4,030	3,961	5,542	5,171
Denmark	5,653	5,152	3,911	4,737
Austria-Hungary	2,091	6,309	3,395	4,980
Turkey	2,909	3,242	3,610	3,227
German South-West Africa	2,569	3,261	2,689	2,764
French West Africa	2,567	10,432	4,068	2,231
Liberia	2,837	1,947	1,843	1,259
Portuguese West Africa	3,748	4,398	4,148	4,664
Argentina	2,846	3,376	839	4,687
Costa Rica	1,623	1,981	1,942	1,047
Ecuador	1,580	3,421	4,306	965
Mexico	1,975	1,174	174	—
Peru	1,572	1,549	1,550	1,114
Haiti	1,424	3,137	2,280	1,080
Uruguay	4,307	4,960	1,472	2,821
Venezuela	4,007	6,020	4,760	2,968
United States of America	4,235	2,907	2,312	2,918
Other Countries	10,223	15,489	14,397	15,543
Total	169,582	206,912	172,310	184,340

(c) Summary of German Trade in Rice

Year.	Imports. *Metric tons.*	Exports. *Metric tons.*	Difference (excess of imports over exports). *Metric tons.*
1910	448,991	170,382	278,609
1911	419,064	207,140	211,924
1912	419,348	172,335	247,013
1913	477,589	184,340	293,249
Average of 4 years	441,248	183,549	257,700

The above figures are "Spezialhandel" (Special Commerce. See introductory note to Appendix I).

The figures for "Gesamteigenhandel" (General Commerce) for 1912 are as follows: Total imports, 461,416 tons; total exports, 176,552 tons.

The "Transit Trade" in rice (polished and unpolished) in 1912 was 56,417 tons. This is not included in General Commerce in the German Returns.

(*d*) "*Improvement Trade*" ("*Veredelungsverkehr*"), 1912

Import of rice for refining (or improvement) in Germany in 1912

Rice unpolished.	*Metric tons.*
For husking	72,958
For polishing	17,713
Total import	90,671
Rice polished.	
For production of starch	22,218
For polishing	56,401
For rice husking mills	189,056
For production of rice meal	307
For conversion into rice grits	11
For conversion into flaked rice	13
Total import	268,007

Export after refining (or improvement) from Germany in 1912

	Metric tons.
Rice, unpolished	23
Rice, polished	172,059

(*e*) *Transit Trade*, 1912

Rice, Polished and Unpolished

	Metric tons.	
	In.	*Out.*
Total	56,417	56,417
Belgium	—	1,756
Denmark	—	116
United Kingdom	442	838
Italy	146	—
Netherlands	5,660	257
Norway	134	395
Austria-Hungary	1,572	22,249
Portugal	—	206
Roumania	11	10
Russia	23	8,926
Finland	—	136
Sweden	65	692
Switzerland	30	2,058
Serbia	—	62
Turkey	18	4
British East Africa	15	—
British South Africa	—	55
British West Africa	—	11
Cameroons	—	332
Belgian Congo	—	10
Portuguese West Africa	—	33
British India, etc.	45,702	—
China	79	—
Netherlands East Indies, etc.	2,277	105
Persia	17	—
Siam	60	—
Argentina	—	110
Brazil	81	32
Cuba	—	16,432
Dominican Republic	—	34
United States	80	1,512

TABLE IX

Dutch Trade in Rice

(a) Imports

From:	1911. Metric tons.	1912. Metric tons.	1913. Metric tons.	1914. Metric tons.	1915. Metric tons.
Belgium	33,077	37,256	32,339	6,351	3,049
India	233,574	235,085	285,481	264,288	31,042
Netherlands East Indies	36,381	39,048	42,289	21,491	21,241
Other Countries	42,962	28,265	55,863	69,046	67,354
Total	345,994	339,654	415,972	361,176	122,686

(b) Exports

To:	1911. Metric tons.	1912. Metric tons.	1913. Metric tons.	1914. Metric tons.	1915. Metric tons.
Belgium	33,867	39,937	36,024	27,826	71,727
United Kingdom	39,181	35,734	37,447	24,188	393
Hamburg	6,633	9,980	11,644	16,702	—
Prussia	58,130	52,537	50,561	97,974	3,427
Surinam	8,289	8,734	6,619	5,871	2,783
Other Countries	54,927	62,742	92,189	65,277	270
Total	201,027	209,664	234,484	237,838	78,600

(c) Summary of Dutch Trade in Rice

Year.	Imports.	Exports.	Retained for Consumption.
1911	345,994	201,027	144,967
1912	339,654	209,654	129,990
1913	415,972	234,484	181,488
1914	361,176	237,838	123,338
1915	122,686	78,600	44,086

NOTE.—*The above are "general" imports and "general" exports. (See introductory note to Appendix I.) In* 1913 *the "special" imports were* 408,208 *metric tons and the "special" exports* 225,369 *metric tons, leaving* 182,839 *metric tons as retained for consumption.*

The figures in Table IX are taken from the Netherlands Government Trade Statistics. The various descriptions of rice are not shown separately.

TABLE X

Trade of Austria-Hungary in Rice: (a) Imports

(1) *Paddy: Negligible*

(2) *Rice, Whole and Broken, not Cleaned (for Polishing and Starch Manufacture)*

From:	1910. Metric tons.	1911. Metric tons.	1912. Metric tons.	1913. Metric tons.
Italy	30	605	2,664	1,905
Spain	199	—	300	795
India	117,344	107,407	78,198	80,426
Dutch Indies	419	1,156	187	1,960
Japan	5,608	2,047	997	—
Egypt	478	506	598	—
Netherlands	1,205	153	—	—
French Indo-China	1,804	—	—	—
Other Countries	10	10	—	—
Total	127,097	111,874	80,944	85,086

(3) *Imports of Whole and Broken Cleaned Rice*

From:	1910. *Metric tons.*	1911. *Metric tons.*	1912. *Metric tons.*	1913. *Metric tons.*
Belgium	—	—	—	9
Germany	184	44 / 1,170	787	4,995
Great Britain	80	526	90	136
Italy	8,638	10,972	11,885	9,818
Netherlands	1,039	1,847	2,428	2,850
India	1,406	6,276	4,441	4,648
Netherlands East Indies	368	1,525	203	265
Other Countries	12	59	36	50
Total	11,728	22,419	19,870	22,771

(*b*) *Exports*

(1) *Paddy: Negligible*

(2) *Cleaned, Whole and Broken Rice*

To:	1910. *Metric tons.*	1911. *Metric tons.*	1912. *Metric tons.*	1913. *Metric tons.*
Germany	16	23	38	61
Greece	20	—	—	—
Italy	—	3	2	3
Montenegro	3	4	20	—
Roumania	2	3	5	3
Russia (European)	32	23	15	33
Turkey (European)	10	6	42	8
Other Countries	2	3	—	—
Total	85	65	122	108

(*c*) *Summary of Trade of Austria-Hungary in Rice*

	Imports.[1] *Metric tons.*	Exports.[1] *Metric tons.*	Retained for consumption. *Metric tons.*
1910	138,831	87	138,744
1911	134,296	65	134,231
1912	100,827	123	100,704
1913	107,869	113	107,756

NOTE.—*The above figures are "Spezialhandel." "Transit" trade is given separately in the Trade Returns, and was as follows in recent years:* 1910, 3,225; 1911, 2,700; 1912, 1,829; 1913, 2,344 *metric tons.*

Figures taken from the Statistics of the Foreign Trade of Austria-Hungary.

[1] *Including paddy.*

TABLE XI

Trade of France in Rice: (a) Imports

(1) *Riz en Paille (Cargo Rice)*

From:	1911. *Metric tons.*	1912. *Metric tons.*	1913. *Metric tons.*	1914. *Metric tons.*
Italy	7,657	10,026	7,663	6,306
Spain	—	1,740	3,460	200
Egypt	6,970	3,068	1,926	660
British India	17,067	7,186	20,844	16,842
Netherlands East Indies	7,743	3,623	6,750	3,506
Madagascar	2,183	1,073	711	201
Indo-China	36,689	33,118	10,798	12,450
Other Countries	826	64	11	239
Total	79,134	59,898	52,163	40,407

(2) *Riz Entier, Farines, et Semoules (Whole, Flour and Grits)*

From:	1911. *Metric tons.*	1912. *Metric tons.*	1913. *Metric tons.*	1914. *Metric tons.*
United Kingdom	192	263	280	2,637
British India	906	186	3,767	568
Egypt	—	—	497	210
Germany	355	348	186	65
Netherlands	8,341	5,718	5,185	2,909
Netherlands East Indies	—	123	—	—
Belgium	738	258	339	112
Italy	1,745	1,387	598	5,403
Madagascar	177	270	3,324	1,126
Indo-China	145,974	108,087	155,711	229,489
Algeria	—	117	227	—
United States	—	196	—	—
Spain	—	—	227	2,166
Other Countries	590	473	203	757
Total	159,018	117,428	170,545	245,442

(3) *Brisures de Riz (Broken Rice)*

From:	1911. *Metric tons.*	1912. *Metric tons.*	1913. *Metric tons.*	1914. *Metric tons.*
United Kingdom	433	201	233	40
British India	511	445	79	10
Netherlands	406	—	69	19
Switzerland	400	—	—	—
Madagascar	259	85	109	66
Indo-China	41,790	26,384	49,738	76,035
Italy	—	1,229	—	—
Algeria	—	—	254	244
Other Countries	729	1,018	15	3
Total	44,528	29,362	50,497	76,418

(*b*) *Exports*

(1) *Riz en Paille* (*Cargo Rice*)

To:	1911. *Metric tons.*	1912. *Metric tons.*	1913. *Metric tons.*	1914. *Metric tons.*
Switzerland	3,313	834	1,662	1,289
French Colonies	172	249	121	18
Other Countries	616	28	5	—
Total	4,101	1,111	1,787	1,309

(2) *Riz Entier, Farines et Semoules* (*Whole, Flour and Grits*)

To:	1911. *Metric tons.*	1912. *Metric tons.*	1913. *Metric tons.*	1914. *Metric tons.*
United Kingdom	1,163	728	1,067	No details given.
British West Africa	630	658	795	do.
Germany	1,061	259	678	do.
Switzerland	1,092	603	4,531	do.
Turkey	109	554	285	do.
West Africa	257	296	—	do.
Hayti	112	187	140	do.
Morocco	134	148	510	do.
Tripoli	—	—	178	do.
Algeria	4,776	5,529	7,175	do.
Tunis	377	1,200	363	do.
French Congo	137	598	283	do.
Senegal	12,236	9,369	4,734	do.
French Guiana	389	406	216	do.
Martinique	1,532	371	1,060	do.
Guadeloupe	1,493	566	1,124	do.
Belgium	—	305	113	do.
Spain	—	319	—	do.
Italy	—	103	816	do.
Greece	—	—	177	do.
Other Countries	4,685	4,164	2,944	do.
Total	30,184	26,365	27,189	31,176

(3) *Brisures de Riz* (*Broken Rice*)

To:	1911. *Metric tons.*	1912. *Metric tons.*	1913. *Metric tons.*	1914. *Metric tons.*
United Kingdom	245	150	50	424
British West Africa	—	150	506	200
Germany	1,211	57	—	—
Belgium	103	—	264	1,124
Switzerland	104	—	—	—
Senegal	2,967	3,423	8,664	26,752
West Africa	—	385	—	—
Other Countries	140	349	170	496
Total	4,771	4,514	9,655	28,996

(*c*) *Summary of Trade of France in Rice*

Year.	Imports. *Metric tons.*	Exports. *Metric tons.*	Retained for consumption. *Metric tons.*
1911	282,681	39,056	243,625
1912	206,688	31,990	174,698
1913	273,205	38,631	234,574
1914	362,267	61,481	300,786

NOTE.—*All the above figures are "Commerce Général."*
Statistics in Table No. XI are taken from the "Tableau Général du Commerce de la France."

TABLE XII

Trade of Belgium in Rice: (*a*) *Imports*

(1) *Uncleaned Rice*

From:	1911. *Metric tons.*	1912. *Metric tons.*	1913. *Metric tons.*
China	—	2,425	—
French West Africa . .	2,335	—	—
Egypt	—	1,082	—
India	7,149	31,439	20,939
British Indo-China (*sic*) .	20,219	—	—
Persia	—	8,351	—
Spain	—	—	275
Netherlands . . .	915	—	2,296
Siam	1,795	—	—
Turkey	5,972	15,972	1,000
Other Countries . .	617	706	714
Total . . .	39,001	59,974	25,226

(2) *Cleaned Rice*

From:	1911. *Metric tons.*	1912. *Metric tons.*	1913. *Metric tons.*
Germany . . .	2,250	2,501	3,383
United Kingdom . .	5,677	—	1,174
Austria-Hungary . .	2,911	237	—
Denmark	—	—	1,963
France	—	146	272
India	15,021	35,537	20,367
British Indo-China (*sic*) .	10,140	—	—
Italy	323	1,379	147
Spain	—	169	372
Japan	413	247	145
Netherlands . . .	35,094	10,609	13,536
Netherlands East Indies .	566	423	456
Argentina . . .	534	350	—
Roumania . . .	1,358	645	257
Siam	2,415	—	15,387
Other Countries . .	620	606	107
Total . . .	77,324	52,849	57,567

(*b*) *Exports*

(1) *Uncleaned Rice*

To:	1911. *Metric tons.*	1912. *Metric tons.*	1913. *Metric tons.*
Netherlands	3,428	10,664	3,196
Other Countries	499	148	26
Total	3,927	10,812	3,222

(2) *Cleaned Rice*

To:			
Belgian Congo	4,163	3,875	3,762
Germany	7,462	7,053	4,575
Colombia Republic	1,965	—	455
French West Africa	1,115	578	—
Cuba	11,313	3,111	2,185
Spain	1,324	664	1,305
France	7,009	719	—
Luxemburg	622	303	301
United Kingdom	1,001	1,957	1,003
Mexico	672	—	—
Panama	318	—	—
Morocco	—	—	967
Netherlands	20,559	18,561	18,733
Portugal	830	623	1,966
Russia	—	555	248
Argentina	1,510	24	50
Roumania	—	—	252
Turkey	972	1,181	1,447
Other Countries	3,337	2,151	3,073
Total	64,172	41,355	39,318

NOTE.—*The above figures are "Commerce Spécial." Transit trade is shown separately, and in* 1913 *was as follows*:

Paddy or uncleaned rice . . 11,173 *m. tons.*
Cleaned rice . . . . 29,567 *m. tons.*

All the figures in Table XII are from the Belgian Official Trade Returns.

TABLE XIII

Trade of United States in Rice[1]*: (a) Imports*

(1) *Uncleaned Rice* (*including Paddy*)

From:	1912–13. *Tons.*	1913–14. *Tons.*	1914–15. *Tons.*
Japan	21,214	23,220	38,848
India	—	151	99
United Kingdom	25	—	500
British Guiana	—	356	—
Hong Kong	1,422	257	50
Netherlands	—	227	25
Mexico	430	184	605
Other Countries	25	61	159
Total	23,116	24,456	40,286

[1] *The United States produces about* 1 *per cent. of the world's output of rice, and supplies the bulk of its own requirements.*

(2) *Cleaned Rice*

From:	1912–13. *Tons.*	1913–14. *Tons.*	1914–15. *Tons.*
Netherlands	1,125	21,611	3,538
United Kingdom	1,622	2,175	13,741
Canada	3	184	870
Hong Kong	1,274	1,870	2,873
Germany	97	2,106	202
Japan	9	69	809
China	9,625	13,579	27,462
Italy	553	635	152
Other Countries	297	408	405
Total	14,105	42,637	50,052

(*b*) *Re-exports*

(1) *Uncleaned Rice*

Total (to Mexico)	—	49	40

(2) *Cleaned Rice*

To:			
Panama	499	2,801	6,249
Mexico	955	1,984	3,069
Nicaragua	2,208	1,018	2,231
Netherlands	—	27	455
Costa Rica	348	435	935
Cuba	16	1	1,183
Dominican Republic	83	223	3,970
Colombia Republic	136	57	2,177
Ecuador	3	135	849
Venezuela	138	77	2,139
Other Countries	1,263	1,119	3,112
Total	5,649	7,877	26,369

(*c*) *Exports*

To:			
Cuba	299	5,079	11,313
Honduras	484	670	946
Panama	76	126	2,170
Dominican Republic	24	22	2,994
Argentina	3,401	1	1,752
Chile	—	9	817
Colombia Republic	20	8	1,154
Venezuela	19	12	1,899
Mexico	196	577	778
Belgium	—	206	1,021
Germany	990	173	—
Greece	1	—	1,316
Netherlands	3,819	5	2,260
United Kingdom	218	302	1,583
Canada	863	466	245
Belgian Congo	—	—	607
Other Countries	661	486	2,470
Total	11,071	8,142	33,682

NOTE.—*Broken rice is included with rice flour and meal in the United States Returns.*

Table XIII. Figures taken from the "Foreign Commerce and Navigation of the United States."

Table XIV

Trade of the United Kingdom in Rice: (a) Imports

(1) *Rice, Whole and Cleaned*

From:	1903. *Tons.*	1904. *Tons.*	1905 *Tons.*	1906. *Tons.*	1907. *Tons.*	1908. *Tons.*	1909. *Tons.*	1910. *Tons.*	1911. *Tons.*	1912. *Tons.*	1913. *Tons.*	1914. *Tons.*	1915 *Tons.*
India	55,356	91,697	99,726	78,306	85,516	70,581	78,817	110,613	91,398	119,747	79,652	115,390	227,055
Straits Settlements	2,840	2,370	1,532	1,376	1,650	178	20	—	27	—	212	238	3,103
Other British Countries	4	10	—	—	2	4	—	1	—	—	—	—	—
Belgium	1,466	1,582	933	1,614	409	325	545	99	—	—	—	—	—
Indo-China	—	2,000	—	1,839	5,467	6,614	6,872	4,774	—	—	1,991	—	4,839
Japan	864	3,389	651	4,370	1,742	2,290	3,152	5,340	3,246	921	—	177	22,294
Italy	—	—	—	—	—	—	—	—	733	2,077	559	1,460	—
Germany	5,116	5,178	6,733	6,719	9,942	10,781	7,647	7,199	9,224	4,668	4,446	4,311	20
Netherlands	20,568	21,609	25,186	26,888	24,653	26,006	25,279	28,345	28,229	22,364	26,218	14,639	166
Siam	—	1,921	1,834	5,957	12,737	12,324	10,679	17,120	6,279	3,533	11,252	17,992	59,528
Other Countries not specified	886	1,274	5,119	1,505	3,086	1,812	998	930	5,132	2,187	2,808	6,861	4,724
Total Imports	87,100	131,030	141,714	128,574	145,204	130,915	134,009	174,421	144,268	155,497	127,146	161,068	321,737

(2) *Rice, other than Whole and Cleaned*

From:	1903. *Tons.*	1904. *Tons.*	1905. *Tons.*	1906. *Tons.*	1907. *Tons.*	1908. *Tons.*	1909. *Tons.*	1910. *Tons.*	1911. *Tons.*	1912. *Tons.*	1913. *Tons.*	1914. *Tons.*	1915. *Tons.*
India	101,611	116,359	93,540	58,668	71,661	61,909	46,800	58,558	57,338	58,991	46,790	42,001	55,813
Straits Settlements	1,087	7,091	8,663	4,934	1,499	79	—	191	200	100	—	492	1,445
Other British Countries	217	—	—	—	11	31	23	24	39	—	—	—	300
Indo-China	2,403	14,770	2,035	11,047	20,517	9,572	4,314	3,255	—	—	—	3,000	23,996
Germany	9,129	3,958	6,297	6,794	9,634	5,103	5,115	3,897	3,875	4,122	5,414	536	—
Austria-Hungary	—	—	—	—	—	—	—	—	9,363	3,142	—	—	—
Turkey (Asiatic)	2,459	65	800	328	2,250	7,578	2,718	4,788	7,039	4,675	2,938	—	1,650
Netherlands	3,507	4,094	4,445	7,425	5,536	6,086	5,760	5,359	5,775	10,882	8,658	4,457	—
Java	1,376	400	148	152	1,101	103	497	1,695	123	253	667	1,190	2,123
Siam	1,923	3,641	15,710	36,730	29,478	48,807	43,075	39,474	8,068	6,071	21,747	50,228	83,500
Other Countries	2,389	990	2,540	2,374	887	5,762	2,355	6,618	6,204	7,069	976	1,856	2,394
Total Imports	126,101	151,368	134,178	128,452	142,574	145,030	110,637	123,859	98,024	95,305	87,190	103,670	172,221
Mixtures of whole and broken rice	17,806	2,307	1,545	3,193	1,374	3,282	2,030	2,876	1,180	518	549	1,836	5,665
Grand Total of Imports	231,007	284,705	277,437	260,219	289,152	279,227	246,676	301,156	243,472	251,320	214,885	266,574	499,623
Total Imports from India	169,216	209,176	193,726	137,791	157,238	133,341	126,201	170,274	149,111	178,993	126,442	158,296	289,249

(3) *Rice Flour (including Rice, Ground or Granulated)*

Source.	1903. *Tons.*	1904. *Tons.*	1905. *Tons.*	1906. *Tons.*	1907. *Tons.*	1908. *Tons.*	1909. *Tons.*	1910. *Tons.*	1911. *Tons.*	1912. *Tons.*	1913. *Tons.*	1914. *Tons.*	1915. *Tons.*
Canada	—	—	—	—	176	251	267	159	368	186	65	—	—
Other British Countries	63	157	230	513	63	10	—	—	11	26	—	20	1
Germany	—	—	—	—	747	397	219	876	1,119	1,274	494	386	—
Netherlands	2,373	2,655	2,254	2,415	2,620	2,731	3,248	4,323	4,340	5,715	6,270	3,852	—
Other Countries not specified[1]	1,099	880	489	802	537	166	229	126	526	857	431	48	27
Total Imports	3,535	3,692	2,973	3,730	4,143	3,555	3,963	5,484	6,364	8,058	7,261	4,306	28

[1] *Includes Germany prior to* 1907.

Re-exports of rice flour from the United Kingdom are negligible.

The exports of rice flour (home produce) have averaged about 5,400 *tons in the years* 1911–13.

(4) *Rice Starch*

Source.	1909. *Tons.*	1910. *Tons.*	1911. *Tons.*	1912. *Tons.*	1913. *Tons.*	1914. *Tons.*	1915. *Tons.*
Belgium	5,145	5,520	5,302	4,623	4,416	3,058	227
France	1,531	971	773	622	604	649	629
Germany	2,107	2,138	2,121	1,776	1,702	961	2
Austria-Hungary	619	1,488	2,016	1,166	1,129	809	—
Netherlands	1,773	2,199	3,298	3,078	3,252	3,308	2,342
Other Countries not specified	—	—	31	2	3	30	129
Total	11,175	12,316	13,541	11,267	11,106	8,815	3,329

NOTE.—*Prior to* 1909 *imports of rice starch were not shown separately from imports of other kinds of starch.*

Re-exports of rice starch from the United Kingdom are negligible.

Exports of rice starch (home produce) have averaged about 3,000 *tons in the years* 1911–13.

(*b*) *Re-exports*

(1) *Rice, Whole and Cleaned*

To:	1911. *Tons.*	1912. *Tons.*	1913. *Tons.*	1914. *Tons.*	1915 *Tons.*
West Indies	9,669	6,812	7,295	7,738	14,773
West Africa	4,161	3,659	3,429	3,175	2,035
Canada	1,518	1,048	954	1,554	1,785
Other British Countries	969	1,236	995	999	2,327
France	13	59	32	1,282	1,612
French West Indies	1,490	74	77	—	562
Portugal	672	1,990	1,701	3,274	6,188
United States	573	601	909	2,736	11,565
Cuba	36,935	33,085	34,183	47,055	62,134
Brazil	1,524	1,439	1,241	697	939
Germany	229	4,538	374	455	—
Sweden	4	4	—	1,177	871
Denmark	10	9	12	1,793	3,411
Netherlands	48	98	53	1,922	7,602
Other Countries	5,064	5,195	3,363	3,459	13,310
Total	62,880	59,847	54,618	77,316	129,115

(2) *Rice, other than Whole and Cleaned*

To:	1911. *Tons.*	1912. *Tons.*	1913. *Tons.*	1914. *Tons.*	1915. *Tons.*
Canada	662	1,006	535	6,179	2,300
British West Indies	4,024	1,435	1,036	2,860	117
Other British Countries	51	233	214	154	73
Belgium	6,056	105	1,255	585	—
France	—	—	—	600	784
French West Indies	510	44	17	102	—
Spain	50	—	—	200	1,643
United States	—	149	222	871	1,247
Germany	1,309	2,012	869	2	—
Netherlands	288	—	128	950	18,405
Other Countries	1,299	550	105	133	1,684
Total	14,249	5,534	4,378	12,636	26,253

(3) *Mixtures of Whole and Broken (Cleaned) Rice*

	449	685	172	175	111
Grand Total, Re-exports	77,578	66,066	59,168	90,127	155,479

(c) *Exports of British-milled Rice*

To:	1911 *Tons.*	1912. *Tons.*	1913. *Tons.*	1914. *Tons.*	1915. *Tons.*
Gambia	934	831	766	1,308	311
Gold Coast	3,885	4,496	4,896	5,441	5,699
Nigeria	8,325	7,162	4,961	7,098	4,938
Canada	2,119	2,265	2,284	1,699	123
British West Indies	578	145	305	927	245
British Honduras	940	772	739	764	614
Other British Countries	2,591	963	1,105	942	2,049
Russia	433	177	361	146	92
France	—	—	5	944	117
French West Africa	1,158	733	373	421	477
Portugal	1,160	936	834	2,053	7,440
Madeira	456	644	425	404	294
Portuguese West Africa	922	484	599	1,099	530
United States	1,843	1,443	1,338	1,950	5,557
Cuba	2,544	3,925	7,051	2,023	5,684
Brazil	2,594	2,211	1,211	957	468
German West Africa	603	717	326	313	1,556
Switzerland	—	—	—	—	1,204
Spain	522	1,355	16	—	—
Canary Islands	703	498	421	331	368
Liberia	558	654	370	552	1,201
Colombia	668	1,412	75	653	3,234
Panama	1,003	625	332	152	54
Peru	297	328	340	191	546
Other Countries	1,057	750	1,017	1,491	5,957
Total	35,893	33,526	30,160	33,379	51,358

(d) (1) *Summary of Trade*

	Imports of rice of all kinds. *Tons.*	Re-exports of rice of all kinds. *Tons.*	Retained for consumption or working. *Tons.*	Exported after milling. *Tons.*	Retained for consumption. *Tons.*
1911	243,472	77,576	165,894	35,893	130,001
1912	251,320	66,066	185,254	33,526	152,728
1913	214,885	59,168	155,717	30,160	125,557
1914	266,574	90,127	176,447	33,379	143,068
1915	499,623	155,479	344,144	51,358	292,786

(d) (2) *Chief Sources of Supply*

Percentages of Total Imports supplied by Countries named in Years 1911–15

	1911.	1912.	1913.	1914.	1915.
1. Producing Countries.					
India	61	71	58	59	57
Siam	6	4	15	26	29
Indo-China	nil	nil	below 1	1	6
2. Importing and Milling Countries.					
Germany	5	4	5	—	—
Netherlands	14	13	16	7	—

(*d*) (3) *Percentages of British Home Consumption of Rice supplied by Germany*

	1911. *Tons.*	1912. *Tons.*	1913. *Tons.*	1914. *Tons.*	1915. *Tons.*
TOTAL BRITISH IMPORTS FOR CONSUMPTION.					
Rice	130,001	152,728	125,557	143,068	292,786
Rice flour . . .	6,364	8,058	7,261	4,306	28
Rice starch . . .	13,541	11,267	11,106	8,815	3,329
Total	149,906	172,053	143,924	156,189	296,143
IMPORTS FROM GERMANY.					
Rice	13,099	8,790	9,850	4,847	—
Rice flour . . .	1,119	1,274	494	386	—
Rice starch . . .	2,121	1,776	1,702	961	—
Total	16,339	11,840	12,046	6,194	—
IMPORTS FROM NETHERLANDS.					
Rice	34,004	33,246	34,876	19,096	166
Rice flour . . .	4,340	5,715	6,270	3,852	—
Rice starch . . .	3,298	3,078	3,252	3,308	2,342
Total	41,642	42,039	44,398	26,256	2,508
GERMAN PERCENTAGE . .	11	7	8	3	—
DUTCH PERCENTAGE . .	28	24	31	17	1
Total	39	31	39	20	1

NOTE.—*In compiling this table it has been assumed that, as stated by representatives of the rice trade, practically none of the polished rice and rice products received from Germany and Holland are re-exported from the United Kingdom, and that they may therefore fairly be regarded as imported for consumption. The percentages arrived at are, if anything, too low, because the total imports include a large proportion of unfinished produce, whilst the imports from Germany and the Netherlands are almost entirely finished products (polished rice, rice flour and rice starch) ready for consumption.*

All figures in Table XIV are taken from the Annual Statements of Trade of the United Kingdom.

APPENDIX II

PORT CHARGES ON RICE AT HAMBURG, LIVERPOOL, LONDON, AMSTERDAM AND ROTTERDAM

Hamburg

1.	Port dues	Nil
2.	Landing charges	Nil (most mills at waterside).
3.	Lighterage to mill	10*d.* per ton where incurred.
4.	Transhipment charge	10*d.* to 1*s.* 8*d.* per ton (depending on demand for storage barges) per month.

Liverpool

		Per ton. s.	d.
1.	Port dues (inwards)	1	1
2.	Landing charges: Porterage	1	4½
	Handling	0	6
3.	Cartage to mill	1	0
	Total Cost of Landing and Delivery to Mill	3	11½
4.	Cartage to export steamer	1	0
5.	Port dues, outward	0	6½
	Total Cost of Landing, Delivery to Mill and Re-export	5	6
	Total Cost of Transhipping Rice for Re-export (Omitting Items 1 and 3 in above list)	3	5

London

		Per ton. s.	d.
1.	Port dues	0	4
2.	Landing charges[1]	3	9
3.	Delivery overside from steamer—		
	(*a*) Weighing and sampling	0	11
	(*b*) Lighterage in port	1	6
	Total Cost of Rice Landed and Warehoused (Items 1 and 2)	4	1
	Total Cost of Rice Delivered to Export Steamer or Waterside Mill (Items 1 and 3)	2	9[2]

[1] *Includes cost of weighing and four weeks' rent.*
[2] *With a minimum charge of* 50*s.*

Amsterdam

		Per ton. s.	d.
1.	Port dues (inwards)[1]	0	3
2.	Discharging from steamer	1	6
3.	Cost of receiving, weighing, sampling and repairing bags	0	9
4.	Storage on lighter and transport to mill by water	0	9
	Total Cost of Discharging to Lighter and Delivery to Mill	3	3
5.	Lighterage to export steamer	0	9
6.	Loading into steamer	0	6
7.	Port dues (outwards)[2]	nil	
	Total Cost of Landing, Delivery to Mill and Re-export	4	6
	Total Cost of Transhipping Rice for Re-export by Sea-going Vessels[3] (Omitting Items 1, 4 and 7 above)	3	6

[1] *Charged at 4½ cents per cubic metre, gross tonnage of the ship.*

[2] *No outward port dues are charged if steamer leaves within three months of arrival.*

[3] *There is practically no re-export of rice from Amsterdam by sea-going vessels, the direction of trade being practically all to Germany.*

Rotterdam

		Per ton. s.	d.
1.	Port dues	nil	
2.	Sampling, weighing and bringing overboard into lighter, storing in lighter and transport to mill by lighter[1]	1	9
	Total Cost of Discharging to Lighter and Delivery to Mill	1	9
3.	Lighterage to export steamer and loading into steamer	1	8
	Total Cost of Discharging to Lighter, Delivery to Mill and Re-export	3	5
	Total Cost of Transhipping Rice for Re-export	2	8½

[1] *Cost of discharge is borne by steamer and is not included in this schedule: it amounted to 5d. per ton before the war.*

APPENDIX III

FOREIGN IMPORT DUTIES ON RICE IN FORCE IN 1914

Countries.	Description of Rice.	English equivalent of rates of entry. *Per cwt.* s.	d.
Russia	In the husk	3	11¼
	Not in the husk	6	10¾
Finland	In the husk	1	0¼
	Husked	2	0½
	Rice groats	4	10½
Sweden	Rice unhusked or with the outer husk removed	Free	
	Rice groats and rice flour	1	1½
Norway	In the husk—in bulk in vessel	2	2½
	Ditto —in packages	2	10
	Not in the husk	3	11½
Denmark	In the husk (nellou and paddy)	Free	
	Rice groats, ground rice and rice starch	1	1½
Germany	Rice, in the husk or not	[2]2	0
Netherlands	Rice, rice offal, etc.	Free	
Belgium	Rice in the husk or not	Free	
France [3]	In the husk	[2]1	2¾[1]
	Broken rice	[2]2	5¼[1]
	Whole rice, flour and grits	[2]3	3[1]
Portugal	Rice	8	11
	Broken rice and residues of cleaned rice for starch manufacture	7 per cent. *ad valorem*	
Spain	Rice in the husk, and rice waste	2	1¾
	Rice husked	4	3¾
Italy	In the husk	[2]2	0½
	Partly husked, *i.e.* having to undergo further manipulation before it can be used for alimentary purposes (including Burma rice)	[2]3	0½
	Not in the husk	[2]4	5¾
Austria-Hungary	Rice wholly or partly in the husk, imported to be cleaned, and rice and broken rice for the manufacture of starch, and coming by sea (by special permission and under control)	[2]0	4½
	Rice, other:		
	In the husk	[2]2	6½
	Not in the husk; also broken rice	[2]1	6¼
	Rice waste	[2]Free	

[1] *With a surtax of* 1s. 5½*d. per cwt. if produced in extra-European countries but transhipped in European entrepôts.*

[2] *Gross weight.*

[3] *Rice imported into France direct from Indo-China is admitted free of duty.*

Countries.	Description of Rice.	English equivalent of rates of entry. *Per cwt.* s.	d.
Switzerland	Unhusked or merely husked; rice offal for use as cattle food	[2]Free	
	Pearled, bruised, crushed, etc.	[2]0	9¾
	Rice flour in receptacles weighing:		
	More than 5 kilos	[2]1	0½
	5 kilos or less	[2]8	1½
Greece	In the husk	4	7¾
	Husked, glazed or not	7	10¾
Turkey	Rice	11 per cent. *ad valorem*	
Bulgaria[1]	Husked	[2]2	0½
	Unhusked	[2]1	7½
Roumania	Rice in the husk	[2]0	4·88
	Husked rice	[2]2	0½
	Broken rice imported for industries	[2]1	2¾
	Consumption duty in addition on rice	1	7½
Serbia	Husked	[2]2	7¾
	Unhusked and broken rice	[2]1	7½
	Broken rice for making starch under supervision	[2]0	9¾
	Tresharina, in addition, on rice	8	1½
United States	Cleaned rice	4	8
	Uncleaned rice, or rice free of the outer hull and still having the inner cuticle on	2	11
	Paddy, or rice having the outer hull on	1	9
	Rice flour, rice meal and broken rice which will pass through a No. 12 sieve of a kind prescribed by the Secretary of the Treasury	1	2
Mexico	Rice	[2]8	3½
Argentina	Rice (including weight of sack)	4	4¾
	Rice unhusked (including weight of sack)	1	1½
Japan	Rice and paddy	1	8¾
China	Rice	Free	
Persia	Rice	0	7¾

NOTE.—*The above table is extracted from "Foreign Import Duties" (Cd. 7180) prepared by the Board of Trade,* 1913.

[1] *Plus octroi duty of* 20 *per cent. of import duty payable.*
[2] *Gross weight.*

APPENDIX IV

EXPORT DUTIES ON RICE IN INDIA, SIAM AND FRENCH INDO-CHINA

India

The rate of duty on rice of all kinds, but not rice dust, exported from Burma is 3 annas per maund of $82\frac{2}{7}$ lb., which is equivalent to 6*s.* 9½*d.* per ton (or 6*s.* 8*d.* per metric ton).

Siam

The duty levied on the export of rice is 3 ticals per ton. With exchange at the rate of 1*s.* 6*d.* per tical, this is equivalent to 4*s.* 6*d.* per ton.

French Indo-China

Rice exported from Indo-China is subject to payment of the following duties :

(1) An export duty levied exclusively on rice exported *to foreign countries*, and from which rice shipped to France or French Colonies is consequently exempt.

	Per metric ton.	
	s.	*d.*
Dust and broken, 0·03 f. per 100 kilos. . =	0	2·85
Paddy and cargo rice, including more than 33 per cent. of paddy, 0·75 f. per 100 kilos . =	5	11
Cargo rice, including less than 33 per cent. of paddy, 0·43 f. per 100 kilos . . . =	3	4
White rice, 0·32 f. per 100 kilos . . . =	2	6½

(2) An export tax, representing the land tax, collected on all rice exported from Indo-China *to any destination whatever* :

This tax is in piastres, and is fixed as follows (a piastre =24*d.*) :

	Per metric ton.	
	s.	*d.*
Paddy and cargo rice, including more than 33 per cent. of paddy, per 100 kilos gross—0·12 p. . . . . =	2	5
Paddy and cargo rice, including less than 33 per cent. of paddy, per 100 kilos gross—0·15 p. . . . . =	3	0
White rice per 100 kilos gross—0·19 p. . . =	3	9½
Broken rice per 100 kilos gross—0·09 p. . . =	1	9½
Dust per 100 kilos gross—0·05 p.. . . =	1	0

(3) Rice, paddy and rice dust exported through the port of Saigon *for all destinations* are, in addition, liable to a port tax, the rates of which are as follows :

	Per metric ton. s.	d.
Rice per 100 kilos, 0·02 p. . . . . =	0	5
Paddy and dust per 100 kilos, 0·01 p. . =	0	2½

The total effect of these taxes may be summarised as follows :

	(1) Export duty.[1]		(2) Land Tax.		(3) Port Tax.		Total of duties on rice exported to foreign countries.		Duty on rice exported to France or French Colonies.	
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
White rice . .	2	6½	3	9½	0	5	6	9	4	2½
Cargo rice, including less than 33 per cent. of paddy . .	3	4	3	0	0	5	6	9	3	5
Paddy and cargo rice, including more than 33 per cent. of paddy	5	11	2	5	0	2½	8	6½	2	7½
Broken rice . .	0	3[2]	1	9½	0	2½	2	3	2	0
Dust	0	3[2]	1	0	0	2½	1	5½	1	2½

[1] *No "export duty" is levied on rice of any kind exported to France or French Colonies.*

[2] 2·85*d. actually.*

II

THE PRODUCTION AND USES OF RICE

Summary of general information prepared at the Imperial Institute for the Committee

In the *Bulletin of the Imperial Institute* (1913, **11**, 634; 1914, **12**, 85) an article was published on the cultivation and preparation of rice, in the course of which the varieties of rice, methods of cultivation and preparation, pests and diseases were described, and some account of the production of this grain in the British Empire was given. In the present report it is proposed to deal with the production of rice and its commercial movement, especially in the British Empire, and with the uses of rice.

Since the war it has become apparent that the resources of the Empire in food and raw materials have not hitherto been used to meet the needs of the Empire itself to anything like the extent that is desirable, and rice is a striking example of this state of things. Thus India, which produces about 40 per cent. of the world's exportable surplus of rice, distributed its exports in 1913–14 in the following proportions: to British countries 42·6 per cent., to foreign countries 57·4 per cent. The gross imports of rice into the British Empire were little less than the total exports of rice from India, so that it would be quite possible to find a market within the Empire for nearly all the rice India can spare for export.

Of the exports of Indian rice in the year 1913–14 Holland took 13·8 per cent., Germany 13·1 per cent., and Austria-Hungary 8·7 per cent., the United Kingdom coming next among European countries with 6·7 per cent. While this country occupied a relatively unimportant position as a direct importer of rice from India, it imported con-

siderable quantities of rice from Holland and Germany, which had been first exported from India to those countries, and after being milled and polished there had been re-exported to England. Rice-milling, at one time a flourishing industry in this country, had declined before the war owing to severe competition from the Dutch and German mills, with the result that not only was the British home market partly supplied by foreign-milled rice, but what was at one time the considerable British export trade in fully-milled rice had been reduced in many directions. Since the war both the home and export trade in milled rice have been largely recovered by the British rice-millers, and it is hoped that this industry and trade may be retained after the war.

It is clear from this brief statement of the position as regards rice that there is much leeway to make up in the way of developing inter-Imperial trade in food and raw materials. So far as Indian exports of raw materials are concerned, the possibility of increasing the usage of these raw materials within the Empire is now being fully investigated by the Committee for India of the Imperial Institute at the request of the Secretary of State for India. In connection with that enquiry Special Committees have investigated the trades in question, and have now almost completed their work. It has become apparent in the course of that enquiry that something can be done to increase the market for rice, and especially for Indian rice, within the Empire. It is hoped that this summary will assist in that direction by giving precise information as to the production of rice and the demand for this grain within the Empire, the general tendencies of the trade, the directions in which markets should be sought, and various uses to which rice is as yet scarcely applied within the Empire.

Terms Employed.—Before being hulled to remove the husk, rice is known as paddy, or rough rice. After the hulling process it is known as "cargo rice." After being milled for the removal of the outer skin it is known as skinned or white rice. A final milling process turns out polished rice—the article of ordinary domestic consumption in the Western world. At each stage various by-products are obtained.

In statistics of rice production and trade it is important to know to what precisely they refer, as there is a big difference both in volume and in weight between a given quantity of paddy and its yield of polished rice, with lesser differences, of course, between the intermediate stages. Often this information is not available, owing to lack of uniformity in the terms employed to denote the different stages. In the published statistics of most countries, indeed, the only distinction drawn is between " paddy " and " rice." The *Crop Estimates* of the Indian Department of Statistics give the calculated production (weight) of " cleaned rice," which, according to *Agricultural Statistics of India*, is obtained by deducting from 33 to 38 per cent. (the proportion differs slightly in different provinces) from the estimated weight of the paddy crop. According to the *Review of the Trade of India*, one maund of paddy gives 25 sers ($\frac{5}{8}$ maund) of rice, or 62½ per cent. by weight. In the present article cleaned rice of this description has been adopted as the standard, and the fraction employed in converting paddy statistics (weights) to their rice equivalent has been $\frac{5}{8}$, unless official usage in the country in question favours a different proportion. In British Guiana, for example, paddy is reckoned to yield $\frac{3}{5}$ (60 per cent.) of its weight in rice, while the ratio adopted by the United States Department of Agriculture is 100 : 162, or just under 62 per cent.

By volume the proportion of rice obtained from paddy is less. For purposes of rough-and-ready reckoning two measures of paddy are generally regarded as equivalent to one measure of rice. This proportion has been adopted here for countries which record their paddy statistics in measures of volume. To assist comparison with other countries, volumes of rice have further been reduced to their weight equivalent at the rate of 2½ bushels to 164 lb. (about 65½ lb. per bushel), this being the rate adopted by the Ceylon Customs (see Ferguson's *Ceylon Handbook*).

World Resources

From the crop returns which are available for some countries, and from the estimates of normal production in

others, it may be calculated (see table on page 139) that the world's output of cleaned rice in 1916–17, excepting that of China, amounted to about 60,000,000 tons. Of this the British Empire produced about 36,000,000 tons, almost wholly in India, where the crop (including an allowance of 1,000,000 tons for Native States) was no less than 35,000,000 tons. Of the foreign production of 24,000,000 tons, over 20,000,000 tons was grown in five countries—Japan, Netherlands East Indies (chiefly Java), French Indo-China, Siam, and Korea. The estimates of production in China are largely guess-work and differ widely. The *Yearbook* of the United States Department of Agriculture, 1914, quotes an estimate which claimed a production of over 21,000,000 tons in 1910 for three provinces only—Yunnan, Hunan and Kiangsi; on the other hand, the *China Year Book* for 1916 says that the annual production of rice in China is officially estimated at 3,750,000 tons. Both the extent of country over which rice is grown in China and the numbers of the Chinese who consume it as a staple article of diet suggest that the production of rice in China is not likely to be much inferior to that of India, and may exceed it. Possibly 40 per cent., or a little less, would be a fair allowance for India's proportion of the world's annual production of rice.

To quote again the United States agricultural *Yearbook*, the quantity of rice which entered into international trade in 1913 may be estimated from the export returns of different countries at about 6,400,000 tons. This includes exports from European countries which import partially milled rice, complete the milling process, and do a re-export trade in the finished product. Even so, more than three-fourths of the export trade in 1913 was done by India (chiefly Burma), Siam and Indo-China. Among producing countries these three alone play any large part in international trade in rice. Of the total exports of 6,400,000 tons, as calculated by the United States Department of Agriculture, those from India amounted to 2,570,000 tons (40 per cent.), while those from French Indo-China (1,260,000 tons; nearly 20 per cent.) and Siam (1,130,000 tons; nearly 18 per cent.) together amounted to almost

as much. The chief importing countries were, in order, Japan, Netherlands East Indies, Germany, Netherlands, British Malaya, Ceylon, the United Kingdom, China and France. As will be seen later, the increase of her own crops has altered materially Japan's position as an importing country since 1913.

In the following notes on the countries of production, British countries are considered first, and then foreign countries ; in both groups the arrangement is geographical.

British Empire

India.—The predominant position occupied by India in respect of the world's production of rice and trade in rice has already been seen. In India itself the cultivation of rice is of prime importance among agricultural industries. According to *Agricultural Statistics of India*, out of a gross area of 261,000,000 acres [1] under crops in British India in 1914–15, 78,000,000 acres, or 30 per cent. of the whole, were under rice. This was more than three times the area under any other food grain in British India. In Assam, rice occupies nearly 80 per cent. of the cultivated land ; in Burma, 74 per cent. ; in Bengal, 70 per cent. In addition to the area under cultivation in British India, it was estimated in 1913–14 that 2,500,000 acres were under rice in Native States, this estimate being only partial, as a number of Native States do not furnish returns.

The acreage and production of rice in British India in the last five years, according to the estimates (forecasts) issued by the Department of Statistics, have been as follows :

Year.	Area under rice. *Acres.*	Production (cleaned rice). *Tons.*	Yield per acre. *Cwts.*
1912–13	71,623,000[1]	28,485,000[1]	8·0
1913–14	75,425,000	28,790,000	7·6
1914–15	76,181,000	27,964,000	7·3
1915–16	78,152,000	32,824,000	8·4
1916–17	79,700,000	34,079,000	8·6

[1] *Not including Central Provinces and Berar.*

[1] The area cultivated was 228,000,000 acres, of which 33,000,000 acres were cropped more than once. In the gross totals, areas cropped more than once are counted as separate areas for each crop.

These estimates cover 99 per cent. of the total rice area of British India, and also the Native States in the Bombay Presidency and Sind. On the other hand, the estimates for Bombay and Sind relate only to the chief rice-growing districts.

The distribution of the acreage and production between the different Provinces in 1916–17 was as follows :

Province.	Area.		Production.	
	Acres.	*Percentage.*	*Tons.*	*Cwts. per acre.*
Bengal	21,120,000	26·5	8,028,000	7·6
Bihar and Orissa	16,442,000	20·6	8,898,000	10·8
Madras	11,377,000	14·3	5,536,000	9·7
Burma	10,520,000	13·2	4,417,000	8·4
United Provinces	7,156,000	9·0	2,675,000	7·5
Central Provinces and Berar	5,086,000	6·4	1,481,000	5·8
Assam	4,265,000	5·4	1,406,000	6·6
Bombay	2,430,000	3·0	1,094,000	9·0
Sind	1,220,000	1·5	490,000	8·0
Coorg	84,000	0·1	54,000	12·9
Total	79,700,000	100·0	34,079,000	8·6

The acreage and production of rice in each Province in 1916–17 per head of the population, on the basis of the 1911 census returns, are shown in the following table. The figures are not, of course, absolutely true, but are instructive for comparative purposes. The calculations relate to the population of British India only, as distinct from Native States of every description.

Rice Acreage and Production (1916–17) *per Head of Population* (1911)

Province.	*Acres.*	*Cwts.*
Bengal	0·46	3·5
Bihar and Orissa	0·48	5·2
Madras	0·27	2·7
Burma	0·99	8·3
United Provinces	0·15	1·1
Central Provinces and Berar	0·37	2·1
Assam	0·64	4·2
Bombay	0·15	1·4
Sind	0·35	2·6
Coorg	0·48	6·2

It will be seen that though Burma was only fourth among the Provinces of British India in 1916–17 in respect of total area under rice and production of rice, it was easily first in respect of both acreage and production per head of

the population. This is its normal relationship to the other Provinces, and as a result its crop is of the first importance in the rice export trade. Besides sending large quantities of rice to other Indian Provinces to supplement local supplies,[1] Burma furnishes 70–75 per cent. of the total exports of rice from India. In the latest year of normal trade, 1913–14, India exported 2,419,863 tons of rice not in the husk, and of this amount 1,834,998 tons were exported from Burma. The exports of rice in the husk (paddy) are comparatively small, ranging in the quinquennium ending 1913–14 from 30,000 to 55,000 tons per annum. The total exports in 1913–14 formed 9 per cent. of the estimated production, and the average proportion of exports to production in the quinquennium ending 1913–14 was also 9 per cent. The distribution of the exports of husked rice in 1913–14 is shown in the following table, which includes all countries to which more than 50,000 tons were exported. Java is included, as being usually among such countries.

Exports of Rice from India in 1913–14

Destination.	*Tons.*	*Per cent.*	£
Ceylon	335,059	13·8	3,162,450
Straits Settlements	284,589	11·8	1,915,029
United Kingdom	161,409	6·7	1,129,677
Egypt	53,884	2·2	371,097
Mauritius and Dependencies	51,344	2·1	503,988
Other British countries	144,878	6·0	1,189,541
Total British countries	1,031,163	42·6	8,271,782
Holland	333,732	13·8	2,026,221
Germany	315,895	13·1	2,096,054
Austria-Hungary	211,442	8·7	1,370,032
Japan	160,646	6·6	1,076,886
Asiatic Turkey	81,057	3·4	665,869
Java[1]	39,412	1·6	261,158
Other Foreign countries	246,516	10·2	1,831,580
Total Foreign countries	1,388,700	57·4	9,327,800
All countries	2,419,863	100·0	17,599,582

[1] *The exports to Java in the years* 1909–10 *to* 1912–13 *were* 103,000 *tons*, 258,000 *tons*, 278,000 *tons and* 160,000 *tons.*

[1] Imports of rice into these other provinces (chiefly Bengal and Bombay) from abroad, though relatively small, are actually considerable in some years (41,462 tons valued at £404,551 in 1915–16, nearly all from the Straits Settlements).

It will be seen that three British countries—Ceylon, Straits Settlements and the United Kingdom—took about one-third of the total exports, and three foreign countries—Holland, Germany and Austria-Hungary—took another third. This statement is approximately true not only for the year 1913–14, but for the last five years before the war.

During the war the exports of rice from India have fallen off considerably; they dropped to 1,538,000 tons in 1914–15 and to 1,340,000 tons in 1915–16, *i.e.* to little more than half the quantity exported in 1913–14. This is due to the loss of enemy markets and the shortage of shipping, and has come about in spite of greatly increased exports to the United Kingdom, amounting to 297,000 tons in 1915–16. There is an export duty of 3 annas per maund (3*d.* per $82\frac{2}{7}$ lb.) on rice from India, and the revenue of the Government of India from this source declined from £858,000 in 1913–14 to £553,000 in 1914–15 and £508,000 in 1915–16. In view of the predominant position it occupies in the rice export trade, Burma has been the Province chiefly affected, but it has been helped over the difficulty by finding increased markets for its surplus produce in other parts of India, partly owing to a shortage in certain Provinces, and partly owing to the fall in the price of rice, which has enabled other Provinces to buy more freely from Burma. The importance of this branch of Burmese trade in normal times as well as during the war is shown by the following table:

Exports of Paddy and Rice from Burma

Year.	Foreign trade.[1]	Coasting trade (with other parts of India).		
		Paddy.	Rice.	Total.
Average of 5 years 1906–7 to 1910–11	*Tons.* 1,457,000	*Tons.* 298,000	*Tons.* 609,000	*Tons.* 907,000
1911–12 . .	1,930,000	104,000	141,000	245,000
1912–13 . .	2,062,000	76,000	190,000	266,000
1913–14 . .	1,855,000	277,000	612,000	889,000
1914–15 . .	1,126,000	316,000	907,000	1,223,000
1915–16 . .	960,000	276,000	956,000	1,232,000
1916–17 . .	1,215,000	159,000	869,000	1,028,000

[1] *Exports under this head consist almost entirely of husked rice, the quantities of paddy included amounting to only from* 10,000 *to* 29,000 *tons per annum in the eleven years covered by the table.*

It has already been stated that Burma's exports of rice to countries outside of India form about three-fourths of the total exports from India. The other fourth, exported from other provinces, includes rice required for consumption by Indian coolies abroad, and varieties specially grown for the European market, such as Patna rice. India's total exports of rice in 1913–14 were fully equal to the gross requirements of the rest of the British Empire ; but more than half the Indian exports went to foreign countries, while Indo-China and Siam sent a corresponding quantity to British countries. The following are the figures :

Exports of Rice from India in 1913–14

To British countries.	To foreign countries.	Total.
1,031,000 tons.	1,389,000 tons.	2,420,000 tons.

Exports of Rice to British Countries from India, Siam and Indo-China

	Tons.
India (1913–14)	1,031,000
Siam (1913–14)	810,000
Indo-China (1913)	491,000
Total	2,332,000

These are the returns of primary distribution, not of final destination. The above exports of rice from Siam and Indo-China went almost entirely to the distributing centres of Singapore and Hong Kong. Part of the Indian rice exported to foreign countries (notably Germany and the Netherlands) found its way to the United Kingdom after being cleaned and polished. During the war, this trade has been largely recovered by the British mills. It may not be practicable to limit the rice trade of the Empire wholly to British countries ; but efforts might at least be made to maintain the British rice-milling industry at such a level after the war that Indian rice for consumption within the Empire shall reach its destination without the intermediary of foreign countries. Another point to be borne in mind is the importance of increasing the low average yield of rice in India. Up to a certain point, increased production would be absorbed by increased local consumption, but beyond that point even a small percen-

tage increase of the total would mean a big percentage increase in the exportable surplus. There is plenty of scope for effort in this direction. In 1916–17, a good year, the average yield of cleaned rice in India was 958 lb. (8·6 cwts.) per acre. In Italy (1916) the average yield was 18 cwts., in Spain (1916) 29 cwts., while in both Egypt (1915) and Japan (1916) it was between 21 and 22 cwts. per acre.

Active steps are being taken in India to improve both the quality and the yield of the rice crops. In Burma, which is of primary importance from the point of view of the export trade, over 100 tons of improved rice seed were distributed for the first time in 1915–16 from the Hmawbi Experimental Station, and a similar quantity will be available from the Mandalay Farm during the present year. It is also proposed to start a seed and demonstration farm in each district of the Pegu Division. The following notes on rice production in Burma, extracted from a paper contributed to the International Congress of Tropical Agriculture at the Imperial Institute in 1914 by Mr. A. McKerral, Deputy Director of Agriculture in the Southern Circle, Burma, are instructive.

Burma has three climatic zones : (1) a southern tract with 70 to 200 in. of rainfall, (2) a northern area with 60 to 100 in., and (3) a central or dry area with 25 to 35 in. The main crop is from the first area, embracing the deltaic plains, where the soil varies from a sandy loam to a darkish clay of lateritic origin. Owing to the rapid hardening of the soil after the rains are over, the cultivation can only be by means of irrigation. Manuring is done in the nurseries, but scarcely at all in the transplanted fields. Only cattle manure is used, green manuring being impossible owing to the soil and the sudden approach of the monsoon ; weeds, however, are ploughed in when possible. Four main varieties of crops are recognised : (1) Early, maturing in 75 days ; (2) medium, maturing in 75 to 100 days ; (3) long lived, up to 120 days ; (4) glutinous varieties, used for special purposes, and never exported. The short-lived varieties are grown in the higher lands of the deltaic region, the long-lived in the lowest lands. The reaping of the main crop is done in

December and January, largely by coolies from Madras and Bengal.

Mr. McKerral put the yield in Lower Burma at 1,500 to 4,000 lb. of paddy (say 8·4 to 22·3 cwts. of cleaned rice) per acre. According to the Indian crop estimates for 1916–17, the average yield of rice throughout Burma was 8·4 cwts. per acre, against an average yield of 8·6 cwts. per acre for India as a whole. Cropping is continuous, and there are no rotations, with the result that the natives complain of declining yields. Hence Mr. McKerral reached the conclusion that Burma had arrived, before the war, at the stage of necessary transition from extensive to intensive methods of rice cultivation. Such a conclusion is strengthened by the further fact that the rice acreage of Burma, in the chief rice districts, has practically reached its natural limit, and increased production can only be achieved in those districts by more intensive cultivation. This is the more necessary in the interests of Burmese agriculture because there are no competing crops in the great rice-producing area of Lower Burma, though in certain parts of Upper Burma paddy is faced with possible competition from sugar cane, and lately there has been a movement to substitute wheat for paddy. Not only improved methods of cultivation, but improved methods of marketing the rice crop demand attention. At present Burmese rice is not in the highest category, the defects being chiefly due to (1) premature harvesting; (2) faulty storage; (3) damage from insects; (4) excess of red grain, whose presence in the mill damages the other grain; (5) excess of awned grain having the same effect; (6) mixture of several varieties in one sample; and (7) the presence of dust and grit.

These and other problems are under investigation at the two Government Experimental Stations at Mandalay and Hmawbi. To avoid glutting the market when the main crop is harvested it has been suggested that the rice should be stored in elevators. These are considered to be of doubtful value under the conditions which obtain in Burma, but storage sheds have been erected in recent years, with promising results in the way of extending shipments over a longer period. With regard to the

preparation of the crop for shipment, up-to-date mills owned by European firms are established at Rangoon, the chief centre of the rice trade, and also at the ports of Bassein, Moulmein, and Akyab. A large number of small mills throughout the country are owned by Chinese and Indians.

Ceylon.—The cultivation of rice is the principal industry of the native agriculturist in Ceylon. The area under crop is subject to considerable fluctuations from year to year. In 1911 it was officially estimated at 644,763 acres, in 1912 at 801,024 acres, in 1913 at 671,711 acres, in 1914 at 685,147 acres, and in 1915 at 785,100 acres. Over a period of twenty years before the war (1894 to 1913) production showed little more variation than might be expected from such fluctuations, and from the differences between good and bad seasons. The range of the official crop estimates in that period was from 10 million bushels of paddy to 16½ million bushels, the latter return (for 1912) being quite exceptional. If the relation of paddy to rice by volume be reckoned as 2 to 1, and the weight of rice in relation to volume as 164 lb. per 2½ bushels, the annual production of rice during the twenty years is found to have ranged from about 145,000 tons to 240,000 tons. The average for the period was about 11,500,000 bushels of paddy, or 168,000 tons of rice. The returns available for 1914 and 1915 are not complete, but the production showed little variation from the average. In 1915 the official crop estimates for all districts but Matara (where there were 42,000 acres under paddy cultivation) amounted to 11,145,553 bushels of paddy, equivalent to 163,000 tons of rice. This gives an average yield of only 4·4 cwts. of rice per acre, and a proportionate allowance for Matara would bring the total production in 1915 up to 172,000 tons.

In 1913, when the area under paddy was returned as 671,711 acres, and Matara was credited with the unusually high yield of 13 cwts. of rice per acre, the total crop was estimated at 12,822,761 bushels of paddy, or 187,750 tons of rice. This gives an average yield of 626 lb. (5·6 cwts.) per acre, which is much lower than in India. Taking the paddy acreage of 1915 (785,100 acres), and the census

population of 1911 (4,109,470), the area under crop per head of the population works out at no more than 0·19 acre, which is also much less than in most of the rice-growing provinces of India. Hence it is not surprising that production in Ceylon is not nearly equal to the needs of the population. Imports of rice in recent years have been about double the quantity produced locally. These imports are mostly from India, and amounted in 1913 to 376,678 tons of rice and 26,309 tons of paddy—equivalent to a total rice import of 393,121 tons. In 1914 it was 387,218 tons, and in 1915 it was 376,159 tons.

One of the chief impediments to progress appears to be the apathy of the native farmers. Experimental work has been carried out, and various suggestions have been made as to methods by which the Government could assist and encourage the farmers, but up to the present little has been achieved. An important question is that of irrigation, a large part of the rice area of the island being still dependent upon the rainfall ; but though it would no doubt be possible to extend irrigation to these parts, the more immediate prospects of improving the cultivation of rice would appear to lie in the proper utilisation of the areas that are already easily irrigable from the tanks. The Mannar District, where rice is grown under irrigation from the Giant's Tank and the works connected with it, is a good example of such an area ; for an account of the cultivation of rice in this district reference may be made to *The Tropical Agriculturist* (1915, **45**, 157). In many cases a lack of organised co-operation between native cultivators is a bar to the proper carrying out of irrigation schemes ; as a paddy field may sometimes belong to as many as fifty owners, it is evident that in the absence of co-operation little progress can be made.

Malaya.—In British Malaya, as in Ceylon, though rice cultivation is an important native industry, the production does not equal the consumption, nor are there any immediate prospects that it will do so. On the contrary, the annual reports on both the Straits Settlements and the Federated Malay States for the year 1915 refer to the growing neglect of rice cultivation, and the former report says : " From rice a Malay might expect, if the season did

not fail, to make with the united labour of his wife and family a bare livelihood. A small rubber plantation yields him enough to make him a comparatively rich man ; and instead of the dried fish and the cloth garment that were all that he could afford as a rice-grower, he eats imported rice and dresses himself and his family in silks. Such of the rice fields as are not cultivated are lying fallow, and cultivation can be resumed when required."

The uncertainty of the rice crop under present conditions of cultivation is an important contributing cause of its decline in native favour. In the *Agricultural Bulletin, Federated Malay States* (1912–13, **1**, 161), Mr. N. W. Barritt defined the main requirements of successful cultivation as (1) protection against the ravages of rats and wild pigs ; (2) an adequate water supply under control ; (3) the maintenance of soil fertility ; and (4) protection against insect and fungoid pests. The Agricultural Department of the Federated Malay States has been giving serious attention to these and other problems. In the Krian district of Perak, where extensive irrigation works have been established, some 50,000 to 60,000 acres have been brought under cultivation. The results have not been an unqualified success in all parts of the district, but it has been demonstrated that rice can be grown profitably where the crops have hitherto failed, if there is careful regulation of the water supply. Experience in the Krian area tends to show, also, that the natives are eager to engage in rice cultivation if there is reasonable prospect of success.

In the Straits Settlements, mainly in Malacca and Province Wellesley, there are about 91,000 acres under paddy cultivation, and in the Federated Malay States about 125,000 acres. Among the Unfederated States, Kelantan is credited with 93,000 acres, and the little State of Perlis with 20,000 acres. The rich alluvial plain of Kedah, adjoining that of Perlis, is largely devoted to rice cultivation, while in Trengganu, on the opposite side of the peninsula, the main plain contains a limited area of rice land which is also fully settled and cultivated. The yield of paddy in the Federated Malay States in 1913, according to a report by the Director of Agriculture, was 3,143,542 bushels. This was equivalent to about 46,000 tons of

rice, or about 819 lb. (7·3 cwts.) per acre. If the average yield in other parts of the peninsula was about the same in 1913, the production in the Straits Settlements in that year might be roughly estimated at about 35,000 tons, in Kelantan at about 35,000 tons, and in Perlis at about 7,000 tons. No data are available for estimates of the production in other parts of British Malaya.

As regards trade, the imports of paddy into the Straits Settlements have gradually increased from 59,238 tons in 1911 to 109,559 tons in 1915, while exports (including re-exports) have declined from 7,435 tons to 2,891 tons, the balance of imports over exports thus increasing in the five years from 52,000 tons to 107,000 tons. The net imports of rice have not increased at the same rate, for while gross imports have risen steadily from 595,156 tons in 1911 to 759,177 tons in 1915, exports in the same period have risen from 472,702 tons to 664,093 tons, the net imports for the five years being 122,000 tons, 194,000 tons, 162,000 tons, 182,000 tons, and 95,000 tons. Moreover, in estimating the position in British Malaya as a whole, it must be borne in mind that from 30 to 40 per cent. of the exports from the Straits Settlements go to other parts of the Malay Peninsula. If the returns for this inter-state trade be excluded from both the import and export accounts, the net imports of paddy into British Malaya through the Straits Settlements are found to have increased from 20,000 tons in 1911 to 70,000 in 1915, while the net imports of rice for the five years have been 296,000 tons, 396,000 tons, 368,000 tons, 385,000 tons, and 302,000 tons. These figures show the extent to which British Malaya is dependent on outside countries (chiefly India, Siam and Indo-China) for its supplies of one of the staple foods of its native population.

In the Federated Malay States alone, while there is a small net export trade in paddy, amounting to a few thousand tons annually, there is a net import trade in rice which amounted to 132,000 tons in 1905, whereas in each of the years 1913–15 it was from 174,000 tons to 190,000 tons. The increase in the ten years denotes the growing dependence of the Federated Malay States on outside sources of supply to meet its needs in rice.

Among the Unfederated States, Kelantan is practically

self-supporting in respect of rice. In Trengganu, according to an estimate by the British Agent, there is a total net import of rice, after allowing for the export of paddy, of about 6,000 tons. From Kedah there were exported in 1914–15 about 8,000 tons of rice and 39,000 tons of paddy, and from Perlis (from the accumulated stocks of two or three years) between 8,000 and 10,000 tons of paddy and rice. On the other hand, Johore imported about 31,000 tons of rice in 1915. On the whole, therefore, the supplies and requirements of the Unfederated Malay States may be said approximately to balance.

British North Borneo.—Rice is grown by the natives as one of their staple food crops. In the season 1914–15 an attempt was made for the first time by the Director of Agriculture to estimate the area under cultivation and the crop. The area under "wet" paddy was returned as 19,498 acres, of which 13,474 acres (two-thirds) were in the West Coast Residency and practically all the remainder in the Interior Residency, the East Coast Residency being credited with only 12 acres. The wet paddy crop in 1915 was 420,318 bushels, equivalent to about 6,154 tons of rice, or 707 lb. (6·3 cwts.) per acre. The area under "dry" paddy was returned as 31,597 acres, of which 18,980 acres (three-fifths) were in the Interior Residency, and the remainder chiefly in the West Coast, Kudat, and Sandakan Residencies, the return for the East Coast being again very small—86 acres. The dry paddy crop reaped in 1915 was 249,703 bushels, equivalent to about 3,656 tons of rice, or only 259 lb. (2·3 cwts.) per acre. The smallness of the average production of dry paddy was largely due to drought, the crop being a complete failure in some districts. The combined returns for wet and dry crops show the total area under cultivation as 51,095 acres, and the total crop as equal to 9,810 tons of rice, or 430 lb. (3·8 cwts.) per acre. Of the total area planted with paddy, 24,992 acres, or one-half, were in the Interior Residency, and 17,655 acres, or one-third, in the West Coast Residency. For the following season, 1915–16, the area returned as planted with wet paddy was 22,299 acres, and with dry paddy 27,169 acres, a total of 49,468 acres, or slightly less than the total for 1914–15.

Apart from drought and such pests as rats, the small average production is partly explainable by the primitive methods of cultivation. Even in good years production is far from being equal to consumption, taking the country as a whole. In the published trade returns the imports of rice are not shown separately, but the imports of "Rice Flour and Grain," which largely consist of rice, increased from about 8,000 tons in 1903 to about 15,000 tons in 1913. In the latter year the Sandakan Residency alone imported 4,625 tons of rice. The exports of paddy and rice—really in the nature of re-exports—are rarely more than about 200 tons per annum; in the period 1903–13 the maximum figure was 585 tons in 1907.

In his report for 1913 the Governor stated: "The native population grows about sufficient for its own consumption in an average year, but does not seem inclined to extend cultivation to any appreciable extent, in spite of the excellent market available for any surplus rice. It is to the Chinese settlers that the country must look for supplies in the future. Any amount of suitable land is to be had for the asking, and it is to be hoped that with the active assistance of Government in the important matters of drainage and irrigation enough rice may be produced eventually to feed the whole of the Asiatic population, and thus retain in the country some $750,000 (£87,500) per annum at present expended on importation of foreign rice." In the Agricultural Report for 1913 it was noted that foreign seed paddy introduced in 1912 appeared to be much appreciated both for its quality and its rapid growth.

Sarawak.—Rice is largely grown by the natives, and to a less extent by some of the Chinese settlers, but the country is not self-supporting in rice. There is little trade in paddy; imports and exports amount in some years to a few hundred tons, with the balance now on one side and now on the other. But the importation of rice is on a comparatively large scale, and is a Government monopoly. In the five years 1912–16 the quantities imported were 13,100 tons, 11,600 tons, 10,500 tons, 12,400 tons, 16,650 tons.

Hong Kong.—The total area under crop in the colony in 1916 was 47,629 acres, of which 33,942 acres were under

paddy. Of the paddy area 2,100 acres produced one crop, 20,342 acres produced two crops, and 11,500 acres produced two crops of paddy and one catch crop. There are no returns of production. Precise returns of the trade of Hong Kong are also lacking. According to returns (not compulsory and not vouched for officially) which are furnished by shipmasters and published in the annual reports on the colony, the annual imports of rice in the years 1909–14 inclusive ranged from 550,000 tons to 750,000 tons. A United States Commerce Report published April 26, 1917 (No. 97, p. 338), stated that the actual turnover of rice on the Hong Kong market in 1916 was placed by commercial estimates at 820,000 tons, or perhaps 20,000 tons above the turnover in a good normal year. The imports are mostly supplied by French Indo-China and Siam. The imports from Indo-China consist principally of whole cleaned rice, and from Siam of broken white rice. China gets the bulk of her imports of rice and paddy, which amount in some years to over half a million tons, through Hong Kong.

Australia.—The production of rice in Australia is at present a negligible quantity, though there are considerable areas suitable for growing rice, especially in the tropical and sub-tropical parts of the continent—North-Western Australia, the Northern Territory, and Queensland. A quarter of a century ago rice was grown on more than 1,000 acres in Queensland, but it was never a popular crop, and its cultivation has become practically extinct in that State ; one acre was planted with it in 1915. Commenting on the dwindling production, the Report on Agricultural and Pastoral Statistics of Queensland for the year 1914 stated that " this grain struggles for a home in Queensland but does not succeed." Efforts to revive the industry have not, however, been abandoned. Though the rice crop has been quite insignificant for many years, details of it have regularly been given in the Queensland crop returns, and the *Queensland Agricultural Journal* has repeatedly sought to stimulate interest in the subject. In an article recalling the past cultivation of rice in the State and indicating the potential value of the industry, the *Journal* (1916, **5**, 224) stated : " It seems strange that,

whilst we have thousands of acres of land admirably suited for rice-growing, we have allowed the industry to drop, and import rice to the value of £96,000 a year, all of which could be as easily grown as wheat or maize and to a greater profit, employing, as in other rural industries, only white labour." The districts in which rice used chiefly to be grown are the Cairns district, in North Queensland, and the Logan district, in South Queensland, near Brisbane. The portion of the Logan district known as Pimpama Island, lying between the Logan, Albert and Pimpama Rivers, is particularly well adapted to rice cultivation, the best results having been obtained from the variety known as White Java. The yield in this area has frequently amounted to 40 bushels of paddy (about 12 cwts. of cleaned rice) per acre. In the ten years 1906–15 the average yield from all rice plots in Queensland varied from 11 to 38½ bushels, the highest area under cultivation in any one year being 24 acres.

In the Northern Territory considerable attention has been given to the experimental cultivation of rice, both on the Government Farms and in the Botanic Gardens at Darwin. On Batchelor Farm 50 acres were sown in December 1914 with Java rice of different varieties. Grown primarily for fodder, the crop averaged about 2 tons of hay to the acre. Part which was left for seed produced about 20 bushels of grain per acre. The yield both of hay and grain would have been much greater if the dry season had not set in much before its time. In his report for the year 1914–15 the Administrator says: "It has been demonstrated that rice may be grown as an ordinary crop suitable for chaff as fodder, and probably, with a better year's rainfall, for milling."

While tropical Australia would seem to be the most promising field for rice-growing in the Commonwealth, the experimental cultivation of rice has been practised for some years in both Victoria and New South Wales. Such success as has attended these experiments is due mainly to the enterprise of Mr. I. Takasuka, a Japanese settler at Tyntynder, on the Murray River, who has developed by selection a variety bearing his own name. It is claimed that the seed germinates at a temperature of 56 degrees, and

that the plant does not suffer from frosts. In 1914–15, with an inadequate water supply, Mr. Takasuka obtained an average of 10 cwts. of rice per acre from an area of 10 acres. In the *Journal, Department of Agriculture, Victoria* (1916, **14**, 493) were reported the results of a trial cultivation of Takasuka seed by an Australian farmer near Koyuga (not far from the junction of the Murray and Goulburn Rivers). The yield was at the rate of 756 lb. (6¾ cwts.) of hulled rice per acre, and led to the suggestion that crops should be grown for grain in seasons of plentiful water supply and for fodder in dry years. These crops would utilise low-lying land which at present is too wet for wheat. There are said to be thousands of acres of such land along the Murray River and elsewhere in Victoria.

At the Yanco Experiment Farm, in the Murrumbidgee irrigation area of New South Wales, a plot of Takasuka rice, grown in 1915–16, was spoiled by hot, windy weather. At the Grafton Experimental Farm, in the north-east corner of the same State, where trials in earlier years with other varieties met with little or no success, a small plot under Takasuka rice gave a return of fodder at the rate of over 2 tons per acre and of grain at the rate of nearly 7 cwts. per acre. The *Agricultural Gazette, New South Wales* (1916, **27**, 799) stated that the grain was large and of excellent quality, while the foliage was soft and succulent, apparently of high feeding value, and much relished by stock.

Farmers with suitable land have been showing their interest in these various trials. Last year the crops of Takasuka rice, grown by private enterprise at Tyntynder and Koyuga, were sold for seed purposes at from 1*s.* to 2*s.* per lb. As an ordinary commercial proposition, rice-growing in both Victoria and New South Wales, as in other parts of Australia, has still to prove its value. At Koyuga it was calculated that if the crop (6¾ cwts. per acre) had been sold for food purposes, and had realised 2*d.* per lb. (£18 13*s.* 4*d.* per ton), there would have been a profit, after allowing for all expenses, including rent of land, of 16*s.* per acre. With larger experience it was hoped to secure a larger crop. The Australian farmer has an

advantage in the Australian tariff, which imposes import duties of 3*s.* 4*d.* per cental (100 lb.), equivalent to £3 14*s.* 8*d.* per ton, on uncleaned rice, and 6*s.* per cental (£6 14*s.* 5*d.* per ton) on other forms of rice, unless the rice is imported for the manufacture of starch, when it is given free entry. In addition the Commonwealth Bounties Act of 1907 made provision for a bounty of £1 per ton on uncleaned rice produced in Australia during a period of five years; but the *Official Year Book* of the Commonwealth states (1916 edition) that no such bounty has been paid.

Before the war, in the year 1913, Australia's imports of rice, according to the Commonwealth trade returns, had grown to 24,882 tons of "uncleaned" rice, of which 14,856 tons paid duty; 7,595 tons of rice "N.E.I." (not elsewhere included), of which 4,944 tons paid duty; and 13 tons of rice meal and flour. The uncleaned rice comes almost entirely from India, and according to the Indian trade returns it consists of "rice not in the husk," so that presumably it denotes rice which has been husked (cargo rice) but not fully milled. As regards the Australian imports of cleaned rice, China shares with India the great bulk of the trade. There is a re-export trade from Australia, which includes only a trifling quantity of uncleaned rice (5 tons in 1913), but reaches considerable proportions in respect of cleaned rice (6,072 tons in 1913), and rice meal and flour manufactured in Australia (2,126 tons in 1913). These exports go to New Zealand and the Pacific islands. In the first year of the war, 1914–15, imports were lower and exports higher. There were imported into Australia 19,406 tons of uncleaned rice, of which 18,873 tons paid duty; 7,224 tons of rice N.E.I., of which 4,041 tons paid duty; and 8½ tons of rice meal and flour; while exports amounted to 50 tons of uncleaned rice, 9,786 tons of cleaned rice, and 2,325 tons of rice meal and flour. The imports of uncleaned rice averaged in value, before payment of customs duty (£3 14*s.* 8*d.* per ton), nearly £9 per ton in 1913 and between £7 and £8 per ton in 1914–15; imports of rice N.E.I. averaged in value, before payment of duty (£6 14*s.* 5*d.* per ton), over £13 per ton in 1913, and nearly £12 per ton in 1914–15.

New Guinea.—The climate of Papua (British New

Guinea) is stated to be very congenial to rice ; but little if any of this cereal is grown by either natives or Europeans. In the five years 1910 to 1914–15 the exports of rice from Australia to Papua averaged 689 tons, with a minimum of 516 tons in 1913 and a maximum of 826 tons in 1912, when the export value was £10,650.

Experiments of an elaborate character have been made in rice cultivation at one of the mission stations in "German" New Guinea, and in 1912 it was reported that the prospects were very promising.

Fiji.—Indian settlers in Fiji have developed the cultivation of rice until it has become the third most extensive crop in the country. Expanding and contracting from year to year, with a marked upward tendency over a series of years, the returns of land under rice increased from 10,183 acres in 1910 to 14,195 acres in 1915, when they formed 10 per cent. of the total returns of cultivated land (excluding native cultivation). The two crops in Fiji covering larger areas were sugar cane, 62,308 acres (44 per cent.), and cocoanuts, 45,102 acres (32 per cent.). The production of rice in 1915 was returned as 18,157 tons, or about 25½ cwts. per acre. The returns do not specify whether this is rough rice, husked rice, or cleaned rice ; and it is doubtful to what extent the estimate can be relied on. Exports are practically nil. The production is unequal to the consumption, and in spite of an import duty of £2 per ton, the average annual imports of rice in the five years 1911–15 were 1,981 tons, the extremes being 1,317 tons in 1914 and 2,573 tons in 1915.

The Agricultural Department has engaged in the experimental cultivation of rice, but without much result, so far as can be gathered from its annual reports. In the report for the year 1914 it was mentioned that, as part of an effort to encourage the natives (Fijians) to extend the range of their crops, arrangements had been made to supply them with seed rice, and brief directions for planting rice had been translated into the Fijian language.

Egypt.—In normal years rice has a regular though minor place among Egyptian crops. According to the *Annuaire Statistique de l'Egypte*, in the ten years 1903–4 to 1912–13 inclusive the area under rice cultivation varied

from 234,000 to 298,000 acres. From 90 to 95 per cent. of this acreage was in Lower Egypt, and the whole formed between 3 and 4 per cent. of the total cultivated area in Egypt. In 1913–14, owing to the abnormally low level of the Nile, the area under rice dropped to 37,000 acres, but in 1914–15 it increased again to 331,000 acres, forming just over 4 per cent. of the total cultivated area. According to the crop report of the International Institute of Agriculture, Rome, the production of "rough rice" (paddy) in 1915 from an area of 331,000 acres was 585,000 tons, this being about 45 per cent. above the average for the quinquennium 1909–13. The equivalent production of cleaned rice in 1915 may be taken to have been about 366,000 tons, or 21·5 cwts. per acre. This is between two and three times the average yield in India.

Egypt does a moderate export trade in rice of her own production (almost entirely with Turkey before the war), but imports, as a rule, much larger quantities of cheaper rice, mostly from India, for home consumption. Last year the balance of trade was reversed. The following are the returns for the five years 1912–16 :

Year.	Imports. *Tons.*	Re-exports. *Tons.*	Exports. *Tons.*
1912 . .	33,793	230	24,740
1913 . .	53,442	86	23,169
1914 . .	49,514	29	13,077
1915 . .	24,464	78	10,422
1916 . .	7,752	50	22,473

Anglo-Egyptian Sudan.—In his report for the year 1915 the Director of the Commercial Intelligence Branch of the Sudan Government Central Economic Board mentioned the extended cultivation of rice as one of the most promising means of reducing the dependence of the Anglo-Egyptian Sudan on imports from abroad. At present rice is being grown in the Southern Provinces, notably the Bahr-el-Ghazal, only on a small scale, but the results are considered to justify efforts to extend its cultivation as soon as means are available. Samples received at the Imperial Institute from time to time have, at their best, been described by brokers as much superior to Rangoon rice ; the quality has not, however, been uniformly good.

As yet the local demand is rather limited. Imports of

rice, though considerable, are not a very big item in the total imports, and do not point to rice as a very important article of native diet. The population is estimated at nearly 3,500,000, and in the last few years rice imports (chiefly from India and Egypt) have been: in 1910, 1,815 tons; in 1911, 2,199 tons; in 1912, 3,136 tons; in 1913, 2,505 tons; in 1914, 3,073 tons; in 1915, 1,200 tons. It will be seen that the imports in 1915 (1,200 tons) were less than half the average imports during the previous five years (2,546 tons). In 1916 they increased again slightly to 1,620 tons. A small re-export trade, chiefly with Eritrea and Arabia, has developed in the last few years—25 tons in 1914, 157 tons in 1915, 111 tons in 1916.

Uganda Protectorate.—Only the merest beginnings have been made with rice cultivation in the Uganda Protectorate. The Blue Book for 1915–16 gave the ascertainable area under rice as 254 acres, practically all in the Buganda and Eastern Provinces. Several excellent Upland varieties can be grown, and a much larger area might be cultivated, especially in the rainy districts bordering the Victoria Nyanza; but hitherto efforts to bring the crop into favour with the natives have met with little success. The natives eat little rice themselves, and have trouble in husking the paddy, which in the rough state is practically unsaleable. The Department of Agriculture is showing much perseverance in trying to overcome these difficulties. The Director's report for 1915–16 stated that "further efforts have been made to extend rice cultivation, with some success, particularly in Bukedi and parts of the Northern Province. The local demand for rice is good, and there is every reason to hope that this will be satisfied in the coming years by local production." Imports during the five years 1911–12 to 1915–16 ranged between 352 tons (1915–16) and 562 tons (1913–14), the chief source of supply before the war being German East Africa.

East Africa Protectorate.—Rice is grown to some extent by the natives in the coast zone and in the country bordering the Victoria Nyanza. The Director of Agriculture, in his report for 1913–14, stated that the area under

rice was increasing, and mentioned in particular that large swamps in the Mumias and Kisumu districts (near Lake Victoria) had been drained and brought under cultivation. There is even a trifling export of locally grown paddy, decreasing from 27 tons in 1911–12 to less than 2 tons in 1914–15, the intervening period embracing a series of dry years. In 1916 only 5 cwts. were exported.

Production is nothing like equal to the requirements of the population (which includes a considerable Indian community), and imports of rice, chiefly from India, ranged from 6,295 tons in 1910–11 up to 8,178 tons in 1914–15. In 1915–16 imports dropped to 5,352 tons, valued at £58,421 ; but rice was still first among the imports of grain in respect of both quantity (56 per cent.) and value (52 per cent.). There is a 10 per cent. import duty on rice.

The experimental cultivation of Upland varieties has been tried on the Government farms at Mazeras, near the coast, and at Kibos, near the Lake. At both places the experiments have been hampered by droughts ; but in a good season at Kibos a yield of 1,100 lb. (9·8 cwts.) per acre was obtained from a 2-acre plot.

Zanzibar and Pemba.—Rice is cultivated in both islands by the natives for their own use, but not in large enough quantities to supply local needs. In Zanzibar it is grown in the low, swampy flats : in Pemba it is mostly grown in the swampy valleys, but very fair crops are also grown on the hillsides. The conditions in Pemba especially are very favourable to rice cultivation, and in the days of slave labour, when rice is said to have been grown by the Arabs in nearly every valley, a considerable export trade existed. With the decline of the plantation industry the water courses in many of the larger valleys have become choked with weeds, and the ricefields have degenerated into swampy wastes. The natives prefer more easily cultivated crops, such as mahogo (cassava). A good deal of rice is still grown, however, in Pemba, and as prepared locally it is stated to be far superior to any that can be bought in the open market, though owing to the laborious way in which it is harvested it could not compete commercially with cheap Indian rice. (See Capt. J. E. E. Craster's *Pemba*.)

There are considerable imports of rice into Zanzibar, coming almost entirely from India. A very large proportion of these imports are retained for local consumption. Normally most of the re-exports go to the mainland; German East Africa took the bulk of them in 1913. In the official returns the trade in rice is recorded in "packages." From the value assigned to them the net imports may be put at between 10,000 and 20,000 tons.

Mauritius.—A local variety of "wet" rice was formerly grown in Mauritius by irrigation, but its cultivation was given up partly because land was wanted for sugar, and partly because the Indian population preferred Indian rice. Indian varieties have been introduced, and are grown by peasant proprietors at Grand Post, but the area under cultivation is not large enough to be separately recorded in the published returns of agricultural industry in the island. Trials with different kinds of seed are being made by the Agricultural Department. Rice is the chief article of food of the majority of the population (376,000 in 1914, of whom 261,000 were Indians), and the annual imports amount to from 50,000 to 60,000 tons, mostly obtained from India.

Nyasaland.—Introduced among the natives by the Arabs and the Portuguese, the cultivation of rice in Nyasaland was encouraged under British rule partly in order that local supplies might be available for the native troops, for whom about 500 tons per annum were required, and partly in order that the natives might be provided with a means of paying their hut tax in kind. A promise was given that, as far as possible, a market would be found for any surplus production. At present the development of the industry is just about adequate to the local needs. Rice does not figure in the import returns; in some years a few tons are exported. The crop varies a good deal according to the season. In the six years 1911–16, the smallest crop was 717 tons in 1914, and the largest 1,317 tons (preliminary estimate) in 1916. There are large tracts in the lake region suitable for rice, and cultivation could probably be extended if freight and other charges permitted of its export at a price which would both offer inducement to the natives to grow it, and enable it to compete with other supplies in open market.

Rhodesia.—Rice is grown by the natives in both Southern and Northern Rhodesia. In Southern Rhodesia its cultivation was so far successful that in 1905 the *Rhodesia Agricultural Journal* (1904–5, **2**, 84) raised the question of adopting rice as a staple crop. But the results of experimental work have not been encouraging, and instead of rice becoming a staple crop, the Director of Agriculture, in his report for the year 1909, noted a widespread tendency among the natives to abandon their old crops—millets, Kaffir corn, and rice—in favour of mealies, beans, and ground nuts. Rice is not much favoured by the natives in the western districts of Southern Rhodesia, and where it is still grown in other parts of the country it generally supplies purely local and individual needs. Rice is eaten by many of the natives in the mines, especially by the Nyasaland natives, and for their requirements as well as for those of the white population it has to be imported, chiefly from India. For some years before the war the imports ranged from about 1,500 tons to nearly 2,000 tons, valued at from £15,000 to £25,000; in 1915 and in 1916 the quantity dropped to between 700 and 800 tons, and the value to £10,000.

In Northern Rhodesia the natives cultivate both red and white varieties of rice, the latter having been introduced by the Arabs. The authors of *The Great Plateau of Rhodesia*, Messrs. Gouldsbury and Sheane, both of the Rhodesian service, express the hope that " by gradually fostering the cultivation of rice and of cassava, the natives [of North-Eastern Rhodesia] will in time become alive to the easiness with which these foods are grown, and slowly substitute them for their more uncertain crops of millet." In the last few years (1913–16) the annual imports of rice into Northern Rhodesia have ranged from about 30 to 80 tons.

Union of South Africa.—The conditions of rainfall and water supply are not generally favourable to rice cultivation in the South African Union, and there is not much grown, though trial crops in Natal between Tongaat River and Stanger are said to have given good results. There is an ample market within the Union, the net imports of rice for several years past having been between 30,000

and 40,000 tons, with a value of between £300,000 and £400,000. Imports are subject to a duty of 1*s.* per 100 lb., or about 22*s.* 5*d.* per ton.

Gambia.—Rice is grown by the natives in the low-lying, swampy country near the River Gambia. The conditions are favourable to its cultivation, and an irrigation expert who visited the colony some years ago reported that the natives understood this branch of agricultural industry as well as the natives of the East. The crops are so liable to destruction by floods, however, that the quantity grown is limited, and falls far short of the colony's requirements. In 1915, in spite of transport difficulties, the imports of rice amounted to 2,163 tons valued at £27,115. Of this quantity all but 13 tons (which came from Sierra Leone) consisted of Asiatic rice, mostly imported from Europe. Only 19 tons were re-exported, and one ton of locally grown rice was sent out of the country. These figures are typical of the trifling character of all branches of the trade except the imports of Asiatic rice. The average quantity of such imports in the five years 1910–14 was 6,273 tons, and the average value about £67,000, the greater part being supplied before the war by Germany. There is an import duty of 10*s.* per ton. Much larger quantities might be grown within the colony under a proper system of irrigation and protection from floods, but hitherto the cost has been considered by Government to be prohibitive.

Sierra Leone.—This dependency is the premier rice-growing country in British West Africa. There are no crop statistics, but to judge from the import and export returns the production of rice is seldom much short of local requirements. Trifling quantities of African rice are imported from other parts of the West Coast, and considerable quantities from Europe. In 1910 the latter amounted to nearly 7,000 tons, and in 1911 to over 3,000 tons; but in no other year from 1900 to 1915 did they total 1,000 tons, and generally they were less than half that amount. Against these imports have to be set considerable exports of rice grown in Sierra Leone, which find a market in other West African countries. Comparison between the imports and exports is complicated

by the fact that while the trade in " European " rice is measured by weight, the trade in African rice is measured by volume, and is divided between rice in the husk and clean rice. Reckoning that two bushels of paddy yield one bushel of clean rice, and that a bushel of rice weighs about 65½ lb., the total exports of home-grown rice from Sierra Leone in the five years 1911–15 work out at 340 tons, 474 tons, 323 tons, 329 tons, 435 tons. The imports of " European " rice in 1915, after allowing for re-exports (14 tons), were 462 tons, or only 27 tons more than the exports of home-grown rice ; and the exports were actually the more valuable. No doubt the special conditions created by the war, notably in respect of high prices, were partly responsible for this result in 1915 ; but the Governor of Sierra Leone notes that the exports increased in that year, compared with 1914, " in spite of restrictions which it was found necessary to impose on the exportation of rice." There is no import duty on rice.

A former District Commissioner, Mr. T. J. Alldridge, stated some years ago that " Sierra Leone is absolutely a rice country, and can produce any quantity of it." Rice, fish, and cassava are the staple foods of large numbers of the native population, and the production of rice has received much encouragement from Government. Extended cultivation has been reported in recent years from various districts, notably in the neighbourhood of railway construction. Experiments have been carried out by the Agricultural Department with a view to the introduction both of new varieties and of improved methods of cultivation. The value of deep hoeing and green manuring in increasing the yield of local varieties has been shown, and satisfactory trials have been made with Indian and British Guiana rices. The Indian rices are not viewed with favour by the natives, because they are smaller in grain than the Sierra Leone varieties. The brownish colour of the native rice is against its sale on the European market, but the local varieties are well liked along the West Coast, where Sierra Leone rice at present finds its market. There seems to be no doubt that white rices can be grown in Sierra Leone. Apart from the experi-

ments of the Agricultural Department, Mr. Alldridge, so far back as 1905, stated that for some time past a fine variety of white American rice, introduced by American missionaries, had been grown in Sierra Leone with very good results.

Gold Coast.—Rice in the Gold Coast is classed among those minor products whose cultivation " at present is scarcely sufficient to meet local demands, and there is little likelihood of an export industry being started, although there are large areas of available land which might be profitably put under cultivation " (*Report of the Agricultural Department for* 1913). A certain amount of experimental work has been carried out at Agricultural Stations in the Northern Territory, especially at Tamale, where rice has been successfully grown in a three years' rotation, following two crops of cotton. So far, however, from the production of rice in the Gold Coast as a whole becoming more nearly equal to the consumption, imports tend to increase. During the 12-year period for which statistics are available, 1904–1915, the imports of rice advanced from 4,464 tons to 7,696 tons, the minimum for the period being 3,595 tons (value £42,013) in 1907, and the maximum 7,982 tons (value £111,233) in 1913. There are no exports of locally grown rice, and only trifling re-exports. On nearly all rice there is an import duty of £1 per ton, though some of the imports of rice from neighbouring countries are charged at the rate of 4 per cent. *ad valorem*.

Nigeria.—Rice is grown to a small extent in the Southern Provinces of Nigeria and to a much larger extent in the Northern Provinces, where it occupies a greater area than is under wheat. The locally-grown varieties, which are large in the grain and of a slightly reddish tint when cleaned, are highly esteemed in the Northern Provinces, and command a higher price than the imported white rice. There is little trade movement in rice, either outward or inward, so far as the Northern Provinces are concerned, so that the supplies grown there would seem to be about equal to the consumption ; but in the Southern Provinces there are large imports, chiefly from the United Kingdom. In 1915, when there was a scarcity of shipping due to the war, these imports amounted to 5,441 tons,

valued at £80,617. In the previous year they were 10,641 tons (£109,520), and in the three pre-war years (1911–13) they averaged 10,896 tons in weight and £119,014 in value.

There is scope for greatly extended cultivation of rice in Nigeria. If such development should take place, it might be necessary to clean the grain more thoroughly than is usual in native practice, to enable it to compete in Southern Nigeria with the imported rice, which is now securely established in the market there. Average yield and price are perhaps still more important factors. Improved transport facilities will help to reduce the cost of marketing the native product, while as to yield the Northern Nigeria Blue Book for 1913 stated: "Imported maize and rice have yielded returns considerably in excess of native varieties, which they are likely gradually to replace."

British Guiana.—Among the agricultural industries of British Guiana the cultivation of rice ranks next in importance to sugar planting. Rice was first introduced from Carolina by the Dutch some two hundred years ago, and it used to be a favourite crop among the runaway slaves; but efforts to develop its cultivation as a settled industry met with little success till towards the close of last century. Since then such rapid progress has been made that in 1915 the area under rice was returned as 50,737 acres—the highest on record up to that year. The rice acreage formed 29 per cent. of the total area under cultivation, the area under sugar-cane being 75,744 acres (43 per cent.), and under miscellaneous crops 49,888 acres (28 per cent.). If allowance be made for holdings from which two crops were gathered, the area reaped was 55,574 acres.

The crop in 1915 was estimated by the Department of Agriculture as 65,700 tons of paddy or 39,420 tons of cleaned rice (the Department reckons the production of rice as 60 per cent. of the paddy by weight). With 50,737 acres under rice, this is equivalent to an average yield of 15·5 cwts. of cleaned rice per acre, which is nearly double the average yield in India, and higher than the average for the United States, though much below that of some other countries, such as Egypt and Japan. In 1914 a

smaller area (47,037 acres) under rice cultivation in British Guiana was estimated to have produced a slightly larger crop (39,760 tons of cleaned rice), or an average yield of 16·9 cwts. of rice per acre. Such an average must be regarded as a very favourable feature of the rice industry in British Guiana. The Agricultural Department has shown much enterprise in conducting experiments to discover the most suitable varieties of seed and the best methods of cultivation. Over two hundred kinds have been imported from other countries for trial, and the long-grained varieties find most favour. Among other assistance given to cultivators, the Department distributed in 1915 alone 22 tons of selected seed paddy, or sufficient to plant nearly 1,000 acres.

The rapid expansion of the area under cultivation has been largely due to the industry and skill of East Indian coolies who have settled in the country after completing their terms of contract labour on the sugar estates. Of the 50,737 acres under rice in 1915, 13,600 acres, or rather more than one-fourth, were situated within the empoldered areas of sugar plantations. Very much larger areas of the flat, heavy coastal lands are suitable for rice cultivation ; and if the industry continues to expand as it has been doing, British Guiana may become an appreciable factor in the rice trade. Already the position occupied by rice in the colony's own trade has been reversed. Imports, which amounted to 11,300 tons in 1899, dwindled to 2 tons in 1915, while exports, which began with 5 tons in 1902–3, increased to 9,058 tons in 1915, nearly all going to the British West Indies. In addition there are small exports of paddy (172 tons in 1915) and rice meal (266 tons in 1915). The rice produced, both for local consumption and for export, is " brown " rice, which is obtained by soaking and steaming the paddy before it is milled. White polished rice is not favoured, and the numerous rice mills which have sprung up in the colony are specially adapted to the manufacture of brown rice. A cattle food known as " colco " has been made from rice tailings and molasses.

Trinidad.—Rice-growing in Trinidad is chiefly done by settlers of the Indian coolie class. The report of the Agricultural Department for 1915 gives the area under rice

cultivation in 1914–15 as 12,328 acres (out of a total cultivated area of about 450,000 acres), against 10,410 acres in 1909–10, an increase of 2,000 acres in five years. On the other hand a report drawn up in January 1917 by a Special Committee of the Board of Agriculture estimated the area under paddy cultivation at about 5,000 acres, and the paddy crop at roughly 40,000 bags of 160 lb. each, yielding approximately 60 per cent. of cleaned rice by weight. On this basis the production of cleaned rice would be rather more than 1,700 tons, and the average yield about 7 cwts. per acre. The report—published in the *Bulletin of the Department of Agriculture, Trinidad and Tobago* (1917, **16**, 15)—stated that swamp rice was principally grown. Upland rice is also cultivated widely, but on a very limited scale. Hitherto the trials made with imported Indian varieties have not given good results ; the yield has been poor and the grain not so good as that of local varieties. But some varieties imported from British Guiana have given good results, both in yield and in the quality of the milled product. There are three rice mills—at Port of Spain, St. Augustine, and Chaguanas. These are capable of dealing with more than double the present crop, which is not nearly equal to the consumption. Imports (principally from British Guiana, India and the United Kingdom) amounted to 11,884 tons in 1911, 10,536 tons in 1912, 8,409 tons in 1913, and 11,522 tons in 1914, the value of these imports ranging from £116,284 to £154,472. An import duty of *2s. 2d.* per 100 lb. (about 48*s.* 6*d.* per ton) is levied. A few hundred tons are re-exported, and in 1913 there were exported (to Germany) 9 tons of rice grown in Trinidad. There is a sufficiency of suitable land in the island to grow rice for all local requirements, especially in the swamp lands of Oropuche and Caroni, adjoining the west coast. Most of the lands at present returned as under rice cultivation are in the neighbourhood of these swamps or lagoons. The rice is generally sown in May or June, soon after the beginning of the rainy season, and is harvested about five months later. To encourage increased cultivation the Committee, whose report has been adopted by the Board of Agriculture, recommended prize competitions, the importation of seed rice from British Guiana

for sale at the same price as local seed rice, the continuation of experimental work, the opening up to cultivation of suitable Crown lands, and the investigation of proposals for reclaiming certain areas of swamp land by an irrigation scheme. If such a scheme is found to be feasible, it is suggested that the Government might guarantee interest on the capital cost.

St. Lucia.—Rice is grown in small patches by the East Indian labourers employed on the large sugar estates. This statement appears in a pamphlet on the resources of St. Lucia by the Agricultural Superintendent. Imports of rice (practically all for home consumption) in the five years 1910–14 averaged 262 tons. There is an import duty of 2*s.* per 100 lb. (about 44*s.* 10*d.* per ton).

Jamaica.—Rice is grown in small patches in the Western parishes of the island by numbers of coolies on the sugar estates. They grow it for their own food requirements in swamp lands considered worthless by the proprietors. From the coolies the industry has spread to the creole population, and, though cultivation is still on a small scale, the interest taken in it is much greater than the official returns indicate. In the five years 1909–10 to 1913–14 the area returned as being under rice ranged from 80 to 100 acres; in 1914–15 it was 13 acres, and in 1915–16 it was 12 acres—out of a total of 278,262 acres of tilled lands. Rice, however, from the circumstances of its cultivation, is one of those minor products for which it is difficult to gather adequate statistics; as the Collector-General points out in his report for 1915–16, "perhaps the most that can be said in regard to these minor items is that the agricultural product specified can be and is the object of cultivation." Writing in the *Journal of the Jamaica Agricultural Society* (1917, **21**, 16), Mr. R. C. Somerville, Agricultural Instructor for Southern Westmoreland and Hanover, estimates roughly that there are 500 acres under rice in Westmoreland parish alone. Not only a superior quality of brown or "coolie" rice, but fine white varieties are grown. Rice-milling plants have been erected on two estates. Good results are said to have been obtained by feeding mules on a mixture of rice bran and corn in equal weights. While it remains a coolie and creole industry,

rice cultivation must be in small patches, because the cultivators have not the capital to drain the swamp lands on a large scale. But it is claimed that if these lands, forming the Great Morass of Westmoreland, with an area of from 10,000 to 20,000 acres, could be properly reclaimed, they could grow sufficient rice (among other crops) to meet all the needs of the colony and leave a surplus for export. At present there is a large import trade in rice, varying in quantity during the six years 1910–15 from 5,086 tons (1914) to 7,687 tons (1912), with an average of 6,367 tons, the annual value of the imports during the same period ranging between £59,000 and £106,000. An import duty is levied of 3*s*. per 100 lb. (over 67*s*. per ton).

British Honduras.—This colony has not the labour supply required for growing rice on a large scale, though the natural conditions are believed to be very favourable. A little upland rice is grown (the only return given in the Blue Book for 1914 is 50 acres in Toledo District). Crops are said to be of good quality, but very liable to damage from birds. No attempt has been made to grow rice under irrigation. There is a considerable import trade, valued in the five years 1910–14 at from £9,000 to £11,500 per annum, the average being about £10,000. The quantity of rice imported is not given in the trade returns.

Foreign Countries

Italy.—The largest rice-producing country in Europe is Italy. It easily retains that position, though the acreage of its rice fields has declined by over one-third in the last fifty years, owing to the competition of Asiatic supplies, trouble with disease, and the tendency to grow rice as a rotation instead of a permanent crop. In the quinquennium 1870–74 the area under rice cultivation is said to have been 573,000 acres; in 1916 it was 353,000 acres. The total area of irrigated land on which rice is grown is estimated at over 2,000,000 acres. The yield per acre has increased at a greater rate than the annual area under crop has declined, averaging 9 cwts. of cleaned rice (14·5 cwt. of paddy) per acre in the years 1880–84, and 16·7 cwts. of cleaned rice in the years 1909–14. As a result, the

total production has increased. In 1894 an area of 408,000 acres, with an average yield of 9·5 cwts. of cleaned rice per acre, produced a crop of 194,000 tons; in 1916 an area of 353,000 acres, averaging 18·1 cwts. per acre, produced a crop of 320,000 tons.

The chief rice-growing centre is the Vercellèse in Novare Province; thereafter come Lombardy, Venetia, etc. In some irrigated areas cultivation is extending, rice being recognised to be both a weed-cleaning and a profitable crop. The transplanting method of cultivation, introduced by the Experimental Rice-growing Station at Rieti, has proved useful in reclaiming marshes.

Italy not only meets her own needs in rice, but does a considerable export trade. Imports amounted to some 10,000 tons of husked and cleaned rice in 1910, but this was exceptional; in no other year of the quinquennium 1910–14 were they more than a few hundred tons, and in 1912 they were only 38 tons. On the other hand the exports of rice of one kind and another (mostly cleaned rice) are normally between 50,000 and 100,000 tons per annum. In the quinquennium 1910–14 the exports of paddy averaged 9,000 tons (minimum 7,700 tons in 1910; maximum 11,500 tons in 1914); of husked rice (*riso semi-greggio*), 11,650 tons (minimum 2,500 tons in 1910, maximum 18,000 tons in 1912); and of milled rice (*riso lavorato*), 51,270 tons (minimum 36,675 tons in 1910; maximum 62,855 tons in 1914). Of the exports of cleaned rice in 1914 nearly 25 per cent. went to Argentina, over 20 per cent. to Austria-Hungary, 12 per cent. to Germany, 10 per cent. to Switzerland, and 9 per cent. to France.

Spain.—Among European rice-producing countries, Spain ranks next to Italy. Rice cultivation was introduced into Spain by the Moors, who probably introduced also the transplanting system. The industry is carried on by means of irrigation, and is confined to the east coast provinces, nearly three-fourths of the total area under cultivation being in Valencia. The official delegate for India to the International Rice Congress held at Valencia city in May, 1914, in an article published in the *Agricultural Journal of India* (1914, **9**, 326), expressed the opinion that the cultivation of rice has probably been brought to a higher pitch of

perfection in Valencia province than in any other part of the world. Owing to the increased thoroughness of the cultivation, the Andalusian breed of horses has been found to be too light for the heavy work required in the rice fields, and in consequence nearly two-thirds of the horses in the province are now of French (Breton) or mixed origin. The rice lands are mostly permanent, and their cultivation is more nearly according to Indian methods than is the case in Italy, where, as also in Greece, rotational methods mainly obtain. The average yield per annum in Spain is between three and four times as high as in India, a result due to heavier manuring, better cultivation, and the use of improved varieties. It is also more than 50 per cent. higher than in Italy, chiefly owing to the prevalence of transplanting in Spain. In the five years 1911–15 the area under rice cultivation in Spain averaged about 96,000 acres, and production averaged about 125,000 tons of cleaned rice, or 26 cwt. per acre. In 1916 the area under cultivation was about 101,000 acres and the production 148,500 tons of cleaned rice, or 29 cwt. per acre. Thus in 1916 the rice acreage in Spain was less than 30 per cent. of the acreage in Italy ; but the rice production in Spain was more than 45 per cent. of the production in Italy.

The chief characteristics of the Spanish methods of cultivation are (1) the universally accepted importance of a thorough cold weather cultivation of the fields, made possible by the use of specially adapted implements ; (2) the necessity of employing considerable quantities of suitable nitrogenous and phosphatic manures ; and (3) the value of introducing exotic varieties (notably Japanese) with a view to checking deterioration of races cultivated too long in the same locality.

There is an Experimental Rice Station at Sueca, near Valencia.

During the ten years 1905–14 Spain imported between 1,000 tons and 2,000 tons of paddy annually, and usually a much smaller quantity of cleaned rice, though in 1912 (following the failure of the Spanish rice crop in 1911) the imports of cleaned rice rose to 5,670 tons. The exports of rice from Spain in the same decade ranged between 2,000

tons (1911) and 20,000 tons (1913). In 1915 the exports jumped up to 50,000 tons, of which Argentina took 22,000 tons (44 per cent.), Uruguay 8,500 tons (17 per cent.), and Italy 7,500 tons (15 per cent.).

Bulgaria.—The largest area under rice cultivation in Bulgaria in recent years was in 1909–10, when 9,650 acres produced 4,350 tons of clean rice, an average of 9 cwts. per acre. In 1912–13, the latest year for which returns are available, the area under cultivation was 7,220 acres and the production 2,300 tons, or nearly 6½ cwts. per acre.

Greece.—Before the war the returns of land under rice cultivation in Thessaly were increasing rapidly. According to British consular reports, 400 acres planted in 1908 produced 35 tons of rice (whether paddy or cleaned rice is not stated) in 1909—an average of only 1¾ cwts. per acre. The area planted in 1910 was 817 acres and the production (1911) 177 tons—an average of between 4 and 5 cwts. per acre. In 1913 the area placed under cultivation jumped up to 3,320 acres and the 1914 crop was 664 tons—4 cwts. per acre.

It has been estimated that in the new provinces of Greece (gained in the Balkan wars before 1914) there are from 2,000 to 3,000 acres normally under rice, and there is also cultivation on a small scale in the districts of Elis, Bœotia and Marathon.

In the decade 1905–14 Greece imported between 5,000 and 6,000 tons of rice annually.

Turkey in Europe.—In the *Annuaire International de Statistique Agricole* covering the decade 1905–14, the only year for which returns are given of rice cultivation in European Turkey is 1910–11, when the area was recorded as 7,327 acres and the production as 1,003 tons of rough rice—say 627 tons of cleaned rice, an average of only 1¾ cwts. per acre. Much of the territory to which these returns related was lost by Turkey in the Balkan Wars of 1912–13.

European Russia.—In 1912–13 it was estimated that 2,929 acres under rice cultivation in the northern districts of Caucasia yielded 693 tons of cleaned rice (nearly 5 cwts. per acre). In 1913–14 the corresponding area was only

1,313 acres and the yield 255 tons of cleaned rice (nearly 4 cwts. per acre).

In the decade 1905–14 the annual imports of rice into the Russian Empire as a whole (European and Asiatic), Finland excepted, were about 100,000 tons, consisting mostly of cleaned rice, while the annual exports were only from 2,000 to 5,000 tons.

Portugal.—In Portugal a certain amount of Government encouragement has recently been given to rice growing, but the facilities offered are not considered sufficient to induce cultivation on a large scale. At present rice is grown only in a few patches on the coast.

France.—Efforts have been made to popularise rice cultivation in the Rhone delta, and before the war a few hundred acres were under cultivation there.

China.—Mention has already been made, in the brief survey of the world's production of rice, of the difficulty of computing China's contribution to the total. Whether it is actually greater or less than that of India, there is no doubt that it is very large indeed. The country over which rice is grown extends from Manchuria in the north to Yunnan in the south, and the itineraries of travellers in the great rice-producing provinces of Central China abound in references to paddy fields as one of the most prominent features of the countryside. On the other hand, the importance even of rice among the field crops of China must not be exaggerated. It is grown in Manchuria, not under irrigation as in the Yangtse basin, but on dry land like other cereals. Mr. (afterwards Sir) Alexander Hosie noted in 1904 in his book *Manchuria* that rice cost twice as much to buy as tall millet, the staple food of the people, and that it was not extensively grown in that part of China. In his later work, *On the Trail of the Opium Poppy* (1914), he states: "As in Manchuria and North China, rice is a luxury to the peasantry of the north-west." Mr. E. H. Wilson, in *A Naturalist in Western China*, does full justice to rice as the most important foodstuff of the Chinese people, but points out that as it requires an aquatic habitat its area of cultivation is restricted, and "probably a third of the people never taste this grain save on festival occasions."

In an attempt to indicate roughly the northern limit of the area in which rice is grown in China as the staple food-crop, the 32nd parallel has been chosen. This cuts the coast at the mouth of the Yangtse, passes through Nanking, and continues westward to the north of the great middle reaches of the Yangtse. Except in the coastal province of Kiangsu, the amount of rice grown to the north of this latitude is comparatively small. Even to the south of it rice is not universally the staple food of the people. Writing of the north-east corner of Yunnan, Sir Alexander Hosie mentions that the people of the Chao-tung Plain are mostly maize eaters, and those who require rice have to obtain their supplies from a district six or seven days' journey to the south-west.

Similar reservations, however, might be made with regard to the cultivation and consumption of rice in India ; and when all due limitations have been imposed on China's claims as a rice-growing country, it remains generally true that " rice is to the Chinese what wheat is to us, only more so " (Wilson). The typical methods of cultivation are by irrigation and transplanting ; but, as already noted, rice is grown without irrigation in Manchuria, and in Yunnan also upland varieties are grown, though the crops are described as being very inferior to those obtained from aquatic rice. Over most of the rice lands of China one crop per annum, occupying the ground from May till early September, is the rule, but some districts in the south yield two crops in the year. Three main groups of varieties are distinguishable—ordinary, red and glutinous. Only the first two are grown for food purposes. Glutinous rice is sometimes eaten for a change, but its ordinary uses are industrial. It yields a weak spirit, as well as a kind of sugar, and is also used in the manufacture of cakes and sweetmeats. Rice straw is largely used for making bed mattresses and sandals, and to a less extent for making ropes.

Great as is the production of rice in China, it is inadequate to the needs of the vast population. There is a large internal trade, both overland and coasting, but the export of rice abroad is prohibited, and can only take place in small quantities under special arrangements. According

to the Maritime Customs returns, exports of rice and paddy in the years 1912–15 ranged from 1,300 to 5,000 tons. On the other hand imports in 1910–15 ranged from 161,000 tons (1912) to 549,000 tons (1910). The imports in 1912 were usually small, the next lowest figure during the period named being 316,000 tons (1911). Most of these imports are received *viâ* Hong Kong, and no precise figures as to the countries of origin are available; but most of the imports of rice into Hong Kong are derived from French Indo-China (chiefly whole cleaned rice) and Siam (chiefly broken white rice). Hong Kong's total imports of rice, as noted in the section dealing with that colony, have varied in recent years, according to unofficial returns, from about 550,000 to 750,000 tons.

It is possible that the paddy fields of China have been or may be extended by the utilisation for that purpose of lands formerly under poppy cultivation for opium. Sir Alexander Hosie found evidences of such change during his travels in the Yangtse basin in 1911.

Japan.—Among rice-producing countries, as distinct from rice-exporting countries, Japan ranks next to India and China. Known in very early times as "Mizuhono Kuni," "Land of Luxurious Rice Crops," it justifies the description to-day to a greater extent than ever before. In the last forty years, in particular, the increase of production has been very marked. This is partly due to extension of the area under rice cultivation, but more to growth of the average yield. In 1878 the cultivated area was 6,100,000 acres; now it is about 7,500,000 acres, an increase of between 20 and 25 per cent. In 1878 the crop was returned as 25,282,540 koku, or 3,546,000 tons of cleaned rice[1]; in 1916 it was 58,301,680 koku, or 8,177,000 tons,

[1] One koku = 4·96 bushels. The *Financial and Economic Annual of Japan* records the production simply as "rice." The United States Department of Agriculture, which estimates the weight of cleaned rice produced in the principal rice-growing countries, used to base its estimate for Japan on the assumption that the Japanese returns related to paddy. In the Department's *Yearbook* for 1916, however, the estimate has been revised to accord with the view that the official figures relate to cleaned rice. The equivalents adopted for the conversion of the returns from volume to weight are not given in the *Yearbook*, but they are evidently, from the results obtained, in close agreement with the equivalents adopted by the International Institute of Agriculture at Rome, namely, 1 koku of rice = 1·425 quintals—*i.e.* 4·96 bushels

an increase of over 130 per cent. In 1878 the yield per acre averaged between 11 and 12 cwts.; in 1916 the average was between 21 and 22 cwts. per acre. While the increase has been spread over the whole period, it is noteworthy that 1916 was a year of exceptionally heavy crop, as also were the years 1915 (7,843,000 tons) and 1914 (7,995,000 tons). For some years before 1914 the crop averaged about 7,000,000 tons of cleaned rice per annum. The average for the ten years 1907–16—the decade ending with the three years of big crops (about 8,000,000 tons)—was 7,342,000 tons. Improvements in the methods of crop determination may partly account for the sudden increase in the returns for the last three years; but the increase is largely due to recent improvements in the selection of seed and methods of cultivation, as well as to the prevention of damage from natural causes. Even if the last three years be left out of account, it will be seen that the production (7,048,000 tons from 7,422,777 acres in 1913) had nearly doubled since 1878, and that the average yield in 1913 was 19 cwts. per acre, or between two and three times the average yield in British India. With about one-tenth of India's rice acreage, Japan has about one-fourth of India's crop. Such comparisons may be misleading, unless the highly intensive character of Japanese farming is taken into account. According to *Outlines of Agriculture in Japan*, published by the Agricultural Bureau at Tokio in 1910, 70 per cent. of the farmers cultivate less than 1 cho (2·45 acres), and only 3 per cent. cultivate more than 3 cho (7·35 acres).

Rice is easily first among the crops of Japan. It is grown on about half the cultivated area, and provides over half the value of all farm products, including livestock and poultry. About 40 per cent. of the paddy fields carry two crops in the year, the second being usually barley, wheat,

= 314·16 lb. This works out at almost exactly 63¾ lb. to the bushel, and agrees fairly well with the reckoning of Messrs. Lockie, Pemberton & Co., quoted in the *Indian Trade Journal*, that 7⅛ koku = 1 ton—*i.e.* nearly 62¾ lb. to the bushel. In the interests of international uniformity, the former basis of calculation (1 koku = 314·16 lb., or 7·13 koku = 1 ton) has been adopted in the present article. This does not apply to the section on trade, since in the Japanese trade returns the imports and exports of rice and paddy are already calculated in terms of weight.

rape, or some crop for manuring the soil. In 1914, about 88 per cent. of the paddy fields were devoted to the cultivation of ordinary rice by irrigation, while upland varieties were grown on 4 per cent. of the total rice area, and glutinous rice on the remaining 8 per cent. While upland cultivation accounts for such a small percentage of the whole, it is to be noted that whereas the area under glutinous varieties showed little change in the decade 1905–14, and, if anything, tended to decline, the area under upland rice increased 65 per cent. in the decade. Relatively the areas and production of both upland and glutinous rice are small, but actually they reach a considerable total. In 1914 the area under upland rice was 303,000 acres and the production 158,000 tons. This is equivalent to an average yield of between 10 and 11 cwts. per acre, which is only about half the yield from the irrigated fields. The area growing glutinous rice in 1914 was 619,000 acres, and the production 624,000 tons, or over 20 cwts. per acre. Glutinous rice is chiefly used for making pastry and cakes, and as a special foodstuff on fête days. Saké is brewed from non-glutinous varieties. The chief centres of the rice-milling industry are Tokio and Kobé, but milling for local purposes is done in almost every town and village.

Great as the growth of production has been, it failed, prior to the new advance made by the crops of 1914–16, to keep pace with consumption. Prices rose rapidly, and as rice is the staple food of the Japanese, many difficult economic problems were created. The question of the rise in prices was complicated by many factors, including the speculative buying and selling of rice, but these factors were mostly rooted in supply and demand, the supreme importance of which has been clearly demonstrated in the last three years of suddenly increased crops. Before this development, a study of fluctuations in prices and wages in Japan published by the International Institute of Agriculture in Rome led to the conclusion that " in only thirteen years [1900–13] the price of the most important commodity on the Japanese market, of the first necessity for the population, has increased by more than 90 per cent., or on an average by 7 per cent. a year." The acme of this long

climax was reached in 1912, when prices for rice were the highest ever recorded in Japan. A sharp decline set in before the crop of 1914 was harvested, and, after its magnitude was realised, the effect of the fall in prices on the farming industry and on business generally was such that in February 1915 the Minister of Finance was authorised by Imperial ordinance to purchase rice in order to keep up prices to a certain level.

This change in the internal position has naturally reacted on the foreign trade in rice. In recent years, prior to 1914, the crops fell so far short of home requirements that Japan had come to rank among the great importing countries. A little was exported, chiefly for the use of the Japanese residents in Hawaii, etc., who insist on having rice from Japan, but the balance of the foreign trade was largely on the side of imports. In the twelve years 1901–12 the imports of "rice and paddy" averaged 396,000 tons, the minimum quantity being 136,000 tons (1910) and the maximum 886,000 tons (1904). In 1913 the imports stood at 541,000 tons and in 1914 they still amounted to 299,000 tons. These figures do not reveal the full extent of the imports; they relate only to trade with countries outside the Japanese Empire, in this case principally British India, French Indo-China, and Siam, the first two of these three countries having supplied between 80 and 90 per cent. of the total imports, and Siam most of the remainder. But, in addition, Japan used to get considerable quantities of rice from Korea and Formosa. According to the reports on the trade of Japan in the annual series of Diplomatic and Consular Reports, in the year 1912, when the imports from foreign countries amounted to 333,000 tons, the imports from Formosa were 91,000 tons, and from Korea 36,000, bringing the total imports of rice and paddy up to 460,000 tons. In 1913, when the imports from foreign countries were 541,000 tons, Formosa supplied 158,000 tons and Korea 81,000 tons, making the total 780,000 tons. In 1914, Japan imported 83,000 tons from Formosa and 146,000 tons from Korea, and with 299,000 tons coming from other countries the total reached 528,000 tons. This was the last year of big imports. In 1915 the quantity of rice and paddy coming

from foreign countries dropped abruptly to 68,000 tons, and in 1916 there was a further decline to 46,000 tons, the loss of trade being principally borne by India and Indo-China, the imports from Siam being fairly well maintained. Returns of the imports from Korea and Formosa during the last two years are not available, but as regards foreign countries the decline in the imports, coupled as it was with an increase of exports, was sufficient to convert a large import balance into a small export balance. Against the average imports of 396,000 tons from foreign countries in 1901–12, the average exports of rice and paddy were only 58,000 tons, the maximum for the twelve years being 113,000 tons (1902) and the minimum 29,000 tons (1912). In 1913 the exports were still only 29,000 tons, and in 1914 they were 37,000 tons ; but in 1915 they jumped up to 93,000 tons and in 1916 to 97,000 tons, the increased trade being mostly with the United Kingdom, the United States, Hawaii, Canada, and Asiatic Russia. Formerly all but a small fraction of these exports consisted of uncleaned rice. In 1915 the proportion of cleaned rice rose to 25 per cent., and in 1916 it was 44 per cent.

In the first five months of the present year (1917) the exports of rice and paddy (60,000 tons) showed a further increase compared with those for the corresponding period of 1916 (44,000 tons) ; but imports have also begun to increase again (30,000 tons in the first five months of 1917 against 12,000 tons in the same period of 1916), so that even on the trade with foreign countries, excluding Korea and Formosa, the balance of exports remains small, and may easily become an import balance again if the population continues to increase, and there is no further marked advance in the size of the annual rice crop. In this last connection it must be remembered that Japan is already a very highly cultivated country, having regard to its physical characteristics ; but patient industry, combined with agricultural science, has accomplished so much in the way of extending cultivation and increasing the annual yield that it would be unwise to attempt to limit the further advances which may be achieved in these respects.

Korea.—Rather more than a third of the land under cultivation in Korea is devoted to rice. The recorded

area of the paddy fields has rapidly expanded in recent years. In the five years before the war the acreage increased by one-third—from 1,914,000 acres in 1909 to 2,560,000 acres in 1913. During the same period the production increased from 1,046,000 tons of rice to 1,414,000 tons (see footnote to section on Japan for rate of conversion from koku to tons). This gives an average yield of between 11 and 12 cwts. per acre. The Japanese administration is devoting much attention to the extension and improvement of cultivation, and if the yield should be brought up to the average in Japan, Korea might take an important place among exporting countries. Already it provides a surplus for export. In the five years (1909–13) the exports averaged 93,000 tons, the minimum being 74,000 tons in 1912 and the maximum 116,000 tons in 1913. Against these exports must be set a smaller quantity of imports (37,000 tons in 1913). About two-thirds of the imports were from Siam, while the great bulk of the exports went to Japan, the balance being taken by China and Asiatic Russia.

As in Japan, the last three years have been years of largely increased crops in Korea. Calculated from British trade reports, giving returns in bushels, the production was about 1,705,000 tons in 1914; 1,595,000 tons in 1915; 1,758,000 tons in 1916. Acreage figures are not available to show how far the increase is due to extended cultivation and how far to improved yield. In 1914 the imports of Japan alone from Korea amounted to 146,000 tons.

Formosa.—Rice is grown throughout the island, and usually two crops are raised in the year. In a Japanese official publication issued in 1914 the area of the paddy fields was estimated at about 820,000 acres, this being nearly half the total cultivated area. In 1910 the area was estimated at 760,000 acres. As these figures denote, the rice acreage has been extending. Output has also been increased by the progress of irrigation and other improvements in the method of cultivation, though the liability of the island to be swept by typhoons still occasions considerable fluctuations in the crop. The average of the official returns of annual production in the decade 1904–13 is 619,000 tons, the extremes being 557,000 tons in 1906 and

719,000 tons in 1913. In 1914, when several storms damaged the crops, the production was estimated at 647,000 tons. On the basis of the above estimates of the area under cultivation, these crop returns denote a high average yield (from 15 cwts. to 17 cwts. per acre). According to the *Yearbook* of the United States Department of Agriculture, however, the area cropped was about 50 per cent. more, namely, 1,222,000 acres in 1913 and 1,235,000 acres in 1914. As two crops a year are often reaped, the difference may possibly be due to the areas under each crop being counted separately in the larger estimates.

With production on this scale, Formosa has a considerable surplus of rice for export. Until a year or two ago, at any rate, practically all the exports went to Japan. They mostly consisted of unhusked rice. The exports to Japan were recorded in the British consular reports on Formosa as 92,000 tons in 1911, 91,000 tons in 1912, and 157,000 tons in 1913 ; the report on Japan for 1914 gave the imports from Formosa in that year as 83,000 tons. Rice was imported into Formosa in 1913 to the amount of about 30,000 tons (mostly cleaned rice), of which about one-fourth or one-fifth was from Japan.

French Indo-China.—In Indo-China, as in other countries of the Far East, rice is the staple food of the natives, and the cultivation of rice dominates all other branches of agricultural industry. This is more or less true of all the States comprising France's Indo-Chinese Empire, but both relatively and actually Cochin China is easily first in respect of the extent of its ricefields. Commercially its crop governs the rice export trade of the whole country, and in this connection it may be described as the Burma of Indo-China.

It is only in modern times that the cultivation of rice in Cochin China has attained its present importance. The State has an area of about 20,000 sq. m. (12,800,000 acres) and a population of about 3,000,000. In 1879 there were less than 1,000,000 acres under paddy ; by 1887 the area had increased to 2,000,000 acres, and by 1902 to 3,000,000 acres. In 1907, a year of record exports, the figures for which have not yet been surpassed, the area under paddy

was returned as nearly 3,750,000 acres. For the time being this represented the high-water mark of the rice-growing industry in Cochin China. In 1914–15 the area under paddy was down to 3,361,000 acres. It is considered, however, that, with the increase of population and the extension of land improvement works, a very much larger area will be capable of growing rice—three times as large, it has been estimated, as the area hitherto brought under cultivation. Meanwhile the paddy fields form about nine-tenths of the total cultivated area (3,766,000 acres in 1914–15) and over one-fourth of the whole country. Only one crop is reaped annually, the harvest extending from December to March, with January and February as the chief harvest months. In 1914–15 the production was estimated at rather more than 2,000,000 tons of paddy, or 1,250,000 tons of cleaned rice. This is a good average crop. Comparatively, such a yield from an area of roughly $3\frac{1}{3}$ million acres corresponds very closely with the acreage and yield in India in the same year (76,000,000 acres; 28,000,000 tons).

In Tonkin, which has an area of 46,000 sq. m. (29,500,000 acres) and a population (1911) of over 6,000,000, two crops of paddy are reaped in the year, and their cultivation is the chief occupation of the inhabitants of the deltaic region. It is stated (Russier and Brenier: *L'Indochine française*. Paris, 1911) that the paddy fields of the delta cover from 2,000,000 to 2,250,000 acres, and that another 250,000,000 acres could be brought under crop by irrigation. In 1907, according to the estimates of the provincial administrators, the first crop was reaped (May—June) from 1,151,000 acres and the second (October—November) from 1,719,000 acres; thus the total area reaped, reckoning each crop separately, was 2,870,000 acres. On the assumption that there had been no appreciable change in the cultivated area, and that the yield per acre averaged about the same as in Cochin China in 1914–15, the normal production in Tonkin in terms of cleaned rice might be put at nearly 1,100,000 tons. The actual output fluctuates greatly from year to year according to the incidence of floods and droughts and other vagaries of the season. Exports of all kinds of rice in the

decade 1905–14 averaged about 160,000 tons, the remainder being required for local consumption.

In Annam, which lies between Cochin China and Tonkin, and which has an area of about 52,000 sq. m., with a population of over 5,000,000, the conditions of rice production are very variable. In the south, as in Cochin China, one crop per annum is reaped (January—February), while in the north, on the Tonkin side, two crops are obtained (May—June and October—November). In Central Annam the soil yields sometimes one and sometimes two crops (April—May and August—September). By comparison with Tonkin on a population basis, the requirements of Annam for local consumption might be estimated to be equivalent to about 750,000 tons of cleaned rice. As Annam grows barely enough rice for its own needs, this estimate would imply a production of not more than 750,000 tons.

In the *Bulletin Economique de l'Indochine* (1910, **13**, 274) Cambodia was credited with having 1,670,000 acres under paddy, producing about 617,000 tons of paddy (385,000 tons of cleaned rice). The figures denote a lower average yield than in the neighbouring country of Cochin China, which from double the acreage gets a crop more than three times as large. Though covering an area of 45,000 sq. m., Cambodia has a population of only 1,634,000, and is able to export nearly half its relatively meagre crop.

The largest and most sparsely populated part of French Indo-China is the Laos territory (98,000 sq. m.; 640,000 inhabitants). Some years ago M. de Reinach, in his *Notes sur le Laos* (Paris, 1906), calculated that the total requirements of the population (then estimated at 500,000) for human consumption, for the feeding of livestock, for use in the manufacture of confectionery and intoxicants, and for seed, amounted to about 225,000 tons of paddy, or 140,000 tons of cleaned rice. The standard of living which this presupposes is not, however, by any means general, and, moreover, maize partly takes the place of rice in many parts of the country.

Altogether, the total production in Indo-China in a good average year may probably be put at about 3,500,000 tons

of cleaned rice. It must be understood that this is only a tentative estimate based on very imperfect data. In the present year (1917) the total may have been between 3,500,000 and 4,000,000 tons, the crop in Cochin China and Cambodia being reported to be the best on record (about 1,850,000 tons).

The exports of rice from Indo-China, like the crops, are liable to big fluctuations. Since the beginning of the present century they have fallen as low as 612,000 tons in 1905 and risen as high as 1,406,000 tons in 1907. The general tendency of the returns, over a long period, has been strongly upward until the last few years. In the quinquennium 1886–90 the exports averaged 495,000 tons; in 1901–5 the average was 845,000 tons, and in 1906–10 it was 1,135,000 tons; in 1911–15 it remained practically the same—1,133,000 tons. These figures, which relate to the exports of rice of all kinds (paddy, cargo rice, cleaned rice, broken rice and rice meal) place French Indo-China in the front rank of rice-exporting countries, contesting with Siam for the next place to India. The different grades of rice are subject to various export duties which are in part preferential in favour of France and the French Colonies.

As already indicated, French Indo-China owes its importance as a rice-exporting country chiefly to Cochin China. Naturally enough, in view of the facts previously given about the expansion of the rice-growing industry in that State, the export trade is largely the creation of the last half century—that is, the period during which France has exercised control there. In the early 'sixties considerably less than 100,000 tons of rice of all kinds were exported annually from Cochin China; in 1885, the first year for which returns were available for French Indo-China as a whole, Cochin China supplied about 455,000 tons out of a total of 493,000 tons; in 1915 it supplied 1,068,000 tons out of a total of 1,351,000 tons, the balance being provided almost entirely by Tonkin. It must be noted, however, that most of the exports from Cambodia pass through Saigon and are credited to Cochin China; it has been estimated that these average, at the present stage of development, about 150,000 tons. In one form or another

rice provides about 75 per cent. of the exports from Saigon, both in weight and in value.

The total exports from Indo-China in 1915 were slightly less than in 1914 (1,397,000 tons), but were greater than in any earlier year except 1907. The greater part of the exports go to other countries in the Far East, and these countries were able to absorb most of the European trade which was dropped in 1915. The requirements of the Far Eastern countries themselves depend on the character of their own crops, and vary considerably from year to year ; but a brief analysis of the export returns for 1913 may give some idea of the distribution of trade in a normal year. The total exports of rice of all kinds in 1913 amounted to 1,266,000 tons. Of this total France took 270,000 tons (171,000 tons of cleaned rice, the rest nearly all broken rice and cargo rice), or more than one-fifth. Exports to French colonies to the amount of 36,000 tons (nearly all cleaned rice) brought the movement of trade within the French Empire up to 306,000 tons, or nearly one-fourth of the total. Trade with European countries outside France was practically confined to the United Kingdom and Germany, which took in the one case about 44,000 tons, mostly of rice meal (*farines*), and in the other case about 49,000 tons, also mostly of rice meal. On the other hand the exports to Hong Kong amounted to 427,000 tons (mostly cleaned rice), or a full third of the total, while Singapore, the Dutch East Indies, the Philippines, and Japan took 414,000 tons (in each case consisting mostly or wholly of cleaned rice), or nearly another third of the total. As showing the variability of the different items of the trade it may be noted that in 1915, though Singapore, the Dutch East Indies, the Philippines, and Japan again took a third of the total exports (which were greater than in 1913), the exports to Japan in the later year were practically nil, whereas in 1913 they accounted for 106,000 tons.

As will have been gathered from this brief analysis, the great bulk of the exports consist of cleaned rice. In each of the years 1913, 1914, and 1915 the proportion was about three-fourths (about a million tons). Broken rice and rice meal compose most of the remaining exports. In Cochin China rice milling is the leading industry next to rice

growing. Milling for export is practically confined to Cholon (now almost a suburb of Saigon). Here, according to a recent U.S.A. Commerce Report (No. 78 : April 4, 1917), ten large mills turn out annually over a million tons of rice of all grades valued at about £6,000,000, of which value perhaps one-fourth is contributed by the milling process. The rice required for local consumption is prepared in smaller mills.

Siam.—The rice grown in Siam provides not only the chief food supply of the people, but four-fifths of the total exports from the country in respect of value. Both local consumption and exports have increased greatly in the last few decades. In the British Consular report for 1890 it was estimated that an ordinarily good rice crop in Siam yielded rather more than 1,200,000 tons, of which about 700,000 tons were consumed in the country itself, leaving about 500,000 tons for export. Since then these figures have been more than doubled. Possibly insufficient allowance was formerly made for local requirements, but production has undoubtedly increased, as is evident from the growth of the export returns. These are subject to violent fluctuations, for owing to the small development of modern irrigation works—though plans for such works have been drawn up—the crops are very dependent on the seasonal weather conditions. In spite of intermediate setbacks, however, the Siamese export trade in rice has gone on from record to record until in thirty years it has quadrupled in weight. In 1884 the exports of rice of all grades reached a then maximum of 274,000 tons. The next advance was to 402,000 tons in 1887 ; in 1888 the amount was 450,000 tons, and in 1890 it was 480,000 tons. In 1892 the exports fell as low as 198,000 tons, but in the following year they rose as high as 776,000 tons. There was no improvement on this for nine years, though the lowest return in the interval was 415,000 tons. In 1902 a fresh record was established—798,000 tons, and every alternate year after that saw a further advance, until in 1908 the exports stood at 986,000 tons. In 1910–11 they reached 1,047,000 tons, but in 1911–12 there was a drop to 627,000 tons, and 1912–13 saw a further decline to 588,000 tons. All records, however, were surpassed again

in 1913–14, when the exports totalled 1,174,000 tons, and up to the end of 1916 there had been little falling away from this high level.

The decennial averages over a period of fifty years show at a glance the rapid growth of the trade :

Exports of all Grades of Rice from Siam

	Tons.
Average 1860–69	100,000
,, 1870–79	155,000
,, 1880–89	260,000
,, 1890–99	460,000
,, 1900–09	760,000

The quinquennium 1909–10 to 1913–14, though including the two years of reduced returns already mentioned, resulted in a further advance of the average rice exports to 878,000 tons.

As to the production which makes possible such exports, M. Petithuguenin, First Interpreter to the French Legation at Bangkok, in a study of the economic situation in Siam published in the *Bulletin Economique de l'Indochine* (1914, **17**, 129), expressed the opinion that the home consumption of rice could not be less than about 1,200,000 tons without descending below starvation point, and estimated that it was actually over 1,700,000 tons. With exports in recent years averaging, say, 800,000 tons (exclusive of rice meal), this would give a production of about 2,500,000 tons. That is also the amount given by the American Vice-Consul at Bangkok as the usual output. According to the *Yearbook* of the United States Department of Agriculture for 1916, the production in 1913 was equivalent to 2,627,000 tons of cleaned rice, in 1914 to 2,550,000 tons, and in 1915 to 2,463,000 tons. On the other hand, American consular reports from Bangkok give the paddy crop in 1913–14 as 4,767,000 tons, and in 1914–15 as 4,626,000 tons. If the yield of clean rice from paddy be taken as five-eighths by weight (62½ per cent.), these two crops would be equivalent respectively to 2,980,000 tons of rice and 2,890,000 tons of rice. On a review of these various estimates it may be said that in an ordinary good year the Siamese rice crop is between 2,500,000 and 3,000,000 tons, and that about one-

third of the crop is exported. The area under cultivation in recent years has been estimated at over 5,000,000 acres (5,181,000 acres in 1915–16). On the basis of these figures, the average yield per acre would be normally about 10 cwts.

As already stated, the export figures quoted above embrace all kinds of rice. The following is an analysis of the total for the latest pre-war year :

Exports of Rice and Rice Meal from Siam in 1913–14

Grades of Rice.	*Tons.*	*Per cent.*
White Rice . . .	514,330	43·8
Broken White Rice .	414,354	35·3
Cargo Rice . . .	76,061	6·5
Broken Cargo Rice .	9,505	0·8
Paddy	28,657	2·4
White Rice Meal . .	103,416	8·8
Cargo Rice Meal . .	27,657	2·4
Total . . .	1,173,980	100·0

It will be seen that white rice and broken white rice formed 79 per cent. of the total exports, cargo rice and paddy only 10 per cent., and rice meal 11 per cent. As may be gathered from these figures, the milling of rice for export is an important industry in Siam. The mills for this purpose are established in and around Bangkok, through which city the whole of the trade in rice passes. In 1916 it was reported that there were 53 rice mills inBangkok and 5 in neighbouring towns. With two or three exceptions these were owned and worked by Chinese firms. According to the American Vice-Consul, paddy husk is furnished in sufficient quantities to provide fuel for all the local industries of Bangkok.

It is difficult to determine precisely the distribution of the exports, as the great bulk of them are shipped in the first instance to the entrepôts of Singapore and Hong Kong. In 1913–14 the exports (chiefly white rice) to Singapore were 426,989 tons (36 per cent. of the total), and the exports (chiefly broken white rice) to Hong Kong 461,236 tons (39 per cent.). Thus Singapore and Hong Kong together took 75 per cent. of the total. Among the exports consigned direct to Europe, Germany and Austria-Hungary took 95,441 tons (rather more than 8 per cent. of the total ;

Germany alone, 81,336 tons, or 7 per cent.), the Netherlands 76,058 tons (6·5 per cent.), the United Kingdom 49,656 tons (4·2 per cent.), and Belgium 28,103 tons (2·4 per cent.)—altogether 21 per cent. out of the 25 per cent. not dispatched to Singapore and Hong Kong. Since the outbreak of war these two entrepôts have played a still larger part in the distribution of the Siamese rice exports. Out of total exports of 1,138,168 tons in the year 1916, Singapore took 622,641 tons (55 per cent.) and Hong Kong 409,784 tons (36 per cent.), or between them 91 per cent. of the total; while the exports to Europe direct amounted to only 67,055 tons (6 per cent.).

Netherlands East Indies.—Though producing more rice than either French Indo-China or Siam, the Netherlands East Indies support so large a population, particularly in Java, that they are numbered among the rice-importing countries. In Java and the adjoining island of Madura, which are almost exactly the same size as England and contain about as many people, nearly 45 per cent. of the area under cultivation in 1915 carried rice crops (6,940,000 acres out of 15,529,000 acres according to the *Statesman's Year Book* for 1917). Particulars of production in 1915 are not available, but the *Yearbook* of the United States Department of Agriculture gives the crop from 6,310,000 acres in 1913 as equivalent to 3,550,000 tons of cleaned rice, and from 6,346,000 acres in 1914 as 3,494,000 tons—an average yield of about 11 cwts. per acre. The remaining islands of the Netherlands East Indies, with an area over thirteen times that of Java and Madura, are credited with about one-third the population. If their production of rice was proportionate, by population, to that of Java and Madura, their crops would amount to over 1,000,000 tons, and the rice production of the whole of the Netherlands East Indies might be estimated at over 4,500,000 tons. It may be doubted, however, if the "Outposts," as they are called, do grow rice on the same scale, even in relation to population, as Java and Madura. They are not nearly so highly developed agriculturally, and proportionately they are much heavier importers of rice. Possibly the total rice production of the Netherlands East Indies amounts to between 4,000,000 and 4,500,000 tons.

Though the Java rice crop is insufficient to meet local requirements, a certain amount of rice is exported. In the five years immediately preceding the war these exports averaged about 53,000 tons, and showed little variation from year to year. About half the rice exported goes to Borneo and China. Rice imports, on the other hand, averaged during the same period about 316,000 tons, and varied considerably from year to year, the minimum being 211,000 tons in 1909 and the maximum 484,000 tons in 1910. The supplies of rice from abroad are drawn almost entirely from Burma, French Indo-China, and Siam—principally the first two countries, though the distribution of trade is very variable. The following table is from the British Consular Report for 1913:

Imports of Rice into Java and Madura

Source of Supply.	1911. *Tons.*[1]	1912. *Tons.*[1]	1913. *Tons.*[1]
Rangoon . . .	278,300	197,700	65,900
Saigon . . .	62,000	16,000	144,000
Siam . . .	49,000	21,200	44,000
Other countries .	1,000	2,000	300
Total . .	390,300	236,900	254,200

[1] *Approximate.*

No exports of rice from the other Netherlands East Indian possessions are shown in the British *Statistical Abstract* for foreign countries, but these possessions (Sumatra, Netherlands, Borneo, etc.) imported rice in the quinquennium 1908–12 to the average amount of 191,000 tons (minimum 142,000 tons in 1908; maximum 221,000 tons in 1911). Thus the annual requirements of the Netherlands East Indies as a whole in the way of rice from outside sources amount to about 500,000 tons.

Philippine Islands.—Of the area returned as under cultivation (nine principal crops) in the Philippines in 1913–14, rice was grown on nearly half (48 per cent.). It is not a proportionately valuable crop, and the amount of rice produced from year to year is influenced by the demand for labour in other directions, as well as by the weather conditions. The liability of the crop to serious damage from typhoons, droughts and floods is a serious check on

development. Comparatively little has been done at present to control the effect of the climatic conditions by irrigation. In an official pamphlet, *Rice Culture in the Philippines* (Manila, 1912, *Bulletin* 22), it was stated that only about 125,000 acres were under irrigation, though the area easily irrigable was at least 1,200,000 acres. An active policy of extension is being pursued by the Irrigation Division of the Bureau of Public Works, and in the pamphlet quoted it was anticipated that within a very few years many thousands of acres which had hitherto remained idle would be producing good crops of rice. In other ways much enterprise is being shown by Government with the objects of extending cultivation and improving the average yield. The Agricultural Department has been engaged for several years in selecting the best kinds of rice out of the large number grown (according to *Bulletin No.* 22, something like 1,300 names have been recorded and 910 more or less distinct varieties have been collected and tested). With scientific research are combined popular educational methods, such as the issue of posters giving advice to farmers and the dispatch of a rice demonstration train through the principal rice-growing districts. As in Japan, cultivation is mostly on small holdings. Writing in the *Philippine Agricultural Review* (1916, **9**, 61), the Director of Agriculture stated that 50 per cent. of the farmers work less than 2½ acres, that nearly 90 per cent. work less than 12½ acres, and that only a fraction of 1 per cent. work over 250 acres. Four-fifths of the rice grown is transplanted, and non-glutinous white rice constitutes about 75 per cent. of the total production. It is claimed by the Director of Agriculture that a comparison of the crops in two years enjoying fairly normal weather conditions, 1906 and 1913, shows an increase of production during the interval of 40 per cent., due to the increase in the average yield. The educational propaganda which is carried on by the Agricultural Department should certainly bear fruit in this direction; but even now, as is admitted, the yield is extremely low. In the quinquennium 1911–15, the area under rice cultivation increased steadily from 2,579,000 acres in 1911 to 3,076,000 acres in 1914, but declined in 1915 to 2,794,000 acres. During the same period the crops,

expressed in terms of cleaned rice, ranged from 320,000 tons (1912) to 675,000 tons (1913). Both in 1912 and in 1915 (491,000 tons) there were partial crop failures; the average for the other three years was 623,000 tons. It will be seen that at its best the crop averages only between 4 and 5 cwts. per acre, which is not much more than half the average yield in British India.

As a result of this low yield, the Philippine Islands are heavy importers of rice. Exports are negligible (2 tons in 1913, 35 tons in 1914, 17 tons in 1915). Imports, from 1899, when the islands were ceded to the United States, up to and including 1915, averaged not far short of 200,000 tons, reaching their maximum in 1903 (over 300,000 tons) and their minimum in 1913 (85,600 tons). In 1914 they were 95,400 tons, and in 1915 they were 215,000 tons. French Indo-China supplies about 90 per cent. of these imports (204,500 tons, or 95 per cent. in 1915) and Siam most of the remainder (7,300 tons in 1915).

Asiatic Russia.—Though Asiatic Russia is not among the great rice-producing countries, there is a considerable quantity of rice grown in Russian Turkestan. According to M. Woeikof's *Le Turkestan Russe* (Paris, 1914) the area under rice-cultivation in that country has largely increased since the Russian conquest. Formerly the cultivation of rice was confined to natural rice lands, and the rice fields were not allowed water from the irrigation canals till other crops had been served. After the Russian conquest these restrictions ceased to be observed, with the result that in Samarkand and Katta Kurgan the area under rice increased from 27,000 acres in 1869 to about 50,000 acres in 1875, while in 1900 there were 106,000 acres growing rice in Samarkand alone. The following particulars of acreage and crop in three provinces in 1909 are given by M. Woeikof from the returns of the Russian Central Statistical Committee:

Rice Cultivation in Russian Turkestan

	Acres.	*Tons.*
Syr-Daria	176,000	88,000
Ferghana	181,000	86,000
Samarkand	136,000	64,000
	493,000	238,000

In the report on the British consular district of Batum for the year 1914, the Vice-Consul at Baku, referring to the agricultural products of "Transcaspia," gives the rice crop as approximately ten million poods (about 160,000 tons). It is obvious from this and other returns given by the Vice-Consul that the reference is not merely to the sparsely populated Transcaspian Province, and presumably the estimate embraces Russian Turkestan.

The corresponding consular report for 1913 contains the following particulars of the two principal rice-growing districts in Transcaucasia :

Rice Cultivation in Transcaucasia

District.	1912.		1913.	
	Acres.	*Tons.*	*Acres.*	*Tons.*
Geokchai .	—	6,000	—	6,000
Linkoran .	40,770	36,000	41,120	31,000
		42,000		37,000

It is possible that the estimates of production quoted by M. Woeikof for Turkestan (equivalent to an average yield of nearly 10 cwts. per acre), and by the British Vice-Consul at Baku for the Linkoran district of Transcaucasia (equivalent to an average yield of nearly 18 cwts. per acre in 1912 and 15 cwts. per acre in 1913) are in terms of rough rice, or paddy. The *Yearbook* of the United States Department of Agriculture gives the production of cleaned rice in Transcaucasia and Turkestan in 1912 as 124,000 tons from 491,000 acres (5 cwts. per acre) ; in 1913 as 229,000 tons from 668,000 acres (7 cwts. per acre) ; and in 1914 as 170,000 tons from 636,000 acres (5 cwts. per acre). Bokhara and Khiva are not included in these estimates. Their addition might bring the total rice production of Russian Western Asia, on the basis of the estimate of the United States Agricultural Department, to about 200,000 tons in an ordinary year, rising in a good year to over 250,000 tons.

Production is not equal to consumption, and rice is imported in considerable quantities, chiefly from the Caspian provinces of Persia. The extent of the Persian trade will be seen from the following section.

Persia.—Rice enters largely into the diet of the Persian people. It is grown in most of the provinces, in places where there is natural swamp land or a sufficiency of water to inundate the fields. Such places are not very numerous or extensive in the high, dry plateau region of the interior. Among them may be mentioned the neighbourhoods of Shiraz and Isfahan. But the great bulk of the rice produced in Persia is grown in the low-lying, humid country adjoining the southern coast of the Caspian Sea, comprising the provinces of Gilan, Mazandaran, and Astarabad. Rice is there a staple crop and constitutes the staple food of the people. Practically the whole of the rice exports of Persia come from that quarter, and considerable quantities are also sent to other parts of Persia.

A small quantity of rice is imported, chiefly into the south of Persia from India, but the exports which are dispatched from the Caspian ports into Russian territory, and which find their principal market in Baku, are on a much larger scale. In 1914–15 the exports were three times as valuable as the imports, and usually, in the past, the proportion has been much higher. The following table gives the returns for five years :

	1910–11.	1911–12.	1912–13.	1913–14.	1914–15.
Imports . .	£62,000	£66,000	£96,000	£159,000	£117,000
Exports . .	£531,000	£632,000	£769,000	£766,000	£356,000

In the six years 1906–7 to 1911–12 imports ranged from 1,392,000 batmans (1906–7) to 2,718,000 batmans (1909–10) *i.e.* if the batman be taken as the Tabriz batman of 6½ lb., from about 4,000 tons to 8,000 tons. In the same six years exports ranged from 16,809,000 batmans (1907–8) to 24,054,000 batmans (1911–12) or from about 49,000 tons to 70,000 tons. Usually about 75 per cent. of the exports consist of husked rice. About 80 per cent. of the total are furnished by the province of Gilan, and most of the remainder by Mazandaran, which also sends large quantities to the Teheran markets. Generally speaking, it is the inferior and medium qualities of rice which are exported to Russia. A considerable part of the exports, especially the lowest grades, are used in the manufacture of starch for dressing light cotton goods.

Production and trade have both undergone considerable development in the last half century. A consular report on Gilan for 1892–3 spoke of the exports of rice as having made great strides since the 'seventies, and ten years later (1903) it was noted that " a prodigious quantity of timber has been felled during the past thirty years to make room for rice fields and plantations of dwarf mulberry trees." In an elaborate monograph, *La Culture du Riz en Guilan (Perse) et dans les autres provinces du sud de la Caspienne*, by MM. Rabino (formerly British Vice-Consul) and Lafont, reprinted from *Annales de l'Ecole nationale d'Agriculture de Montpellier* (Montpellier; 1911), a list of the annual exports of rice from the Caspian provinces showed a fairly steady progression from 38,000 tons in 1901–2 to 59,000 in 1908–9, and in 1911–12, as already noted, exports had further increased to 70,000 tons. Previously a consular report had returned the exports in 1895 as 43,000 tons, and the Hon. George Curzon (now Earl Curzon of Kedleston), in his work on Persia published in 1892, quoted an estimate which put the exports of rice from Gilan and Mazandaran to Russia even in those days at 58,000 tons per annum. M. Rabino, however, regards the latter estimate as an exaggeration. With modern irrigation works and better cultivation the present output might be much increased.

Data are lacking for any estimate of the production of rice in Persia as a whole. M. Rabino, in the monograph previously quoted, estimated the annual consumption in Gilan at 128,000 tons, and as the exports from Gilan in 1908–9 were 41,000 tons to Russia and 6,000 tons to the interior of Persia, he arrived at a total production of rice in that province in that particular year of 175,000 tons.

Mesopotamia.—Before the war, paddy formed about one-sixth of the grain harvest. A record crop in 1911 was estimated at 48,000 tons of paddy (30,000 tons of cleaned rice). Production varied greatly; with a proper irrigation system it might be steadied and much increased. Basra exported considerable but irregular quantities of paddy (estimated at 65,000 tons in 1912, from accumulated stocks; usually under 25,000 tons; only 3,000 tons in

1913, when the crop failed), and much smaller quantities of rice (usually two or three thousand tons ; only 16 tons in 1913). These exports went chiefly to the United Kingdom and Germany for distilling and sizing purposes, the quality being inferior. Basra also did a small import trade in rice from India (normally from 1,000 to 2,000 tons ; in 1913, 8,000 tons). Asiatic Turkey as a whole offered a large market for rice, taking about 80,000 tons a year from India.

Madagascar.—For centuries rice has been the staple food crop in this French colony, especially in the central and eastern provinces. " Carolina " rice is said to have been first imported into America from Madagascar at the end of the 17th century. The best rice fields are in the neighbourhood of the capital, Antananarivo, to the west of which the great marshy plain of Betsimatatra is devoted to the production of rice. Cultivation, however, is widespread, and is capable of much greater extension. Many varieties are grown ; they may be divided broadly into two classes, white and red rice.

Many years before the French occupation in 1895, the crops were not only meeting local needs, but providing a surplus of some thousands of tons for export. There set in, however, a period of decline in cultivation, except in Imerina (the country round the capital) and among the Betsiléo (in the south central provinces), where irrigation systems of a very ingenious character have been developed by the natives. The unsettled conditions which attended the French conquest intensified the decline, and crops were also badly damaged in successive years by ravages of locusts. Thus for a time crops fell below consumption, and in 1901 the imports of rice amounted to as much as 25,000 tons. With the return of more settled conditions, recovery was rapid. In 1908 rice was exported to the amount of 4,600 tons, and though there was some ebb and flow later, exports were continuous and amounted in 1915 to 19,000 tons. In the latest pre-war year, 1913, they amounted to 10,500 tons, of which 1,460 tons were paddy. About 30 per cent. were consigned to France, 40 per cent. to French Colonies, and over 20 per cent. to British colonies. As communications are improved and new rice mills erected,

further developments of production and trade are anticipated. The Comoro Islands, which used to import Indian rice from Zanzibar, now draw their supplies almost entirely from Madagascar, and the hope has been officially expressed (*Bulletin de l'Office Coloniale*, 1916, **9**, 471) that in a few years Réunion and Mauritius will also be able to supply their needs from Madagascar. In South Africa there is said to be an increasing demand for Madagascar rice.

According to the *Bulletin Economique de Madagascar* (1909, **9** (i), 68), the area under rice cultivation in 1908 was estimated at 875,000 acres. Allowing for an average yield of 16 cwts. of paddy (10 cwts. of cleaned rice) per acre, the total production was estimated at about 700,000 tons of paddy (440,000 tons of cleaned rice).

Portuguese East Africa.—Rice is one of the native food crops, though in the Zambezi valley, at any rate, Mr. Consul Maugham notes in his book *Zambezia* (Murray, 1910) that it " is only found in large areas near the coast." It is grown by the " prazo " companies—companies to whom the native tax is farmed out—and in the Government reserves of Quelimane, but is essentially a native crop (R. N. Lyne's *Mozambique*; Fisher Unwin, 1913). Samples have been imported and distributed for experimental purposes from Dar-es-Salaam, Burma, Bengal and Ceylon. In 1913 nearly 7,000 tons were imported, chiefly through Beira and Lourenço Marques.

German East Africa.—Before the war the cultivation of rice by the natives was being widely extended, and it was anticipated that the Central Railway (Dar-es-Salaam to Lake Tanganyika) would open up fresh tracts of rice-producing country. Aquatic rice is chiefly grown, and the supplies are mostly consumed in the country; exports, which go principally to Uganda, amounted to 590 tons in 1911 and 900 tons in 1912. The Muansa district (round the southern shores of the Victoria Nyanza) is the main rice-producing and exporting area. There were also 1,165 acres under rice cultivation by Europeans in 1912, and the results were said to be satisfactory. Production is not, however, equal to consumption, and in 1913 there were imported 15,735 tons of rice, against 13,213 tons in 1912 and 17,330 tons in 1911. The imports were almost

entirely from India. The native rice is said to be at least of as good quality as the imported.

Belgian Congo.—According to Sir Harry Johnston (*George Grenfell and the Congo* ; Hutchinson, 1908), though there is a kind of wild rice, *Zizania*, of poor quality, apparently indigenous to the rivers of the northern Congo basin, rice was practically unknown in the central basin until the German explorer, Dr. Pogge, introduced it in 1875 or 1876. About the same time the Zanzibar Arabs introduced rice into the Eastern Congo. To-day it is widely grown, not only in the Central Congo basin, but along the Upper Congo River and parts of the Lomami. Between Kasongo and Stanley Falls, especially, where the Upper Congo flows through park-like or even treeless country, large quantities of rice are grown. It is only quite recently, however, that production has overtaken consumption. In 1913 only a little over 3 tons of rice were exported, whereas imports amounted to 4,430 tons. In 1915 imports had dropped to 643 tons and exports amounted to 1,122 tons. In 1916 the Stanleyville region alone produced over 5,000 tons, and it has been estimated that by 1918 the total rice crop will, after meeting local requirements, leave an exportable surplus of over 15,000 tons.

French Equatorial Africa.—Rice cultivation is of comparatively recent introduction and has been little developed. The coast region of Mayombé is believed to be particularly well adapted to this branch of agricultural industry. In 1913 the colony of the Gabun imported about 1,000 tons, and the Middle Congo and Ubangi colony about 500 tons.

French West Africa.—The position in regard to rice in the French West African colonies—Senegal, Upper Senegal and Niger, Guinea, Ivory Coast, and Dahomey—is much the same as in the British West African colonies : rice is widely cultivated, and in some districts attains considerable importance, but production is not equal to consumption, and there is a moderate import trade. Cultivation is practised especially along the banks of the Niger, in the Casamance district of Senegal (south of the Gambia colony), and in French Guinea, where it is grown not only in the

coastal districts, but in the Futa Jallon highlands. A Governmental experimental station has been established in Guinea, and private enterprise has erected a milling plant on the middle Niger. Imports in 1913 amounted to about 20,000 tons, Senegal importing about three-fourths of the total and the Ivory Coast nearly one-fifth. France is the chief source of supply. Exports are a negligible quantity.

Liberia.—Rice is an old-established crop in this country. It is largely grown by the natives throughout the hinterland, but not in sufficient quantities to meet the demand. According to Sir Harry Johnston (*Liberia*; Hutchinson, 1906), the annual imports amount to about 700 tons.

United States.—In 1916 the area under rice cultivation in the United States was 866,300 acres, and the crop was officially estimated at 520,600 tons. This was about 45 per cent. in advance of the 1915 crop, itself the highest then on record. The increase is accounted for partly by the increased area under cultivation, but mainly by the greater average yield, which was as much as one-third more than in 1915. Following are the returns for five years :

Year.	Acreage.	Cleaned Rice. *Tons.*	Average Yield. *Cwts. per acre.*
1912 . . .	722,800	310,700	8·6
1913 . . .	827,100	319,200	7·7
1914 . . .	693,500	293,300	8·5
1915 . . .	802,600	359,000	8·9
1916 . . .	866,300	520,600	12·0

It will be seen that until last year the average yield was not greatly in excess of that obtained in India.

Formerly the chief rice-growing States were the Carolinas and Georgia, but in the last forty years these have sunk into insignificance in respect of both cultivation and production, and the three great rice States now are Louisiana, Texas and Arkansas. In these Gulf States are extensive areas specially suited to the crop alike by the nature of the soil and by facilities for irrigation. Louisiana alone had a larger acreage under rice in 1916 than all the other States in the Union put together. The distribution of cultivation and production in 1916 is shown in the following table :

State.	Acres.	Percentage of area.	Percentage of crop.
Louisiana . . .	443,300	51·2	50·1
Texas . . .	235,000	27·1	26·0
Arkansas . . .	125,000	14·4	15·5
California . . .	55,300	6·4	8·0
Other States . .	7,700	0·9	0·4
Total . . .	866,300	100·0	100·0

Though doing a variable export trade in home-grown rice, the United States has hitherto required to import rice and rice products on a much larger scale. The balance of trade on the import side was, however, much reduced in 1915–16, as will be seen from the following returns for the quinquennium ending with that year :

U.S.A. Trade in Rice and Rice Products

	1911–12. *Tons.*	1912–13. *Tons.*	1913–14. *Tons.*	1914–15. *Tons.*	1915–16. *Tons.*
Imports . .	84,800	99,200	129,600	123,700	118,000
Re-exports . .	4,600	5,700	7,900	26,400	32,050
Net imports . .	80,200	93,500	121,700	97,300	85,950
Domestic exports .	17,600	17,400	10,000	34,600	54,450
Balance of imports over exports .	62,600	76,100	111,700	62,700	31,500

The imports, though fluctuating considerably, have shown a decided tendency to increase over a long series of years. Forty years back, in the quinquennium 1872–6, they averaged 34,400 tons, against an average of 111,000 tons in the quinquennium for which returns are given in the preceding table. In the United States trade statistics the imports of rice are classified under three heads—" cleaned," " uncleaned, including paddy," and " rice flour, rice meal and broken rice." There has been a striking change in the last five years in the proportions in which these different classes of rice figure in the returns. While the imports of cleaned rice have rapidly increased, and there has been a considerable though less marked increase in the imports of uncleaned rice, the imports of rice meal, etc., have declined. In 1911–12 broken rice and meal formed 61 per cent. (52,000 tons) of the total imports, uncleaned rice 26 per cent. (21,600 tons), and cleaned rice only 13 per cent. (11,200 tons). In 1915–16

the order was reversed : cleaned rice (54,030 tons) formed 46 per cent. of a larger total ; uncleaned rice (39,140 tons), 33 per cent. ; and broken rice and meal (24,830 tons) only 21 per cent. The chief countries of supply are China, the United Kingdom and the Netherlands for cleaned rice ; Japan for uncleaned rice ; and the Netherlands, the United Kingdom and China for broken rice, flour and meal.

While the imports of cleaned rice have been increasing, re-exports of the same product have also been increasing. The rice exported from the United States under the head of foreign merchandise consists almost entirely of cleaned rice (over 98 per cent. in 1915–16, and an even larger proportion in previous years). Thus the sudden large increase in the re-exports in 1914–15 and 1915–16 has affected in particular the net imports of cleaned rice. These, however, still remained at the end of the quinquennium 1911–12 to 1915–16 considerably higher than at the beginning. The following are the figures for the imports and re-exports of cleaned rice only :

Cleaned Rice

	1911–12. *Tons.*	1912–13. *Tons.*	1913–14. *Tons.*	1914–15. *Tons.*	1915–16. *Tons.*
Imports . .	11,200	14,600	42,600	50,050	54,000
Re-exports . .	4,600	5,600	7,900	26,400	31,400
Net imports .	6,600	9,000	34,700	23,650	22,600

The re-exports are distributed mostly through Central and South America and the West Indies.

Exports of home-grown rice and its products from the United States fall into two categories in the trade returns—" rice " and " bran, meal and polish." The latter class of exports is now quite insignificant ; nearly 99 per cent. (53,880 tons) of the combined exports in 1915–16 consisted of " rice." Here, as in the case of the rice imports, there has been a complete change in the character of the trade in recent years. In 1911–12 bran and polish formed 32 per cent. (5,640 tons) of the combined exports, and in 1905–6 as much as 90 per cent. (15,260 tons). The normal amount of the total exports was between 10,000 and 20,000 tons till the sudden advances of 1914–15 and 1915–16. In one

earlier year, however, the exports were little short of the total in 1915–16, having amounted in 1904–5 to over 50,000 tons. Before the war practically all the exports of bran and polish went to Germany. Of the exports of rice, Europe (chiefly the Netherlands, the United Kingdom and Germany) used to take from one-half to two-thirds; but both in 1913–14 and in 1914–15 the greater part of these exports went to the Central American and West Indian Republics, especially Cuba.

Central and South America.—Rice is already grown in considerable quantities in the countries of Central and South America, and its cultivation is capable of great extension. At present production is not equal to consumption. None of the republics but Brazil has yet developed, on balance, an export trade in rice, and it has been estimated (*Bull. Pan-American Union*, February 1917) that the total imports, including those into Cuba, the Dominican Republic and Haiti, had an annual value according to the latest returns of between £3,000,000 and £4,000,000. The imports into Cuba (143,000 tons in 1915) accounted for half the total value. After Cuba the chief importing countries are Argentina (42,000 tons of rice, 17,000 tons of paddy, in 1913) and Chile (21,000 tons in 1915), these two countries together taking nearly one-fifth of the total imports by value.

Data are lacking for a complete estimate of production. From such crop returns as are available it may be said that production in general is not on a large scale, that of Brazil being probably in excess of the production of all the other republics in Central and South America.

In Mexico the crop in 1914 was estimated at about 15,000 tons of cleaned rice. The chief areas of rice cultivation are in the Pacific Coast States of Colima, Guerrero, and Michoacan, the Gulf State of Tabasco, and the inland State of Puebla—all in Southern Mexico. Production falls little short of consumption, the imports in 1911–12 being only about 1,300 tons.

In Guatemala the rice crop of 1916 was estimated at about 7,500 tons. In the previous year it had been returned as 10,700 tons. Salvador had a crop of about 5,500 tons in 1914, and Honduras nearly 1,500 tons in

1915. Costa Rica, which with 7,000 acres under rice cultivation in 1914 might have perhaps normally a crop of about 2,000 tons, imported 2,300 tons in 1914 (over half from Germany). Nicaragua imported 2,300 tons in 1915 (all from the United States) and Panama 4,500 tons in the first half of 1914, chiefly from the United States and Germany.

Dutch Guiana produced over 2,000 tons of cleaned rice in 1913 and 3,000 tons in 1914. An anticipatory estimate of the 1917 crop in Ecuador placed it at 15,000 tons.

In Peru, which is perhaps the country of largest production in South America next to Brazil, the crop in 1913, according to the *Yearbook* of the United States Department of Agriculture, was 48,600 tons of cleaned rice from 138,000 acres (7 cwts. per acre). From other estimates this would seem to be rather above the average. Rice cultivation is the staple industry in Lambayeque and La Libertad (two coast departments with an abundant water supply), where about 60,000 acres are cultivated. The land is not manured, and after being cropped is allowed to lie fallow. The rice is of excellent quality, and some of it is exported, but not to the extent of the imports.

Rice growing in Brazil is mentioned in some of the earliest records of European settlement. It declined for a time in the second half of last century, when coffee was introduced, and in 1902 production had fallen so far below consumption that the imports amounted to about 100,000 tons. Energetic measures (including the establishment of heavy import duties) were taken to restore the balance. The Ministry of Agriculture, Industry and Commerce has encouraged the introduction of new varieties and modern methods. Cultivation generally is still rather primitive, but has extended rapidly. Japanese immigrants have taken up the industry, among other branches of agriculture. An estimate covering the south-eastern States of Minas Geraes, São Paulo, Rio Grande de Sul, Rio de Janeiro, and Santa Catharina gave a production equivalent to about 210,000 tons of cleaned rice. São Paulo is the only State for which regular crop estimates are available. From returns given in *United States Commerce Reports*

(No. 273, September 18, 1917) the yield of cleaned rice in that State in the last six years works out as follows: in 1912, 64,000 tons; in 1913, 51,000 tons; in 1914, 54,000 tons; in 1915, 37,000 tons; in 1916, 72,000 tons; in 1917, 72,000 tons. In Brazil as a whole not only has production overtaken consumption, but this year (1917) the United States Consul-General reports a considerable export trade (20,000 tons in the first six months; whether paddy or rice is not stated), chiefly with France and Argentina.

In Argentina also the Government, with the aid of a Japanese expert, has been seeking to develop rice-growing along progressive lines. The results, however, hitherto have been inconsiderable. Production is said to have more than doubled between 1911 and 1916; but the area under cultivation was returned at the census of 1908 as 20,000 acres, and there can have been no great extension in the interval, since according to a United States *Commerce Report* (January 9, 1917) production in 1916 was under 7,000 tons, drought being responsible for the loss of about one-third of the crop. There remains in Argentina a desire to make that country independent of outside sources of rice supply. Fifty per cent. (21,000 tons) of the rice imports in 1913 were from Italy, the imports from British possessions amounting to only 4,700 tons; but British possessions supplied over 40 per cent. (7,250 tons) of the total imports of paddy. Of the imports into Chile in 1915 India supplied over one-third (7,670 tons).

As regards future developments, some of the most promising fields for the extension of rice-growing on a large scale in South America are to be found " in the vast reaches of level lands in Brazil; in the Pacific Coast sections of Peru and Ecuador; in the northern lowlands of Colombia, Venezuela, and the Guianas; and in the extensive and fertile plains of northern Argentina " (*Bull. Pan-American Union*, February 1917).

Table of the World's Rice Crops

In the following table are gathered together the conclusions reached in the preceding investigation of rice

production in the different rice-growing countries. The chief omission is China. For most of the other leading countries official estimates are available, and in such cases the year to which the estimate relates is given in brackets after the name of the country. In other cases the estimates are of normal production, and the reader is referred to the various sections for the data on which they are based. The totals, being composed of valuations of a heterogeneous character, are useful only as affording a general idea of the magnitude to which the world's production of rice (outside of China) has attained.

Country.	Production (cleaned rice).
	Tons.
India * :	
British India (1916–17)	34,079,000
Native States	1,000,000
Ceylon † (1915)	172,000
Malaya † :	
Straits Settlements	35,000
Federated Malay States (1913)	46,000
Kelantan	35,000
Perlis	7,000
British North Borneo † (1914–15)	9,800
Hong Kong †	15,000
Fiji †	9,000
Egypt † (1914–15)	366,000
Uganda †	100
Nyasaland (1916)	1,300
British Guiana * (1915)	41,000
Trinidad †	1,700
British Countries (approximately)	35,818,000
Italy * (1916)	320,000
Spain * (1916)	149,000
Bulgaria † (1912)	3,000
Greece †	1,200
European Russia † (1913)	250
Transcaucasia and Russian Turkestan † (1914)	170,000
Bokhara and Khiva †	40,000
Persia *	250,000
Mesopotamia *	30,000
Siam *	2,500,000
Netherlands East Indies † :	
Java and Madura (1914)	3,494,000
Sumatra, etc.	750,000
French Indo-China *	3,500,000
Japan (1916)	8,177,000
Korea * (1916)	1,758,000
Formosa * (1914)	647,000
Philippines † (1915)	491,000
Madagascar *	450,000
United States † (1916)	520,000
Mexico † (1914)	15,000
Guatemala † (1916)	7,500
Netherlands Guiana † (1914)	3,000
Ecuador † (1917)	15,000
Peru † (1915–16)	40,000
Brazil *	250,000
Argentina † (1916)	7,000
Foreign Countries (approximately)	23,589,000
World's Total (for countries listed)	59,407,000

The preceding table distinguishes between : (1) countries (marked *) in which, normally, production exceeds consumption. These are the mainstay of the rice export trade. India, Korea, Formosa, Persia, and Mesopotamia, besides contributing, in very different degrees, to this

trade, import considerable quantities of rice for home consumption. (2) countries (marked †) in which, normally, consumption exceeds production. Java, the United States, and Egypt, while large importers of rice for home consumption, do a considerable export trade in home-grown rice. Owing to recent crop developments in Japan it is doubtful, pending receipt of fuller trade returns, to which category that country now belongs.

Preparation of Rice for the Market

The rough rice (paddy) as it leaves the thresher consists of the fruit or grain, comparable with the wheat grain, surrounded by a closely enveloping scaly bract, known botanically as the palea or, more generally, as the husk, hull or shude. The grain itself, like other grass fruits, is composed of an outer skin, which consists of the fruit wall (pericarp) and seed coat (testa) fused together, enclosing, except at one end where the germ or embryo is situated, a layer of cells rich in proteins and known as the aleurone layer, within which, and forming the bulk of the grain, is the starchy portion of the endosperm. The latter is white in the ordinary rice of commerce, and in order to obtain a product of good appearance and of better cooking quality, the germ and outer brownish layers, together with the husk, are removed by milling.

In the native method of milling the paddy is pounded by means of a pestle and mortar, worked either by hand or by machinery. The husks are thus broken, and a portion both of the outer layers of the grain and of the germ is removed. The husks and dust are then separated from the grain by winnowing. Before being cooked the grains are submitted to a further pounding in order to remove the remainder of the outer layers and germ and so obtain a cleaned product. The percentage yields of the various products in one case of hand-pounding noted in Burma were as follows: cleaned whole rice 57·4, broken rice 10·1, meal and dust 13·3, husk 19·2 (*Burma Department of Agriculture, Bulletin* No. 10, 1913).

In modern rice mills the paddy is treated by elaborate

power-driven machinery, the process consisting of either four or five stages, viz. :

1. Sifting and winnowing,
2. Hulling,
3. Skinning,
4. Polishing,

and sometimes

5. Coating or facing.

(1) *Sifting and winnowing.*—The paddy is freed from dirt and other foreign matter.

(2) *Hulling.*—The clean paddy is passed through milling-stones or a series of hullers, screens and winnowing machines in order to remove the husks. In this process a certain amount of dust, known as " mill dust," is produced, consisting largely of husk-fragments, together with some rice skin and a little starch.

(3) *Skinning.*—The husked rice is milled in cones to produce " skinned " or " white " rice (known in Burma as " loonzein "). During this process the skin is removed with much of the aleurone layer, and also the germ, and these together constitute " rice bran or meal." The term " rice meal " is also used to designate a product consisting of the " rice bran " mixed with the " rice polish " (polished meal) produced in the next stage of milling.

(4) *Polishing.*—The " skinned " rice is passed through a polishing machine, consisting of a cylinder made of wood and wire-gauze in which revolve rollers covered with sheep-skin or pig-skin. These rollers remove the remainder of the aleurone layer and any adhering floury matter from the grain and give it a smooth surface. The matter removed by polishing is known as " rice polish."

In the three stages of hulling, skinning and polishing a certain amount of broken rice is produced, and this is usually graded and sold separately.

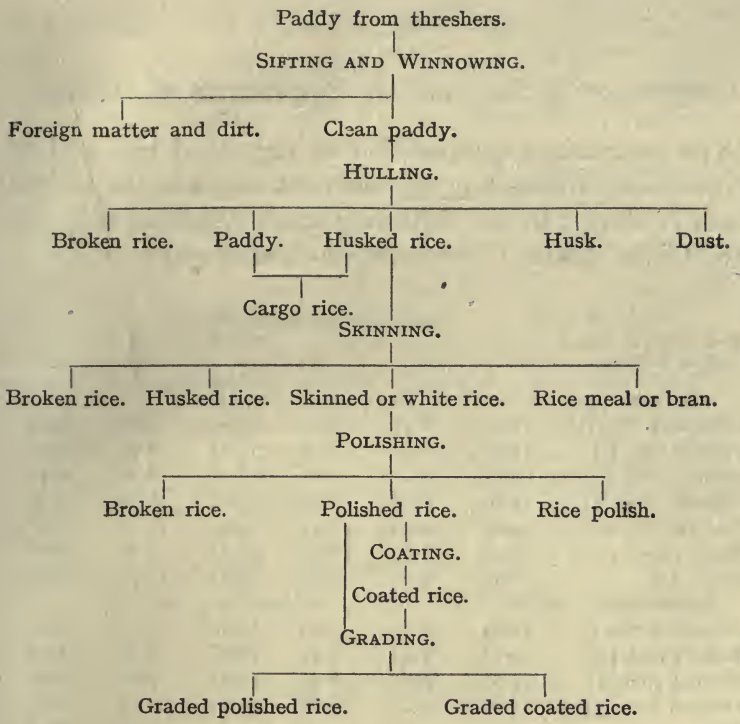
(5) *Coating or facing.*—Further to improve the appearance of the rice for commercial purposes, powdered talc (or

alternatively steatite), colouring matter and oil are used for the respective purposes of imparting a more lustrous surface, a desired colour effect, and a translucent appearance. Other materials have been tried in place of talc, *e.g.* powdered mica, kaolin and gypsum. The talc is usually mixed with glucose, glycerine and starch paste, and sometimes also with mineral oil. In some mills talc and ground rice are previously added to the grain while it is passing through the mills. In any case the glazing mixture supplies the polished rice with most of its mineral surface, the addition varying from 0·15 to 0·44 per cent. in English mills, and from 0·16 to 2·00 per cent. in foreign mills. The colouring material, in the form of a powder —usually a blue pigment (ultramarine, Prussian or aniline blue) in order to counteract the milky whiteness of the rice—is generally mixed with the rice after milling and before polishing. The amount of pure pigment varies, but in many cases about 0·013 lb. of ultramarine is added to 1 ton of rice. The oiling material—generally a mineral oil—is added to produce a translucent effect only when no glaze has been used, and is then added after the milling. The amount of oil used is about 0·3 gallon to the ton. In England no limit as to the quantity of talc employed for coating rice has been laid down by law, and it is left to the consumer to take action under the Sale of Food and Drugs Act.

In a report made to the Local Government Board, Dr. Hamill points out that 0·5 per cent. of added mineral matter would appear amply to meet the requirements of traders who regard this practice as necessary.

In the United States the use of talc is permitted, provided that each package is plainly labelled with the name of the preservative and that proper directions for its removal be given. The Department of Agriculture, who administer the United States Food and Drugs Act, have decided that rice coated with glucose and starch must be labelled to that effect, and in no case may a coating of any kind be applied if it has the effect of concealing damage or inferiority.

The various stages of milling and the products at each stage are shown in the following diagram :



Large quantities of " cargo rice," consisting of incompletely husked rice in which a certain amount of paddy remains, are shipped from the producing countries, mainly to Europe, where the milling is completed. The proportion of paddy in " cargo rice " varies from 5 to 20 per cent.

The following figures show approximately the outturn of the various products in the case of Burmese mills, according to experimental investigation by the Burma Department of Agriculture :

	Per cent.		*Per cent.*
Polished rice . .	44·0	Meal and polish .	8·8
Broken rice . .	24·0	Husk . . .	20·0
Dust . . .	3·2		

In the United States the average yields in trials made with rices of the Honduras and Japan types were as follows :

	Honduras type. *Per cent.*	Japan type. *Per cent.*
Cleaned rice (whole and broken) . .	62·3	65·4
Meal	13·6	12·3
Polish	3·7	3·7
Husk and milling loss	20·4	18·6

Composition of Rice and the By-products of Milling

The percentage composition of unhusked rice and of the products obtained at the different stages in the United States is shown in the following table (*Bulletin No.* 330, 1916, *United States Department of Agriculture*) :

Description of Rice and By-products.	Moisture.	Percentage Organic Composition. Fat.	Proteins.	Carbohydrates (by difference).	Crude fibre.	Ash.
Honduras type.						
Unhusked rice (1) .	11·27	1·58	7·48	65·6	8·67	5·40
Husked rice (1) .	12·32	1·79	8·57	75·15	0·99	1·18
Skinned rice (1) .	12·50	0·28	7·88	78·57	0·30	0·47
Polished rice (1) .	11·89	0·25	8·06[1]	79·14	0·30	0·36
Meal (2) . .	9·61	10·65	13·41	44·04	11·71	10·58
Polish (2) . .	8·28	10·84	12·81	58·43	3·28	6·36
Husks (2) . .	6·62	0·50	2·56	36·13	35·99	18·20
Japan type.						
Unhusked rice (3) .	11·50	1·74	6·50	67·19	7·93	5·14
Husked rice (3) .	12·38	1·52	7·24	76·88	0·85	1·13
Skinned rice (3) .	13·38	0·31	6·59	79·03	0·29	0·40
Polished rice (3) .	12·82	0·22	6·61[1]	79·74	0·29	0·32
Meal . . .	9·39	15·13	12·81	41·8	13·54	11·33
Polish (2) . .	8·70	8·79	11·40	63·74	2·01	5·31
Husks . . .	6·12	0·86	2·69	34·15	36·08	20·10

(1) Average of 4 samples. (2) Average of 2 samples.
(3) Average of 3 samples.

[1] *These analyses are unusual in showing no diminution in proteins after polishing, in spite of the fact that the "polish" taken off is richer in protein than the skinned rice from which it is removed in preparing polished rice.*

Analyses of a single complete series of products are not available in the case of Burma rice. In the following table the organic analyses of the skinned rice, polished rice, and the by-products are taken from " The Chemical Composition of Paddy Mill Products," by F. J. Warth and D. B. Darabsett (*Bulletin* No. 10, 1913, *Dept. Agric., Burma*) ; they represent the averages for samples derived from three varieties of paddy. The analysis of unhusked rice is from " Indian Food Grains and Fodders : their Chemical Composition, II.," by J. W. Leather (*Agric. Ledger*, 1903, No. 7, p. 150). The analysis of husked rice is the average of five samples of Burma rice given in " The Composition of

Indian Rice," by David Hooper (*Agric. Ledger*, 1908–9, No. 5, p. 535). In all cases the figures for the mineral constituents are taken from the first-named publication.

	Percentage Organic Composition.						Mineral Constituents: Percentage of Total.					
	Moisture.	Proteins.	Fat.	Carbohydrates.	Fibre.	Ash.	Nitrogen (N).	Silica (SiO_2)	Lime (CaO).	Magnesia (MgO).	Phosphoric acid (P_2O_5).	Potash (K_2O)
Unhusked rice [1]	12.55	6·35	2·14	65·19	7·84	5·93	0·92	3·84	0·039	0·10	0·54	—
Husked rice [2] .	11·68	7·71	1·19	77·79	0·70	0·93	—	—	—	—	—	—
Skinned rice .	13·02	6·91	2·24	75·71	0·68	1·44	1·11	0·13	0·026	0·19	0·69	0·30
Polished rice .	12·90	6·47	0·46	79·43	0·25	0·49	1·01	0·02	0·017	0·05	0·24	0·08
Meal . .	8·10	11·50	13·50	53·50	4·50	8·90	1·88	1·40	0·061	0·99	3·86	1·46
Polish . .	11·40	10·20	7·80	63·20	1·20	6·20	1·64	0·97	0·040	0·18	2·82	—
Dust . .	9·60	6·20	3·80	41·00	22·10	17·3	1·13	11·50	0·068	0·45	1·09	—
Husks . .	—	—	—	—	—	—	0·027	17·18	—	—	0·04	—

[1] *Average of 4 samples.* [2] *Average of 5 samples.*

Rice as a Foodstuff

Rice is the most important of all cereals used as human food. It forms the staple diet of most Eastern races and is also largely eaten in Europe and America. Its nutritive value depends on the form in which it is eaten, polished rice being, as a rule, poorer in all constituents, except carbohydrates, than unskinned and unpolished rice (cf. foregoing tables of analyses). There is, however, no strict relation between the chemical composition and the value of the rice from the consumer's point of view. The method of cooking also has an influence on the nutritive value of the rice. According to Hooper, in the case of Indian rice, boiling removes more than half the fat contents, over 8 per cent. of the proteins, less than 8 per cent. of the carbohydrates and 17·6 of the ash. To obtain the greatest possible value as a food rice should be steamed, not boiled ; or it should be cooked by the gradual addition of water, in quantity merely sufficient to soften the rice.

The percentages of the organic constituents of rice, compared with those of other common foodstuffs, are shown in the following table :

	Water.	Proteins.	Fat.	Carbo-hydrates.	Fibre.	Ash.	Food units.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	
Rice, Burma, husked	11·68	7·71	1·19	77·79	0·70	0·93	102
„ „ polished	12·90	6·47	0·46	79·43	0·25	0·49	97
„ Bihar and Orissa, husked	11·95	7·48	2·36	75·86	0·76	1·59	101
„ Bihar and Orissa, polished	10·89	7·25	0·88	79·99	0·20	0·79	100
„ Patna, coated[1]	11·97	8·06	0·18	78·59	0·46	0·74	99
„ Siam, uncoated[1]	11·81	7·06	0·21	80·14	0·40	0·38	98
„ Java, uncoated[1]	11·86	7·75	0·17	79·42	0·40	0·40	99
„ Bassein, coated[1]	12·33	7·19	0·25	78·93	0·41	0·89	98
„ Japan, partly milled[1]	11·52	6·75	1·92	77·49	1·10	1·22	99
„ „ coated	12·21	6·14	0·43	79·50	0·41	1·31	96
„ „ polished	12·82	6·61	0·22	79·74	0·29	0·32	97
„ Chinese, uncoated[1]	12·06	6·59	0·20	80·20	0·40	0·55	97
„ Honduras, polished	11·89	8·06	0·25	79·14	0·30	0·36	100
Wheat	13·0	12·5	1·7	68·5	2·5	1·8	104
„ flour, straight or standard	10·54	11·99	1·61	75·36		0·5	109
Maize, dent	10·56	10·25	5·02	70·40	2·24	1·53	108
„ meal	14·98	9·17	3·77	68·76	1·90	1·42	101
Oat meal	10·0	15·0	8·0	60·0	3·0	4·0	117
Sago flour	11·70	0·13	0·13	87·56	0·13	0·35	88
Tapioca flour	12·70	0·88	0·23	80·47	4·87	0·85	83
Potatoes	74·98	2·08	0·15	21·01	0·69	1·09	26
Lentils	14·0	25·5	1·9	52·2	3·4	3·0	121

[1] *Typical of rice imported into the United States.*

It is not possible to compare accurately these different materials, as it is necessary to know the digestibility of the constituents in each case when used as human food, and this is not known in most cases. Speaking generally, rice is no more completely digested than other cereals, its proteins, indeed, being said to be slightly less digestible than those of wheat. Rice proteins, however, it is asserted, more closely resemble those of animal tissues than do those of wheat and maize.

In countries where polished rice constitutes a large part of the diet, the natives frequently suffer from the disease known as beri-beri. That the disease is caused by living mainly on polished rice seems to have been conclusively proved, as sufferers have been cured by the addition of rice polish to the diet or by the replacement of polished by unpolished rice. Funk and others maintain that the skin which is removed by polishing contains a substance or substances, known as vitamines, which are

essential to normal growth, whilst others believe that the disease is caused by a deficiency in phosphates. The latter view is supported by experiments with poultry, etc., in which cases have been cured by the addition of phosphates to the diet. Although husked rice is therefore preferable to polished rice from this point of view, besides containing a greater proportion of nutritive constituents, it has the disadvantage of being more difficult to cook and, when cooked, of being less pleasant in appearance. The question is of course only of importance where rice is practically the sole diet.

As rice is essentially a carbohydrate food, it is necessary to supplement it with foods rich in proteins, such as meat or legumes, in order to obtain a well-balanced diet. Even in China, where it is popularly supposed rice is almost the sole food amongst certain classes, and where, as a matter of fact, the annual *per capita* consumption of rice is said to amount to 300 lb., a large amount of protein is consumed in the form of preparations of soy beans, edible seaweed, etc.

Industrial Uses of Rice

In addition to its primary use as food, rice is employed in brewing, distilling, vinegar manufacture and starch-making. For the former purpose, either whole rice or broken rice is employed. In the United States the term "brewers' rice" is given to broken rice which is small enough to go through a No. 12 sieve. In the case of both whole and broken rice, the grain is usually converted into the form of grits, flakes or starch before use, but is sometimes merely crushed. The flakes are made by extracting the crude starch with tepid water so as to form a thick paste which is dried by being passed between hollow, steam-heated rollers. This form of rice is said to be capable of being saccharified at a comparatively low temperature and gives a high yield, 100 parts being equivalent to 120 to 130 parts of malt. Rice is not, as a rule, used alone in brewing, but only in admixture with malt, replacing from 20 to 50 per cent. of the latter. It tends to produce a light beer and, if a large proportion is used, the beer is said not to keep well, and the yeast deteriorates and has to be renewed or rejuvenated with malt.

As a source of alcoholic beverages, rice is used largely in Japan for the production of the drink known as saké. The special feature of the process of brewing saké is the use of a single ferment for the two operations of saccharification and fermentation. There are about 20,000 saké breweries in Japan producing 150,000,000 gallons annually. Saké is something between a wine and a beer, is of a pale sherry colour, and has a rather acid taste. There are many varieties brewed. The liquor is stored in vats made from the wood of *Cryptomeria japonica*, which gives it a characteristic flavour. There is a tax of 1*s*. a gallon on saké, which yields a revenue of about £7,000,000 a year.

In the manufacture of starch the rice is treated with a weak solution of caustic soda to soften and swell the grain. It is then washed in pure water, drained, crushed and afterwards sifted. The flour thus obtained is again treated with alkali solution and the starch is separated in a pure form by means of fine sieves, washing and settling in water. The moist starch is moulded in high-pressure filtering moulds and then dried gradually at a moderate temperature. An acid process is often employed instead of the above. About 85 to 90 per cent. of the starch present in the grain is extracted by modern methods. Rice starch is chiefly employed for laundry work, and finely-ground rice is largely used for sizing and finishing textiles.

Rice Meal and Polish

As a general rule the rice bran or meal produced by the milling of the husked rice is mixed with the rice polish formed during the polishing process, the mixture being sold for feeding purposes as rice meal. Experiments with fattening pigs at the Arkansas Experiment Station have indicated that rice polish is of more value for feeding purposes than rice bran. A certain amount of the rice dust produced in the hulling process is also sometimes mixed with the meal. Rice meal is essentially a starchy food and is therefore much in demand for feeding pigs and for use as a diluent to nitrogenous foods, such as oil

cakes, in the manufacture of compound feeding cakes. Rice polish was formerly exported from the United States to Germany, where it is said to have been used in the manufacture of buttons and similar articles.

The average composition of rice meal, compared with that of other feeding stuffs in common use, is as follows :

	Rice meal.[1]	Barley meal.[2]	Dried brewers' grains.[2]	Linseed cake.[3] English.	Palm-kernel cake.[4] English.	Maize meal.[3]	Maize germ meal.[3]
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Moisture . .	9·72	13·29	10·1	11·16	9·4	12·45	10·45
Crude proteins .	12·21	13·19	19·50	29·50	17·8	10·01	23·14
Fat . . .	13·24	3·14	6·93	9·50	8·2	4·20	11·77
Carbohydrates, by difference .	48·56	61·87	42·31	35·54	50·6	70·13	48·25
Crude fibre .	7·31	5·63	17·60	9·10	10·1	1·96	5·37
Ash . . .	8·96	2·88	3·65	5·20	3·9	1·25	1·02
Nutrient ratio .	1 : 6·5	1 : 5·2	1 : 3·0	1 : 1·94	1 : 3·9	1 : 8·0	1 : 3·2
Food units .	112	103	108	133	116	105	136

[1] *Average of 20 analyses quoted by various authorities.*
[2] *Journal S.E. Agricultural College, Wye, 1912, p. 257.*
[3] *Smetham, Journ. Roy. Lancs. Agric. Soc., 1914.*
[4] *Analysed at the Imperial Institute.*

It will be seen that rice meal is rich in fat and carbohydrates and fairly rich in protein and compares favourably in composition with barley meal, dried brewers' grains and maize meal. The high proportion of fat is due to the fact that the meal contains practically the whole of the germ of the rice grain which is rich in that constituent. The fat however has a tendency to turn rancid quickly, and for this reason it is not advisable to store the meal for any length of time.

Rangoon rice meal is superior to the average quoted in the above table, its percentage composition, according to Smetham, being as follows :

Moisture	9·10	Crude fibre . . .	6·23
Crude proteins . . .	13·31	Ash	8·90
Fat	15·46		
Carbohydrates, by difference	47·00	Food units . . .	119

Rice meal is a comparatively cheap food, as is indicated in the following table, which shows the price of various feeding stuffs at the beginning of 1917 and the cost per food unit :

	Price at beginning of 1917, per ton. £ s. d.	Food units.	Cost per food unit. s. d.
Rangoon rice meal . .	16 5 0	119	2 8¼
Barley meal . . .	17 15 0	103	3 5¼
Dried brewers' grains .	14 15 0	108	2 8¾
Maize germ meal . .	16 7 6	136	2 5¾
Linseed cake, English .	19 10 0	133	2 11¼
Palm-kernel cake, English	15 15 0	116	2 8¼

In considering the cost of a feeding stuff, the value of the manure that results from its consumption must be taken into account. This is commonly calculated by taking the value of each unit per cent. of nitrogen in the residues resulting from the consumption of 1 ton of the feeding stuff to be 15*s.*, that of the phosphoric acid to be 3*s.* per unit, and that of the potash to be 4*s.* per unit, and assuming that half the nitrogen, and three-quarters of the phosphoric acid and potash present go into the manure when the latter is made into dung (cf. Voelcker and Hall, *Journ. Roy. Agric. Soc.*, 1913, **74**, 104). According to Warth and Darabsett (*Bulletin* No. 10, 1913, *Dept. Agric. Burma*) Rangoon meal contains 1·88 per cent. of nitrogen, 3·86 per cent. of phosphoric acid and 1·46 per cent. of potash. On this basis the compensation value of the manure per ton of feeding stuff would be 27*s.* 2*d.*, as compared with 15*s.* 8*d.* in the case of feeding barley, 29*s.* for brewers' grains, 44*s.* 4*d.* for linseed cake and 22*s.* 11*d.* for palm-kernel cake.

The price of rice meal, like that of all other feeding stuffs, has risen considerably since the outbreak of war, as is indicated in the following table which shows the highest, lowest and average prices in London or Liverpool, during the years 1913, 1914, 1915 and 1916 :

	1913. £ s. d.	1914. £ s. d.	1915. £ s. d.	1916. £ s. d.
Highest . .	5 7 6	6 2 6 to 6 5 0	8 7 6	16 0 0
Lowest . .	4 5 0	3 17 6	6 10 0	6 5 0 to 7 0 0
Average . .	4 14 3	4 17 6	6 2 3	9 8 4

Feeding of Rice Meal to Live-stock

Pigs.—Rice meal is much used for feeding to pigs in Holland and the present extent of the rice milling industry

in that country is due largely to the fact that the by-products sell readily to the local farmers for feeding purposes. Careful feeding experiments with pigs have been carried out in this country, in Canada, the United States and elsewhere, and almost without exception rice meal has proved to be a valuable food when mixed with some other meal richer in nitrogenous substances, or with a highly nitrogenous liquid food such as separated milk or whey to form a properly balanced ration. At the South Carolina Experiment Station for example, rice meal was found to be more economical than maize meal when fed in conjunction with skimmed milk. Similar results were obtained at the Hatch Experiment Station, Massachusetts, where it was concluded that the choice between the two meals depends on relative market price. It is not advisable, however, to replace the whole of the grain ration with rice meal, as there is a tendency for pigs which are fed mainly on this food to develop weak hind legs. Experiments conducted at the Experimental Farm, Agassiz, British Columbia, seem to indicate that this injurious effect is due primarily to lack of phosphorus in the rice meal, and that this can be counteracted by the addition of ground phosphate to the grain ration.

Rice meal may be used, together with an equal proportion of maize germ meal, as a substitute for barley meal for pigs. Other substitutes for barley meal which have been recommended are (1) 2 parts rice meal, 2 parts maize meal, 1 part coconut or palm-kernel cake and 1 part bean meal, and (2) 2 parts rice meal, 2 parts maize meal and 1 part ground-nut cake.

The following rations for pigs of various ages are given in *Special Leaflet*, No. 16, *Bd. of Agric. and Fisheries*:

	Live weight of pigs.			
	40 lb.	80 lb.	140 lb.	180 lb.
Rice meal . .	½ lb.	¾ lb.	1½ lb.	2 lb.
Middlings . .	½ ,,	—	—	—
Sharps . . .	—	¾ lb.	1½ lb.	2 lb.
Bran . . .	—	¾ ,,	¾ ,,	1 ,,
Gluten meal . .	½ lb.	¾ ,,	¾ ,,	1 ,,

Sows which are suckling young may be given 4 lb. rice meal, 4 lb. sharps and 2 lb. bran.

Milch Cows.—Rice meal is at present not used to any great extent for milch cows, except when mixed with other foods in compound cakes, although it might well be included in the concentrated food supplied to these animals to replace more expensive foods. A mixture of rice meal, coconut cake and ground-nut cake in equal proportions, for example, is a satisfactory substitute for the mixed linseed and cotton-seed cakes fed to cows in stalls. In conjunction with a liberal supply of green fodder, cows yielding 2½ to 3 gallons of milk per day may be given 4 or 5 lb. per head per day of a mixture consisting of 1 part rice meal, 2 parts maize gluten feed and 1 part linseed cake, the amount being increased in the case of cows giving higher yields of milk.

Fattening Cattle.—Rice meal may also be employed as a diluent to cake and other concentrated foods for feeding bullocks. Feeding trials with steers at the Texas Experiment Station showed that 10 lb. of rice meal was equal to 6 lb. of cotton-seed meal when forming two-fifths of the concentrated food in the ration. For calves a suitable mixture consists of equal parts of rice meal, linseed cake, ground-nut cake and maize.

Sheep.—Rice meal is not often fed to sheep, but here again it can be profitably employed as a constituent of the concentrated food. Lambs which are fed on tares or clover aftermath may be given ¼ lb. to 1 lb. per head per day, according to their age and weight, of a mixture consisting of equal parts of rice meal, linseed cake, dried brewers' grains and crushed maize.

Trade in Rice Meal

The chief countries producing rice meal are India, Indo-China, Siam, United States and Egypt. In addition to the large quantities consumed in these countries there is a considerable export. In the case of India, rice meal is included in the official trade returns under the heading "bran and pollards." The total quantity exported under this head in 1914–15 was 194,588 tons, of which 183,697 tons were shipped from Burma, and as the Burma exports

are known to consist entirely of rice meal, the figures for that country only will be considered. The United Kingdom has always been the principal customer for Burma rice meal, taking about 120,000 tons each year, the Straits Settlements and Germany coming next in importance, taking about 30,000 to 40,000 tons each in normal years. The exports from Indo-China have been taken in about equal proportions by Hong Kong, Germany and the United Kingdom, whilst Siam rice meal is sent almost entirely to the Straits Settlements and Hong Kong. The United States at one time exported about 6,000 tons of rice bran and polish each year, practically the whole of which went to Germany, but in 1913–14 only 1,871 tons were shipped, and in 1914–15 only half this quantity; in the latter year most of the material was sent to Norway. Rice meal is not shown separately in the Egyptian trade returns, being included under the heading "son" (bran), of which about 2,800 tons were exported in 1915, mostly to the United Kingdom.

The exports of the by-products of the rice milling industry from the chief producing countries in the last year for which statistics are available are shown in the following table, together with the countries of destination:

Destination.	Burma,[1] 1914–15.	Indo-China, 1913. Rice meal and dust.	Siam, 1915–16.		United States, 1914–15.	Egypt.[2] 1915.
			"White rice" meal.	"Cargo rice" meal.	Rice bran and polish.	
	Tons.	*Metric tons.*	*Tons.*	*Tons.*	*Tons.*	*Metric tons.*
United Kingdom .	116,798	43,111	—	—	—	1,947
Straits Settlements	35,384	361	71,484	527	—	—
Hong Kong . .	2,432	57,557	18,925	16,777	—	—
Other countries of the British Empire	246	—	—	—	5	2
France . .	—	59	—	—	1	60
French Colonies .	—	678	—	—	—	—
Italy . . .	—	—	—	—	—	654
Germany . .	20,091	50,416	—	—	—	—
Denmark . .	8,654	—	4,217	—	—	—
Greece. . .	—	—	—	—	—	139
Norway . .	—	—	—	—	800	—
China . . .	80	1	—	232	—	—
Other foreign countries . .	12	—	—	—	101	50
Total . .	183,697	152,183	94,626	17,536	907	2,852

[1] *Recorded in official trade Returns as "bran and pollards."*

[2] *Recorded in official trade Returns as "son" (= bran).*

About half the rice meal imported into the Straits Settlements is re-exported, mainly to the Federated Malay States, the Dutch East Indies and the Unfederated Malay States. The actual exports in 1915 were as follows :

Destination.	Quantity. *Tons.*
Federated Malay States	28,197
Unfederated Malay States	5,066
Dutch East Indies	9,984
Other countries	3,595
Total exports	46,842
Total imports	93,043

A large proportion of the meal imported into Hong Kong is also re-exported, but detailed figures of the trade are not published.

Rice Husks or Hulls

Many attempts have been made to find a use for the enormous quantity of rice husks which accumulate during the milling process. In Burma a large proportion of the husks is simply thrown into the rivers, a practice which tends to silt up the rivers. Some of the husks are used as fuel in the rice-mills, and attempts have been made to convert them into briquettes in conjunction with petroleum by-products ; the calorific value of the husks is sufficiently high to admit of their use for the latter purpose, but difficulty has been experienced in preparing a sufficiently coherent briquette, owing to their resilient nature. They are also employed as a packing material, and it has been suggested that they might be utilised in the manufacture of linoleum. Trials which were carried out by a firm of manufacturers, in conjunction with the Imperial Institute, did not, however, give promising results for the latter purpose.

Rice husks have been used as a " filler " in compound feeding stuffs for live-stock. They are of comparatively little nutritive value, as is clear from the following statement of their composition, and, owing to their hard, siliceous nature, are actually dangerous to stock. The husks are occasionally ground and used as an adulterant of

barley meal, sharps and middlings, but their use for this purpose, unless their presence is definitely stated, renders the seller of such feeding stuffs liable to a penalty under the British Fertilisers and Feeding Stuff Act.

The composition of rice husks is as follows ; the figures given represent the average of seven analyses quoted by various observers.

	Per cent.
Moisture	9·02
Crude proteins	3·27
Fat	1·18
Carbohydrates (by difference)	33·71
Crude fibre	35·68
Ash	17·14

The following notes are supplementary to the above report.

India.—In dealing with the production of rice in Burma, it was stated above (p. 78) that in the deltaic region, where the main rice crop is grown, " owing to the rapid hardening of the soil after the rains are over, the cultivation can only be by means of irrigation." This statement was based on the following passage in a paper contributed to the Third International Congress of Tropical Agriculture 1914, by Mr. A. McKerral, Deputy Director of Agriculture in the Southern Circle, Burma (*Trans. of the Congress*, vol. ii., p. 95) : " The surface soil is in all cases characterised by the extreme rapidity with which it loses water as soon as the rains are over, so that attempts at cultivation without irrigation can only end in failure."

It has been represented that this statement, in the condensed form in which it appears in the *Bulletin* article, may be misleading, and Mr. McKerral has been consulted as to what exactly is implied. He states in reply, " that while no irrigation is required for the rice crop, which is grown during the rains, the rice soils lose water so rapidly as soon as the rains are over, and become so hard, that if cultivation is attempted at that time of year irrigation is necessary. As a matter of fact very little cultivation of second crops is attempted, but near Rangoon and some of the bigger towns, vegetables are grown by means of well irrigation."

III

THE UTILISATION OF BURMESE RICE AND ITS BY-PRODUCTS

Summary of Special Information prepared at the Imperial Institute for the Committee

A GENERAL account has been given (see page 147 above) of the various uses to which rice and its by-products are applied apart from its direct use as food, and this may now be supplemented with the results of an investigation carried out at the Imperial Institute as to the suitability of various kinds of Burmese rice for industrial and other purposes. The possibility of utilising rice straw and rice husks for paper-making has also been investigated recently, and the results of these investigations are given in the following pages.

RICE FROM BURMA

A series of 12 samples of husked rice, and 12 corresponding samples of paddy, produced in the course of selection experiments at the Agricultural Station, Hmawbi, Lower Burma, were forwarded in March 1917. The samples were clean and free from dirt and extraneous matter.

The samples were divided at the Imperial Institute, after consultation with commercial experts, into four groups, viz. (1) Hard long grain, (2) Hard transparent

grain, (3) Soft transparent grain, and (4) Soft opaque grain. This classification of the samples and the characters of the different kinds are summarised in the following table :

Sample.	Rice.					Paddy.
	Hardness.	Colour.	Shape.	Size. No. of whole grains in 10 c.c. volume.	Percentage of broken grains.	Percentage of husk.
Hard Long Grain :						
Emata (343) .	Hard	Transparent	Long and fairly broad	365	40·0	21·1
Letywezin (SS 25)	,,	,,	Same as Emata, but not so large	477	6·8	23·1
Bankouk (8) .	,,	,,	Long and fairly broad	390	25·2	21·2
Taungdeikpan (70)	,,	,,	Long and slender	481	35·8	24·5
Bausamati (105)	,,	,,	Short and thin. Poor small grain	592	53·1	23·2
Hard Transparent Grain :						
Byatcale (10) .	Hard, but not so hard as 1st group	Transparent to semi-transparent	Short and broad	388	48·6	21·4
Ngasein (8) .	,,	,,	,,	413	9·6	21·1
Soft Transparent Grain :						
Beelugyun-Ngasein	Soft	Semi-transparent	Long and broad	295	50·6	19·6
Byatthidat (14)	,,	,,	Short and broad	346	16·2	20·7
Bawyut (32) .	,,	,,	,,	383	11·6	21·2
Soft Opaque Grain :						
Byatcale (20) .	,,	Opaque	Long and broad	314	32·5	20·8
Sabanat (311) .	,,	,,	Short and broad	364	13·6	21·3

The samples of rice were analysed with the following percentage results :

Sample.	Moisture.	Total proteins.	Fat.	Starch (by difference).	Fibre.	Ash.
Emata (343) . . .	14·3	9·1	0·7	75·3	0·1	0·5
Letywezin (SS 25) . .	14·2	8·9	0·9	75·2	0·2	0·6
Bankouk (8) . . .	13·7	9·3	0·6	75·3	0·5	0·6
Taungdeikpan (70) . .	13·6	8·9	0·8	75·7	0·3	0·7
Bausamati (105) . .	13·7	10·0	0·8	74·6	0·1	0·8
Byatcale (10) . .	14·1	7·4	1·1	76·5	0·2	0·7
Ngasein (8) . . .	14·1	6·9	0·9	77·3	0·2	0·6
Beelugyun-Ngasein . .	12·6	8·0	0·7	77·9	0·2	0·6
Byatthidat (14) . .	12·9	8·0	0·6	77·5	0·2	0·8
Bawyut (32) . . .	13·8	7·9	0·7	76·6	0·2	0·8
Byatcale (20) . .	13·5	7·4	0·7	77·5	0·2	0·7
Sabanet (311) . .	14·3	6·9	0·6	77·3	0·2	0·7

Suitability of the Rices as Food-stuffs

Samples of each variety of rice were submitted to commercial experts for expression of opinion as to their quality and suitability for the British market, with the following results :

(1) A firm of brokers reported that the following varieties, which are arranged in order of merit, would be saleable in the United Kingdom : Emata, Letywezin, Byatcale No. 10, Bankouk, Taungdeikpan, Ngasein. They stated that the first three samples were similar to Java rice, whilst the Bankouk and Taungdeikpan varieties were similar to Siam rice and the Ngasein rice was equal to a very superior Rangoon. They added that there might be a limited sale for the Beelugyun-Ngasein variety, but that the grain appeared to be too soft to compete with other rices, whilst the Bausamati variety is too small-grained to be of much commercial value.

The firm stated that the 4 remaining samples appeared to be very soft in grain and not suitable for the United Kingdom market, adding that Austria was the principal market for rice of this quality before the war.

(2) British rice millers were asked to report jointly on these rices, and furnished the following statements :

Emata.—This is a full-grained rice which would satisfy all the requirements of British millers.

Letywezin.—A useful grain, similar to the Emata variety, but inferior in size and quality.

Bankouk.—This has the appearance of being ordinary

No. 1 Siam rice of good quality, containing the usual amount of defects but useful for general purposes.

Taungdeikpan.—This is a useful rice somewhat similar to the Bankouk variety, but inferior in size and colour.

Byatcale (10).—A good grain as regards transparency and evenness of quality, and answering all requirements of this class of grain.

Ngasein.—This appears to be a fine sample of ordinary pinky Ngasein grain, which is very useful and keeps well in hot climates, but is hard to mill and on that account not greatly liked by rice millers.

Beelugyun-Ngasein.—This is a good milling grain which should give the highest satisfaction to both millers and consumers. The production of this quality of Burma rice can be specially recommended.

Byatthidat.—A very useful soft-grained rice, much the same as the Beelugyun-Ngasein variety, but smaller in grain and not so good in colour.

Bawyut.—This is also a useful rice somewhat similar to the two previous samples, but again of inferior growth.

Byatcale (20).—This is a good full-grained rice, very similar to fine Moulmein rice from which a good grocery product is milled, and which is much sought after by some buyers.

Sabanet.—This is similar in type to the previous sample but very inferior, and not worth bringing to the notice of importers.

Bausamati.—An inferior rice of no value to British millers.

The percentages of broken grain in these samples show considerable variation, some of the best types containing large amounts. If the husking was conducted uniformly throughout in the preparation of these samples, these figures indicate considerable variations in the milling properties of the rices, but it is realised that as the grain was husked by native methods, no great importance need be attached to the amount of broken rice in these samples as an indication of the amount that would be produced by milling in modern machinery. The percentage of husk in the samples of paddy varies only slightly.

It will be seen that the brokers and millers are in

agreement as to the merits of Emata, Letywezin, Byatcale (No. 10), Bankouk, Taungdeikpan, and Ngasein rices, but differ considerably in their estimates of the value of Beelugyun-Ngasein and Byatcale (No. 20). It was suggested to the Burmese authorities that as the millers were favourably impressed with the two last-named types, it would be useful to have large samples of these rices, preferably in the form of either cargo rice or " loonzein " (skinned rice), sent to this country for milling trials. The rices milled from these samples would be examined at the Imperial Institute, and it would then be possible to obtain the opinions of representative firms throughout the rice trade as to their commercial value, and the information so obtained should leave no doubt as to the suitability or otherwise of these rices for this market.

Suitability of the Rices for Industrial Purposes

I. *Starch-making*

The rices were submitted to a firm of starch manufacturers, who stated that the chief points to which starch makers devote attention when judging rice for their purposes are as follows :

(*a*) *Hardness of grain.*—Rice of medium hardness is preferred, as hard rices are troublesome to soften and grind.

(*b*) *Percentage of starch.*—The variation in the amount of starch in different kinds of rice is small. The percentage of starch cannot, however, be taken as an index of the yield of pure rice starch obtainable in practice, as some kinds of rice starch are more difficult to purify.

(*c*) *Fat.*—The amount of fat present only varies slightly and does not influence the value of the rice for starch manufacture.

(*d*) *Colour of the grain.*—" Red skin " is an objection, as it produces a dark liquid when the rice is treated with alkali for softening the grain before grinding and tends to stain the starch. Yellowness of the grain is also objectionable, but this appears to be due generally to heating during transit and not to be an intrinsic characteristic

of special kinds of rice. In this connection the manufacturers suggested that disinfection of cargoes with sulphur dioxide would be useful.

(*e*) *Protein.*—The lower the amount of protein present the better, as a low percentage entails the removal of less material in the purification of the starch.

Starch makers are accustomed to buy clean broken rice, as it is suited to their needs and is cheaper than whole clean rice. With regard to the possibility of growing varieties of rice specially suited to starch manufacturers, the firm stated that there seems to be no need for this, as they depend entirely on broken grain for their supplies. They stated that a fully matured rice was preferable, as it seems to contain a higher proportion of starch granules of full size, and less of the very minute granules which cause waste of time and material in the " settling out " stages of the process of manufacture.

II. *Brewing*

The rices were submitted to a firm of brewers who specialise in the use of rice. They reported that all twelve varieties would be quite suitable for brewing, but that the rices with the minimum amount of fat are preferable to those containing a larger quantity, whilst rices with the greatest amount of starch will yield more beer for a given weight of rice. These points taken in conjunction with the price of the grain would be the governing factor in buying rice for brewing.

It appears from the results of these enquiries that any of these twelve varieties of rice could be used for brewing and starch manufacture.

It is clear, however, that better prices would be obtained for the whole rice for food purposes, and that only the broken rice need be considered as a raw material for brewing or starch-making. In these circumstances it would not be worth while to select varieties of rice for cultivation with the special object of meeting the requirements of these industries.

Rice Straw for Paper-making

A sample of rice straw was forwarded from Egypt in April 1917 in order to ascertain its suitability as a paper-making material.

The sample consisted of clean rice straw of brownish-yellow tint. It was examined with the following results :

	Per cent.	
Moisture	11·8	
Ash	17·6	Expressed on the dry straw.
Cellulose	50·0	

Length of ultimate fibres, 0·6 to 3·0 mm. ; mostly 0·9 to 1·3 mm.

The straw was submitted to treatment with varying quantities of caustic soda under conditions similar to those usually employed for the manufacture of paper pulp, with the results given in the following table :

Experiment.	Caustic soda used.		Conditions of boiling.		Yield of dry pulp expressed on the straw as received.
	Parts per 100 parts of straw.	Parts per 100 parts of solution.	Time.	Temperature.	
			Hours.		*Per cent.*
A	14	4·0	4	140° C.	44
B	10	2·5	4	140° C.	50
C	8	2·0	4	140° C.	52
E	6	1·5	4	140° C.	53

The pulp obtained in these experiments was in all cases of pale colour, and yielded a strong opaque paper of excellent quality which did not shrink greatly on drying. Except in the case of experiment E the pulp bleached easily to a very pale cream colour, almost a pure white.

A further experiment was made in order to ascertain whether the straw could be converted into a satisfactory pulp by boiling with milk of lime under the following conditions :

Experiment.	Lime (CaO) used. Parts per 100 parts of straw.	Conditions of boiling.		Yield of dry pulp expressed on the straw as received.
		Time.	Temperature.	
		Hours.		*Per cent.*
F	20	12	140° C.	56

The pulp produced by this method was bright yellow-brown and did not beat easily. It yielded an opaque paper of fair strength, but it could not be bleached satisfactorily. This pulp should, however, be quite suitable for the manufacture of brown paper and straw board.

It will be seen that this rice straw gives a good yield of pulp, and only requires mild treatment, i.e. the use of comparatively small amounts of caustic soda to produce a pulp which will bleach easily to a pale cream colour. The advantage which rice straw possesses of only requiring small amounts of caustic soda to convert it into pulp will, however, be counteracted to some extent by losses in the recovery of the soda, which is incomplete in the case of materials containing a large proportion of silica.

The results obtained at the Imperial Institute with this Egyptian rice straw confirm those already recorded in the United States, and show that the straw when treated by the soda process yields pulp of good quality which is suitable for the manufacture of white paper. The straw will also serve for the production of straw board and brown paper if treated by either the soda or lime processes.

It is improbable that rice straw could be remuneratively exported from the producing country as a paper-making material in normal conditions, but if adequate supplies are available, its conversion into " half-stuff " for export would be worth consideration. It is also possible that the rice straw might be used locally for the manufacture of paper or straw board, either to supply the requirements of the local market or for export.

Rice Husks

The profitable utilisation of the enormous quantity of rice husks produced in the milling of rice has long been under consideration. It has been suggested that they might be used for paper-making, and as no experiments on this subject appear to be on record, the matter was recently investigated at the Imperial Institute.

The sample of rice husks examined contained 7·9 per cent. of moisture and the dry husks yielded 14·7 per cent.

of ash and 42 per cent. of cellulose. The ultimate fibres varied in length from 0·5 to 1·5 mm., being mostly from 0·5 to 0·7 mm.

The husks were treated with caustic soda under conditions similar to those employed at a paper-mill with the following results :

Caustic soda used.		Conditions of boiling.		Yield of dry pulp expressed on husks as received.
Parts per 100 parts of husks.	Parts per 100 parts of solution.	Time.	Temperature.	
		Hours.		*Per cent.*
16	4	4½	140° C.	36

The pulp contained a large proportion of gelatinous material which could not be satisfactorily removed by beating and washing. It furnished paper of a medium brown colour which was very weak and brittle and cracked when folded. The pulp could not be satisfactorily bleached.

The results of this experiment indicate that rice husks are unsuitable for the manufacture of paper. The pulp might be used as a filler in admixture with longer fibred pulps for the manufacture of low-grade paper or straw-board, but it is somewhat unlikely that its preparation for such purposes would be remunerative.

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