1-2 Commercialization of Major Crops

1-2-1 Trends in Agricultural Exports of Major Crops

(1) General trends

Table II-1-26 shows the export trends of five major crops and their related products. Fluctuations are usual in the export of any agricultural commodity, but they have been more pronounced in wheat in Argentina. Wheat exports dropped substantially to some 1.6 million tons in the early 1970s mainly because of unfavorable weather, but continued to increase afterward, partly boosted by the USA's grain embargo against the USSR in 1980, and reached a historical high of a little over 9 million tons during 1983-1985.

In contrast, two coarse grains of maize and sorghum maintained rapid growth in their exports since the 1960s. Maize exports increased 2.5 times from 2.4 to 6.0 million tons over two decades from the early 1960s to the early 1980s, and continued to expand through the mid-1980s. Sorghum exports began in the 1950s, and more than doubled from 1.6 million to 3.9 million tons over ten years from the early 1970s to the early 1980s. The trend continued through the 1983-1985 average, though it began to show a declining tendency after the peak in 1983. Argentina's maize and sorghum exports also benefited greatly from the USA's grain embargo during 1980-1982.

With respect to oilseeds, exports of sunflower seeds have been always small and fluctuated, while its oil and by-products began to be exported since the 1960s. Crude oil exports in grain equivalent increased from 140,000 tons in the early 1970s to nearly 900,000 tons in the early 1980s, and then jumped to 1.7 million tons in 1983-1985, reflecting the tremendous increase of production achieved by the diffusion of hybrid varieties since the late 1970s. Soybean exports began in the mid-1970s, and quickly expanded afterward. Exports of its grains increased well over 9 times to 2.3 million tons in five years from the mid-1970s to the early 1980s and the trend continued through 1983-1985. Exports of crude oil and by-products also expanded rapidly because of the construction of new oil mills which started in the late 1970s, and reached in grain equivalent to 3.0 million tons in 1984 from 170,000 tons in the mid-1970s. Grains accounted for three-fourths of the total soybean exports in 1980-1982, but it was reduced considerably by 1983-1984 when crude oil in grain equivalent made up nearly 50%.

Table II-1-27 shows the export price quotations (FOB Buenos Aires) in real terms for wheat, maize, sorghum and soybean from 1975 to 1985. Except for the period of 1980-1982 when prices rose because of the USA's grain embargo against the USSR, prices generally show a declining tendency. The decline in price was especially sharp in 1985, amounting to some 20% relative to the previous year for all four crops. The price level in 1985 was 50% less than the average of 1975-1977 for wheat, and 40% less for maize and sorghum, while the price of soybean was 45% less than the average of 1977-1979. This is related to the softened international supply and demand situation due

Table II-1-26 Expórts of Five Major Crops

(1,000 tons)

	Wheat	Maize	Sorghum	Soybean	Subtotal Grains	Sunflower Oil	Sunflower By-Products	Soybean Oil	Soybean By-Products	Total Exports (Grains)
1940-42	2,735	883			3,618					
1945-47	2,010	1,713			3,722					
1950-52	1,762	581			2,343					
1955-57	2,934	739	10		3,679					
1960-62	2,128	2,410	258		4,796					
1965-67	4,592	3,624	540		8,756	70 (227)	338			9,843
1970-72	1,595	4,789	1,620	0	8,004	45 (141)	321			9,010
1975-77	3,523	4,164	3,280	240	11,207	56 (169)	301	50 (305)	245	11,682
1980-82	4,023	5,951	3,951	2,279	16,204	314 (874)	588	130 (799)	688	17,877
1983	10,174	6,476	5,260	1,419	23,329	614 (1,590)	943	300 (1,831)	1,704	26,752
1984	7,281	5,558	4,236	3,100	20,175	595 (1,513)	846	490 (2,994)	2,460	24,678
1985	9,612	7,037	3,305	2,988	22,942	840 (2,100)	1,191			

Source: Bolsa de Cereales de Buenos Aires, Numero Estadistico 1985.
Junta National de Granos, Anuario 1984.

Note: Figures in parentheses are grain equivalents calculated by the annual average oil extraction rates.

Table II-1-27 Export Prices of Four Argentine Grains

(1980 US$/ton)

	FOB Buenos Aires				Differences from FOB Mexican Gulf[1]			
	Wheat	Maize	Sorghum	Soybean	Wheat	Maize	Sorghum	Soybean
1975	221	191	151	-	-8	5	-28	-
1976	186	164	144	-	-9	-2	-15	-
1977	137	126	101	351	-7	-9	-23	-20
1978	160	130	104	307	-6	-3	-20	-21
1979	178	131	108	292	-5	-3	-23	-21
1980	204	159	147	252	28	42	14	-16
1981	176	123	112	232	13	0	-10	-19
1982	145	97	86	198	1	-1	-13	-9
1983	121	117	100	223	-17	-3	-14	-13
1984	115	117	91	217	-17	0	-13	-21
1985	90	95	75	175	-27	-3	-11	-10

Source: AACREA, Precios agropecuarious, various issues.

Note: 1) Differences from the prices of wheat durum, maize No. 2 USA, sorghum No. 2 USA, and soybean No. 2 USA.

to the increased surplus in major producing countries and the stagnant world demand.

As shown in the table, FOB Buenos Aires prices of four crops have been generally lower than the levels of FOB Gulf of Mexico prices for US products, excluding the period affected by the embargo. What is notable is that Argentine wheat has increased its price disparity during the last ten years. In contrast, the price difference for maize has been small, and the relative disparity for sorghum appears to have been narrowing down. For soybean, the relative disparity has been more or less stable. The difference in price of over 20% in the case of wheat is partly related to the delined quality (lower gluten) of wheat after the introduction of non-traditional varieties of wheat.

Table II-1-28 shows the monthly prices at Buenos Aires and Gulf of Mexico for three crops in 1983-1985 average. The exports of Argentine crops commence right after harvests, and with respect to wheat, 60 - 75% of the total exports fall in the four months from January to April, for maize 60 - 70% from April to July and for soybean over 80% from May to August. Because of the difference in seasons, the bulk of Argentine products are exported during the months when the price levels in the Northern Hemisphere are generally higher than in other months, but at the same time, it is noticeable that the relative price disparity widens during the Argentina's peak export months.

Table II-1-29 shows the total export values of agricultural, livestock and fishery products over the last seven years. The total exports averaged US$6.0 million in 1980-1982 and US$6.3 million in 1983-1985, and livestock products accounted for 28% and 17% and fishery products 3% in both periods. Reflecting the continued stagnation of the livestock and fishery exports since the late 1970s, the contribution of agricultural exports rose from 70% in 1980-1982, when the USA's embargo boosted their prices, to over 80% during 1983-1985.

Among the agricultural exports which increased from US$3.4 million to US$4.5 million, cereals, oilseeds and their related products expanded their share from 81% in 1980-1982 to 88% in 1983-1985. As clearly seen in the table, five major crops account for well over 90% of these exports. In sum, wheat, maize, sorghum, sunflower and soybean, including oil but excluding by-products, account for some 60% of the total agricultural, livestock and fishery exports of the country.

The agricultural, livestock and fishery exports have long been the most important source of foreign exchange earnings, contributing three-fourths in 1985, and also one of the major sources of government revenues. Traditional exports have been almost always subject to taxation, except for the periods of 1962-1966 and 1977-1981 when the tax rates were reduced to minimal. The present Government is no exception, and the rates on major export commodities as of March 1986 are, for instance, 15% for wheat (reduced to 5% in June), 21% for maize, 20% for sorghum, 27% for soybean, 24% for

Table II-1-28 Movements of FOB Buenos Aires and FOB Mexican Gulf Export Prices (1983-1985 Average)

(1980 US$/ton)

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Average
(1) FOB Buenos Aires													
Wheat	113	111	112	108	104	109	111	110	110	104	104	101	108
Maize	100	101	104	107	107	107	108	108	114	116	117	118	110
Soybean	206	201	204	210	208	196	191	215	213	209	211	208	205
(2) FOB Mexican Gulf													
Wheat (durum)	136	134	135	131	132	129	123	122	127	126	126	125	129
Maize (No. 2 USA)	108	109	111	116	116	115	116	115	111	108	109	106	112
Soybean (No.2 USA)	216	212	216	221	221	216	207	225	222	216	215	212	220
(3) Difference (1) - (2)													
Wheat	-23	-23	-23	-23	-28	-20	-12	-12	-17	-22	-22	-24	-21
Maize	-8	-8	-7	-9	-9	-8	-8	-7	3	8	8	12	-2
Soybean	-10	-11	-12	-11	-13	-20	-16	-10	-9	-7	-4	-4	-15

Source: Calculated from data compiled in AACREA, Precios Agropecuarios, various issues.

Table II-1-29 Structure of Agricultural, Livestock and Fishery Exports

(US$ Million)

	1979	1980	1981	1982	1983	1984	1985
Cereals	1,598	1,607	2,823	1,805	2,887	2,237	2,195
Wheat	605	815	763	676	1,474	966	1,044
Maize	605	512	1,306	585	803	948	775
Sorghum	322	208	637	508	554	454	299
Oilseeds	751	662	616	450	360	902	739
Soybean	703	605	581	426	322	850	597
Oils	436	450	324	395	498	889	866
Soybean oil	52	53	36	72	134	329	275
Surflower oil	158	183	125	197	259	420	474
Oilseed By-products	265	277	272	328	529	636	464
Wheat By-products	88	88	81	70	76	58	36
Fruits and Vegetables	309	286	255	261	195	174	716
Industrial Crops	191	490	366	212	265	266	176
Total Crops	3,807	4,018	4,894	3,697	4,967	5,335	4,872
Total Livestock Products	2,049	1,795	1,766	1,434	1,207	1,010	894
Total Fishery Products	202	140	138	188	166	158	158
Grand Total	6,057	5,953	6,799	5,320	6,340	6,504	5,925

Source: SNESR

sunflower and 15% for oils thereof. Export taxes were estimated to account for 16.5% of the total government revenues in 1985.

(2) Major export destinations of five crops

Partly reflecting the fluctuations in production, wheat exports do not have stable destinations in terms of volume. Before the USA's grain embargo, the largest destination was either one of the USSR, Brazil and China, but the export volume to these countries varied widely from year to year (Table II-1-30).

After the embargo in January 1980, the dominant position of the USSR became immediately apparent. Exports to this country increased from the average of 600,000 tons during 1975-1979 to 2.3 million tons in 1980 and averaged 2.8 million tons in the subsequent two years, accounting for 70% - 80% of the total wheat exports. During this period, the exports to other major destinations showed sharp declines. The exports to the USSR reached a historical high of a little less than 5 million tons in 1983, the year of a bumper harvest, but its share dropped to less than 50% because of the recovery of exports to other destinations, especially to China and Iran. Exports to the EC have been decreasing as a long-term trend, mainly affected by the latter's protection of intra-community producers by the Common Agricultural Policy.

Because of the sizable increase in exportable surplus since the late 1970s to the mid-1980s, Argentina's share in the total world export increased from 2% in 1978 to nearly 7% in 1984. However, the increased production in major producing countries has considerably softened the international supply and demand situations, and given the EC's subsidized exports and the recent agricultural policy announced by the USA, Argentine wheat is facing hard export prospects immediately ahead.

Compared with wheat, the trend of maize production has shown less fluctuations, and thus its export destinations have been relatively stable since the mid-1970s. During the period from 1974 to 1979, the combined exports to three major destinations of Italy, the USSR and Spain accounted for 60% to 80% of the country's total maize exports.

After the embargo, which came before the time of normal export contracts, exports destined to the USSR jumped to nearly 3 million tons in 1980 and rose to some 8 million tons in 1981, accounting for well over 80% of the country's total maize exports. This also reduced the exports to other major destinations, most notably to the EC. After the termination of the embargo, the exports to the USSR declined to some 2 million tons, accounting for about 40% of the total, and exports to other destinations recovered somewhat in 1983 and 1984. However, the country's exports to Spain and Italy never recovered after 1982 to the pre-1980 levels, implying that Argentina lost its important traditional market to the USA, the formidable competitor in the international maize market. Exports to the Middle East and Africa have been appreciably increasing in recent years, but the USA's new agricultural policy announced in late 1985 also suggests the difficult time ahead for Argentine

Table II-1-30 Major Export Destinations of Three Cereals

(1,000 tons)

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Wheat											
EC (12)	149	280	300	537	46	162	-	9	14	53	149
USSR	-	746	827	262	961	238	2,272	2,954	2,741	4,981	2,863
Latin America	308	234	1,534	1,482	410	2,495	1,285	339	434	772	1,778
Brazil	83	59	727	871	107	1,494	853	50	257	-	200
Asia	423	73	14	888	-	885	665	126	94	3,197	451
China	145	65	-	850	-	885	665	126	94	2,946	1
Middle East	-	22	16	143	-	7	93	187	401	1,072	1,405
Iran	-	-	-	-	-	1	88	-	90	1,012	1,200
Total	1,126	1,505	2,969	5,266	1,443	4,149	4,375	3,660	3,811	10,165	7,269
Maize											
EC (12)	3,472	1,899	2,417	3,371	2,803	3,249	417	647	755	1,416	1,237
Spain	390	479	480	1,203	1,004	1,461	1	225	397	697	591
Italy	2,738	1,316	1,731	1,814	1,579	1,497	328	300	227	395	335
USSR	672	544	264	406	1,793	1,617	2,965	7,989	3,301	2,022	1,909
Latin America	365	1,278	319	479	691	375	117	294	203	540	635
Asia	843	105	10	646	387	203	1	0	221	335	93
Middle East	6	-	7	41	106	105	6	51	533	977	666
Total	5,525	3,883	3,080	5,430	5,985	5,959	3,525	9,112	5,214	6,427	5,558
Sorghum											
EC	1,131	943	1,310	447	493	619	11	114	720	299	363
USSR	-	-	-	-	-	-	1,478	3,966	2,701	2,091	2,089
Latin America	143	326	115	456	512	211	-	793	415	43	514
Asia	1,353	792	1,448	2,513	2,832	2,657	-	57	1,268	2,676	1,192
Japan	914	667	1,215	2,128	2,489	2,367	-	26	1,151	2,375	1,179
Middle East	42	44	116	123	222	61	5	-	251	33	30
Total	3,059	2,154	3,436	4,217	4,523	3,898	1,516	4,932	5,359	5,260	4,236

Source: Bolsa de Cereals de Buenos Aires, Numero Estadistico, 1981 and 1985.

maize, which accounts for a little over 8% in the world total exports.

Sorghum exports also expanded steadily over the 1970s and averaged over 4 million tons in the last three years. Before the embargo, its export destination showed a tendency of concentration, with Japan increasing its share from 30% in 1974 to 61% in 1979. The embargo also drastically changed the structure of exports, and the USSR accounted for nearly 70% of the exports during 1980-1982. Exports to Japan recovered to 2.4 million tons (45%) in 1983 from zero in 1980, but was again halved to 1.2 million (28%) in the next year when the priority was given to the USSR because of the reduced production.

The exports of sunflower seeds have been traditionally negligible, and totalled 400,000 tons for the entire period of 1978-1984, a little over 50% of which were destined to European countries such as the Netherlands, Italy and Portugal. The exports of crude oil remained small until the mid-1970s, but began to pick up rapidly since the late 1970s (Table II-1-31). Major export destinations during the 1970s fluctuated among the Netherlands, Algeria, Spain and Venezuela. Since the beginning of the 1980s, the USSR emerged as a stable export destination, with its imports from Argentina increasing from 51,000 tons in 1980 accounting for 15% of the total exports to 160,000 tons with the share expanding to 75% in 1981. The exports to the USSR averaged 155,000 tons, or nearly 30% of the total, during 1982-1984. The EC members, most notably the Netherlands, have been relatively stable export destinations, but the recent increase of sunflower production within the Community (Spain and France) and the subsidizing policy for domestic oil mills have begun to curtail Argentina's exports of sunflower oil to these countries.

As mentioned earlier, the exports of soybean as grains and crude oil increased rapidly since their start in the mid-1970s, and Argentina now accounts for 12% of the total world exports of soybean grains. The largest export destination of grains has been the Netherlands, accounting for some 40% of the total exports of soybean grains during most of the 1970s. Italy and Spain imported a little over 10% each of the total exports over the same period. During the time of the embargo, the exports to the USSR also increased averaging some 720,000 tons during 1980-1982 and accounted for about 30% of the total exports. The exports to the traditional markets in Europe were accordingly affected, but recovered quickly by 1984, especially with respect to the Netherlands and Italy, while the share of the USSR dropped to 5%.

Exports of crude soybean oil increased since the beginning of the 1980s, partly encouraged by the devaluation of peso which improved the country's competitiveness. Among the export destinations, Chile has been a variable but consistent importer, with its share reaching nearly 60% in 1981. Other destinations have been variable from year to year, but on the whole Latin American countries like Brazil, Peru and Colombia in addition to Chile together accounted for some 60% of Argentina's exports of soybean oil during 1977-1981.

Table II-1-31 Major Export Destinations of Two Oilseeds

(1,000 tons)

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Sunflower Oil											
EC(12)	-	-	27	80	72	26	72	12	138	99	69
Netherlands	2	-	24	66	22	11	65	11	125	98	66
USSR	-	-	-	-	-	-	51	160	129	155	183
Latin America	-	-	-	-	22	87	21	11	55	74	133
Middle East	-	-	-	-	-	-	74	-	-	67	11
Africa	-	-	4	18	47	78	68	4	63	209	59
Algeria	-	-	3	17	45	46	53	2	54	62	28
Total	2	-	38	129	183	221	338	212	394	615	576
Soybean Grains											
EC (12)	-	-	77	475	1,731	2,463	1,589	782	488	729	2,239
Netherlands	-	-	75	267	769	1,248	584	338	114	410	1,119
Italy	-	-	-	84	256	408	313	195	262	257	491
USSR	-	-	-	-	33	-	747	717	716	636	149
Latin America	-	-	-	74	96	81	247	540	637	-	275
Brazil	-	-	-	-	6	63	247	266	515	-	157
Asia	-	-	-	23	63	118	29	119	53	-	19
Total	-	-	77	613	1,985	2,810	2,709	2,207	1,923	1,419	3,100
Soybean Oil											
EC (12)	18	10	3	9	1	3	3	2	-	2	3
Latin America	5	4	25	21	37	55	59	56	118	162	168
Chile	-	-	8	14	12	7	31	41	59	46	6
Brazil	-	-	-	-	-	32	14	-	16	37	73
Asia	-	2	-	-	15	11	8	-	5	20	94
India					15				2	20	94
Middle East	-	-	8	8	6	-	4	-	31	65	113
Total	38	21	64	40	66	81	92	70	174	293	444

Source: Bolsa de Cereales de Buenos Aires, op. cit.

But since 1982, exports to India and Iran began to increase substantially, and together accounted for a little over 45% in 1984.

The world trade of cereals and oilseeds fluctuated widely between oversupply and shortage during the 1970s, but the supply and demand situation has been eased considerably in the earlier half of the 1980s, partly because the increased production in major producing countries and partly because the slower growth of demand due to the economic recession. Because of this general market situation, coupled with the subsidized export drives by some producing countries, the international prices of major grains produced in Argentina have declined, reducing the country's much needed foreign exchange earnings and the profitability to producers. Moreover, the recent adjustments of US dollars will improve the advantage of US producers in the markets of developed countries, further intensifying the competition in the international market in the near future.

In order to offset the decline of the returns to agricultural producers, the present government is trying to change the function of export taxation. By introducing the land tax on agricultural land as a stable source of government revenues, it is being proposed to apply the system of export taxation flexibly for the purpose of stabilizing and supporting the prices paid to producers and thus the returns to agricultural undertakings. This decision will have an important impact on the production and commercialization of major export crops in Argentina.

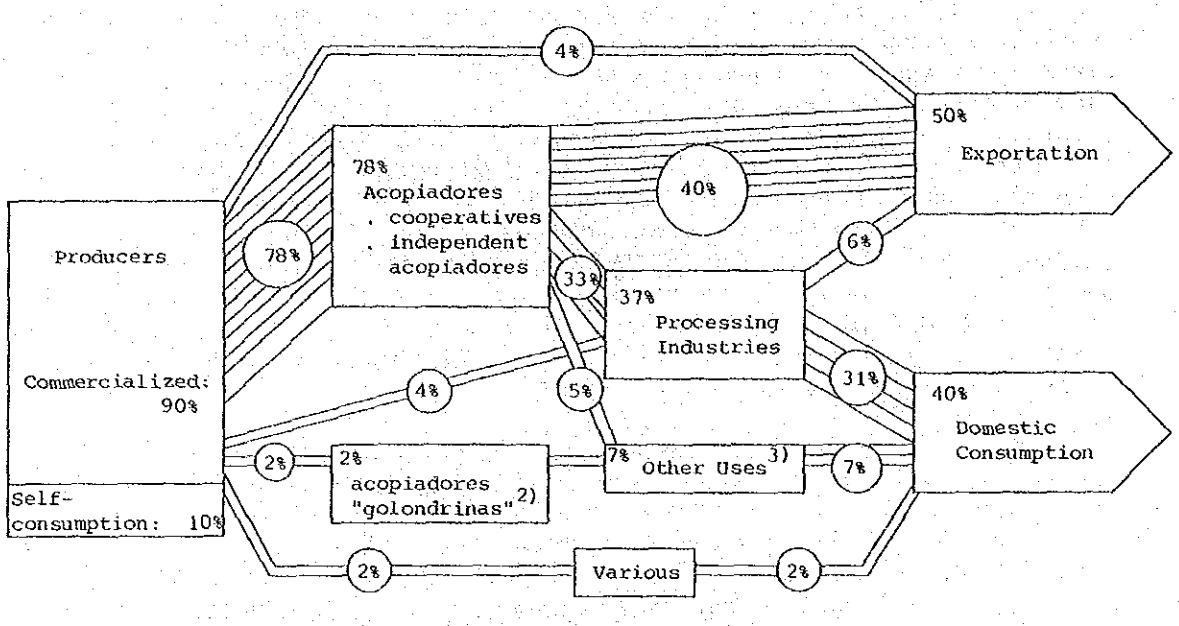
1-2-2 Structure of Marketing and Distribution

It has been pointed out that in contrast with the remarkable progress in agricultural production, the delay in modernizing the physical facilities and streamlining their operations in transportation and storage is one of the bottlenecks for a further expansion of grain exports. The infrastructural aspect of this issue is discussed in detail in the chapter on transportation, and this section deals mainly with institutional aspects of grain marketing and distribution.

(1) Marketing channels and functions of intermediaries

Figure II-1-8 shows the marketing channels of cereals and oilseeds in Argentina. Of the total grains produced in Argentina, an estimated proportion of 10% is retained by producers for self-consumption. The remaining 90% is commercialized through various channels, of which nearly 90% is handled by grain merchants (hereafter referred to as "acopiadores") and agricultural cooperatives, to be distributed to external markets, domestic processing industries or other uses (mainly animal feed), and the rest is distributed directly from producers, especially of large scale, to the above-mentioned destinations.

Figure II-1-8 Marketing Channels of Grains[1)]



Source: Coscia, Adolfo A., Comercializacion de Granos, 1980
Notes : 1) Figures show estimated shares in the total production volume.
2) Acopiadores "golondrinas" (swallows) are those who have no establishment at a fixed place, normally conducting purchase and payment simultaneously, including some cases without commercial documents.
3) Here, the grains have already reached end-use stages, mainly as animal feed.

The commercialization process from producers to acopiadores, cooperatives or other buyers including exporters and processors is regarded as primary marketing, which is regulated by the Government largely to protect producers' interests. The subsequent process from acopiadores/cooperatives to exporters, processors or wholesalers directly or through the Grain Exchanges is secondary marketing, which is less regulated by the Government. The principal agents and organizations involved in grain marketing and their functions therein are as follows.

(a) Grain merchants (acopiadores)

Acopiadores, warehousemen in its original meaning, play a very important role in grain marketing, engaging in not only trading and storing grains but also in preparing them for commercialization such as drying, cleaning, disinfection, and classification and blending based on the quality standards regulated by the National Grain Board (JNG). The acopiadores officially approved by the JNG are those who have a storage capacity of 1,500 tons or more, but reportedly there are a considerable number of acopiadores with below that capacity.

The total number of acopiadores in Argentina is estimated to be 1,200-1,400. According to the Federation of Centers and Syndicated Entities of Grain Dealers, which consists of 22 centers with over 1,200 members, acopiadores presently mobilize more than 60% of the total cereales and oilseeds produced in the country, and have an aggregate storage capacity of 9.8 million tons, equivalent to approximately one third of the country's total capacity of 29 million tons. Besides storage and preparation charges, acopiadores normally receive a gross commercial margin of 2.5 - 5.5% of the FAS price.

Another important role of acopiadores is to supply producers such agricultural inputs as seeds, fertilizers, agricultural chemicals, equipment and machinery, very often on credit in exchange for grain delivery. They also offer some technical advice, and act as agents of real estate and agricultural insurance policies.

(b) Agricultural cooperatives

Agricultural cooperatives are organized by producers normally of medium and small scale, and have functions similar to acopiadores in grain commercialization. There exist a total of 700 cooperatives which engage in trade, storage and preparation of grains and other related services, and the majority of these cooperatives are organized into one of the two nation-wide entities, namely, the Argentine Federation of Agricultural Cooperatives (FACA), and the Association of Argentine Cooperatives (ACA), each of which has some 300 primary cooperatives as their members. The two organizations are involved in a wide range of activities not only related to cooperative movements but also commercial and financial services for their member cooperatives. In order to reinforce the cooperative movements, they further organized themselves to the Agriculture and Livestock Intercooperative Confederation (CONINAGRO). Judging by the share of acopiadores mentioned above, cooperatives have an estimated share of 20% in the total grains commercialized in Argentina. According to another source of information, however, their aggregate share in the primary marketing is a little less than 50% around 1980, probably including the trade from producers to acopiadores through cooperatives.

ACA and FACA occupy an important position in the country's external grain trade, and own grain elevators and loading facilities at the main ports like Rosario and Bahia Blanca. They handled some 20% of the exports of five grains (excluding processed products and by-products) in 1984.

(c) Exporters

A salient feature of the Argentine grain export is the predominance of transnational corporations such as Cargill S.A., CIA Continental S.A. and Bunge y Born S.A., which have on the one hand wide information and trading networks in the world grain market, and on the other, strong business relations with financial institutions, insurance companies, maritime transporters, etc. Due to these factors, they have made considerable contributions to the Argentine

grain exports under the instability regarding transport and storage systems and official export policies. According to the Grain Exporters Center, its 13 member-corporations deal with 70% of the total grains exported by the country in recent years.

It is reported that in the 1984/85 crop year the private sector (including cooperatives) accounted for 43% (13 million tons) of the total shipments of grains, vegetable oils and by-products, while having shares of 19% and 38% respectively in the total port storage and loading capacities. This indicates that, although the privatization of storage and loading services has been reportedly in progress since 1979, further privatization and/or improvement in the public sector with regard to the said services is needed for more efficient exportation.

d) Grain exchanges (Bolsas de Cereales)

The Grain Exchange, which is a nonprofit organization consisting of chambers and associations of producers, acopiadores, manufacturers, exporters, brokers and other parties concerned, plays an important role in the secondary market. Its principal function is to provide a place of encounter for sellers (producers, cooperatives and acopiadores) and buyers (manufacturers, exporters, etc.) through communication media, which is similar to commodity exchanges in the other countries. However, a distinct aspect of the Argentine Exchanges is that they have been functioning as cash markets. Futures markets have not been well developed due to economic instability in the past. The underdevelopment of futures markets is considered as one of the institutional constraints for increasing grain purchase especially by foreign buyers in Argentina.

With regard to the operation of the cash market, the Arbitral Chamber of the Grain Exchange, which consists of producers, brokers or commission agents, acopiadores, manufacturers, exporters and the Government representatives, presents a reference weekly price for each commodity by taking note of such factors as commodities' quality and market situations. The cash transactions are based on the reference price. The Arbitral Chamber also engages in the analysis of quality and the classification of grains marketed therein.

There are six Grain or Commodity Exchanges which are located in Buenos Aires, Rosario, Bahia Blanca, Santa Fe, Cordoba and Tucuman. Among them, the Grain Exchanges of Buenos Aires and Rosario account for 85-90% of the total volume of transactions through the Exchanges.

(e) The National Grain Board

The National Grain Board (JNG) has performed regulatory functions in the Argentine grain trade since its inception in 1935. The directorate consists of nine members, of which five represent the public sector (the Secretariats of Agriculture, Livestock and Fisheries, Finance, Commerce, and Transportation), and the remaining four the private sector (cooperatives, producers, processing industries, grain traders).

One of the main functions of the JNG is to establish and execute regulations concerning grain trade. For instance, the JNG is in charge of the certification of institutions and private corporations involved in grain trade, and controls the means used to weigh, prepare, store, transport, buy and sell the grain. The JNG also controls the grain quality, by setting periodically trade regulations and quality standards to be applied both to domestic trade and export. The controlling division has a network of 33 district offices spread over the country.

Secondly, the JNG operates its official grain elevators and storage facilities. It owns a network of terminal elevators located at main ports and country elevators in the producing areas. The JNG's storage capacity totalled 2.6 million tons in 1985, of which 42% was elevators, 55% underground silos and 3% other kinds of silos. The total shipments of grains and by-products loaded through its port elevators were 15.8 million tons, equivalent to 57% of the country's total shipments in the said year. However, it is being argued that the lower efficiency in the JNG's operations of elevators, especially at ports of shipment, coupled with the delay in the modernization of facilities, is constraining a further expansion of grain exports.

Thirdly, the JNG intervenes in domestic and international grain trade. With regard to domestic market, the JNG's main function is to execute the support price and the stocking of wheat for the purposes of guaranteeing producers a domestic price in line with international prices, of keeping a minimum stock to assure an adequate supply for the domestic market, and of warranting the fulfilment of official exporting commitments. The JNG also implements purchasing programs for other grains such as maize, soybean, sunflowerseed, sorghum and safflower, which are usually applied to small-scale producers and underdeveloped regions.

With respect to the international trade, the JNG posts a daily index price (minimum export price) for each of the major grains, at and over which traders are obliged to export grains, taking into account of the corresponding international prices such as those at Chicago and Rotterdam. Based on the index price and other advices by the JNG, the authority concerned decides export tax rates for grains.

The JNG also engages in signing and implementing official bilateral agreements of grain trade. To fulfil such bilateral agreements, cooperatives and private corporations are currently allowed to participate by contract with the JNG. The share of the private sector in the total shipments based on the agreements accounts for 40% in the case of wheat and 70% in other grains and oilseeds in recent years.

Considering the possibility of a further expansion of grain exports, it would be necessary to improve the JNG's operations especially at ports, including the possibility of the privatizing related facilities.

(2) Commercialization costs

It is said that the inland commercialization costs including transportation in Argentina is much higher than in the other major grain producing countries, for example, like the USA and Canada. This indicates that there would be possibilities to enhance the competitiveness of the Argentine grains in the world market through reducing the commercialization costs.

Figure II-1-9 shows Buenos Aires FOB prices per ton with various taxes and commercialization costs for five major crops in 1983/84-1985/86. The commercialization costs per ton has a larger share for a lower priced grain, since it includes fixed costs such as storage and loading charges and the port administration cost, and the transportation cost which is not variable by grain. Accordingly, the commercialization costs not only affect the profitability of relatively low-priced grains, but also function to depress the profitability of grain trade when international prices are lows. In 1985/86, for example, the commercialization costs for sorghum, maize and wheat account for nearly 30% of the FOB prices respectively.

1-2-3 Domestic Consumption and Processing Industry

The grains can be divided into the following three categories from the viewpoint of export/domestic use;

a) Grains exported with a large proportion, around 50%, retained for domestic use - wheat and soybean,

b) Grains mainly exported - maize and sorghum, and

c) Grains mainly retained for domestic use - sunflower.

The percentage used by domestic industries in the total demand for each crop is as follows.

	Wheat	Maize	Sorghum	Sunflower	Soybean
1960/61-1969/70	55%	10%	23%	100%	-
1970/71-1979/80	60%	21%	11%	98%	31% (1976/77-)
1980/81-1984/85	41%	21%	5%	98%	46%

While sorghum and wheat have intensified their export-orientation since the 1970s, soybean transferred its position from b) to a) mentioned above in the early 1980s. This is due mainly to the rapid development of extracting plants for soybean, and the primary processed products, oil and meal, of soybean are oriented more to external markets than to the domestic consumption. The total exports of soybean grains and oil in grain equivalent account for 80 - 90% of the total production.

Figure II-1-9 The Proportion of Commercialization Costs in FOB Buenos Aires Prices

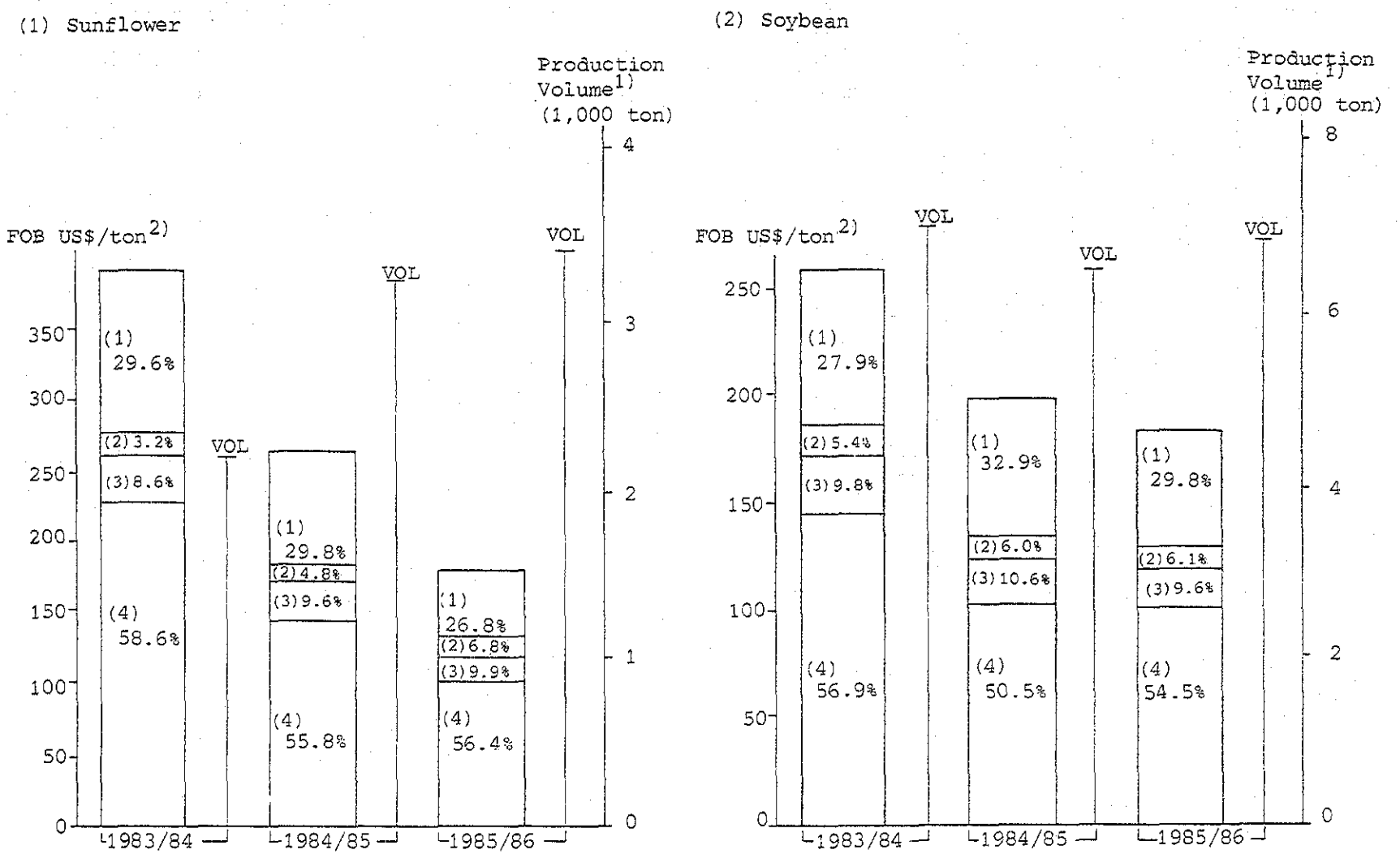
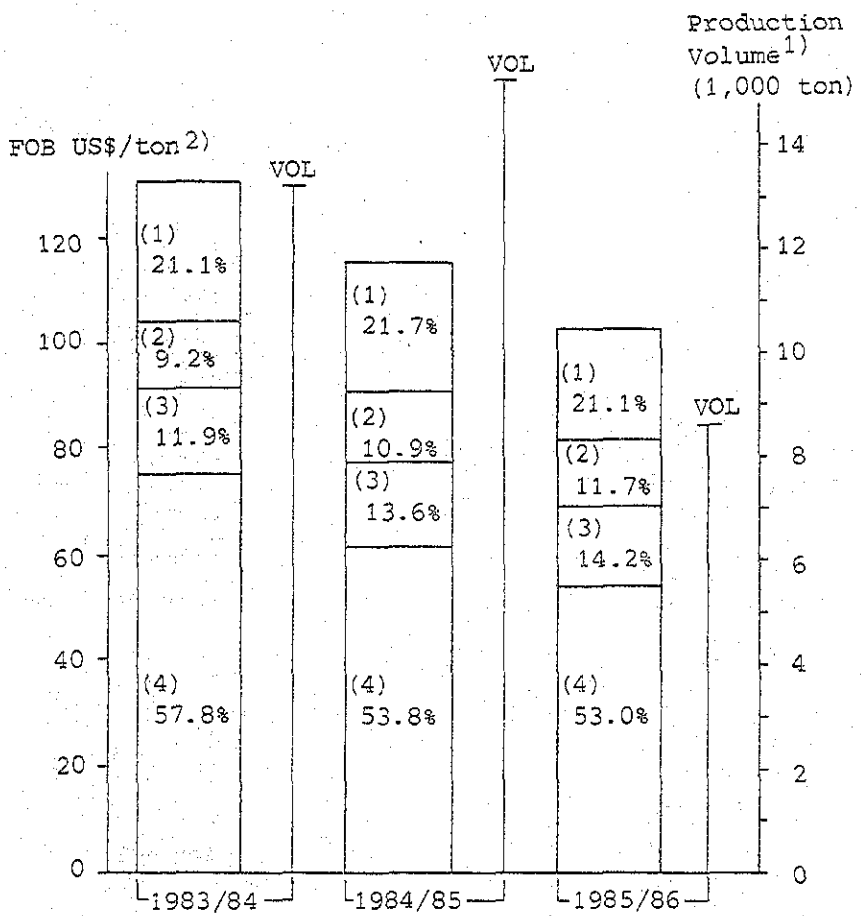


Figure II-1-9 (Continued)

(3) Wheat



(4) Maize

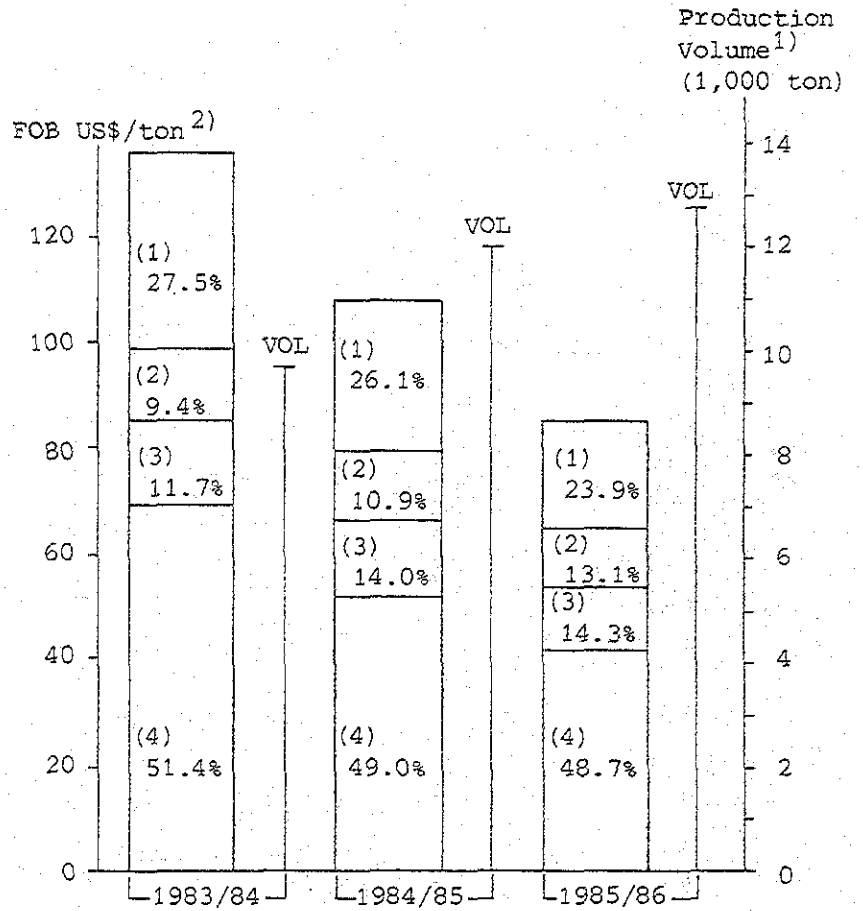
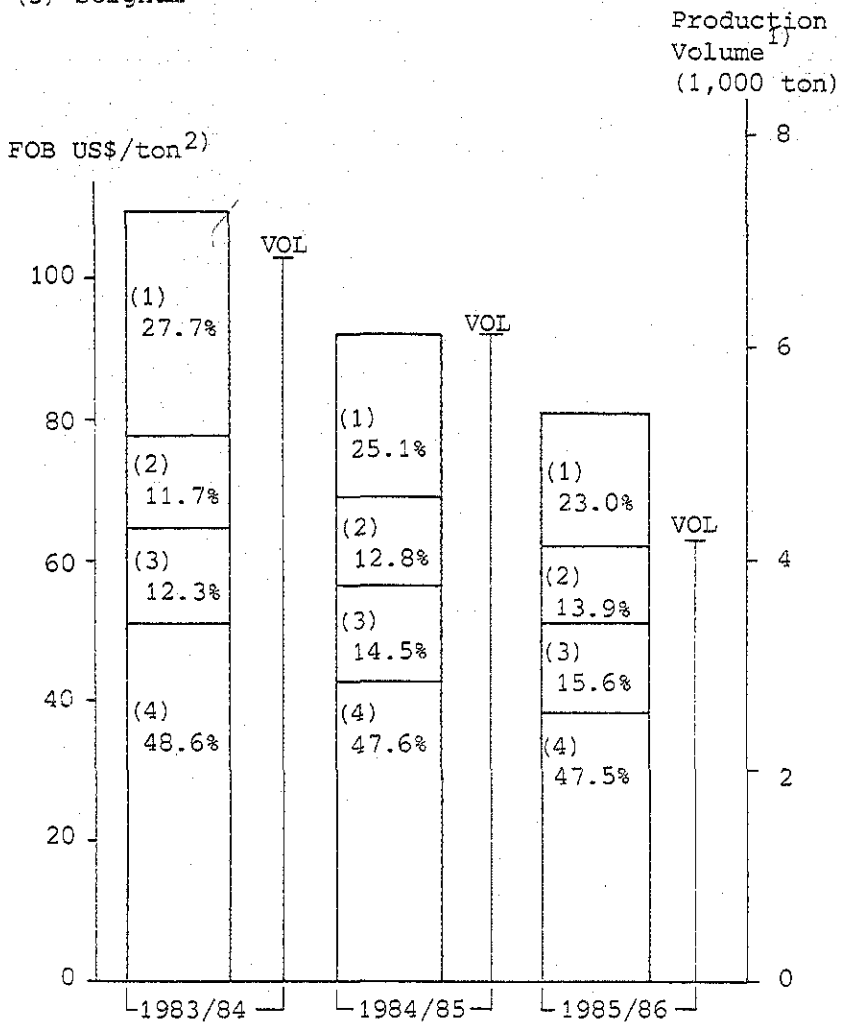


Figure II-1-9 (Continued)

(5) Sorghum



The contents of each cost are as follows:

(1) Taxes
- Export Tax: various by grain and period
- INTA duty (since 9/4/84, 1.5%/FOB, before 0%)
- Transfer tax of foreign currency (0.6%/FOB)
- Stamp duty (0.3%/FAS)
- Gross Income Tax (1%/Producer Price)

(2) Transportation Cost: Farm to FAS

(3) Other Commercialization Costs
- Difference of quality (0.6%/FOB)
- Expenditure of exporter (0.4%/FOB)
- Fixed costs (Storage + loading in bulk + General Port Administration; US$5/ton for 1984 and US$6.5/ton for 1985 and 1986)
- Finance (of the value of goods during embarkation at port; 1.8%/FAS)
- Loss (0.4%/FAS)
- Commission of exporter (1%/FAS)
- Commission of acopiador (6.5%/FAS)

(4) Producer Price: Residual after the deduction of taxes and costs

Source: Servicio Nacional de Economia y Sociologia Rural, April 17, 1986.

Notes: 1) Production volume for 1985/86 is provisional.

2) FOB prices are the average of the following months in 1984 and 1985.
Maize and Sorghum: February to June
Sunflower: January to June
Soybean: April to August
Wheat: November to April
For 1986, the average price during February, except for wheat for which the average price from November 1985 to February 1986 was used.

Table II-1-32 Commercialization of Major Crops in Argentina

(unit: 1,000tons; %)

Year	Wheat Dec. - Nov. 1)		Maize Mar.- Feb. 1)		Sorghum Mar.- Feb. 1)		Sunflower Jan.- Dec. 1)			Soybean (Apr.- Mar.) 1)		
	Used by Domestic Industry	% of Export in Total Demand 2)	Used by Domestic Industry	% of Export in Total Demand 2)	Used by Domestic Industry	% of Export in Total Demand 2)	Used by Domestic Industry	Of which Oil Export Grain Equiv.	% of Export in Total Demand 2)	Used by Domestic Industry	Of which Oil Export Grain Equi	% of Export in Total Demand 2)
1960/61	3,068	26.1	234	90.5	45	55.2	700					
1961/62	3,055	47.2	231	88.3	89	76.4	535					
1962/63	3,083	34.9	209	93.3	102	80.8	781					
1963/64	3,154	50.0	206	92.7	81	87.1	484					
1964/65	3,172	64.3	284	92.3	98	87.0	450					
1965/66	3,085	64.3	422	86.3	129	52.1	977	171	17.5			
1966/67	3,181	40.9	379	91.1	152	87.3	846	201	23.8			
1967/68	3,308	40.4	452	90.1	129	76.5	1,227	309	25.2			
1968/69	3,251	43.2	559	85.3	159	79.7	895	198	22.1			
1969/70	3,346	40.6	623	85.8	166	88.8	939	23	2.4			
1970/71	3,640	18.8	749	88.1	215	90.3	1,198	327	27.3			
1971/72	3,748	29.2	1,016	86.4	216	91.6	942	95	10.1			
1972/73	3,605	46.2	1,181	68.2	282	64.3	953		0.0			
1973/74	3,588	29.4	1,145	80.4	292	88.6	965	183	19.0			
1974/75	3,774	31.2	1,603	78.1	213	93.3	997	6	0.6			
1975/76	3,918	44.1	1,378	72.3	521	81.8	634		0.0	529	117	
1976/77	3,835	60.3	1,372	69.5	278	92.5	872	113	13.0	496	408	85.5
1977/78	3,778	30.7	1,169	81.9	197	95.4	1,003	395	39.4	589	391	83.7
1978/79	3,750	51.6	1,035	85.1	220	95.5	1,271	555	51.3	686	222	82.5
1979/80	3,569	57.0	1,210	83.1	253	93.7	1,363	657	48.3	639	613	99.3
1980/81	3,546	51.9	1,351	71.9	132	92.1	1,720	968	56.3	720	524	94.3
1981/82	3,641	49.8	1,342	87.1	177	96.5	1,115	589	53.8	1,097	504	81.9
1982/83	3,782	72.2	1,464	79.7	172	96.9	1,768	1,065	60.7	2,006	1,369	84.1
1983/84	3,971	66.1	1,496	80.2	165	96.9	2,318	1,590	68.6	2,399	1,831	84.8
1984/85			1,518	77.5	215	95.1	2,039	1,513	76.1	3,617	2,994	90.7
1985/86							2,908	2,100	75.4	3,669		

Source: Junta Nacional de Granos, Anuario 1981, 1983 and 1984.

Notes: 1) Commercial year
2) Total Demand is export plus domestic use.

The long-term trends in domestic consumption (utilization by domestic industries) since the 1960s vary by grain as shown in Table II-1-32. While the utilization of three cereales has been rather stagnant since the mid-1970s, that of two oilseeds has been increasing. Especially, the volume of milled soybean nearly doubled to 2 million tons in 1982/83 from the previous year, and continued to increase to 3.7 million. The different trends in domestic industrial utilization between cereales and oilseeds can be attributed mainly to the external marketability of their processed products. Crude vegetable oils and pellets of by-products can be produced for external markets, while cereales are favored unprocessed.

The following part examines the present situation of processing industries related to the five major grains as well as trends in domestic consumption of their manufactures.

(1) Flour milling

Argentina's flour milling industry has a history for more than 150 years. Presently there are 79 companies with over 100 milling plants. The number of milling plants exceeded 200 once, but dropped to the present level through the process of integration. The top 15 companies produce approximately 50% of the country's total wheat flour production. The milling capacities of these plants in general are between 1,000 and 10,000 tons per month, averaging 3,000 tons, which is relatively large by comparison with the average capacities in Europe. This appears to be due to the lower profitability of the Argentine milling industry, and in consequence, the need for economies of scale in milling performance.

The plants are concentrated in the Federal Capital including Greater Buenos Aires, and the Provinces of Buenos Aires, Cordoba, Santa Fe and Entre Rios, which totalled 93 in 1984. The one area and four provinces accounted for over 95% of the country's total wheat flour production in 1984, and the combined share of the five has not changed much since 1975.

It is reported that many of the milling companies are currently in a critical condition of management, because the domestic consumption of wheat flour has been stagnant, and because the exports of flour and pellets have not been doing well (Table II-1-33). The inactivity of flour exports is considered to be due partly to the subsidized export drives by the EC and USA. There are a certain number of plants that have curtailed or suspended their operations. Some plants are operating with rather inefficient facilities of the old type, but find it difficult to make a new investment under the slack business condition.

The majority of the milling plants produce merely flour and pellets as by-products. However, it seems to be necessary for them to make efforts to develop, for example, quality flour and more diversified products using flour to generate new demand in the domestic market as well as in external markets.

Table II-1-33 Wheat Flour Production, Domestic Consumption and Export (1975-1984)

(1,000 tons)

Year	Wheat Milled	Wheat Flour			Pellets of Bran Export
		Production	Domestic Consumption	Export	
1975	3,963	2,683	2,567	116	622
1976	3,771	2,690	2,616	74	982
1977	3,731	2,860	2,624	236	947
1978	3,741	2,687	2,566	121	981
1979	3,649	2,961	2,630	61	869
1980	3,504	2,623	2,592	31	749
1981	3,417	2,573	2,554	19	737
1982	3,570	2,625	2,598	27	720
1983	3,779	2,819	2,782	36	834
1984	3,908	2,970	2,895	74	670
1975-84 Average	3,676	2,722	2,643	80	811

Source: Federacion Argentina de la Industria Molinera, Estadisticas de la Industria Molinera 1984.

(2) Formula feed processing

Argentina's formula feed industry began to expand in the late 1960s, owing largely to the increase in broilers and layers along with the introduction of feeding technologies by foreign capital companies. The formula feed has been produced mainly for domestic use. The total capacity and the number of processing plants were estimated to be approximately 8,000 tons per day and 100 respectively in 1980, concentrated in the Provinces of Buenos Aires, Entre Rios, Santa Fe and Cordoba. These four provinces accounted for 95% of both the total processing capacity and the total number of plants in this country.

Since the 1970s, however, small-scale processing plants have been increasingly established in grain producing areas, where the purchase of such ingredients as maize and sorghum is more favorable in terms of transportation costs. This tendency is further accelerated in recent years. In addition, there are some grain merchants (acopiadores) and livestock producers who began formula feed processing, utilizing their advantages in the access to grain producers and to consumers. Although the top ten companies still account for over 40% of the country's total production, large-scale plants are reportedly losing their competitiveness relative to those small-scale plants. For this reason, foreign capital companies with large-scale plants have withdrawn from this country, and the majority of the capital in this industry is presently national.

The total production of formula feed remarkably increased through the 1960s, but seems to have been rather depressed since the early 1970s. Table II-1-34 shows the trends in formula feed produced by the

member firms of the Argentine Chamber of Manufacturers of Balanced Feed (CAFAB), which are organized by 48 members with relatively large-scale plants. Taking account of the fact that the CAFAB's share in the country's total production declined from 80% in 1980 to 70% at present, the stagnant production in the last 15 years could be attributed to the already mentioned increase of small-scale plants. Nevertheless, the figures in the table can illustrate a general tendency of the Argentine formula feed production, judging from the stagnant consumption of maize and sorghum, which accounts for about 70% of the components of formula feed, since the mid-1970s as shown in Table II-1-34.

Table II-1-34 Trends in Formula Feed Produced Members of CAFAB[1)] (1967-1985)

(1,000 tons)

Year	Broilers	Breeders	Layers	Reproducers	Cattle	Pigs	Others	Total
1967	278	53	89	30	8	3	6	468
1968	386	85	118	43	7	6	7	652
1969	470	102	157	51	5	9	8	804
1970	596	113	177	67	6	9	10	978
1971	781	130	203	85	8	12	12	1,231
1972	980	164	290	104	17	23	14	1,591
1973	863	117	320	96	23	22	19	1,459
1974	1,040	153	344	105	50	34	49	1,776
1975	1,084	128	367	94	52	47	33	1,805
1976	793	95	364	76	55	57	27	1,468
1977	664	98	323	66	48	40	27	1,266
1978	633	77	314	65	32	43	11	1,175
1979	702	83	335	71	76	70	15	1,353
1980	832	95	404	83	100	75	14	1,603
1981	843	79	332	88	94	39	13	1,488
1982	733	72	302	73	141	51	14	1,385
1983	749	60	276	65	180	62	16	1,407
1984	696	58	275	68	230	79	21	1,428
1985	713	59	278	52	363	88	23	1,576

Source: CAFAB, Estadistica de Produccion de Alimentos Balanceados, various issues.

Note: 1) Camera Argentina de Fabricantes de Alimentos Balanceados. The production by its member-companies accounted for 80% of the country's total formula feed production (excluding concentrates) in 1980, and the share is estimated to be 70% in more recent years.

The stagnant formula feed production, especially for poultry, is related to the drop of the beef price during the liquidation phase of the livestock cycle since the mid-1970s. As the chicken consumption and price have deteriorated by cheap beef available in the domestic meat market, the demand for formula feed shrunk accordingly. In 1985, the demand for formula feed was further affected by the decrease in

production of chicken and eggs because of the price freeze under the counter-inflationary program.

The exception to the tendency of stagnant production is formula feed for cattle, mainly of dairy. However, there does not seem to be much possibility of a rapid increase in formula feed consumption of dairy cattle, considering the characteristics of dairy farming and the past trends in demand for dairy products in Argentina.

(3) Oil milling

In 1984, there are 46 vegetable oil manufacturers with 56 processing plants, of which 30 were equipped with refining facilities, as shown in Table II-1-35. The method of solvent extraction is used for soybean, while both the mechanical and solvent methods are used for sunflower. In this industry, the medium-quality production is undertaken by many firms, but the first-class line is occupied by a little less than ten firms. The total extracting capacity of these plants was nearly 9.5 million tons in oilseeds, but their total operating rate was less than 70% due to the rapid increase in extracting capacity by newly constructed plants and the weak demand in the domestic market and international setbacks to export expansion, especially protective measures taken by the EC.

The extracting plants are mainly located in the Federal Capital and the Provinces of Santa Fe, Buenos Aires, Cordoba and Entre Rios, which aggregately accounted for 84% of the country's total number of oil extracting plants and 96% of the total extracting capacity in 1984.

In 1984, the total production of vegetable oils covering sunflower, soybean, cottonseed, groundnut and tung was 1.6 million tons, in which sunflower and soybean made up 49% and 34% respectively. The total production of the by-products (except for tung) such as pellets and expellers was 4.2 million tons, of which sunflower and soybean accounted for 22% and 65% respectively. The shares of soybean products, especially oil, have been rapidly increasing since 1980, as its extracting capacity has expanded.

Soybean oil production increased from 131,000 tons in 1980 to 616,000 tons in 1985 with an average growth rate of 36% annually, while sunflower oil production from 601 thousand tons in 1980 to 1,163 thousand tons in 1985, growing at 14% per annum (Table II-1-36). The trend is similar with respect to their by-products.

The most of these increases were exported, and the expansion in domestic consumption of these products has been somewhat dull in comparison with the export. The weak demand especially in 1983 and 1984 for sunflower and soybean oils, which accounted for around 80% of the country's total edible oil consumption, can be attributed partly to weakened consumers' purchasing power. In 1985, the stable price situation brought by the counter-inflationary measures and the severe deterioration in international oil prices encouraged the consumption, resulting in high annual growth rates of 35% and 60% in sunflower and soybean oils respectively. This would indicate that there is some possibility to enhance the domestic consumption of these

Table II-1-35 Extracting Capacity of Oilseeds and Production of Oil and By-products in 1984

(1,000 ton)

Province	Number of Plants	Total Annual Capacity[1]	Oilseeds Extracted				Oil Production				By-product Production			
			Total	Soybean	Sunflower	Others[2]	Total	Soybean	Sunflower	Other[2]	Total	Soybean	Sunflower	Others[3]
Federal Capital	8	1,497	1,240	521	652	66	363	85	256	22	756	414	299	43
Buenos Aires	10	1,491	1,206	155	939	112	431	25	369	37	627	124	430	73
Santa Fe	14	4,413	2,698	2,038	274	386	538	333	108	97	1,960	1,620	125	215
Cordoba	8	1,322	906	662	161	84	201	108	63	30	647	526	74	47
Entre Rios	7	317	228	19	-	209	72	3	-	69	151	15	-	136
Chaco	2	126	110	-	10	100	20	-	4	16	48	-	4	44
Mendoza	2	65	3	0	3	-	1	0	1	-	1	0	1	-
Misiones	5	206	85	17	-	68	15	3	-	12	13	13	-	-
Total	56	9,436	6,476	3,412	2,039	1,026	1,643	558	802	283	4,204	2,713	933	558

Source: J.J. Hinrichsen S.A. (Corredor), La Industria de los Aceites Vegetables y la Production de Semillas Oleaginosas.
Notes: 1) Capacity per day multiplied by 300 days.
2) Including cottonseed, linseed, groundnut and tung.
3) Including cottonseed, linseed and groundnut.

Table II-1-36 Apparent Domestic Consumption of Oils and By-products of Soybean and Sunflower (1970-1979 Average and 1981-1985)

(1) Sunflower Oil

(tons)

	1970-79 Average	1980	1981	1982	1983	1984	1985
Initial Stock (1/1)	17,811	22,111	41,851	33,719	22,819	65,890	31,809
Production	336,394	600,537	401,049	653,993	895,389	801,519	1,162,860
Total Supply	354,205	622,648	442,900	687,712	918,208	867,409	1,194,669
Export	77,308	337,877	211,776	393,767	615,193	595,424	840,440
Final Stock (31/12)	17,855	41,851	33,719	22,819	65,890	31,809	30,986
Apparent Consumption	259,042	242,920	197,405	271,126	237,125	240,176	323,243

(2) Soybean Oil

(tons)

	1970-79 Average	1980	1981	1982	1983	1984	1985
Initial Stock (1/1)	5,727	10,671	29,781	37,768	44,404	40,596	56,255
Production	56,118	130,893	168,843	277,069	366,892	557,187	615,536
Total Supply	61,845	141,564	198,624	314,837	411,296	597,783	671,791
Export	41,395	91,756	69,886	174,049	293,032	483,949	524,715
Final Stock (31/12)	6,748	29,781	37,768	44,404	40,596	56,255	54,509
Apparent Consumption	13,702	20,027	90,970	96,384	77,668	57,579	92,567

(3) Sunflower By-products[1)]

(tons)

	1970-79 Average	1980	1981	1982	1983	1984	1985
Initial Stock (1/1)	21,378	21,981	43,322	27,311	79,931	66,142	106,414
Production	445,360	746,085	495,703	767,903	1,019,261	933,219	1,277,157
Total Supply	466,738	768,066	539,025	795,214	1,099,192	999,361	1,383,571
Export	354,421	653,337	498,031	617,876	942,758	816,889	1,190,862
Final Stock (31/12)	21,636	43,322	27,311	79,931	66,142	106,414	65,661
Apparent Consumption	90,681	71,407	13,683	97,407	90,292	76,058	127,048

(4) Soybean By-products[1)]

(tons)

	1970-79 Average	1980	1981	1982	1983	1984	1985
Initial Stock (1/1)	16,749	13,839	36,248	31,140	110,601	160,955	188,813
Production	264,807	608,216	770,537	1,320,216	1,812,584	2,708,891	2,940,515
Total Supply	281,556	622,055	806,785	1,351,356	1,923,185	2,869,846	3,129,328
Export	178,180	289,756	520,530	983,257	1,572,563	2,553,584	2,415,492
Final Stock (31/12)	18,064	36,248	31,140	110,601	160,955	188,813	269,523
Apparent Consumption	85,312	296,051	255,115	257,498	189,667	127,449	444,313

Source: Camara de la Industria Aceitera de la Republica Argentina
Note: 1) Pellets and expellers.

oils in the future. Nevertheless, the soybean oil consumption remains relatively small in contrast with the rapid increase in production. This is said to be because soybean oil with peculiar smell does not meet the Argentine taste. It is technically possible to eliminate the smell of soybean oil by improving the refining technology. However, considering the consumers' traditional taste, it may be necessary to blend soybean oil with sunflower or other vegetable oils more widely consumed in Argentina in order to increase the domestic demand.

With regard to by-products, the stagnant consumption can be attributed to the weak demand for formula feed as mentioned in the previous part. In 1985, however, the consumption of sunflower and soybean by-products increased 67% and 250% respectively compared to the previous year due partly to the improved demand in dairy production on account of the increased consumption of dairy products along with the National Food Plan, and partly to the further deterioration in international prices of those products.

Although oil millers prefer to deliver their output to the domestic market under the present price condition, their greater interest is still found in the international market for which the industry has been originally developed. The millers claim that the reduction of the existing high export taxes on vegetable oils is essential to expand their exports to external markets where the EC (a former main importer of the Argentine products and also a competitor) and the USA (a main competitor regarding soybean oil) are protecting their domestic oil processing industries by means of subsidies. They also point out that exports of packed refined vegetable oils would be abandoned on account of export duties running from 10% to 16%, which are closer to the rates on crude oil exported in bulk. In addition to the export taxes, packed refined oils are subject to taxes on higher value added and materials necessary for the processing such as bottles, tin plates and corrugated boxes.

In connection to export taxes, the difference between rates on grains and oils affects oil millers' access to raw materials. The present difference of 12% for soybean (grains; 27%: oil; 15%) is more favorable to grain exports by comparison to the difference of 15% (grains; 25%: oil; 10%) in 1983-84. With a view to expanding vegetable oil exports as well as reducing the high level of idle capacity in this industry, the export taxation system should be re-examined, since there appears to be little possibility of rapid increase in domestic consumption of oils and by-products in the foreseeable future.

Furthermore, it would be necessary for the private sector to promote their products both in domestic and external markets through such measures as product diversification, improvement in quality and effective advertisement.

1-3 Outlook and Prospects of Development

1-3-1 Policy Orientation and Strategic Measures

Policy objectives, strategies and major policy instruments for the crop sector have been defined in the National Agricultural and Livestock Program 1984-1987 (PRONAGRO), which was announced in 1984 by the Secretariat of Agriculture, Livestock and Fisheries. Some of the policy proposals of this program have already been put into effect, and some others are currently under elaboration.

Three important medium-term objectives of the PRONAGRO are stated as follows.

1) Increased production of food, especially cereals and oilseeds, by realizing the potential productive capacity of agriculture
2) Expansion of agricultural exports
3) Elimination of rural poverty

The central strategies for achieving these objectives somewhat differ between the Pampas and the other regions, but are basically similar in that the primary emphasis is placed on deepening and facilitating the process of technological progress on the farm level. In other words, two important strategic measures proposed for achieving growth and stability in agricultural production and farm income are 1) to lower the relative prices of agricultural inputs vis-a-vis those of agricultural products, and 2) to systematically coordinate policies on prices, technological development, agricultural credit, commercialization and taxation toward this end. By these measures, it is considered possible, for instance, to increase the production of five major export crops to 60 million tons by the end of the 1980s. In the following sections, important proposals made in the PRONAGRO are discussed at some length.

(1) Price policies

The relative reduction of input prices primarily concerns two strategic agrochemical inputs, namely, fertilizers and pesticides (mainly herbicides). Especially in relation to fertilizers, the short-term policy is to increase imports and distribute them efficiently, but the ultimate goal is import substitution. The lowering of the relative prices of these inputs is also tried through the policy on prices of crops. On the basis of the understanding that Argentina is not in the position to influence the international prices of its major export crops, the PRONAGRO purposes the stabilization of domestic producer prices through various measures to be taken by the National Grain Board (JNG), as will be discussed later in this section.

The promotion of increased application of fertilizers and pesticides has been the key policy issue of the present Government, and some steps have already been taken, such as the abolition of import tariffs on fertilizers, reduction of the value-added tax on herbicides, and the introduction of the fertilizer distribution program by the JNG. These measures in fact served to increase the

consumption of fertilizers by lowering their prices. However, during 1985/86 when the export prices of five crops considerably declined, the rate of increase in consumption decelerated, suggesting the need to coordinate the fertilizer distribution program with the proposed price stabilization policies.

Given the policy objective of increasing agricultural production and exportable surplus, it is no doubt necessary to increase the application of strategic inputs, the consumption of which has been increasing since the later half of the 1970s. The key issue is how much and how fast to increase. Excluding a number of advanced farmers, the understanding of and/or the interest in the application of fertilizers and pesticides appear to be still limited among the majority of agricultural producers. The question of readiness on the part of producers will be more important concerning fertilizers.

The proposed policies for agricultural technology emphasize the importance of developing technology packages which utilize higher levels of fertilizers and pesticides, but taking into account the processes involved for such development and diffusion thereof, it does not appear likely that the consumption would increase rapidly as anticipated by the Secretariat of Agriculture, Livestock and Fisheries. Moreover, as seen in some developed and developing countries, the high application of chemical fertilizers and pesticides involve serious risks, and it would be necessary to be careful about expediting the increased consumption of these inputs.

As mentioned already, the imports of fertilizers and pesticides for increased consumption are to be taken over eventually by domestic production. There is only one company producing nitrogenous fertilizers in Argentina, while many companies, including national ones and foreign subsidiaries, participate in the production and/or in the distribution of pesticides. With respect to fertilizers, for which standardized production systems are available, it is quite possible to expand domestic production utilizing ample reserves of natural gas, and in fact a few projects have been already proposed. The Secretariat of Agriculture, Livestock and Fisheries seems to be considering the construction of a large-scale plant which operates with efficiency comparable to international standards, while some provincial governments are proposing smaller plants close to the gas reserves. In either case, the new construciton requires a large outlay of capital for initial investments.

However, considering the need to develop and diffuse technology packages suitable to varying local natural and socio-economic conditions, and moreover the need to coordinate the policy on inputs with the price support policy on crops, it appears better to wait until such time when the domestic consumption rises to the level warranting the construction of a new plant or plants. Besides, the current soft international market of petroleum and its derivatives indicates that fertilizer importation would be a more economical alternative for the time being.

Concerning pesticides, the present multiplicity of suppliers and different brands compared with the concentration of consumption appears to justify a certain degree of consolidation of the domestic

industry in the process of import substitution. However, in relation to the pesticides industry, it is important to take into account the speed of on-going technological innovations in the world. The on-going mergers between the chemical industry and the seed industry, possible development through biotechnology of plant varieties tailored to tolerate particular types of pesticides, emergence of new plant protection technologies like biological control and so on suggest that the simple import substitution approach like the fertilizer industry will not suffice in the case of the pesticides industry. It will be necessary to formulate a master plan of plant protection, including measures to enhance the research and development capability of the domestic industry.

According to the PRONAGRO, agricultural inputs other than fertilizers and pesticides, that is to say, seeds and agricultural machinery, are not considered as constraints to increased production. The existing private seed industry, consisting of national companies and foreign subsidiaries, has a sufficient capacity to increase its supply of hybrid seeds of maize, sorghum and sunflower, and as long as the market size is large enough to justify commercial undertaking, it will be capable of supplying seeds of the other major export crops. However, it will be necessary for the INTA and other public research institutions to strengthen their activities on varietal development and seed multiplication concerning the PRONAGRO's proposals on the appropriate diversification of farming in regions outside the Pampa region and the fostering of domestic seed companies.

Concerning agricultural machinery, the existing productive capacity is considered sufficient to meet the expected increase in demand. However, at least in relation to havesters and a veriety of agricultural implements which are manufactured by many national companies, some measures will be necessary to facilitate the reduction of production costs through economies of scale and to encourage their product development efforts. The public sector research institutions like the INTA and the INTI could coordinate with the private sector by facilitating standardization of parts designs and setting up engineering norms and performance standards for new models. In this regard, the Institute of Agricultural Machinery which was established jointly by the government, farmers organization and manufacturers in Japan might serve as an example.

(2) Policies on technology development

The proposals of the PRONAGRO basically focus on deepening the capability of the INTA which is responsible for both technology development and diffusion. The special emphasis is placed on strengthening the INTA's regional activities by facilitating closer cooperation with other research institutions and universities.

Cereals, oilseeds and forage crops are considered as major targets for technology development and diffusion, and more technified farming methods which utilize better seeds, more fertilizers and pesticides, and efficient machinery are to be developed, including the mixed types of farming systems. Specific issues mentioned by the PRONAGRO in this regard are the consolidation of continuous agriculture that has emerged mainly in the traditional maize zone,

improvement of cattle raising technologies in non-traditional areas, and development of more intensive mixed farming systems including the possibility of irrigation. In relation to small-holder agriculture largely found outside the Pampa region, the emphasis is on developing appropriate technology packages inclusive of crop diversification.

The important issue related to continuous agriculture mentioned above is how to do with the maintenance of soil fertility. Fertilizer application to major crops grown in the Pampas is a relatively recent phenomenon, and still limited mainly to wheat cultivation in the traditional wheat zone. The traditional mixed farming of crops and cattle in rotation has long been the effective method to recuperate the soil fertility lost by cropping. The emerging continuous agriculture requires new technologies not merely for maintaining soil nutrient levels and crop yields but also for preventing the deterioration of agricultural environment. The area affected by soil erosion is reported to be substantial in the zone where agriculture is carried out more intensively.

The INTA's Regional Experiment Station in Pergamino and other private organizations for technical assistance have been promoting the diffusion of the method called conservationist tilling which has been developed in the USA. The method is based on zero, minimum or reduced tilling, depending on the soil conditions, to retain soil moisture and organic nutrients by leaving harvest remains over and in the ground. It is being planned to extend this method to 800,000 ha in the traditional maize zone during five years. Because the method requires higher application of pesticides and special agricultural implements for tilling, and takes four to five years to stabilize itself as a system, its diffusion calls for concerted efforts of the public sector, farmers and suppliers of agricultural inputs.

From the viewpoint of soil conservation, it is also important to reevaluate the traditional mixed farming methods and improve their technological mix and intensity as total systems of land use.

With respect to the policy emphasis on "deepening" research and development efforts of the INTA, it is necessary to enhance its role in varietal development. As mentioned earlier, the private seed industry has been dominant in diffusing the use of hybrid seeds for maize, sorghum and sunflower in Argentina. The INTA has played an important role with respect to autogamous wheat and soybean, and its activities are mostly oriented to adaptive variety improvements of cultivars brought from overseas. Considering the functions of the INTA as an institution for technology development and diffusion, this strong orientation to applied research is rather natural.

The introduction of cultivars with new genetic traits has brought the most important impact on the technological progress observed mainly in pampean agriculture in the last ten to fifteen years. Other technological improvements associated with mechanized farming and application of fertilizers and pesticides followed to support this innovation. However, the present level of inputs application, for instance, is yet inadequate in the sense of actualizing the real potentials of the cultivars. In other words, the INTA has to carry

out the important tasks of diffusing economically and technically feasible technology packages utilizing the already available technology inputs.

At the same time, it is necessary to take note of the imminent impact on agriculture of the on-going biotechnology development in the world. The INTA's central facilities at Castelar engage in basic research, and have already initiated a few projects in the fields of modern biotechnology. Considering the PRONAGRO's proposal to promote the growth of national seed companies, it is important to strengthen the INTA's basic research efforts in agriculture-related biotechnology, which requires considerable lead time to develop. This point will be discussed in the next section, but it is necessary to stress that modern biotechnology is oriented to application, requiring close feedbacks of practical issues from the place of production. In this sense, it would be necessary for the INTA, with its long experiences in applied research, to launch projects in advanced fields of biotechnology.

The most pressing constraint to introducing new research programs is financing. The INTA's major source of funds is 1.5% tax on traditional exports, but the current level of spending does not appear to be sufficient relative to the proposed need to strengthen its regional activities. New research projects would thus need other sources of finance, but for the time being, it might be useful to strengthen programs of international cooperation. In such cases, it is important to formulate a national strategy for biotechnology development and establish priorities of research. This point will be discussed at some length in 1-3-2.

(3) Policies on commercialization

The major emphasis of the PRONAGRO is placed on stabilizing the returns to agricultural producers, including the relative reduction of margins of distributors and exporters. The strategic policy instruments consist of 1) the system of official minimum support prices and purchase by the JNG (this is already applied to wheat), 2) flexible application of export taxes, 3) direct and indirect measures to improve transportation and storage and thereby to reduce the costs of commercialization, and 4) maximization of export prices through the minimum export price system and the official promotion of bilateral trade agreements with importing countries.

The most important policy instrument among the above proposals is the flexible application of export taxes. Taxation on traditional exports has always been an important source of government revenues except for a limited period of time as in the late 1970s. By introducing a new land tax, the present Government proposes to adjust export tax rates primarily for stabilizing domestic prices of agricultural products.

In order to reduce the costs of commercialization to benefit the producers, the PRONAGRO proposes to provide a credit line for investments by cooperatives or other producers' associations in transportation and storage infrastructure. And for the distant areas

like the Northwestern Region (NOA), the JNG has been already constructing its country silos with the World Bank financing, and the PRONAGRO proposes the provision of fiscal incentives to private investments in such infrastructure development.

As seen from the above discussion, the policy orientation of the present Government is a mixed system of commercialization, in which the JNG acts as the central agency representing the role of the public sector. But there is a question of how mixed the system should be from the wider economic perspective. It is often pointed out that the direct operation of economic activity by a public entity in any country tends to fall short of the efficiency achievable by the private sector. The development of physical infrastructure would not lead to the reduction of commercialization costs and would not thus benefit the producers, unless it is operated efficiently. A good example is seen in the success of the 1979 deregulation which enabled the private sector to invest in port elevators. In this sense, it is important to assess the economic effects of further privatizing the operations of the existing as well as prospective infrastructure facilities connected to grain marketing and exportation. From the viewpoint of supporting the interests of producers, it would seem better to orient the direct involvement of the JNG in infrastructure development and operation to areas where structural constraints exist, as in the case of NOA.

The proper activation of the proposed policies on export taxation and the minimum producer support price system will be more effective than the direct operation of port facilities for the purpose of stabilizing the returns to producers. The JNG could on the other hand expand its program of fertilizer distribution with the express aim of remedying the long-standing price distortion in the domestic market of this input. With respect to the marketing margins for distributors, the combination of the systems of minimum export prices and producer support prices as well as the existing regulations over primary marketing would be able to maintain them within a reasonable range.

(4) Fiscal and credit policies

As mentioned earlier, the PRONAGRO proposed a fundamental fiscal reform, which will have an important impact on agricultural production. The proposed land tax, now being deliberated at the Parliament, will secure a stable source of government revenues, thus providing enough room for flexible application of export taxes. Moreover, this tax is designed to give incentives to those producers who directly engage in or supervise agricultural operations and make efforts to increase the productivity.

In addition to various fiscal incentives, the PRONAGRO proposes to institute credit lines designed to support the technological progress in agriculture and the expansion of agricultural exports. The emphasis is placed on supervised credit which will be channelled to a total farming plan rather than to specific crop cultivation. But the fundamental bottleneck at present is the absolute shortage of funds and the high interest rates, though lower than regular bank rates. The Banco de la Nacion, a major source of agricultural credit in the country, currently has credit lines for the purchase of

herbicides in the Humid Pampas, the purchase of agricultural machinery for the entire country, and livestock development in the Northeast Region by securing funds from the Inter-American Development Bank. The primary importance of agricultural credit notwithstanding, the problem lies in the reality that the PRONAGRO's proposal cannot be implemented without external financing.

1-3-2 Importance of Biotechnology Development in Argentina

(1) Outlook for agricultural biotechnology

Biotechnology, a new technology based on cellular and molecular biology, has the potential of making significant contributions to the genetic improvement of important crops. Plant products provide more than 90% of the human diet, and the remainder comes indirectly from plants in the form of animal products. There are only about 20 major crops that stand between the world and starvation.

On a worldwide basis, the breeding of improved crop varieties has been the most important factor in increasing food production. The development of hybrid maize and semidwarf varieties of rice and wheat has had significant impacts on world agriculture. Modern biotechonology is expected to have a much greater impact on agriculture in many aspects.

Biotechnology is expected to transform agriculture from the present highly mechanized and labor-saving single crop or livestock production systems to more scientific and diversified resource-conserving systems. Table II-1-37 shows a forecast of the impacts on the crop productivity in the early next century from various technological inputs including biotechnology. It is obvious that prospective developments in modern biotechnology will offer significant inputs to the yield increase of crops.

Made aware of great opportunities in agriculture, many biotechnology-related industries are now engaged in agricultural research. Globally, no less than 350 firms, ranging from large multinationals to small venture capital firms, have entered the biotechnology fields in less than 5 years. Among these, approximately 101 enterprises currently active in various biotechnology fields are engaged in the manufacturing of products or of control systems which are of potential importance to agriculture. Table II-1-38 shows some of the examples. The first agricultural application of genetic engineering is likely to be to animal and plant disease control like production of protective vaccines, diagnostics and new pesticides, and to food technology.

Early applications of genetic engineering took place firstly in microbiological production, mostly from Escherichia coli, and secondly in tissue cultures of specific crops as shown below.

Table II-1-37 Increase in Crop Productivity by 2030 A.D. Anticipated from Various Crop Technologies and Changes in the Resource Base (1983=100)

Technologies	Productivity Increases (%)
Plant breeding	135
Irrigation and crops to conserve water	133
Genetic engineering	125
Growth regulators	124
Rising level of atmospheric CO_2	120
Biological nitrogen fixation	118
Multiple cropping and polyculture	115
Improved photosynthetic efficiency	117
Temperature acclimation	113
Forage nutritional quality	112
Crop maturity	111
Transpiration suppressants	110
Intercropping	108
Protected cultivation	105

Source: Wiley-International, Agriculture in the Twenty-First Century, 1983

Table II-1-38 Selected Biotechnology Companies with Agricultural Interests

Name	Speciality
Advanced Genetic Sciences, Inc.	Potato, asparagus, strawberry
Agrigenetics Corp.	Cereals, legumes, disease resistance
ARCO Plant Cell Research Institute	Broad interests
Calegene	Stress-salt tolerance
Cetus Corp.	Nitrogen fixation, inoculants
Dekalb-Pfizer Genetics	Maize, sorghum
DNA Plant Technology Corp.	Tomato improvement
Frito-Lay Inc.	Potato
International Genetic Engineering, Inc.	Broad interests
International Plant Research Institute (IPRI)	Disease and stress resistance-wheat
Life Sciences Inc.	Bulbs, seeds
Molecular Genetics, Inc. (MCI)	Cereals, sorghum
Native Plants Inc.	Stress tolerance
Neogen Corp.	Animal disease control, broad interests
Phytogen Inc.	Nutrition, disease resistance, photosynthetics
Plant Genetics, Inc.	Plant cell biology
R and A Plant/Soils Inc.	Microbial soil inoculants
Sungene Technologies Corp.	Crop varieties
Zoecon Corp.	Pest control, growth enhancement

Source: Wiley-International, Agriculture in the Twenty-First Century, 1983

African oil palm	Onion
Asparagus	Papaya
Banana	Pinapple
Boston fern	Potato
Broccoli	Rootstocks (tree fruits)
Brussles sprouts	Spinach
Carrot	Strawberry
Cauliflower	Taro
Citrus	Tomato
Garlic	Welsh onion
Genetically superior trees	Yam

Cell, embryo, meristem, haploid and tissue culture techniques are important because they provide a convenient, efficient and quick method of crop propagation and of establishing experimental crossing lines and genetically superior selections for commercial production. These techniques are the gateway which the development of genetic engineering must pass to be useful in agriculture. Tissue culture will also greatly contribute to developing strains of plants with toxin resistance to diseases and tolerance to herbicides. In vitro selection of cells is expected to greatly accelerate genetic improvement and disease resistance in crop plants.

Biotechnology is also going to play an important role in animal husbandry. Advancement in genetic engineering of new vaccines and hybridomas to produce monoclonal antibodies will aid disease control and diagnosis, and enable rapid genetic improvements of livestock. Fertility improvement is now practical by using estrus synchronization, or controlling the reproductive cycle. Semen preservation, pregnancy detection, multiple births, superovulation, and nonsurgical embryo transfer and implantation are also under development. All of these technologies can be maximized to increase the number of offspring from genetically superior parents. Nonsurgical embryo collection is now helped by extremely sensitive microscope techniques for embryo sexing, freezing, and implantation.

Genetic engineering bridges the gap between basic and applied research. Some results from basic research will find their immediate application. In the era of biotechnology, the field of biology is no longer separable into fundamental sciences and practical technologies. There is a tendency that as research gains in complexity, goals become more profit-oriented than for public interest. For example, major seed companies in the USA and Europe have merged with biotechnology companies or chemical, petroleum, or pharmaceutical companies. The reason is clear. The seed business offers a profitable "biotechnology delivery system" to agriculture.

One of the most significant impacts of plant genetic engineering would be in the changes it creates in the structure of agribusiness. Most of the downstream technologies currently used in agriculture entirely depend on the genetic traits of a given crop. Thus, modification of genetic traits related to a downstream technology will certainly affect the industry which is related with the downstream technology. As pointed out repeatedly, genetic

engineering constitutes the upstream technology in agriculture which makes it possible to directly design the genetic information of crops. This means that modern biotechnology might transform agriculture from the naturally designed downstream technology system to the artificially designed downstream technology system.

For example, types and functions of a harvester machine is designed essentially on the basis of the morphological characteristics of a given crop, or in other words, the crop's naturally built-in genetic traits that determine the height and shape. A significant change in the shape of the crop by genetic engineering might necessitate the appropriate structural modifications of the harvester machine. This implies that an upstream technology can be used to dictate the context for the downstream technology industry.

Such impacts are expected for example in the herbicide market. If a herbicide manufacturer develops herbicide-tolerant crops, it will gain definite advantages, because both the herbicide and the crop (seeds) tolerant to it will exert a synergetic effect in the market and reduce the market share of other companies which do not have such products. The progress of modern plant biotechnology would thus give the upstream industry increased opportunities to constrain the activity of the downstream industry.

(2) Importance of biotechnology in Argentine agriculture

Agriculture is one of the key industries in Argentina, and for the purpose of maintaining its leading position in the world trade of agricultural products, the country should enhance its own research in the area of plant breeding and also develop its own seed business.

Genetic engineering, one of the key technologies in biotechnology, is believed to provide new tools for plant breeding. This technology is considered important not only because it can assure the breeding of new varieties and shorten the period required thereof, but also because the technology is expected to create new species which the conventional plant breeding technology cannot. This implies that Argentina should enhance its own genetic engineering research as part of its plant breeding program. In addition, it should also be emphasized that genetic engineering or molecular breeding is a laboratory type technology by its nature, and thus this technology alone cannot produce any practical useful varieties. Parallel development efforts in both moleculer breeding and conventional breeding are indispensable to obtain practical results. In other words, the systematic approach is essential for modern plant breeding.

The spectrum of the future influence of modern biotechnology on Argentina's agriculture and bioindustries can be classified as follows:

Plants:

Key technologies
- Cell fusion
- Recombinant DNA
- Cell culture

Applications
- Production of a wide range of varieties with desirable characteristics through genetic selection
- Creation of stress-resistant varieties by genetic transformation
- Creation of new varieties capable of producing particular chemicals by genetic transformation
- Production of chemicals by the bioprocess which uses plant cells
- Creation of new microorganisms by introducing plant genes by rec-DNA technology
- Development of biological agricultural chemicals by rec-DNA technology

Animals:

Key technologies
- Cell fusion
- Cell culture
(- Recombinant-DNA)

Applications
- Production of vaccines, fertility control agents, diagnostics
- Production of therapeutics
(- Correction of genetic defect)

Microorganisms:

Key technologies
- Recombinant-DNA
- Cell fusion
- Bioreactors

Applications
- Production of selected nutritional biochemicals
- Production of selected biologically active substances
- Production of selected enzymes
- Production of biofuels
- Production of cell mass
- Utilization of various agricultural products and waste

Agriculture is one of the key industries in Argentina. The modern biotechnology is able to provide a whole spectrum of technologies from plant breeding to the utilization of agricultural products by bioindustries which create new markets. Some technical issues for developing agricultural biotechnology in Argentina are as follows. It should be understood that directions of technical development should be determined by the national research policy, as will be emphasized later, and that the programs recommended below are only the opinion of the writer based on the preliminary survey.

1) Establishment of plant genetic engineering technology

2) Establishment of the plant molecular breeding program that is linked to the conventional plant breeding program

3) Establishment of the system of technology required for promoting a bioindustry system
   a) Development of a spectrum of biotechnologies related to the production of hybrid seeds
   b) Development of a spectrum of biotechnologies related to the utilization of agricultural products or wastes, or both

4) Establishment of a spectrum of technologies required to develop a small-scale integrated farm bioenergy system
   a) Development of selected biomass resources
   b) Development of efficient biofuel conversion systems

5) Establishment of a spectrum of technologies related to animal health

Argentina has extremely high potentials in developing agricultural bioindustries utilizing its resources. Promotion of biotechnology is urgently needed due to the anticipated strong impact on agriculture of this technology. Biotechnology development is currently underway in Argentina, but the country should identify more effective approaches to promote such efforts. The following sections will discuss this subject.

(3) Patterns of biotechnology promotion in advanced countries

There is no doubt that the USA and Japan are the most advanced countries in biotechnology in the world. It is of interest to note that these two countries are using different approaches to promote biotechnology. What follows is the brief explanations about the patterns developed by the two countries.

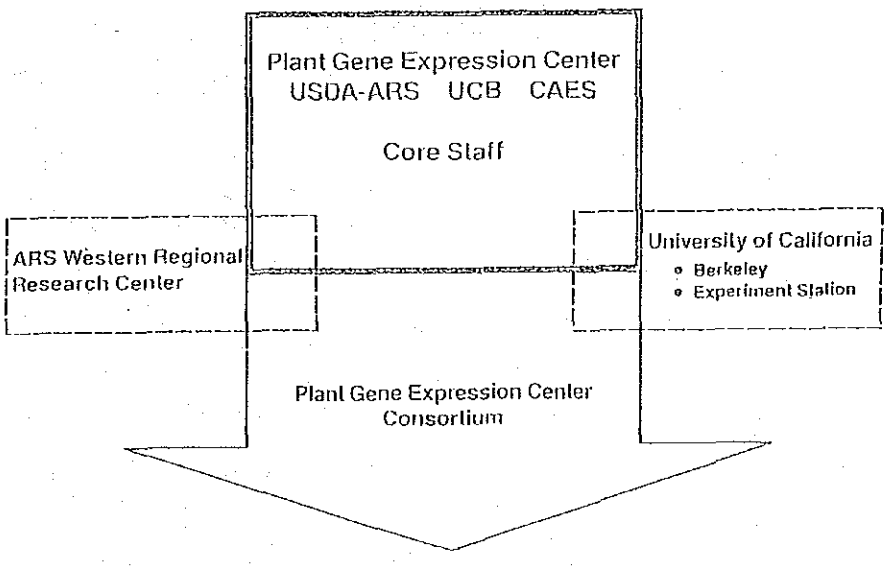
With respect to the USA, in the beginning, the research in genetic engineering was supported mainly by the NIH (National Institute of Health). At that time, the NIH preferred to use universities for genetic engineering research because of the regulatory problems. This arrangement boosted the research activity in this area, which made the USA the leading country, particularly in the area of medical science and human health care. The pattern of technology transfer is from universities to the private industry. The funds for federally supported research in 1981 were US$3.8 billion and US$0.7 billion respectively in medical and agricultural sciences. Evidently, the large research funds made available by the US government have had the greatest impact on the development of genetic engineering in the medical science.

Recognizing the opportunities in agricultural biotechnology, the U.S. Department of Agriculture (USDA) also decided recently to promote technology development in agriculture. The Agricultural Research Service (ARS) of the USDA announced in 1984 to establish a new center for agricultural biotechnology development. The structure of the new center, called the Plant Gene Expression

Center, or PGEC, is shown in Figure II-1-10. The basic understanding behind the establishment of the PGEC is as follows:

- The most promising biological technology of this century should be exploited to serve agriculture, the USA's most important industry.
- New technology is urgently needed for exploring, maintaining, and improving the germplasm of the USA's agricultural plants.
- Only new basic knowledge will ensure the development of new technology that is uniquely suited for US agriculture.
- Funding for the center must be adequate and stable over a period of time that will enable US agriculture to utilize the benefits of the research.
- The ready exchange of information between the Center and geneticists and plant breeders throughout the country will ensure that the new technology is suitable and available for improving crop plants.
- By its nature, the research will require large, long-term capital investment, and in the start-up phases it will not yield high returns attractive to private investors.
- The research will be clearly mission-oriented and targetted at high-priority national agricultural needs.

Figure II-1-10 Structure of the Plant Gene Expression Center



Source: USDA
Note : UCB = Univ. of California Berkeley
CAES = California Agricultural Experiment Station

The stated mission of the PGEC is to provide the means to control plant gene expressions in order to develop plant germplasm with inherent higher productivity and quality characteristics, such as greater resistance and tolerance to pests, natural and manmade chemicals, toxic factors, climatic extremes, adverse soil and water conditions, and variable agronomic practices. The actual approaches to develop these means are stated as follows:

- Generating knowledge of the biochemical steps and developmental mechanisms responsible for plant productivity and quality characteristics

- Exploring the biochemical base of the genetic phenomena of heterosis, combining ability and inheritance

- Developing and characterizing genetically manipulated plant cells

- Correlating the biochemical steps and mechanisms with genetic control

- Developing and characterizing plant genetic vectors

- Developing and characterizing selection systems for identification and recovery of genetic variance at both the cellular and whole plant levels

To facilitate such development, the following two steps are planned to be taken.

- Contracting with and assisting public and private organizations and individuals that conduct research in plant genetic engineering

- Contracting with and assisting public and private organizations and individuals in the application of genetic engineering technologies

The research is expected to generate a spectrum of technologies which will be used to explore and develop approaches to elucidate the molecular and biochemical bases of plant stress, both biotic and abiotic. From this knowledge base, agricultural scientists will be able to develop plants with greater resistance and tolerance to pests, pesticides, heat and cold extremes, and poor soil and water conditions.

Apparently, the pattern of agricultural biotechnology development through the PGEC is very similar to that of the NIH in the past: namely, the tripartite development path involving government, universities, and private industry during the initial stage of technology generation. This approach of university involvement has the advantage of expanding the basis of fundamental knowledge in biology.

Japan is using different approaches for the promotion of biotechnology. In the first phase of technology development, the Government usually requests private industry to make the commitment by forming a research association which it will support. Private

industry will then contact a university either to establish consultation arrangements or training courses for receiving necessary basic information. One good example of this approach is the Research Association for Biotechnology which is being supported by the Ministry of International Trade and Industry (MITI). The following three areas have been selected for research and development in this research association.

- Development of bioreactors
- Development of large-scale cell cultivation technology
- Development of technology utilizing recombinant DNA

The Ministry of Agriculture, Forestry and Fisheries (MAFF) is about to establish a new biotechnology center involving both government and private industries within 1986. This center will focus on agricultural biotechnology in particular, and its actual objective is to promote biotechnology through private industry's participation. The MAFF is also using the government-private industry path to stimulate biotechnology research.

The basic ideas of the Japanese Government are that economic feasibility is one of the important factors in developing biotechnology, and that the involvement of private industry is indispensable. No commitment by universities to the government-promoted research path in Japan does not mean that they are not playing a key role in biotechnology development. Government research supports to universities are the matter of the Ministry of Education, and a fair size of budget allocation has been provided to the universities through this channel. The key difference between the USA and Japan in their respective industry-university relations is that such relations are not well formalized in Japan by comparison.

As described above, depending on the differences in social systems of the two countries, two different approaches are devised for the promotion of biotechnology, and both of them have been quite successful. The path for Argentina should be identified in accordance with its social system.

(4) Policy Suggestions

Agricultural biotechnology is definitely indispensable for Argentina. Policy suggestions for the country's promotion of agriculture-related biotechnology are shown below. As mentioned before, technology development is easily induced once the adequate research environment is established through the appropriate policy. The policy suggestions discussed here therefore mainly concern non-technical issues, as explained in 1-1-4. The suggestions assume that the INTA would be one of the key agencies in Argentina's agricultural biotechnology development, because the institution will and must play an important role with its long experience and expertise in agricultural development.

(a) Need of establishing basic strategy

In order to develop biotechnology, or indeed any technology, it is requisite to define the central goals. The writer strongly suggests that Argentina establish a national strategy for biotechnology development as early as possible before any actual action is taken. This will entail the following steps.

National strategy

A given agricultural system is said to be a function of economics, demography, geopolitics and technology, and the same is true for agriculture-based bioindustries. To establish a national strategy for agricultural biotechnology development, a comprehensive study must be conducted from the viewpoints mentioned above to assess the world impact of biotechnology, on the one hand, and the impact of biotechnology on Argentina, on the other. For this purpose, it is desirable to appoint a committee involving experts in the above mentioned areas.

Setting priorities

Research priorities should be determined, on the basis of the national strategy, through the identification and selection of specific program objectives for both short- and long-term research. In most of advanced countries, research priorities are established to develope crop varieties with higher inherent productivity and quality characteristics such as greater resistance and tolerance to environmental stresses and variable agronomic practices.

The suggested criteria for research priorities are as follows.

1) Technological significance
   - basic technologies with broad impacts (i.e., recombinant DNA and related vector systems)
2) Socio-economic significance
   - economic feasibility
   - impact on industrial structure
   - market significance (domestic and international)
   - social acceptance
3) International relation
   - international cooperation and competition (technology gap)
   - geopolitical consideration
   - resource availability (human, germplasm, etc.)
4) Environmental consideration
   - safety
   - conservation

It is neither practical nor possible for any single core organization like the INTA to achieve the leadership status in all areas of research defined by the national strategy. Selection of program objectives may depend upon the availability of scientific staff, technical and financial resources, and other socio-economic factors. Furthermore, program objectives based on strict modern biotechnology should not be established at the expense of conventional technology development.

New centralized research system

Agricultural biotechnology is a new technology system. For its promotion, a new, efficient centralized research system is definitely required. The new system should be established independently from the INTA, because the involvement of both academic and private sectors in addition to the INTA is essential to boost research efforts in new technology. The key functions of this new system are as follows.

- Providing infrastructure for promoting modern biotechnology which is complementary to the INTA
- Carrying out mission-oriented biotechnology research of national importance
- Providing backup research services to the INTA and other participating organizations

Biotechnology is a new technology and thus a new system is needed to develop this technology. New wine in a new bottle is desirable. The detail of this new system will be discussed further in the next section.

Periodic outside review

An advisory council consisting of some leadig scientists in the research community and reporting directly to the administrator of the new centralized research system should be appointed. The council would also regularly review the progress of projects in the new research system, and in addition suggest new directions for research and advise on strategies for guiding the national research.

It is imperative that the members of the advisory council be selected from individuals who have a strong research background and possess a global view of agricultural science and technology. Their selection should be based primarily on these strengths, independent of their affiliation, be it academic, industry, or government.

Budget

The new biology requires special equipment and supplies, such as specialized biologicals, tissue culture supplies, etc. In development research, adequate budget allocations for purchasing equipment and supplies are essential. At the same time, it is necessary to remember that the flexibility to alter directions in exploratory research is critical to attain scientific excellence. It is true that long-term financial planning is essential, but the budget must be allocated with adequate flexibility to allow redirection of research efforts to unexpected but promising new areas.

(b) Need of a new centralized system

Biotechnology is multidisciplinary by its nature, and thus the existence of a broader research network is desirable for promoting its development. The existing research systems in Argentina may have some problems in meeting the urgent needs of new technology development in agriculture. Suggestions for a new centralized system which promotes and monitors the technology development are described below.

Centralized research system

For the promotion of biotechnology, it is desirable to establish a centralized research system that involves public (e.g.,the INTA), academic and private sectors, and thereby to facilitate systematic technology development, information exchange and technology transfer. The new system can function both as a research institute by itself and as a body which provides funds for the outside research. In other words, the new system needs to function as both hardware and software systems that can meet the requirements for new technology development. The organizations like the PGEC of the USA is one of the approximate examples.

The functions of this centralized research system is tentatively suggested as follows:

1) Research function (a research center for modern biotechnology)
   - basic technology development
   - mission-oriented research (multidisciplinary approach)
2) Consortium (public/academic/industry)
   - technology transfer
   - mission-oriented system development
   - business development
   - incubator for bioindustry
3) Technical support
   - analytical center (biological, chemical, physical)
   - training
   - information service
4) Research coordination
   - coordination of the national biotechnology program
   - funding extramural research
   - international exchange program

Research function (interdisciplinary)

The new biology provides a set of techniques that will make it possible to advance the basic understanding of major biological systems and processes. This understanding should then be translated to new technologies. Central to the successful use of these newer techniques is the promotion of interdisciplinary research. This centralized research system can function in a manner complementary to the INTA by facilitating interdisciplinary research in agriculture. It is desirable that the new system establish its own new research institute for promoting the national basic genetic engineering research and mission-oriented research.

Consortium

The consortium of public, academic and industrial sectors founded under the new centralized system will provide the core research staff to the research institute mentioned above. The basic functions of the consortium are to develop Argentina's bioindustries. One of the apparent deficiencies of Argentina's on-going activities in biotechnology is its weakness in bioindustries. Biotechnology basically generates technologies for industrial use, and the word "industrial" here means industries in a wider sense (including agriculture) but not manufacturing alone. Biotechnology is thus closely related with the growth of bioindustries which utilize fruits of research findings in tangible manners.

During the initial phase of biotechnology development, one of the key issues in advanced countries has been to identify an effective approach to foster bioindustries. There are quite a number of examples showing that the centralized system acting as an incubator of new technologies is an excellent approach for this purpose. Argentina should be able to incubate their infant technologies for tomorrow's industrial use, by having the consortium pursue the programs of mission-oriented system development and transferring the technologies therefrom to the partipating sectors.

Technical support

Supporting functions are important for developing advanced technology, especially at its initial phase, because the availability of resources is usually limited. Generally, there are high demands for technical supports in the area of routine analytical services due to the limited availability of equipment, skills, etc. at the start-up phase of the research. Technical services by an analytical center should be able to allow Argentina's scientific staff to compete effectively with researchers throughout the world.

The proposed centralized system should also provide the training programs for the staff of the INTA and the scientists from the outside sectors. By this approach, the research community of Argentina can enhance the capabilities of some of its scientinsts in newer research-oriented methods.

The effective information service is also another key to the progress of technology. Such an information service system should cover not only the technical information but also the relevant socio-economic information.

Research coordination

One of the key approaches to the promotion of biotechnology is to coordinate the national program that links the research activities of the public, academic and industrial sectors. Many approaches to link such sectors are possible, but funding through the national program seems to be the most effective approach.

International cooperation is particularly important in exchange of technology and germplasms. The activity of international cooperation such as exchange programs of scientists should be incorporated and coordinated by the new centralized system.

(5) Suggested Approach

In Argentina, agriculture is obviously the most important industry. Biotechnology has the potential of making significant contributions to Argentine agriculture. There are three major research goals for Argentina's agricultural development as follows.

1) Development of plant biotechnology related to breeding
2) Development of animal biotechnology such as reproduction technology
3) Development of microbial biotechnology related to biological control, fermentation, etc.

The majority of these technologies need be developed under the long-range program, and the impact of the technology development might not be able to materialize in the short run. On the other hand, there are also quite a number of short-range research programs which can help Argentina to solve the problems that it faces today. The best approach would be to identify an effective short-range program which has both the technological continuity as a part of the long-range national program and the technological significance for solving the current problems.

Assuming that plant biotechnology development is the national program objective, the development of technologies related to biomass industry could be promoted as one of the strategic goals, as suggested in Figure II-1-11. The basic understanding behind this suggestion is as follows.

- Argentina's sugar industry is currently facing economic difficulties and may need diversification.

- The progress of technology to produce high fructose corn syrup may also aggravate the problem in the future.

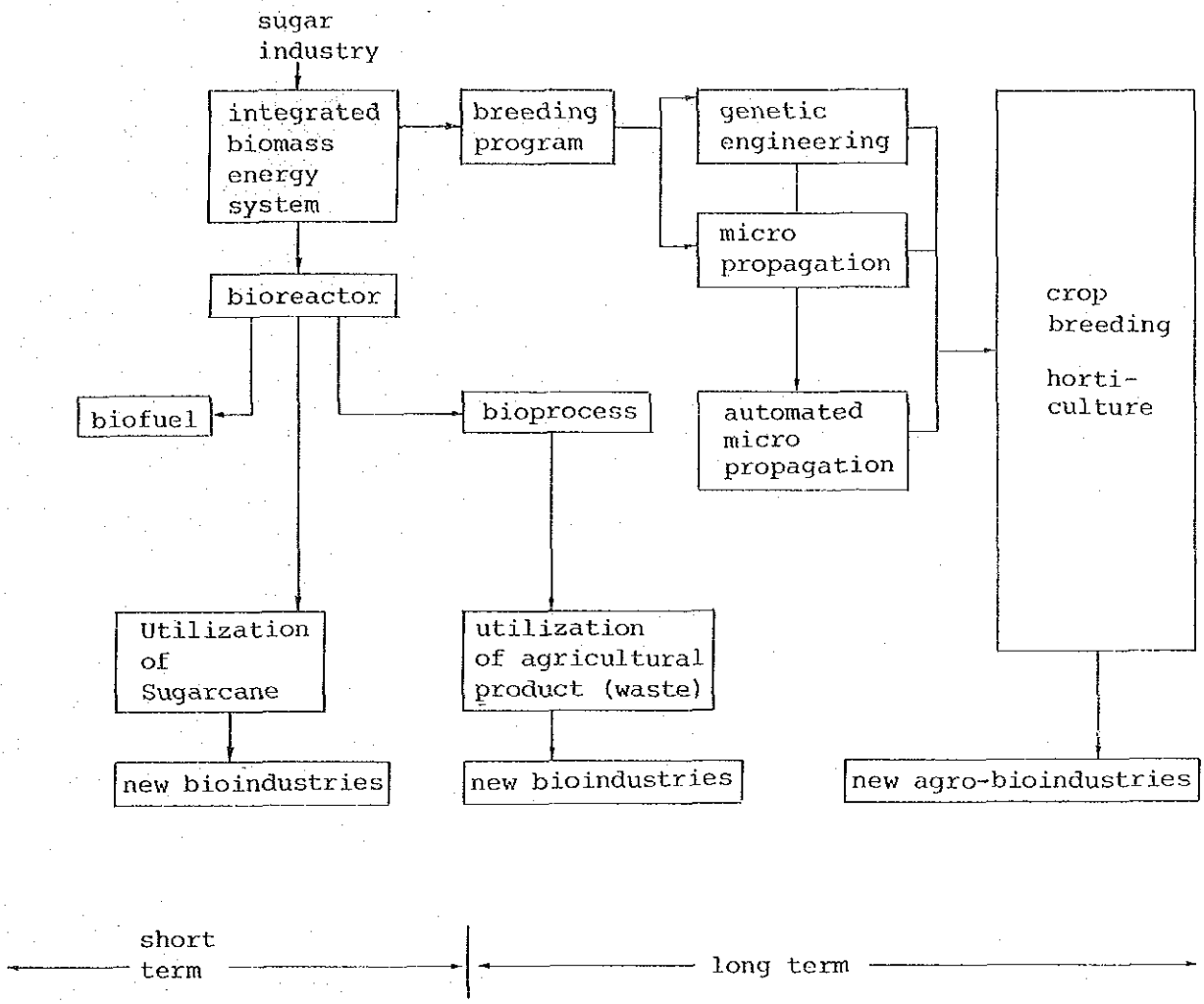
- Biomass industry is expected to be able to solve the local energy problem, if the resources are available. Sugarcane is an excellent raw material for biomass energy production in Argentina.

- The nature of biomass industry is the linkage of agriculture and energy industry. The present approach will provide an opportunity for Argentina to learn how to develop new biotechnology by interfacing agriculture and industry.

- Sugar industry has the high potentiality to develop into a new bioindustry

- The development of such a bioindustry would provide the foundation for promoting new bioindustries in the future.

Figure II-1-11 Suggested Approach in Plant Biotechnology



Source: BioTechno System, Inc.

- As shown in Figure II-1-11, biomass energy technology has many technological interfaces with plant biotechnology.

The basic idea is in developing technologies required for producing sugarcane-based fuel ethanol effectively in Argentina. Some of the technologies like the bioreactor system using immobilized yeast has been already developed and the key objective of the proposed program is how to develop an integrated biomass energy system.

The need of developing agricultural biotechnology in Argentina is obvious. For this purpose, the importance of simultaneous promotion of both long-range and short-range research programs is evident. The key issues are, again, to define what is the national goal and to identify how to approach this goal.

Before closing this section, it must be noted that Argentine scientists have been successful in bringing out some excellent research outputs despite a variety of constraints and unfavorable conditions. It should be emphasized here that human resources are the most important factor to new technology development. No matter how the system is beautifully designed, the performance of the system heavily relies on the human resources which man it. From this point of view, the training of scientists, particularly those who have the firm grasp of both technology and socio-economics, is probably the most important issue for Argentina at the present moment.

1-3-3 Market Prospects of Major Grains

(1) Introduction

This section examines the trends in supply and demand situations of selected grains (rice, wheat, maize and soybean) in Asia in the past decade or so, and discusses prospects of consumption and import in Asia for the later 1980s.

Because Asia comprises a sizable number of countries, the present study limits its more detailed examination of consumption and import dependence to eight selected countries in East and Southeast Asia: namely, Hong Kong, Korea, Singapore, Indonesia, Malaysia, the Philippines, Thailand and Japan. All of these countries are market economies, and seven developing countries have attained substantial economic development in the past decade, accompanied by increased per capita consumption of major food items. According to the World Bank's World Development Report in 1985, per capita GNPs in 1983 and their annual growth rates during 1960-1983 were estimated to be US$560 and 5.0% for Indonesia, US$820 and 4.3% for Thailand, US$780 and 2.9% for the Philippines, US$1,860 and 4.5% for Malaysia, US$2,010 and 8.7% for Korea, US$6,000 and 6.2% for Hong Kong, US$6,620 and 7.8% for Singapore, and US$10,120 and 4.8% for Japan. They and Japan are expected to continue their dynamic growth in the future. As a group, they are hereafter referred to as Selected Asia, and sometimes subgrouped into NICs-3 (Hong Kong, Korea and Singapore) and ASEAN-4 (the rest of the countries).

In order to keep the trends in these countries in some wider perspective, however, the study refers to two regional groupings of Asia: namely, Asia as employed in FAO statistics which includes countries in Near East (hereafter referred to as Asia Total) and Far East Asia which excludes Near East from Asia Total.

(2) Asia in world production and trade

(a) World trend

Food currently accounts for some 70% of the world trade in agricultural commodities in terms of value, and cereals in turn make up roughly 20% of the world food trade. World production of cereals grew at an annual rate of 2.5% from 1969/71 average to 1979/81 average (Table II-1-39). The increase in production was widely spread from developed countries (especially in Western Europe in the later 1970s in addition to major producers like the USA, Canada and Australia) to developing countries and centrally planned economies. The trend on the whole continued into the early 1980s, except for centrally planned economies, most notably the USSR which recorded a substantial decline in their production.

The distribution of the production of three major cereals in 1984 is as follows. With respect to wheat, the developed countries in North America (the USA and Canada) and Western Europe, which accounted for 13% of the world population, produced 35% of the total production of 522 million tons, while the developing countries in Africa, Asia and South and Central America, which made up 50% of the world population, produced only 15%. The combined share of two major centrally planned economies, i.e., the USSR and China, was 31% (17% for China alone) relative to their share of 28% in the world population. Of the total maize production of 449 million tons, the same developed countries accounted for 53% (43% for the USA alone), compared with 21% for the developing countries, and 19% for the planned economies (16% for China). The pattern is different for rice, a regional crop in Asia: the share of the developing countries was 51% (46% for Asia alone), compared with 2% in the developed countries above and 39% in the planned economies (38.5% in China).

World trade of cereals expanded more rapidly than production, growing at an annual rate of 7.1% from 1969/71 to 1979/81. The ratio of export to production thus rose from 10% to 15% over the period, indicating the increased importance of cereals as internationally traded goods. The rise in the export ratio was more rapid in coarse grains than food grains, reflecting the increased consumption of livestock feeds in the world. Maize, for instance, nearly doubled its export ratio from 10% to 19% over the same period, while the ratio for wheat rose from 17% to 22%. With respect to rice, Far East Asia accounts for 90% of world production and 60% of world trade in 1979/81. Its export ratio thus remains low, rising from 4.4% to 4.9% over the same period.

World production and trade of soybean also shows a similar trend. The increase in its production was even more rapid than cereals, growing at an annual rate of 6.6% from 1969/71 to 1979/81, but declined slightly in the subsequent years. Of the total production of

Table II-1-39 Production and Trade of Selected Grains in World and Asia

(1,000 tons %)

	Production	Import	Export	Consumption	Sufficiency Rate	Exp/Prod Ratio
			(1) Total Cereals			
World						
1969/71	1,136,615	109,167	110,534	1,135,248	100.1	9.7
1979/81	1,453,112	217,555	218,956	1,451,711	100.1	15.1
1982/83	1,520,223	221,442	223,030	1,518,635	100.1	14.7
Annual Growth (69/71-79/81)	2.5	7.1	7.1	2.5		
Asia Total						
1969/71	386,978	41,355	7,997	420,336	92.1	2.1
1979/81	514,810	75,737	12,644	577,903	89.1	2.5
1982/83	570,590	84,291	13,362	641,519	88.9	2.3
Annual Growth (69/71-79/81)	2.9	6.2	4.7	3.2		
Far East Asia						
1969/71	345,952	34,663	7,053	373,562	92.6	2.0
1979/81	459,777	55,888	11,176	504,489	91.1	2.4
1982/83	514,654	58,713	11,317	562,050	91.6	2.2
Annual Growth (69/71-79/81)	2.9	4.9	4.7	3.1		
			(2) Milled Rice			
World						
1969/71	202,632	8,765	8,857	202,540	100.0	4.4
1979/81	257,249	12,767	12,668	257,348	100.0	4.9
1982/83	283,820	11,691	11,838	283,673	100.1	4.2
Annual Growth (69/71-79/81)	2.4	3.8	3.6	2.4		
Asia Total						
1969/71	185,967	6,074	5,438	186,603	99.7	2.9
1979/81	233,880	6,556	7,806	232,630	100.5	3.3
1982/83	260,632	4,848	7,341	258,139	101.0	2.8
Annual Growth (69/71-79/81)	2.3	0.8	3.7	2.2		
Far East Asia						
1969/71	183,032	5,590	4,767	183,855	99.6	2.6
1979/81	230,785	4,683	7,630	227,838	101.3	3.3
1982/83	257,429	2,926	7,286	253,069	101.7	2.8
Annual Growth (69/71-79/81)	2.3	-1.8	4.8	2.2		
			(3) Wheat			
World						
1969/71	329,274	53,644	53,754	329,164	100.0	16.3
1979/81	442,664	95,600	95,596	442,668	100.0	21.6
1982/83	492,303	107,750	108,297	491,756	100.1	22.0
Annual Growth (69/71-79/81)	3.0	5.9	5.9	3.0		
Asia Total						
1969/71	80,295	21,878	313	101,860	78.8	0.4
1979/81	136,423	34,753	1,472	169,704	80.4	1.1
1982/83	160,782	40,128	1,215	199,695	80.5	0.8
Annual Growth (69/71-79/81)	5.4	4.7	16.7	5.2		
Far East Asia						
1969/71	58,806	16,478	266	75,018	78.4	0.5
1979/81	105,139	23,212	647	127,704	82.3	0.6
1982/83	128,304	24,610	465	152,449	84.2	0.4
Annual Growth (69/71-79/81)	6.0	3.5	9.3	5.5		

Table II-1-39 (continued)

	Production	Import	Export	Consumption	Sufficiency Rate	Exp/Prod Ratio
			(4) Maize			
World						
1969/71	293,753	28,994	29,249	293,498	100.1	10.0
1979/81	422,192	78,195	78,616	421,771	100.1	18.6
1982/83	397,592	69,631	69,641	397,582	100.0	17.5
Annual Growth (69/71-79/81)	3.7	10.4	10.4	3.7		
Asia Total						
1969/71	60,729	7,258	1,906	66,081	91.9	3.1
1979/81	84,689	23,760	2,660	105,789	80.1	3.1
1982/83	86,888	27,451	3,063	111,275	78.1	3.5
Annual Growth (69/71-79/81)	3.4	12.6	3.4	4.8		
Far East Asia						
1969/71	56,483	6,999	1,904	61,578	91.7	3.4
1979/81	79,163	20,730	2,591	97,303	81.4	3.3
1982/83	80,902	19,525	3,001	97,426	83.0	3.7
Annual Growth (69/71-79/81)	3.4	11.5	3.1	4.7		
			(5) Soybean			
World						
1969/71	44,820	11,783	11,410	45,193	99.2	25.5
1979/81	86,946	26,339	26,154	87,131	99.8	30.1
1982/83	85,892	27,622	27,706	85,808	100.1	32.3
Annual Growth (69/71-79/81)	6.9	8.4	8.6	6.8		
Asia Total						
1969/71	10,662	4,012	473	14,201	75.1	4.4
1979/81	11,233	7,163	215	18,181	61.8	1.9
1982/83	11,811	7,882	276	19,417	60.8	2.3
Annual Growth (69/71-79/81)	0.5	6.0	-7.6	2.5		
Far East Asia						
1969/71	10,645	4,005	473	14,177	75.1	4.4
1979/81	11,025	7,030	215	17,840	61.8	2.0
1982/83	11,503	7,769	276	18,996	60.6	2.4
Annual Growth (69/71-79/81)	0.4	5.8	-7.6	2.3		

Source: FAO, Production Yearbook and Trade Yearbook, various issues.

9 million tons in 1984, the above-mentioned developed countries made up 58% (56% in the USA), developing countries 30% and the two planned economies 11%. The export of soybean expanded at a rate of 8.3% per annum, and its ratio to production thus rose from 26% in 1969/71 to 32% in 1982/83.

The structure of world trade in cereals has undergone some significant changes from the early 1970s to the early 1980s. Developed countries as a whole substantially reduced their share in the world import of cereals from 53% to 33%, reflecting a slowdown in the growth of their per capita consumption. Among the developed countries, Japan alone remains a major importer of cereals. The developed countries traditionally have been the major producers of exportable surplus, but their share in the world total export of cereals expanded further over the same period from 72% to 85%. Furthermore, the exportable surplus became increasingly concentrated

in a limited number of major producers in the developed world and this is especially pronounced in coarse grains like maize.

In contrast, centrally planned economies reduced their exportable surplus because of the increased domestic demand and faltering production, while increasing the dependence on import. Their share in the world export declined from 11% to 3%, whereas their share in the world import rose from 17% to 32%, indicating their widened supply and demand gap.

Despite the notable expansion observed in production, developing countries as a whole also reduced their share in export from 17% to 12% and increased their share in import from 30% to 35%. This was mainly due to their rapid population increase and the improved levels of nutrition that accompanied their economic development. Especially notable is the emergence of Near East countries as sizable importers of cereals.

In brief, the current structure of world trade in cereals is characterized by the surplus in the developed world which chiefly flows to the centrally planned economies, the developing world and Japan. Considering the increasing output of cereals in major exporting countries in the developed world, this structure will continue in the foreseeable future.

(b) Trend in Asia

The annual growth of 2.9% in total cereal production in Far East Asia during the 1970s was appreciably higher than 2.5% of the world production. But the increase was generally to supply food to domestic markets, and the ratio of export to production, though rising, remained well below 5%.

The general trend in Asia over the 1970s can be summarized as improved regional self-sufficiency in food grains and increased import dependence in coarse grains. Total consumption (apparent consumption = production + import - export) of wheat in Far East Asia as a whole, for instance, increased at an annual rate of 5.5% from 1969/71 to 1979/81, which was substantially higher than 3.0% for the world (Table II-1-39). Production grew 6.0% per annum over the same period, raising the rate of self-sufficiency from 78% to 82%. As a result, the region's share in the world total import of wheat declined from 31% to 24%.

Far East Asia's self-sufficiency in rice was already very high in the beginning of the 1970s, but due to the 2.3% annual growth of production, self-sufficiency rose to a little over 100% by the early 1980s, and the region's share in the world total import of rice declined from 64% to 37% over the period.

In contrast to wheat and rice, Far East Asia's self-sufficiency in maize declined over the same period from 92% to 81%. The region's production grew at an annual rate of 3.4% in the 1970s, slightly lower than 3.7% of the world total production, but consumption increased more rapidly at 4.8%, which was higher than 3.6% of the world total. The region's import thus expanded 11.5% per annum and its share in the

world total import rose from 24% in 1969/71 to 28% in 1982/83. Maize is consumed as one of the staple crops in a number of Asian countries, but the rapid growth of import was related with its increased consumption as feedstuffs for livestock in the region.

Asia also reduced its level of self-sufficiency in soybean. Consumption in Far East Asia rose only moderately at 2.3% per annum from 1969/71 to 1979/81 compared with 6.6% of the world total. But stagnant production which only grew at an annual rate of 0.35% reduced the region's rate of self-sufficiency from 75% to 62%. The annual growth of import (grains only) in the region was 5.6%, which was significantly lower than 8.0% of the world total, reflecting the availability of other oilseeds and nuts for extracting vegetable oils in the region.

(c) Trend in Selected Asia

Table II-1-40 summarizes the trend in production and trade of selected cereals and soybean in eight East and Southeast Asian countries. Selected Asia produced approximately 14% of the total cereal production in Far East Asia in 1979/81, but its share in trade was very high, accounting for 67% of import and 61% of export in the region. The bulk of import was destined to Japan, which accounted for 88% of Selected Asia's total cereal import, while a little more than 80% of its export originated in ASEAN-4, more specifically in Thailand which exports rice, maize, and other minor cereals like sorghum and millet.

The overall trend in the past decade was similar to Far East Asia as a whole. That is, Selected Asia attained self-sufficiency in rice, their major staple, by increasing its production at an annual rate of 2.5%. The subgroup of NICs-3 shows a lower rate of self-sufficiency because it contains Hong Kong and Singapore which do not produce rice. In the case of wheat, Selected Asia which do not include sizable producers depend almost entirely on import to meet their domestic demand. The annual growth of total consumption in the 1970s was moderate at 2.3% per annum, but it must be noted that ASEAN-4 increased its consumption rapidly at the annual rate of 6.1%, while the growth rates of demand in Japan and NICs-3 have been small.

In contrast to rice, Selected Asia's import dependence in maize rose from about 40% to over 60% during the 1970s, as their total consumption of maize grew at an annual rate of 8.4% vis-a-vis the increase of 4.7% per annum in production. Selected Asia accounted for 81% of Far East Asia's total import of maize in 1979/81, and Japan in turn made up three-fourths of Selected Asia's total import. Although the total volume is small by comparison with Japan, NICs-3 increased its total demand and import at the rate of some 20% per annum during the 1970s apace with increased consumption of poultry meat and pork in their diet. ASEAN-4 include producers of maize, notably Thailand which began to increase production primarily for export in the 1960s, and Indonesia and the Philippines which consume white maize as staple next to rice. Although those producing countries substantially increased their output of maize during the last decade, the rising domestic demand for maize as feedstuffs for poultry and other

Table II-1-40 Production and Trade of Selected Grains in Selected Asia

(1,000 tons)

	Production	Import	Export	Consumption	Self-Sufficiency(%)	Exp/Prod Ratio
			(1) Total Cereals			
Total						
1963/65	39,268	13,290	3,155	49,403	79.5	8.0
1969/71	49,168	21,700	4,106	66,762	73.6	8.4
1974/76	54,966	27,773	4,244	78,495	70.0	7.7
1979/81	62,773	37,366	6,801	93,338	67.3	10.8
1982/83	65,978	37,703	8,137	95,544	69.1	12.3
Annual Growth (69/71-79/81)	2.5	5.6	5.2	3.4		
Japan						
1963/65	13,087	8,730	99	21,718	60.3	0.8
1969/71	11,899	14,718	742	25,875	46.0	6.2
1974/76	11,001	19,643	140	30,504	36.1	1.3
1979/81	9,658	24,519	841	33,336	29.0	8.7
1982/83	9,542	24,831	597	33,776	28.3	6.3
Annual Growth (69/71-79/81)	-2.1	5.2	1.3	2.6		
NICs-3						
1963/65	3,265	2,049	370	4,944	66.0	11.3
1969/71	6,092	4,042	271	9,863	61.8	4.4
1974/76	6,126	4,368	263	10,231	59.9	4.3
1979/81	5,700	7,988	442	13,246	43.0	7.8
1982/83	5,853	8,476	765	13,564	43.2	13.1
Annual Growth (69/71-79/81)	-0.7	7.0	5.0	3.0		
ASEAN-4						
1963/65	22,916	2,511	2,686	22,741	100.8	11.7
1969/71	31,177	2,940	3,093	31,024	100.5	9.9
1974/76	37,839	3,762	3,841	37,760	100.2	10.2
1979/81	47,415	4,859	5,518	46,756	101.4	11.6
1982/83	50,583	4,396	6,775	48,204	104.9	13.4
Annual Growth (69/71-79/81)	4.3	5.2	6.0	4.2		
			(2) Milled Rice			
Total						
1963/65	31,768	2,981	1,945	32,804	96.8	6.1
1969/71	38,674	2,662	1,896	39,440	98.1	4.9
1974/76	44,264	2,296	1,449	45,111	98.1	3.3
1979/81	49,710	3,585	3,784	49,511	100.4	7.6
1982/83	53,378	2,238	4,020	51,596	103.5	7.5
Annual Growth (69/71-79/81)	2.5	3.0	7.2	2.3		
Japan						
1963/65	10,638	535	0	11,173	95.2	0.0
1969/71	10,577	29	623	9,983	106.0	5.9
1974/76	10,477	40	107	10,410	100.6	1.0
1979/81	8,658	35	716	7,977	108.5	8.3
1982/83	8,384	40	324	8,100	103.5	3.9
Annual Growth (69/71-79/81)	-2.0	1.9	1.4	-2.2		
NICs-3						
1963/65	3,293	849	191	3,951	83.3	5.8
1969/71	3,632	1,447	47	5,032	72.2	1.3
1974/76	4,316	860	22	5,154	83.7	0.5
1979/81	4,407	1,797	21	6,183	71.3	0.5
1982/83	4,848	1,063	12	5,899	82.2	0.2
Annual Growth (69/71-79/81)	2.0	2.2	-7.7	2.1		
ASEAN-4						
1963/65	17,837	1,597	1,754	17,680	100.9	9.8
1969/71	24,465	1,186	1,226	24,425	100.2	5.0
1974/76	29,471	1,396	1,320	29,547	99.7	4.5
1979/81	36,645	1,753	3,047	35,351	103.7	8.3
1982/83	40,146	1,135	3,684	37,597	106.8	9.2
Annual Growth (69/71-79/81)	4.1	4.0	9.5	3.8		

Table II-1-40 (continued)

	Production	Import	Export	Consumption	Self-Sufficiency(%)	Exp/Pro Ratio
			(3) Wheat			
Total						
1963/65	1,361	5,305	241	6,425	21.2	17.7
1969/71	906	8,094	173	8,827	10.3	19.1
1974/76	316	9,451	154	9,613	3.3	48.7
1979/81	634	10,875	421	11,088	5.7	66.4
1982/83	834	11,334	397	11,771	7.1	47.6
Annual Growth (69/71-79/81)	-3.5	3.0	9.3	2.3		
Japan						
1963/65	1,082	3,527	98	4,511	24.0	9.1
1969/71	558	4,628	49	5,137	10.9	8.8
1974/76	232	5,619	34	5,817	4.0	14.7
1979/81	570	5,747	126	6,191	9.2	22.1
1982/83	745	5,765	276	6,234	12.0	37.0
Annual Growth (69/71-79/81)	0.2	2.2	9.9	1.9		
NICs-3						
1963/65	279	942	139	1,082	25.8	49.8
1969/71	348	1,955	108	2,195	15.9	31.0
1974/76	84	1,919	104	1,899	4.4	123.8
1979/81	64	2,413	273	2,204	2.9	426.6
1982/83	89	2,336	95	2,330	3.8	106.7
Annual Growth (69/71-79/81)	-15.6	2.1	9.7	0.0		
ASEAN-4						
1963/65	0	836	4	832	0.0	
1969/71	0	1,511	16	1,495	0.0	
1974/76	0	1,913	16	1,897	0.0	
1979/81	0	2,715	22	2,693	0.0	
1982/83	0	3,233	26	3,207	0.0	
Annual Growth (69/71-79/81)		6.0	3.2	6.1		
			(4) Maize			
Total						
1963/65	5,200	3,333	944	7,589	68.5	18.2
1969/71	6,798	6,291	1,851	11,238	60.5	27.2
1974/76	8,359	9,474	2,428	15,405	54.3	29.0
1979/81	10,777	16,816	2,379	25,214	42.7	22.1
1982/83	10,461	19,712	2,913	27,260	38.4	27.8
Annual Growth (69/71-79/81)	4.7	10.3	2.5	8.4		
Japan						
1963/65	88	3,103	0	3,191	2.8	0.0
1969/71	33	5,505	3	5,535	0.6	9.1
1974/76	13	7,931	0	7,944	0.2	0.0
1979/81	4	12,609	0	12,613	0.0	0.0
1982/83	2	14,136	0	14,138	0.0	0.0
Annual Growth (69/71-79/81)	-19.0	8.6		8.6		
NICs-3						
1963/65	32	158	37	153	20.9	115.6
1969/71	164	546	88	622	26.4	53.7
1974/76	171	1,147	127	1,191	14.4	74.3
1979/81	268	3,472	133	3,607	7.4	49.6
1982/83	313	4,333	185	4,461	7.0	59.1
Annual Growth (69/71-79/81)	5.0	20.3	4.2	19.2		
ASEAN-4						
1963/65	5,080	72	907	4,245	119.7	17.9
1969/71	6,601	240	1,760	5,081	129.9	26.7
1974/76	8,175	396	2,301	6,270	130.4	28.1
1979/81	10,505	735	2,246	8,994	116.8	21.4
1982/83	10,146	1,243	2,728	8,661	117.1	26.9
Annual Growth (69/71-79/81)	4.8	11.8	2.5	5.9		

Table II-1-40 (continued)

	Production	Import	Export	Consumption	Self-Sufficiency(%)	Exp/Pro Ratio
			(5) Soybean			
Total						
1963/65	822	1,729	19	2,532	32.5	2.3
1969/71	880	3,100	18	3,962	22.2	2.0
1974/76	1,111	3,621	29	4,703	23.6	2.6
1979/81	1,215	5,137	26	6,326	19.2	2.1
1982/83	1,151	5,850	23	6,978	16.5	2.0
Annual Growth (69/71-79/81)	3.3	5.2	3.7	4.8		
Japan						
1963/65	263	1,666	0	1,929	13.6	0.0
1969/71	128	3,016	0	3,144	4.1	0.0
1974/76	123	3,377	0	3,500	3.5	0.0
1979/81	193	4,243	0	4,436	4.4	0.0
1982/83	222	4,670	0	4,892	4.5	0.0
Annual Growth (69/71-79/81)	4.2	3.5		3.5		
NICs-3						
1963/65	164	34	11	187	87.7	6.7
1969/71	228	62	10	280	81.4	4.4
1974/76	308	150	14	444	69.4	4.5
1979/81	230	566	18	778	29.6	7.8
1982/83	245	679	20	904	27.1	8.2
Annual Growth (69/71-79/81)	0.1	24.8	6.1	10.8		
ASEAN-4						
1963/65	395	29	8	416	95.0	2.0
1969/71	524	22	8	538	97.4	1.5
1974/76	680	94	15	759	89.6	2.2
1979/81	792	328	8	1,112	71.2	1.0
1982/83	684	501	3	1,182	57.9	0.4
Annual Growth	4.2	31.0	0.0	7.5		

Source: FAO, Production Yearbook and Trade Yearbook, various issues.

livestock has been either increasing their import or decreasing the ratio of export to production.

None of the eight selected countries are sizable producers of soybean, although their consumption has been rising substantially in the past decade. Selected Asia as a whole expanded its consumption at an annual rate of 4.7%, while production increased at a rate of 3.2%. The largest consumer is again Japan, accounting for 70% of total demand and well over 80% of total import in Selected Asia. But it is notable that NICs-3 and ASEAN-4 have rapidly increased their consumption in the latter half of the 1970s.

(3) Characteristics and prospects of consumption in Selected Asia

(a) Consumption as food of selected cereals and soybean

Table II-1-41 shows per capita consumption of major cereals and soybean as food based on FAO's food balance sheets for 1975/77 and 1979/81. In 1979/81 average, total calorie intake per head of population ranges from Singapore's highest 3,165 Kcal to Thailand's 2,330 Kcal, and the proportion of calorie taken from cereals is generally lower in countries with higher levels of income. Except for

Table II-1-41 Per Capita Consumption of Selected Cereals and Soybean as Food in Selected Asia

	Indonesia	Malaysia	Philippines	Thailand	Hong Kong	Korea	Singapore	Japan
1975/77 Average:								
Total Calorie(Kcal/day)	2,115	2,596	2,128	2,206	2,672	2,683	3,040	2,848
% from cereals	66.4	57.3	61.6	70.3	40.3	72.5	47.2	46.1
Consumption of cereals(kg/year)	141.9	148.5	130.8	154.7	107.9	199.4	144.0	132.0
Of which, rice	114.4	25.7	83.8	146.4	70.0	121.9	75.2	90.7
wheat	4.6	25.7	10.1	1.7	28.1	31.5	37.5	32.1
maize	17.6	1.9	36.9	2.2	9.1	1.0	29.5	7.7
Consumption of nuts and oil-seeds(kg/year)	19.7	4.7	6.7	12.0	7.9	10.1	7.4	25.4
Of which, soybean	4.2	1.6	0.2	0.6	3.4	8.5	2.7	17.1
Consumption of vegetable oils (kg/year)	5.4	8.0	4.0	1.4	11.2	0.8	6.7	9.9
Of which, soybean oil	-	0.7	0.1	0.2	2.1	0.2	1.0	4.1
1979/81 Average:								
Total Calorie(Kcal/day)	2,372	2,518	2,405	2,330	2,771	3,056	3,165	2,852
% from cereals	68.4	51.1	59.5	66.1	34.5	67.7	45.6	43.4
Consumption of cereals(kg/year)	217.9	195.9	207.7	230.4	141.4	315.8	204.2	183.5
Of which, rice	185.2	152.9	136.4	223.4	96.3	207.6	109.6	
wheat	8.4	33.8	15.7	3.7	40.6	38.8	41.3	32.4
maize	24.4	2.3	55.5	32.0	3.4	16.3	18.1	
Consumption of nuts and oil-seeds(kg/year)	30.7	2.7	4.0	12.0	9.1	10.7	3.7	11.5
Of which, soybean	4.7	0.0	0.1	0.8	3.5	8.6	2.6	9.1
Consumption of vegetable oils (kg/year)	6.1	11.0	4.2	2.4	14.7	2.7	7.9	11.8
Of which, soybean oil	-	0.7	0.2	0.5	1.3	1.4	3.4	4.5
Total supply of maize(1000mt)	3,830	441	3,390	410	285	2,859	366	10,198
Used as feedstuff(%)	2.0	87.8	4.2	22.7	88.4	77.0	67.5	80.8
Total supply of soybean(1000mt)	766	90	17	111	19	699	41	4,382
Industrial use(%)	3.9	96.7	64.7	60.4	5.2	47.9	83.4	73.3

Source: FAO, Food Balance Sheets: 1975-77 Average, 1980, and 1979-81 Average, 1984.

Korea which depends 67.6% of calorie on cereals, cereals account for well below 50% of total calorie intake in the NICs and Japan.

Levels of per capita consumption of cereals as food substantially increased during the period of 1975/77 - 1979/81 in the eight selected countries, but show wide variations ranging from 141.4 kg per year in Hong Kong to as high as 315.8 kg in Korea on 1979/81. But the Asian characteristic is seen in the predominance of rice in consumption. The most pronounced example is Thailand where 97% of cereal consumption is made up by rice.

Other major cereals consumed as food are wheat and maize. Per capita consumption of wheat is generally larger in higher-income countries. Among the ASEAN countries, Malaysia has the highest level of per capita consumption of wheat, which is comparable to those in the NICs. This is partly due to the country's policy to develop the domestic milling industry, which helped to keep the consumer price of wheat generally lower than that of rice. Maize (white maize) is traditionally consumed as staple next to rice in the Philippines and Indonesia. As seen in Table II-1-41, the larger part of the total supply of maize is consumed as feeds in higher-income countries like Japan, NICs-3 and Malaysia.

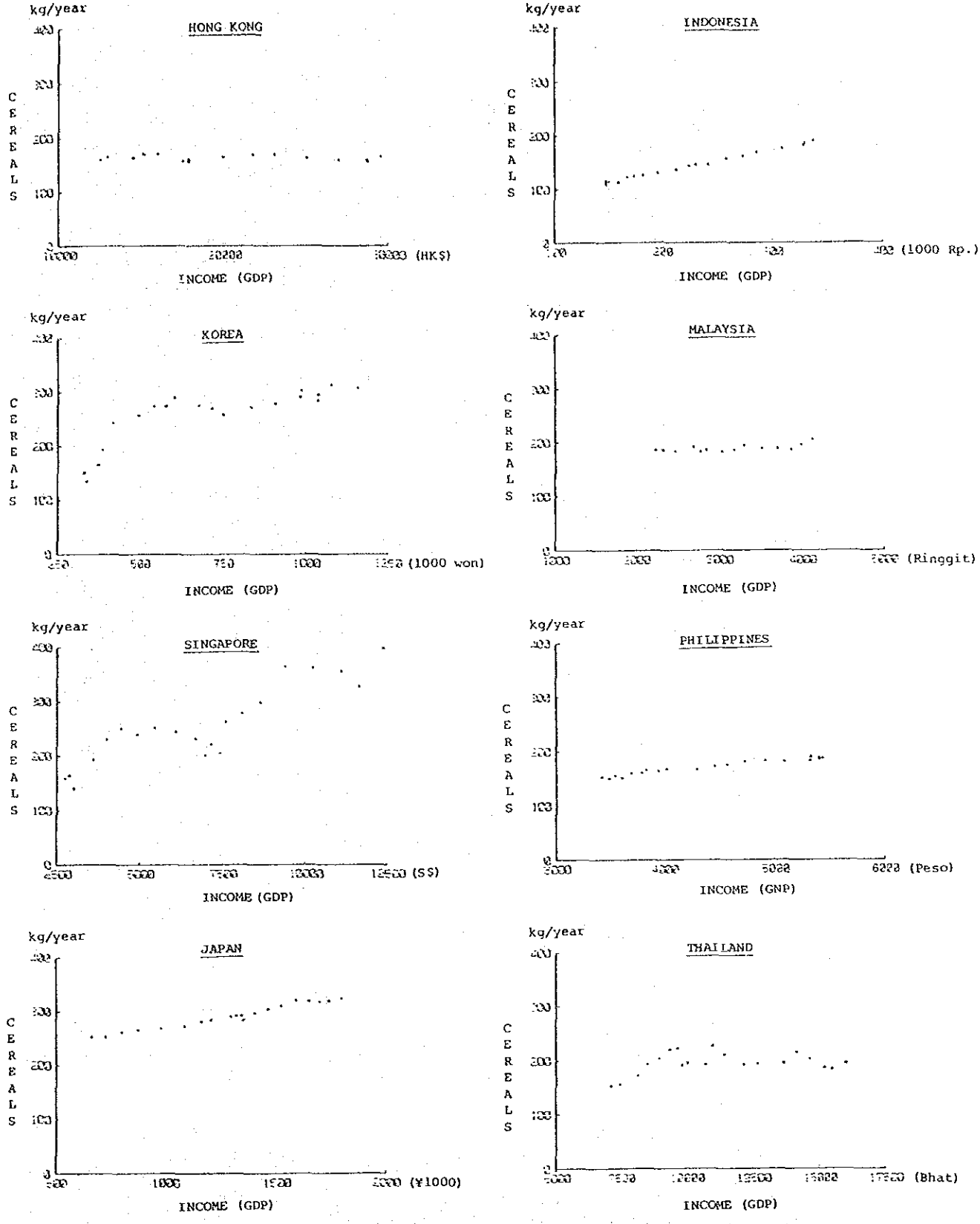
Consumption of soybean as food shows some distinct differences among the eight countries. Japan, Korea and other countries with Chinese cultural backgrounds generally consume more soybean as food. Singapore consumes less soybean in absolute terms than the other NICs and Japan, but the proportion of soybean in total oilseeds and nuts consumed as food is high. In ASEAN countries, the percentage of soybean in total consumption of oilseeds and nuts is generally low. Indonesia's consumption in absolute terms, however, is notably high because the Government has been trying to increase soybean consumption as one of the sources of vegetable protein in recent years.

Southeast Asia is one of the major producing regions of tree crops for oil extraction, and this is reflected in their consumption of vegetable oils and fats. The percentage of soybean oil in total consumption of vegetable oils is generally very small in four ASEAN countries, while it is 40 - 50% in Japan and the NICs. The exception is Hong Kong which has a preference of groundnut and rapeseed oil to soybean oil. None of the selected eight countries consumes sunflower oil in any appreciable amount. The differences in consumption of soybean as food and vegetable oil are more or less reflected in the proportion of soybean put to industrial use (mainly for extracting oil and using residues as feedstuffs for animals). The bulk of total supply for domestic consumption is for such industrial use in Japan, Singapore, and to a lesser extent, Korea. The percentage of industrial use of soybean is also high in Malaysia, the Philippines and Thailand, although the total supply is small in absolute terms.

(b) Per capita income and consumption of cereals and soybean

Figure II-1-12 shows the relationships between per capita annual consumption of total cereals, including non-food uses like feedstuffs for animals and materials for manufacture, and per capita real GNP or GDP shown in local currencies (in 1975 price for Japan, and in 1980

Figure II-1-12 Per Capita Income and Per Capita Consumption of Cereals



Source : FAO, Production Yearbook and Trade Yearbook, various issues.
IMF, International Financial Statistics: Yearbook 1985.
For Japan, Ministry of Agriculture, Forestry and Fisheries, Food Balance Sheets FY1983, and Economic Planning Agency, Annual Report on National Accounts 1985.

price for other countries) for the period from 1963 through 1983 (1967-1983 for Hong Kong, and 1970-1983 for Malaysia). The past trend of per capita consumption for Japan is based on the Food Balance Sheets prepared by the Ministry of Agriculture, Forestry and Fisheries,[1] the Japanese Government. For other countries, apparent per capita consumption is obtained by using FAO production and trade statistics and UN population estimates,[2] and therefore do not include changes in stock. Per capita consumption figures for selected cereals and soybean used in this section are also prepared in the same manner.

With the exception of Hong Kong, rises in per capita income and increases in per capita consumption of total cereals have on the whole positive correlations in the selected Asian countries. However, the structure of the increase in consumption significantly differs between the countries with higher income and the ones with lower income. In Japan, which is the only developed country in Selected Asia, per capita consumption of rice peaked in the early 1960s and has gradually declined, while that of wheat rose steadily (Table II-1-42). The expansion of per capita cereal consumption since the beginning of the 1960s was primarily due to increased use of maize (and sorghum) as feedstuffs for livestock. The decline in per capita consumption of rice was also observed in Singapore and Hong Kong among the NICs, and Malaysia and Thailand among the ASEAN countries. In the rest of the countries, it is possible to observe a slowdown in the rate of increase in consumption.

Per capita consumption of wheat also has begun either to decline or to reduce the rate of increase in countries of higher income like Japan and the NICs in the last decade or so. But it has been showing substantial increases in ASEAN countries where the absolute level of consumption still remains low, except for Malaysia which already has the higher level of consumption similar to the NICs. The lower growth recorded for the Philippines in the 1970s was probably due to sizable food aid which raised the level of wheat consumption in the 1960s. The same probably applies to Korea which used to receive the US concessional export in the 1960s and have sizable US military forces stationed within the country until the mid-1970s. The level of consumption dropped after the decline of such import and the evacuation of the larger part of the US forces, and then slowly began to increase after the mid-1970s. Indonesia imported some 1.6 million tons of wheat in 1982/83, but it must be noted that from 50% to 60% of the import was received as food aid.

Maize is the most important internationally traded crop as livestock feeds. Its per capita consumption has rapidly increased during the 1970s in most of the selected Asian countries. Moderate growth was observed in the Philippines and Indonesia which produce a

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1) Association of Agricultural Statistics, Food Balance Sheets FY1983, Tokyo, 1985.

2) UN Dept. of International Economic and Social Affairs, World Population Prospects as Assessed in 1980, Population Studies No. 78, New York, 1981.

Table II-1-42 Self-Sufficiency and Per Capita Consumption of Selected Grains in Selected Asia

	Rate of Self-Sufficiency (%)					Per Capita Consumption (kg/year)				
	Cereals	Rice	Wheat	Maize	Soybean	Cereals	Rice	Wheat	Maize	Soybean
Japan										
1963/65	62.6	95.5	24.3	2.7	13.6	247.5	135.8	46.0	33.5	19.9
1969/71	48.0	105.7	10.7	0.6	4.1	277.7	114.2	50.3	53.4	30.2
1974/76	40.0	100.5	4.2	0.2	3.5	289.0	110.4	49.9	71.4	31.8
1979/81	31.5	107.5	9.4	0.0	4.4	316.2	84.7	51.6	107.8	37.4
1982/83	30.2	103.3	11.9	0.0	4.2	318.3	83.9	50.8	119.0	44.1
Annual Growth (69/71-79/81)						1.3	-2.9	0.3	7.3	2.2
Hong Kong										
1963/65	1.8	2.4	0.0	0.0	0.0	159.5	106.5	30.5	21.5	2.0
1969/71	1.3	0.6	0.0	0.0	0.0	169.4	93.3	35.2	39.8	4.0
1974/76	0.3	0.0	0.0	0.0	0.0	155.7	76.0	33.5	38.7	3.6
1979/81	0.0	0.0	0.0	0.0	0.0	158.0	59.6	33.6	52.2	3.7
1982/83	0.0	0.0	0.0	0.0	0.0	161.4	66.5	34.1	55.7	3.5
Annual Growth (69/71-79/81)						-0.7	-2.9	-0.5	2.7	-0.6
Korea										
1963/65	79.7	99.2	30.9	77.2	96.9	147.2	119.3	32.6	1.5	6.1
1969/71	69.9	81.9	18.3	23.4	86.2	273.2	138.9	59.7	8.7	8.3
1974/76	67.6	92.7	5.1	9.5	78.4	256.9	132.1	46.8	20.1	11.2
1979/81	49.2	78.0	3.3	5.2	32.0	301.1	148.9	49.8	74.4	18.7
1982/83	49.6	95.0	4.4	3.1	28.3	294.2	127.2	50.1	88.9	21.6
Annual Growth (69/71-79/81)						1.0	0.6	-1.8	23.9	8.5
Singapore										
1963/65	0.0	0.0	0.0	0.0	0.0	162.4	104.0	37.8	18.6	6.0
1969/71	0.0	0.0	0.0	0.0	0.0	236.9	95.8	74.7	41.9	16.7
1974/76	0.0	0.0	0.0	0.0	0.0	219.4	73.7	41.5	92.9	15.7
1979/81	0.0	0.0	0.0	0.0	0.0	359.4	74.8	48.4	152.0	17.3
1982/83	0.0	0.0	0.0	0.0	0.0	361.2	77.2	55.5	157.8	6.3
Annual Growth (69/71-79/81)						4.3	-2.4	-4.2	13.8	0.3
Indonesia										
1963/65	93.1	91.6	0.0	100.1	100.0	112.1	85.3	0.6	26.2	3.4
1969/71	92.9	94.2	0.0	108.8	100.4	121.7	97.5	4.4	19.6	3.7
1974/76	90.7	93.4	0.0	102.2	89.2	142.8	116.3	6.1	20.4	4.6
1979/81	90.6	92.8	0.0	99.2	76.0	173.4	139.9	8.4	27.5	6.0
1982/83	91.3	96.8	0.0	98.5	65.4	183.4	148.9	10.5	23.7	5.5
Annual Growth (69/71-79/81)						3.6	3.7	6.6	3.5	5.0
Malaysia										
1963/65	46.2	60.1	0.0	12.0	0.0	158.1	119.9	29.0	8.7	1.7
1969/71	56.1	78.2	0.0	4.6	0.0	182.6	129.6	30.0	20.6	1.9
1974/76	59.9	85.1	0.0	8.5	0.0	180.8	124.9	30.7	23.2	1.6
1979/81	57.7	78.2	0.0	1.8	0.0	186.9	114.9	33.6	37.3	7.1
1982/83	43.0	59.1	0.0	1.2	0.0	195.2	109.4	35.0	50.8	11.6
Annual Growth (69/71-79/81)						0.2	-1.2	1.1	6.1	13.8
Philippines										
1963/65	82.3	87.3	0.0	100.0	10.0	150.4	93.5	14.8	42.1	0.3
1969/71	88.2	96.5	0.0	98.7	50.0	163.6	93.9	15.2	54.4	0.1
1974/76	88.6	97.1	0.0	96.0	40.5	172.7	94.8	13.8	63.6	0.3
1979/81	91.2	103.0	0.5	94.7	51.0	183.4	99.0	16.1	68.9	0.3
1982/83	86.7	100.4	0.0	88.2	27.1	184.8	97.9	16.7	70.2	0.8
Annual Growth (69/71-79/81)						1.2	0.5	0.6	2.4	20.8
Thailand										
1963/65	157.7	138.6	0.0	2,605.6	113.7	149.0	147.4	1.2	1.2	0.8
1969/71	134.8	116.2	0.0	457.7	108.6	221.0	206.9	1.7	11.9	1.8
1974/76	141.4	116.0	0.0	562.1	107.8	209.3	195.5	2.3	11.5	2.7
1979/81	154.2	135.2	0.0	320.9	104.0	200.3	173.3	4.1	21.5	2.3
1982/83	175.2	146.6	0.0	591.0	100.8	172.9	157.8	3.7	11.2	2.4
Annual Growth (69/71-79/81)						-1.0	-1.8	9.1	6.1	2.3

Source: FAO, Production Yearbook and Trade Yearbook, various issues. For Japan, Association of Agricultural Statistics, Food Balance Sheets FY1983, Tokyo, 1985

sizable volume of maize as staple next to rice, on the one hand, and in Hong Kong where the increase in import began to slow down after the mid-1970s when the import of poultry meat began to increase rapidly, on the other.

In Japan, the growth in per capita income in the last couple of decades was accompanied by a gradual decline in per capita consumption of rice, an increase in wheat consumption, and then by a rapid expansion in consumption of coarse grains like maize and sorghum apace with rising demand for meat and dairy products. Similar tendencies were observed in Hong Kong and Singapore in the last decade, and also in Korea where the growth of per capita maize consumption has been most rapid in recent years, although its consumption of rice has continued to grow, but at a slower pace.

Keeping in mind the cross-country differences of food crops produced and consumed and the diversity of traditional food habits, the above tendency observed in Japan and the NICs will manifest in ASEAN countries in the near future, as their economies continue to grow as they did in the past.

With respect to soybean, the level of consumption is notably high in Japan, and to a lesser extent, in Korea as well. Soybean is consumed not only as food but as materials to extract edible oil and to use its cake and meal as feedstuffs for animals. The rapid expansion of world production and trade observed in the 1970s is primarily related to the increased consumption of soybean oil and cake and meal as feedstuffs. Consumption in Japan and Korea increased for the same reason. Per capita consumption had been also high in Singapore until it dropped sharply in 1982/83. The sudden drop was related to the increased import of soybean oil in these years. In ASEAN countries, which are major producers of other crops for oil extraction such as coconut and oil palm, the level of soybean consumption has been understandably small by comparison with Japan and some NICs, but some of them, notably Indonesia, have been trying in recent years to increase soybean production and consumption to improve the diet.

Demand for soybean cake and meal in Selected Asia has been increasing rapidly in the manner similar to maize. Japan imported, for instance, 0.27 million tons on average in 1979/81 and 0.16 million tons in 1982/83 in addition to the domestic production. In 1982/83, the import averaged 0.2 million tons in Korea, 0.14 million tons in Singapore, 0.32 million in the Philippines, 0.11 million in Malaysia and 0.2 million tons in Thailand. This is a tremendous increase, because these countries imported soybean cake from a couple of thousand to less than 20,000 tons at most a decade ago.

(c) Prospects in consumption of selected cereals and soybean

As discussed in the preceding section, per capita consumption of selected cereals and soybean increased or decreased, on the whole, in correlation with the growth of per capita income in the eight selected countries. In other words, the outlook of demand for the year 1990 can be derived as a function of growth in income on the basis of the past trend.

Per capita GNP or GDP and the size of population expected in the later 1980s are obtained as follows. For Japan, the perspective GNP growth rate announced by the Economic Planning Agency, the Government of Japan, for the later half of the 1980s and the medium figures of the 1981 population projections done by the Institute of Population Studies[1], Ministry of Health and Welfare, are used. For other countries, GDP or GNP growth rates over the period of 1970-1983 and the UN population projections[2] are employed. With respect to per capita consumption figures for the countries other than Japan, three-year moving averages are used in order to offset to some extent the effect of the absence of stock changes. Concerning Japan, the estimation took into consideration the 1990 demand projections done in 1980 by the Ministry of Agriculture, Forestry and Fisheries.

Concerning per capita consumption of rice, most of the selected countries have passed the peak and their income elasticity of demand has turned negative. However, the past trends of three countries, namely, Korea, the Philippines and Indonesia, do not indicate this turning point, although the declining rates of increase in the respective countries' per capita consumption of rice appear to suggest that they are moving toward this turning point. With respect to Korea, which has been showing rapid economic growth and thus can be considered the closest among the three countries to the turning point, the figure of 121.9 kg projected for the year 1991 by the Second 10-Year Comprehensive National Land Development Plan (1982-1991) is used, assuming that the country's per capita consumption would begin to decline from 1984 on at a fixed rate. For the Philippines and Indonesia, per capita consumption is considered as a log linear function of per capita income, assuming that their income elasticity of demand would at least decline in the later 1980s.

With respect to other cereals and soybean, consumption is considered as a log linear function of per capita income, as long as its increase rate has been declining in recent years and/or the absolute level of consumption is already substantially high. Otherwise, it is assumed that the past trend would continue through 1990.

The results of estimation based on the past trends are shown in Table II-1-43. Selected Asia's total consumption of rice, the most important staple in Asian countries, is estimated to increase to some 63 million tons in 1990, increasing at an annual rate of 1.9% during 1980-1990, which is substantially lower than the actual growth rate of 2.9% recorded between 1970 and 1980. The growth in consumption during the 1980s would be restricted to four ASEAN countries, and moreover, chiefly result from the increase of population rather than that of per capita consumption. In NICs-3 and Japan, both per capita consumption and total demand are expected to decrease gradually.

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1) Institute of Population Studies, New Projections of Japan's Future Population, Tokyo, 1981.
2) UN Dept. of International Economic and Social Affairs, op.cit.

Table II-1-43 Estimated Per Capita Consumption and Total Demand of Selected Grains in Selected Asia in 1990

	Rice				Wheat			
			Annual Increase (%)				Annual Increase (%)	
	1980	1990	1970-80	1980-90	1980	1990	1970-80	1980-90
Per Capita Consumption (kg/year) :								
ASEAN-4								
Indonesia	139.9	170.5	3.7	2.0	8.3	15.9	6.6	6.7
Malaysia	114.9	96.5	-1.2	-1.7	33.6	39.1	1.1	1.5
Philippines	99.0	102.0	0.5	0.3	16.1	15.6	0.6	-0.3
Thailand	173.3	150.4	-1.8	-1.4	4.2	6.6	9.5	4.6
NICS-3								
Hong Kong	59.6	50.8	-2.9	-3.1	33.6	34.3	-0.5	0.2
Korea	146.9	122.6	0.6	-1.8	49.8	59.8	-1.8	1.9
Singapore	74.7	60.3	-2.5	-2.1	48.4	49.0	-4.2	0.1
Japan	96.8	87.4	-2.9	-0.9	51.7	53.2	0.3	0.3
Total Demand (1000MT) :								
ASEAN-4	35,353	46,409	3.8	2.8	2,694	4,806	6.1	6.0
Indonesia	20,707	29,683	5.7	3.6	1,237	2,757	8.7	8.3
Malaysia	1,616	1,708	1.4	0.6	473	692	3.8	3.9
Philippines	4,875	6,410	3.3	2.8	792	977	3.4	2.1
Thailand	8,155	8,708	0.8	0.7	192	380	12.0	7.1
NICS-3	6,183	6,034	2.1	-0.2	2,205	3,041	0.0	3.3
Hong Kong	355	317	-0.4	-1.1	172	214	2.2	2.2
Korea	5,649	5,553	2.5	-0.2	1,917	2,694	0.1	3.5
Singapore	179	164	-1.0	-0.9	116	133	-2.9	1.4
Japan	11,209	10,761	-0.8	-0.4	6,054	6,555	1.5	0.8
Total	52,745	63,204	2.9	1.8	10,953	14,402	2.2	2.8

	Maize				Soybean			
			Annual Increase (%)				Annual Increase (%)	
	1980	1990	1970-80	1980-90	1980	1990	1970-80	1980-90
Per Capita Consumption (kg/year) :								
ASEAN-4								
Indonesia	27.5	30.5	3.5	1.0	6.0	7.9	5.0	2.8
Malaysia	37.3	67.9	6.1	6.2	7.1	16.2	14.1	8.6
Philippines	68.9	78.9	2.1	1.1	0.3	0.5	19.6	5.2
Thailand	21.5	31.0	6.1	3.7	2.3	4.0	2.5	5.7
NICS-3								
Hong Kong	52.2	69.2	2.7	2.9	3.7	3.6	-0.5	-0.3
Korea	74.3	133.1	23.9	6.0	18.7	29.0	8.5	4.5
Singapore	152.0	206.1	13.8	3.1	17.3	23.0	0.4	2.9
Japan	111.9	120.5	7.3	0.7	37.5	44.8	2.2	1.8
Total Demand (1000MT) :								
ASEAN-4	8,993	13,245	5.9	3.9	1,183	1,930	8.2	5.0
Indonesia	4,066	5,289	5.5	2.7	886	1,377	78.7	4.5
Malaysia	625	1,202	8.9	8.8	174	287	23.5	5.1
Philippines	3,390	4,959	5.2	3.9	16	33	23.1	7.5
Thailand	1,012	1,796	8.9	5.9	107	234	5.0	8.1
NICS-3	3,488	6,985	18.8	7.2	756	1,389	10.4	6.3
Hong Kong	266	433	5.4	5.0	19	22	1.7	1.6
Korea	2,859	5,994	26.2	7.7	718	1,305	10.5	6.2
Singapore	363	559	15.4	4.4	19	62	-5.9	12.6
Japan	13,098	14,836	8.7	1.3	4,386	6,439	2.9	3.9
Total	25,579	35,066	8.6	3.2	6,325	9,759	4.8	4.4

Source: For Japan, Association of Agricultural Statistics, Food Balance Sheets FY1983, Tokyo, 1985.

Note: 1) The figures for 1980 in countries other than Japan are averages for 1979/81.

With respect to Indonesia, it is perhaps necessary to refer to the projected per capita rice consumption as food of 135 kg for the year 1988 in the current development plan (Replita IV 1984-88). This figure is substantially lower than 170.5 kg for 1990 obtained by the present estimation. However, the total demand for rice, inclusive of other non-food uses such as feedstuff, seed, industrial processing and buffer stock, is projected in the same plan to reach 28.6 million tons in 1988, which does not differ much from 29.6 million tons obtained for 1990 by the present estimation.

Total consumption of wheat in Selected Asia, on the other hand, would annually increase 2.8%, a slightly higher rate than in the 1970s, to reach 14 million tons, chiefly due to increased demand in four ASEAN countries and Korea among the NICs. The share of Japan would be still large, but decline from 55% in 1980 to 45% in 1990.

Total demand for maize would grow at an annual rate of 3.2%, compared with the actual growth of 8.6% during 1970-80 when the demand in Japan and the NICs expanded sharply. The growth rates expected in the 1980s are higher in NICs-3 and ASEAN-4 than in Japan, and thus the share of Japan in Selected Asia's total demand of 35 million tons in 1990 would decline to 42% from 51% in 1980, while Korea's share will increase by 6 percentage points from 11% to 17%.

In the case of soybean, total demand is estimated to grow at an annual rate of 4.4%, compared with 4.8% in the 1970s, to reach 9.8 million tons in 1990. The share of Japan will decline from nearly 70% to 66%, and other major consumers are expected to be Indonesia (14%) and Korea (13%).

The share of import in the respective country's demand for the selected cereals and soybean would be influenced by various factors, namely, government policies on domestic production and trade of agricultural products, international price movements of cereals and oilseeds, current balance of payments positions, and so forth. Table II-1-44 simply applied the actual self-sufficiency rate in 1982/83 average for the respective crop in each country to obtain a rough proportion of the supply and demand gap in 1990, excluding rice for which Selected Asia as a whole is already self-sufficient. The exception is made for Thailand which has sizable exports of maize, and it is assumed that the country's maize production would grow at an annual rate of 4.42% achieved during 1969/71 - 1981/83. Therefore, the figures shown in the table should be treated with due caution, especially by noting the emphases of current agriculture policies in the respective countries, as described briefly below.

The achievement of self-sufficiency in rice has long been the central focus of agricultural policies in Asian countries including Japan. The development of irrigation and drainage facilities and the progress of farming technologies, especially since the late 1960s through the 1970s, enabled the increasingly wider use of modern agricultural inputs such as seeds of high-yielding varieties, chemical fertilizers, pesticides and farm machinery, though to a lesser extent in less developed countries. In Selected Asia, in particular, the substantial increase in output achieved in the last decade eased the problem of supply and demand gaps concerning rice. The Philippines,

Table II-1-44 Estimated Supply and Demand Gaps of Selected Grains in Selected Asia in 1990

(1,000 tons)

	Wheat			Maize			Soybean		
	1982/83 Average (actuals)		1990 (estimates)	1982/83 Average (actuals)		1990 (estimates)	1982/83 Average (actuals)		1990 (estimates)
	Self-Sufficiency (%)	Sup-Dem Gap	Sup-Dem Gap	Self-Sufficiency (%)	Sup-Dem Gap	Sup-Dem Gap	Self-Sufficiency (%)	Sup-Dem Gap	Sup-Dem Gap
ASEAN-4		3,233	4,806		-1,481	-1,064		501	785
Indonesia	0.0	1,623	2,757	98.5	56	79	65.4	292	476
Malaysia	0.0	547	692	1.2	751	1,188	0.0	176	287
Philippines	0.0	877	977	88.2	435	585	27.1	31	24
Thailand	0.0	186	380	590.5	-2,723	-2,916	100.8	2	-2
NICs-3		2,336	2,922		4,333	6,800		682	1,020
Hong Kong	0.0	207	214	0.0	313	433	0.0	27	22
Korea	4.4	1,919	2,575	3.1	3,456	5,808	28.3	621	936
Singapore	0.0	210	133	0.0	564	559	0.0	34	52
Japan	11.9	5,468	5,775	0.0	13,737	14,836	4.2	4,271	6,169
Total		11,037	13,503		16,590	20,572		5,454	7,974

Source : FAO, Production Yearbook and Trade Yearbook, various issues.
For Japan, Association of Agricultural Statistics, Food Balance Sheets FY1983, 1985.

Note : Negative figures indicate surplus.

for example, achieved self-sufficiency by the beginning of the 1980s, and began to export some surplus, while Indonesia and Korea significantly raised their rate of self-sufficiency in the later 1970s. Only Malaysia shows a declining tendency in self-sufficiency after the mid-1970s, but the increase of the exportable surplus achieved in neighboring Thailand is sufficient to fill its shortfall in domestic supply in addition to supplying to Hong Kong and Singapore which do not produce rice.

Diversification of food consumption away from rice has been going on for some time in Japan and NICs-3 along with the rapid growth of their economies, as seen in their increased consumption of wheat, and moreover, of livestock products, vegetables and fruits. Among the ASEAN countries, Malaysia already shows a tendency similar to NICs-3, and the other three countries have begun to change their over-dependence on rice in their diet both in fact and in policy orientation.

With respect to wheat, four ASEAN countries and Singapore and Hong Kong do not produce this crop, and thus their demand will entirely depend on imports. The on-going development plan (1982-1986) of Thailand states that the country would start wheat production in the northern region, but it would take some time for such efforts to bring some appreciable results, partly because the techniques of wheat cultivation in tropical and semi-tropical areas with high rainfalls are not yet developed. It must be remembered, however, that the increase in wheat consumption of countries with lower per capita income like Indonesia and the Philippines has so far depended to a great extent on concessional imports or food aid from such countries as the USA and Australia. Therefore, their imports on the commercial basis would be much smaller than the figures indicated in Table II-1-44. Moreover, the recent worsening in the balance of payments situations might dampen their wheat-importing capacities, even including countries like Malaysia which did not have such constraints before.

Korea and Japan have some domestic production of wheat, but their import dependence is likely to continue. Korea's on-going development plan (1982-1986) explicitly states that the country would restrain consumption of rice and promote that of wheat, and that domestic production of food crops other than rice would be promoted on the basis of comparative advantage. This seems to imply that the country's increasing demand for wheat would be met primarily by imports. In Japan, domestic production of wheat has begun to increase gradually after the mid-1970s, although the volume is still small, primarily due to the diversification of cropping patterns promoted in paddy fields. This trend is likely to continue in the future, but the bulk of wheat consumption will still be met by imports in the remaining 1980s.

With regard to maize, the respective countries' policy emphasis on increased consumption and production of livestock products, as will be mentioned later, indicates that Selected Asia's import needs would continue to increase. In Hong Kong, Singapore, Korea, Japan and Malaysia, the rate of self-sufficiency is zero or practically negligible in the early 1980s, and these countries do not have plans

to sizably increase domestic production, or even if they do, such plans would require stronger and comprehensive policy commitments and take a long gestation period before realizing the expected results. The situation differs in Indonesia, the Philippines and Thailand where domestic production is substantial.

Indonesia used to be a net exporter of maize, exporting 100,000 to 200,000 tons in the late 1960s and the mid-1970s, but became a net importer since the late 1970s. According to the country's current fourth development plan (1984-1988), total domestic consumption of maize is estimated to increase at an annual rate of 2.9% during 1984-1988, reaching 5.6 million tons in 1988, and it is assumed that both total and per capita consumption of maize as food would decrease at annual rates of -1.2% and -3.4% respectively. In other words, the increase in total consumption is expected to come from the demand for maize as feedstuff, which is estimated to grow 16.6% per annum. The percentage of maize consumed as feedstuff is expected to reach 30% of the total consumption by 1988, by comparison with 2% in 1979/81 as estimated in FAO's food balance sheets (Table II-1-41).

Assuming that the annual growth rate of 3.46% achieved during 1969/71 - 1981/83 would continue in the future, Indonesia's production of maize would increase from 3.9 million tons in 1981/83 to around 4.8 million tons in 1988, and thus the shortfall of domestic supply would be about 800,000 tons, which is about the same as the figure estimated for 1990 in Table II-1-44. The supply and demand gap would come to 500,000 tons in 1988, if production continues to increase at the annual rate of 4.71% achieved during 1974/76 - 1981/83, or even less, if production picks up at an annual rate of around 5.1% as envisaged in the plan.

The Philippines was more or less self-sufficient in maize as food until the 1960s, and imports began to pick up since the beginning of the 1970s. The country reportedly attained self-sufficiency in (white) maize as food in 1977, but imports continued to increase presumably for use as feedstuff, and averaged 180,000 tons in 1979/81. The country launched in 1981 its ambitious program called Maisagana to attain by 1983 the self-sufficiency in (yellow) maize as feedstuff as well, by introducing hybrid and other high-yielding varieties and promoting large-scale agri-business undertakings in maize production. But the production actually did not pick up as expected, partly due to the drought in 1982 and 1983 and partly due to the deterioration of economic situations. Maize imports thus jumped to more than 500,000 tons in 1983.

The Philippines' on-going development plan (1983-1987) emphasizes the importance of the Maisagana program and expects to increase domestic production of white and yellow maize at an annual rate of 11.7%, compared with 4.8% achieved during 1969/71 - 1979/81, nearly doubling the output from 3.4 million tons in 1982 to 5.9 million by 1987. The development plan states that most of this increase would go into feed for livestock and for export, providing "either for large exports of corn or for exports of hog and poultry products by the end of the plan period." However, the serious downturn in domestic and external economic situations which has been continuing to this day is likely to affect the implementation of the Maisagana program.

Moreover, the balance of payments constraint is also likely to affect even the country's maize importing capacity, at least in the near future. It is also important to take into consideration the recent change in the government, which is likely to be accompanied by basic policy reorientation not only for agriculture but also for the management of the entire economy.

Thailand has been successful during the last decade in expanding maize production primarily for the purpose of exportation. Bilateral trade agreements with Japan (since 1962) and with Taiwan (since 1970), both of which terminated in 1981, contributed greatly to this expansion of production, and the country's exports rose from 900,000 tons in 1963/65 to 2.7 million tons in 1982/83, now chiefly going to other Southeast Asian countries. In Thailand's on-going development plan (1982-1986), maize is rated as one of the "economic crops with good market and price potentials" together with such crops as rice, rubber, cassava, vegetables, fruits, sugarcane, tobacco and soybean, and its increased production is being promoted.

The country's production would reach a little over 4.7 million tons in 1990, assuming that it continues to increase at an annual rate of 4.42% achieved during 1969/71 - 1981/83. If the percentage of domestic demand to total production remains in 1990 at the same level as in 1982/83, Thailand would have an exportable surplus of some 3 million tons, supplying 12% of the total supply and demand gap in the other seven countries in Selected Asia, as shown in Table II-1-44. The exportable surplus could be smaller, because the country also plans to expand the output of its livestock sector by 4.2% annually, and to promote private investment in the export of meat, which would expand the domestic consumption of feedstuffs. It must be noted that the development plan emphasizes the increase in the productivity of the economic crops rather than the expansion of areas used to cultivate them. With respect to maize, for instance, the plan expects to increase the yield per unit of land by 6.3% annually, although no mention is made of the target growth rate of total production. If the area under maize stays the same, this means that Thailand would have a much larger exportable surplus. To increase exports, the country needs to improve the storage technology and thereby to prevent afratoxin contamination.

With respect to soybean, Indonesia, the Philippines and Thailand have plans to increase domestic production. As for Malaysia, the country at present does not produce soybean, and its soybean imports of about 180,000 tons in 1981/83 were the second largest next to Indonesia among the ASEAN countries. In addition, the country imported 90,000 tons of soybean cake and meal in 1981/83, although it is a large exporter of oilseed cake and meal, about 370,000 tons in 1981/83. Both the completed Fourth Malaysia Plan (1981-1985) and the recently announced Fifth Malaysia Plan (1986-1990) do not mention any specific policy on soybean, and the same applies to maize. Therefore, the country will continue to depend on imports through the late 1980s.

The current development plan of Indonesia estimates that the total demand for soybean would increase at an annual rate of 4.8% during the plan period, reaching 1.22 million tons in 1988, which is close to 1.37 million tons estimated for 1990 by the present study.

Domestic production, which increased 2.36% annually during 1969/71 - 1981/83, is expected to increase by 20.7% per annum. If successful, this means that the country would have a surplus of about 250,000 tons by 1988, compared with a deficit of 550,000 tons if the production continues to increase by 2.36% per annum. The production target appears rather too ambitious, but it is necessary to note that the country is becoming cautious about increasing soybean imports, which averaged 315,000 tons during 1981 - 1983. In addition, Indonesia, a large net exporter of oilseed cake and meal, increased its imports of soybean cake and meal from only 1,000 tons in 1975 to 115,000 tons in 1981/83. Indonesia might try hard to be practically self-sufficient in soybean by the end of the 1980s, though it is less likely for the country to become an exporter.

Domestic production of soybean in the Philippines is small, though it increased rapidly from 6,000 tons in 1974/76 to 11,000 tons in 1981/83. The country expects to increase production during the current development plan, although the quantitative target is not specified. Considering the domestic production of coconut, an increase in the country's demand for soybean as a source of vegetable oil will be probably limited, but the promotion of livestock production is expected to increase its demand for soybean cake and meal, which rose from only 4,500 tons in 1969/71 to nearly 300,000 tons in 1981/83.

As stated earlier, soybean is considered in Thailand one of the "economic crops" to be promoted. Since the mid-1970s, domestic production stayed around 110,000 - 120,000 tons, growing only 0.47% per annum from 1974/76 to 1981/83. The country so far both exported and imported soybean, but the volume was small in either case. The current development plan expects to raise the yield of soybean by 8.9% per annum, and if successful, this would increase the country's exportable surplus to some extent. Thailand is a net importer of oilseed cake and meal contrary to the other three ASEAN countries, and virtually all of its imports are soybean cake and meal, averaging 180,000 tons in 1981/83. Considering the promotion of livestock production, the expected increase in soybean production might largely go for domestic utilization rather than for export.

Japan and NICs-3 are expected to continue their heavy reliance on soybean imports in the later 1980s. Although entirely dependent on imports, the demand for soybean in Hong Kong and Singapore will be rather limited, and thus Japan and to a lesser extent Korea will be the major importers. Japan's rate of self-sufficiency is now very low, and the on-going crop diversification program for paddy fields will probably raise it, but the expected increase in production would be mainly directed to varieties of soybean consumed as food rather than those for oil extraction. With regard to Korea, domestic production declined at an annual rate of -3.8% from 310,000 tons in 1974/76 to 235,000 tons in 1981/83, though the demand increased by 10.9% per annum to 813,000 tons. As already mentioned, the country's current policy apparently does not emphasize the improvement of self-sufficiency in food crops other than rice regardless of the comparative advantage of doing so. Therefore, the shortfall in domestic supply would be met primarily by increasing imports, as would be the case with wheat and maize.

2. LIVESTOCK SECTOR

2-1 Structure of Production

2-1-1 Overview

Argentina's livestock farming is founded on a wide expanse of land endowed with extremely favorable natural conditions such as climate, soils, and topography. It is principally centered in the fertile Pampa region where cattle, sheep, pigs, and poultry are raised, but roughly a half of sheep population is raised in the cold and dry Patagonian plains south of the Rio Negro with annual rainfalls of less than 300 mm. The geographical distribution of the livestock is outlined in Figure II-2-1.

The characteristics by category of livestock can be roughly summarized as follows:

(1) Cattle

The total cattle population during the five years from 1979 through 1983 averaged 54.7 million heads, of which a little over 80% was found in the six provinces in eastern central part of the country (Buenos Aires, Cordoba, Santa Fe, Entre Rios, La Pampa, and San Luis) and 17% are in the nine provinces to the north and northeast of these provinces. In other words, cattle in Argentina are largely brought up in the Pampa region and areas north of it. The number of dairy cows was estimated to be 2 million in 1984, accounting for less than 5% of the total cattle population.

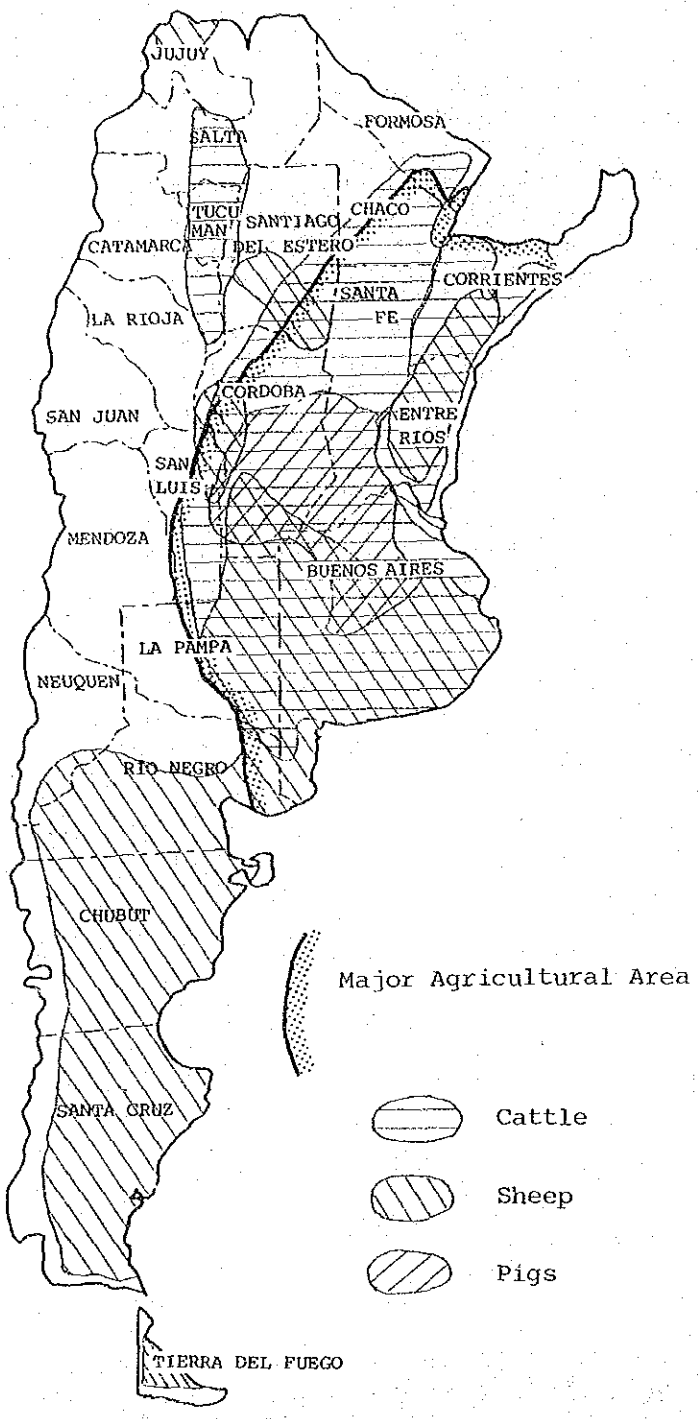
As will be discussed in later sections, the number of beef cattle follows a cyclical trend called the livestock cycle, mainly influenced by changes in price. As shown in Table II-2-1, the number of cattle in Argentina has been decreasing after 1979 until recently due to the liquidation phase of the cycle.

(2) Sheep

According to the livestock censuses conducted in 1960, 1974 and 1977, and the estimates made by the Secretariat of Agriculture, Livestock and Fisheries, a long-term decline is observed in the sheep population in Argentina. The 1977 census indicated that 50% of sheep was raised in the five Patagonian provinces (Santa Cruz, Chubut, Rio Negro, Tierra del Fuego, and Neuquen), 30% in the two provinces in the Pampa region (Buenos Aires and La Pampa), and 10% in the two Mesopotamian provinces (Corrientes and Entre Rios).

The estimate for 1985 indicates a 26% decline in the population since 1977. The decline applies to all of the provinces, but the most affected were the two provinces in the Pampas (-39%) and then the five Patagonian provinces (-22%). The decrease was comparatively small in the two Mesopotamian provinces (-15%) and the other areas (-10%). The drastic decrease in the Pampa region is attributable to the expansion

Figure II-2-1 Geographical Distribution of Livestock



Source : Adjusted from Servicio Nacional de Economia y Sociologia Rural (SNESR), Secretaria de Agricultura y Ganaderia, Cartogramas: Cereales de Verano, Cereales de Invierno, Ganado Vacuno, Ganado Lanar, Ganado Porcino, Promedios de la Compaña 1976/77, 1980

Table II-2-1 Evolution of Livestock and Poultry Population

Year	Cattle	Sheep	Pigs	Horses	Poultry
1960	43,521[1]	48,460[1]	3,881[1]	4,847[1]	
1969	48,298	44,306[1]			35,000
1970	48,440				35,300
1971	49,786				34,750
1972	52,306				35,400
1973	54,771				34,095
1974	55,355[1]	34,691[1]	4,127[1]	2,754[1]	38,690
1975	56,707				37,140
1976	58,174				35,300
1977	59,100[1]	35,220[1]	3,552[1]	3,073[1]	33,475
1978	58,400	32,652	3,737	2,982	34,285
1979	56,864	31,155	3,913	2,841	38,080
1980	55,760	29,494	3,900	2,780	41,680
1981	54,234	28,112	4,099	2,755	43,580
1982	52,650	30,939	3,730	2,750	46,165
1983	53,877		3,210		47,470
1984	54,594		3,302		47,080
1985	53,500	26,114	2,972		41,440
% distribution in six pampean provinces[2] :					
1974	82.4	42.1 (39.2)[3]	87.9	54.4	n.a.
1977	81.0	37.3 (34.7)[3]	82.4	51.0	n.a.
1984	82.0	n.a. (28.8)[3] [4]	82.0	n.a.	n.a.

Source: Servicio Nacional de Economia y Sociologia Rural (SNESR), Secretaria de Agricultura, Ganaderia y Pesca
Junta Nacional de Carnes

Notes : 1) Census data
2) Buenos Aires, Santa Fe, Cordoba, Entre Rios, La Pampa and San Luis
3) Figures in parentheses show the combined share of Buenos Aires, La Pampa and Entre Rios
4) Estimate for 1985