

2. DOMESTIC PRODUCTION, IMPORTATION AND UTILIZATION OF FOOD LEGUMES AND RESEARCH ORGANIZATION IN JAPAN

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Production, importation and Utilization of Legumes

The beans and peas which have been cultivated in Japan are the soybean, peanut and the so-called 'other legumes' in which all other beans and peas, except soybean, peanut and green gram, are contained. The main crops of the 'other legumes' are Azuki bean and kidney bean which have been cultivated rather in large areas.

1. Soybean

The history of the soybean cultivation in Japan seems to be fairly old, because some descriptions on "Daizu" (soybean) can be seen in the ancient chronicles of Japan (Kojiki and Nihonshoki, written at the beginning of 8th century) and the carbonized "Daizu" was found in the vestige of ancient civilization of the strawrope pottery in the period of B.C. But the statistical data of soybean production was not yet established completely before 1878. The Japanese agriculture had been gradually developed since this period, and the soybean was cultivated, at first, as an important food stuff which can be substituted for rice, so the cultivation area of soybean attained to 500,000 hectares. But the production of soybean in Japan was gradually decreased by the cause of sudden increase of importation from China since 1930, and this decrease was accelerated furthermore by the cheap American soybean imported abundantly since 1961 under the free trade system, and consequently the cultivation areas of soybean decreased to 100,000 hectares in 1971.

Though the production of soybean thus decreased, the cultivation has been still continued all over the country. But the soybean as a merchandise has been mainly produced in Hokkaido. The soybean could not be excluded from the upland field crop of Hokkaido, because the cultivation areas of a farmer is very large in this district, the supply of labour is not sufficient and few of the adequate crops exist, for this region is situated on the land of cold weather far from the big market.

Though the soybean is used for various purposes in Japan, it is mainly used as the source of vegetable oil and protein. The soybean oil is mostly used as the people's favourite edible oil, and the soybean protein is utilized in more various uses as compared with the uses in foreign countries, that is, Miso (bean paste), Shoyu (soy sauce), soybean curd, fried soybean curd, Natto (fermented soybean), boiled beans, green soybeans and the materials for cakes. Furthermore the soybean is used as the important feed and fertilizer.

While the demand for soybean for such various uses has been increased every year, the production has been decreased and the importation has been increased year

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by year.

Most of the imported soybean had come from China before 1945, but the import from America has been gradually increased since, and it has now attained to 90% of all imported soybeans.

The important factor that caused the decrease of soybean production in Japan is the free trade system established in 1961.

The price of imported soybean is so cheap that even the farmers, who had mainly cultivated the soybean in the remote regions of cold weather and high altitude, can scarcely keep their agricultural management economically.

As the cultivation of soybean, however, has still remained as an important crop for these regions, "a temporary surcharge law to support prices of soybean and rape" has been established to protect the farmers.

2. Peanut

It is said that the peanut was imported into this country at the beginning of 18th century. The variety of peanut which is now popular in Japan is the Virginia Type (large seed) imported from America by the government in 1874, and its cultivation has been promoted. Thus the history of peanut in Japan is not so old. The statistical data of the cultivation have been obtained since 1905.

And then the cultivation area of peanut increased gradually, but the production was not yet abundant. The peanut was consumed as a favourite food at this period. But, as it was evaluated as a good nutritious food since 1950, the demand for peanut suddenly increased, and it is now cultivated in the fields of 60,000 hectares as an important dry field crop.

In Japan, the peanut is cultivated mainly in the sandy or volcanic ash soils of poor fertility (Kanto and Kyushu districts), and the varieties are Virginir Type (large seed) and Spanish Type (small seed). As the price of large seed was kept higher than that of small seed since 1950, the areas cultivated with large seed variety attained to 80% of all.

The total consumption amount of peanut, both of large and small seed, is about 130,000 tons (ground nuts, not in shell), in which the amount of large seed is 700,000 tons (54%). The demand for large seed is increasing every year, and the large seed is consumed as the fried or roasted nuts. So the farmers are intending to increase the cultivation of large seed variety, but the production of peanut in this country is not so abundant as to be able to supply sufficiently, so the wanting amount has been imported from China.

The quality of Chinese peanut was not so much different from Japanese and, so the consumption dependency to Chinese peanut was very high. But it is not desirable to fix only one country as the exporter, because the demand and supply of peanut in Japan is obliged to vary according to the agricultural and economical conditions of that country, so the peanut is introduced recently from, besides China, America, India and Australia etc., but the qualities of peanut imported from these countries are tended to be inferior to the Chinese.

The small seed peanut is used for various purposes (materials for cakes, peanut butter etc.). The first treatment for processing of this small seed peanut is to grind them, and then they are processed secondary with the other materials to make the marketable merchandises.

The small seed peanut is imported mainly from many countries of Southeast Asia and Africa, and the importation has increased rapidly according to the decrease of production and the increase of consumption in Japan.

In foreign countries, the peanut is used largely as the material of vegetable oil, but the peanut oil is not favourable for the taste of Japanese, so the production of

peanut oil is very rare in Japan. Consequently, the peanut as the raw material of vegetable oil is scarcely imported. Thus almost of the imported peanut is used for the manufactured foods (cakes, etc.), so the quality of imported peanut is used to be examined seriously. Therefore, the variety of peanut of which quality is changeable during the preservation period owing to its high content of water is not wanted to import. And also the peanut contaminated by the Aflatoxin (discovered in 1971) is inhibited to import by the Food Sanitation Law. It is expected more and more to import the peanut of better quality.

3. Other legume

This group of legumes contains many kinds of beans and peas except soybean, peanut and green gram. That is, Azuki bean, kidney bean, broad bean, pea, cow pea, chick pea and lentil. The latter two of these are not cultivated in Japan, but the other beans and peas are cultivated in various regions of this country. They are mainly used as the materials of Japanese cakes.

The green gram is considered as a kind of green vegetables as well as the unripe kidney bean, broad bean and pea, because it is used as the materials for sprouted beans.

The country of origin of the Azuki bean is China. The cultivation areas of Azuki bean in the world are limited to the Far East (China, Formosa, Korea, Japan), but it is mainly used as the materials for the first-class of Japanese cakes. It is cultivated almost all over the country of Japan, and the chief producing district is the east Hokkaido. The Azuki bean is not so resistant against the cold weather, so the crop of Azuki bean can be easily influenced by the weather conditions of the year. Consequently, according to the variable crops of Azuki bean, the importation is also variable by the year, so the supply and demand is often out of balance. Moreover, the price of Azuki bean is also considerably variable because it is very much influenced by the producing conditions of a few exporting countries (China, etc.).

The kidney bean was cultivated in Japan for the first time in 17th century, it was introduced from China by a high priest called Ingen-Zenji who had studied there. Many varieties of kidney bean are now cultivated in Japan, that is, Ohtebo, Kintoki, Uzura and others of high quality. The chief producing areas of kidney bean are concentrated in Hokkaido more thickly than that of Azuki bean, and the amount of kidney bean produced there has attained to 90% of the whole country production. This bean is used as the boiled beans, sugared beans and as the materials for Japanese cakes. And a large quantity of this bean is also imported as the materials for bean-jam. These beans are imported from many countries of Southeast Asia, Africa and America. Some of the beans produced in Southeast Asia and America contain the cyanide substances, so these beans are inhibited by the Food Sanitation Law to use except for the process of bean paste.

The first cultivation of broad bean in Japan is considered very old as well as the Azuki bean. This bean has been cultivated, in Japan, during the winter season as a winter crop, but the crops of this kind are decreasing recently on account of the labour shortage. The broad bean has been used as the popped beans, parched beans, fried beans and as the materials for various kinds of cake.

It is especially used abundantly as the low cost materials for bean-jam. The exporting countries of this bean are China and Ethiopia, etc.

The history of cultivation of pea in Japan is rather obscure. It is now cultivated in spring and summer in Hokkaido, but in the other districts it is a winter crop as well as the broad bean.

The production of pea in Japan is also decreasing year by year in the same way as the broad bean. It is also used, similarly to the broad bean, as the popped beans, parched

Table 1. Domestic production of legumes

Year	Soybean			Peanut			Azuki bean (small red bean)			Kidney bean			Broad bean			Pea			Cow pea			Total	
	Area ha	Yield t/ha	Production t	A.	Y.	P.	A.	Y.	P.	A.	Y.	P.	A.	Y.	P.	A.	Y.	P.	A.	Y.	P.	Area ha	Production t
1955	385,200	1.32	507,100	25,900	1.81	46,800	135,300	1.11	150,000	96,700	1.46	141,000	22,800	1.08	24,700	22,000	1.27	27,900	15,800	0.97	15,300	703,700	912,800
1956	383,400	1.19	455,500	31,800	1.56	49,600	150,100	0.72	107,600	85,300	0.91	77,400	22,500	1.13	25,300	16,600	0.79	13,100	17,100	0.95	16,300	706,800	744,800
1957	363,700	1.26	458,500	39,600	1.81	71,800	141,000	0.99	139,800	94,600	1.16	109,800	20,500	1.00	20,500	14,900	1.12	16,600	17,900	1.02	18,300	692,200	835,300
1958	346,500	1.13	391,200	43,900	1.90	83,300	142,100	1.04	147,500	105,200	1.41	148,900	20,000	1.03	20,700	11,500	1.30	14,900	17,500	0.95	16,700	686,700	823,200
1959	338,600	1.26	426,200	42,900	2.19	94,000	144,300	1.09	156,600	102,200	1.46	148,800	20,000	1.21	24,200	12,100	1.44	17,400	16,400	0.99	16,300	676,500	883,500
1960	306,900	1.36	417,600	54,800	2.30	126,200	138,700	1.22	169,700	89,300	1.59	142,200	19,300	1.20	23,200	17,300	1.35	23,500	15,300	1.04	16,000	641,600	918,400
1961	286,700	1.35	386,900	65,600	2.16	141,800	145,300	1.27	184,900	78,400	1.66	129,800	17,500	1.26	22,100	13,900	1.50	20,900	14,700	1.03	15,100	622,100	901,500
1962	265,500	1.27	335,800	64,200	2.22	142,500	140,200	1.00	140,100	84,700	1.19	100,700	21,100	1.07	22,500	13,300	0.86	11,500	14,400	1.00	14,400	603,400	767,500
1963	233,400	1.36	317,900	61,400	2.34	144,000	121,700	1.14	138,500	95,400	1.42	135,200	17,900	0.46	8,310	9,280	0.89	8,250	11,900	1.10	13,100	550,990	765,260
1964	216,600	1.11	239,800	62,800	2.08	130,600	125,000	0.68	84,500	87,900	0.89	78,600	16,600	1.07	17,700	8,400	0.97	8,120	11,600	0.98	11,400	528,900	570,720
1965	184,100	1.25	229,700	66,500	2.05	136,600	108,400	1.00	107,900	92,200	1.46	134,400	15,500	1.10	17,100	7,910	1.14	8,990	10,600	1.00	10,600	385,210	645,290
1966	168,800	1.18	199,200	64,900	2.14	138,800	122,400	0.76	92,800	91,700	0.88	80,900	13,400	1.13	15,200	8,050	0.90	7,230	9,940	1.04	10,300	479,190	544,430
1967	141,300	1.35	190,400	61,500	2.21	135,900	112,600	1.28	143,600	79,700	1.50	119,800	11,200	0.96	10,800	6,920	1.18	8,180	9,140	0.93	8,490	422,360	617,170
1968	122,400	1.37	167,500	59,100	2.07	122,400	101,000	1.13	114,300	68,400	1.53	104,800	9,330	1.16	10,800	5,950	1.31	7,780	8,380	1.03	8,610	374,560	536,190
1969	102,600	1.32	135,700	59,500	2.11	125,600	91,700	1.04	95,500	63,800	1.56	99,600	7,710	1.12	8,650	5,060	1.20	6,050	7,700	0.97	7,480	338,070	478,580
1970	95,500	1.32	126,000	60,100	2.07	124,200	90,000	1.21	109,000	73,600	1.68	123,700	6,520	1.10	7,170	5,520	1.36	7,510	7,000	1.10	7,700	338,240	505,280
1971	100,500	1.22	122,400	57,300	1.93	111,800	99,600	0.78	77,700	62,300	1.43	89,100	5,500	1.10	6,050	4,810	1.01	4,850	6,300	1.00	6,300	336,310	417,200

Source: The statistics of Ministry of Agriculture and Forestry.

Table 2. Importation of legumes

Year	Soybean		Peanut		Azuki bean (small red bean)		Kidney bean		Broad bean		Pea		Peyin bean		Others		Total	
	Amount	Value	A.	V.	A.	V.	A.	V.	A.	V.	A.	V.	A.	V.	A.	V.	A.	V.
1955	808,177	98,243	14,554	3,438	7,981	2,026	38,793	4,088	10,234	1,093	13,604	1,154	—	—	29,984	3,002	923,327	113,044
1956	717,081	84,648	8,848	2,168	4,278	745	8,454	761	18,799	1,878	810	83	3,009	247	5,463	504	766,742	91,034
1957	805,489	93,391	11,511	2,863	9,363	2,101	25,817	2,703	29,936	3,672	9,013	1,128	10,134	877	20,409	2,292	921,672	109,027
1958	904,700	90,753	8,169	1,652	15,001	2,438	14,663	1,385	19,651	2,143	8,315	768	6,988	620	12,621	1,301	990,108	101,060
1959	997,953	96,238	5,235	1,033	8,428	1,413	13,466	1,206	23,612	2,898	9,437	1,211	4,792	423	13,247	1,507	1,076,170	105,929
1960	1,128,290	107,437	6,154	1,334	17,495	1,976	17,813	1,515	10,726	1,005	8,629	884	5,537	526	13,129	1,175	1,207,773	115,852
1961	1,158,265	128,786	3,313	751	2,395	294	13,418	1,320	7,558	653	4,011	375	5,246	485	21,290	1,939	1,215,496	134,603
1962	1,293,111	132,698	3,337	743	7,847	768	32,942	3,927	13,751	1,255	6,541	639	8,410	744	15,033	1,372	1,380,972	142,146
1963	1,544,358	167,932	9,853	2,135	12,277	1,654	47,025	5,414	14,816	1,460	10,563	1,584	13,371	1,283	21,286	2,093	1,673,549	183,555
1964	1,607,150	184,508	18,701	4,201	23,227	3,560	36,389	4,124	20,244	2,050	8,990	1,390	9,517	997	18,294	1,849	1,742,512	202,679
1965	1,847,469	225,756	25,134	7,057	23,833	6,067	61,528	7,636	28,756	3,078	23,356	2,766	14,300	1,658	20,726	2,206	2,045,102	256,224
1966	2,168,467	271,985	37,824	9,806	43,714	8,575	47,055	5,306	18,222	2,087	17,251	2,232	9,009	1,153	15,182	1,706	2,356,724	302,850
1967	2,169,802	272,016	30,392	7,554	35,371	7,514	67,409	8,014	23,349	2,725	21,381	3,010	11,586	1,464	24,351	2,820	2,383,641	305,117
1968	2,420,767	274,120	49,490	11,329	27,318	4,741	39,539	4,397	18,653	2,548	13,373	1,614	7,355	770	10,074	1,086	2,586,569	300,605
1969	2,590,596	281,011	43,929	12,515	26,781	5,318	88,832	10,022	22,937	2,823	28,521	3,444	6,695	830	12,894	1,568	2,821,185	317,531
1970	3,243,790	365,766	59,007	19,816	18,106	5,835	51,706	7,861	22,056	3,174	35,916	4,608	11,264	1,607	14,495	2,409	3,456,340	411,076
1971	3,211,568	409,242	52,382	18,579	38,982	13,057	59,966	9,323	19,256	2,885	40,016	4,697	11,599	1,690	12,961	2,159	3,446,730	461,632

beans, fried beans and the materials for cakes and bean-jam. It is imported from America, Holland, New Zealand and Australia.

The cow-pea was introduced into Japan before 9th century from China. It has been cultivated almost in the Southwest region of Japan, because it is not so adaptable to the cold weather. It is used as the sugared beans and the materials for Japanese cakes, and also used for "red rice" (rice is boiled together with red colored beans) which has been eaten traditionally at some happy events in Japan.

The varieties of cow-pea cultivated in Japan are of large seed and red color, and the varieties of small seed or white color are imported from Southeast Asia and Africa.

Research and Experiment on Food Legumes in Japan

I. Soybean

The history of the scientific researches on soybean is as old as that of rice, wheat and barley in Japan.

The agricultural experiment stations were established one after another in every prefectures in Japan since the establishment of National Agricultural Experiment Station in 1893.

And it has passed about 80 years since the breedings of rice, wheat, barley and soybean were started in these experiment stations.

The key subject of the researches on soybean which have been studied during this 80 years was the breeding, and many varieties of good qualities have been bred up to now (1972), and 59 excellent varieties have been already recognized and registered by the Government.

Besides the breeding, researches on physiology and ecology, studies on cultivation and labour-saving mechanized cultivation, and studies on utilization and process of soybean have been also carried out in these experiment stations.

1. Breeding of soybean.

(1) Objective of breeding.

Though the soybean is in great demand as the protein food stuffs or oil materials, the production of soybean in Japan is now considerably decreasing owing to the importation of foreign soybean of low price. So the breeding has been promoted to rationalize and increase the soybean production, and items of breeding objectives are as follows:

- 1) high yielding (more than 4 tons per ha.),
- 2) good qualities (yellow hilum, large seed, protein contents over 50% or oil contents over 25%),
- 3) resistance against disease and insect (soybean pod borer: *Grapholita glycinivorella* Matsumura, soybean cyst nematode: *Heterodera glycines* Ichinohe, purple speck: *Cercospora Kikuchii* Matsumura et Tomoyasu, virus disease, etc.),
- 4) resistance against cold weather and adaptability for mechanized cultivation (lodging resistance, shattering resistance, uniformity of pod setting position).

(2) Organization for breeding

The whole country has been divided into five breeding regions according to the ecological types of cultivated soybean to accomplish above described breeding objectives. The national experiment stations and other four public experiment stations which have been entrusted by the Government have cooperated in the breeding taking the partial charges of the work. On the other hand, the Hokkaido National Agricultural Experiment Station has analyzed the protein and oil contents of the samples of soybean varieties which were in the course of breeding at the experiment stations of respective regions, and has offered the data for the convenience of the quality selection. The National Institute of Agricultural Sciences has investigated the characteristics of soybean varie-

ties imported from foreign countries as the original materials for breeding and has kept them as the stocks. The Institute of Radiation Breeding has studied on the utilization of mutants obtained by radiation for the breeding.

Table 3. Cooperation system of soybean breeding in Japan (1972)

Experiment station	Location	Charged areas	Works
The second faculty of physiology, Division of physiology & genetics, Nat. Inst. Agr. Sci.	70, Arai, Kitamoto City, Saitama Prefecture	All over the country	Investigation on the characters of imported varieties and reservation of them
Radiation Breeding Inst., Nat. Inst. Agri. Sci.	Omiya town, Nakagun, Ibaraki Pref.	All over the country	Breeding using the mutants caused by radiation
Hokkaido Agr. Exp. Sta.	1, Hitsujigaoka, Sapporo	All over the country	Analysis of chemical components of varieties and strains for breeding
Tokachi Agr. Exp. Sta. of Hokkaido	Shinsei, Memuro town, Kasai-gun, Hokkaido	Northern and eastern region of Hokkaido	Breeding of the varieties of the flowering and maturity type Ia-Ib, especially the varieties of high protein and oil contents, and of resistance against cold injury
Central Agr. Exp. Sta. of Hokkaido	Kita 15, Higashi 6-sen, Naganuma-chô, Yûbari-gun, Hokkaido	Central and southern region of Hokkaido	Breeding of the varieties of flowering and maturity type IIa-IIb, especially the varieties resistible against soybean dwarf disease
Kariwano Exp. Field, 2nd. div. of cultivation, Tôhoku Agr. Exp. Sta.	Kariwano, Nishi Senpoku-chô, Senpoku-gun, Akita Pref.	Tôhoku district	Breeding of the varieties of flowering & maturity type IIc-IIIb, especially the varieties resistible against virus disease and cyst nematoda
Kikyôgahara Branch Labo. of Nagano Agr. Exp. Sta.	Hirooka, Shiojiri city, Nagano Pref.	Kantô-tôsan, Hokuriku, Sanin, Tôkai, Chûgoku (mountainous regions)	Breeding of the varieties of flowering & maturity type IIb-IIIc, especially the varieties of stable and heavy crops.
2nd. Crop div. of Kyûshû Agr. Exp. Sta.	Suya, Nishi-Gôshichô, Kikuchi-gun, Kumamoto Pref.	Kyûshû, Chûgoku, Shikoku, Tôkai	Breeding of the varieties of flowering & maturity type Ib-IIa (summer crop), IVc-Vc (autumn crop), especially the varieties of high protein contents and heavy crop

Note: The flowering and maturity type was established to classify the soybean varieties by the varietal difference of the number of days from sowing to flowering (flowering days), and from flowering to maturity (ripening days) and by their combinations. The standard number of flowering days and ripening days are as follows;

(1) Flowering days:

I...less than 60 days, II...less than 70 days, III...less than 80 days, IV...less than 100 days, V...more than 100 days

(2) Ripening days:

a...less than 60 days, b...less than 75 days, c...more than 75 days

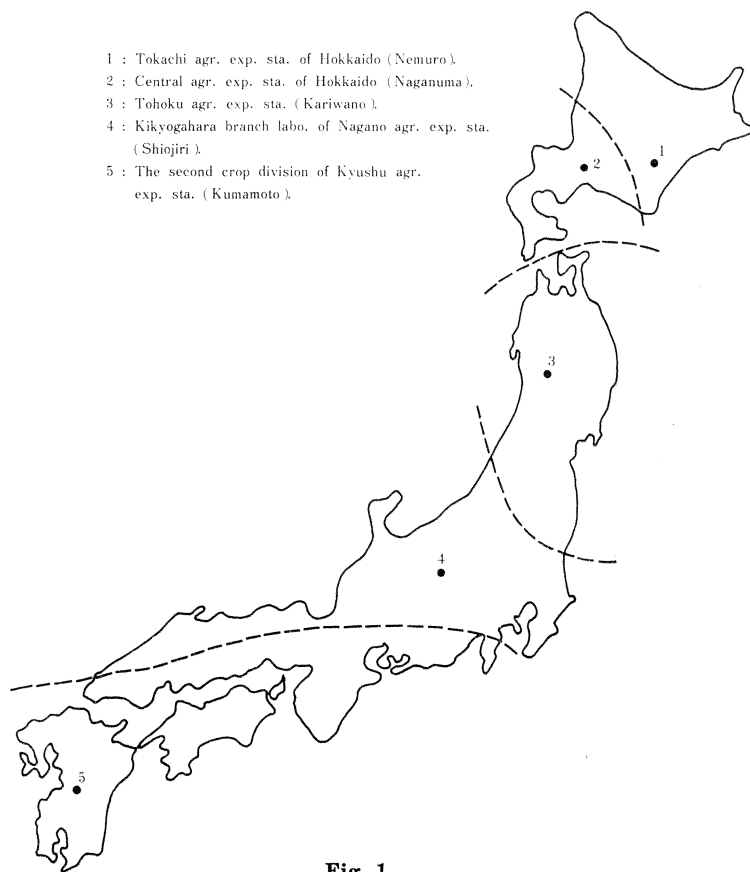


Fig. 1.

(3) Physiological character test and adaptability test of soybean strains.

In the course of breeding, the resistance against diseases and insects is tested in seven experiment stations. The physiological characters are also examined in fourteen prefectural experiment stations entrusted by the Government and, in these stations,

Table 4. The experiment stations for the physiological character test of soybean and their subject diseases and insects (1972).

Experiment station	Subject diseases and insects
Central Agr. Exp. Sta. of Hokkaido	Soybean pod borer
Iwate Agr. Exp. Sta.	Sphaceloma scab
Yamagata Agr. Exp. Sta.	Virus diseases
Tochigi Agr. Exp. Sta.	Soybean cyst nematode
Fukushima Agr. Exp. Sta.	Purple speck
Ehime Agr. Exp. Sta.	Virus diseases
Kagoshima Agr. Exp. Sta.	Root-knot nematode

the adaptability of strains for the cultivation in respective district is tested.

(4) Varieties registered by the Government.

After being tested on the physiological character and adaptability as mentioned above, the excellent strains selected are sent to each prefectural experiment station to be examined on their performances for the determination of recommendable variety of each prefecture.

And the varieties which have succeeded in this examination are applied to the Ministry of Agriculture and Forestry as the candidates for new registrable variety, and the candidates which are recognized their excellent qualities by the Designation and Registration Committee (which is organized in the Ministry of Agriculture and Forestry by the men of learning and experience) are registered and released with proper names.

2. Studies on the high-yielding technics of soybean.

The yield of soybean per hectare in the major producing districts (Hokkaido and Tohoku districts) has been 1.3–1.8 tons at farmer's level, but 3–4 tons of yield has been attained in the experiment stations in certain districts. This difference of yield seems to be attributed to the technical improvement of cultivation, that is, plant breeding, proper application of fertilizer, dense planting, disease and insect control, etc. We hope to augment, in future, the yield of soybean to the level of 4–6 tons per hectare.

The main subjects of the experimental researches are as follows;

- 1) development of protective technics against cold injury by the application of plant growth regulator in the district of cold weather (Hokkaido),
- 2) establishment of controlling technics against diseases and insects by the application of fungicides and insecticides in the warmer, humid and rainy districts,
- 3) improvement of fertilization to get higher crop,
- 4) conservation and increment of soil fertility,
- 5) proper planting density.

These subjects have been studied taking the ecological aspects of soybean variety into consideration.

Recently in Japan, rice has been over produced every year, and it has been seriously considered to substitute rice crop with soybean crop on the dry fields converted from paddy fields. Consequently, the studies on the wet endurance of soybean and on the varietal difference of resistance against the diseases which may break out in the converted fields, have been taken up, at first, for the breeding of suitable variety of soybean. Furthermore, the high-yielding cultivation method and the mechanized labour-saving cultivation method for the converted fields have been investigated. The adaptability test of these new technics are being carried out in the farmer's fields as well.

3. Studies on the mechanized labour-saving cultivation of soybean.

As the Japanese soybean is now obliged to compete with imported soybean of low price, the reduction of production cost is the most urgent necessity. Therefore, it is desired very much to rationalize and increase the production according to the principle of "a right crop in a right region" by using the middle and large types of agricultural machines.

The working hours needed for the cultivation of soybean was about 600 hours per hectare with traditional human labour, but it may be reduced to 350 hours when the cultivation was carried out using the small type of machine, and furthermore, it may be reduced to 50–80 hours by the utilization of the large type of machine including combined harvester. Our target is 2.5–3.0 tons of yield per hectare with 50–70 hours labour using a 30 PS tractor.

As for the mechanized cultivation of soybean, there exist many problems remained unsolved in the practice of weeding, harvesting and drying of plants, so the studies must

be carried out laying emphasis on those problems.

4. Studies on the utilization and processing of soybean.

The studies on the efficient utilization of soybean as a food stuff have been carried out in the Food Research Institute with various zymotechnical or azymotechnical treatments.

2. Peanut

1. Studies on the breeding of peanut.

The breeding objective of the Chiba Prefectural Agricultural Experiment Station is to select out the varieties which are applicable to the cultivation in the plain fields of Kanto district. And these varieties are desired to have good quality, high yielding, semi-upright character, resistance against disease and insect (leaf spot, down leaf spot) and also desired to be the early maturing and large seed variety. The varieties of small seed, early maturing and high yielding have been also bred in this station for the use of peanut process.

The Kumamoto Prefectural Agricultural Experiment Station has been carrying out the breeding of peanut to get the varieties which are suitable for the cultivation in the warm south-west regions of Japan.

The characters desired to be maintained by the varieties are as follows; high-yielding, good quality, large seed, drought resistance, disease resistance, adaptability for the cultivation with abundant fertilizer and for the mechanized cultivation.

The mean value of crop of the whole country has kept the level of over 2 tons per hectare since 1959, and it attained to 2.2 tons in 1967, but it did not increase since.

The target of high yielding is 4 tons per hectare and the breeding is also promoted to attain to this level.

Four excellent varieties have been registered by the Government up to 1972.

2. Studies on the cultivation technics.

The studies on the peanut cultivation have been developed by the agricultural experiment stations of Kyushu, Tohoku and Kumamoto prefectures, besides the Central Agricultural Experiment Station.

The principal subjects of the study are as follows; establishment of the counter measures for the obstructing factors such as injury by continuous cropping, diseases, insect pests, drought, etc., and improvement of cultivation technics especially of sowing season, planting density, fertilization.

On the other hand, the mechanization of cultivation has been promoted to get 2.5-3.0 tons crop by 50 hours working per hectare.

3. Kidney bean, Azuki bean, etc.

The researches on kidney bean and Azuki bean have been carried out at the public experiment stations of the major producing districts (Hokkaido, Tohoku), and the principal subjects of the studies are the breeding and the comparative study of varietal adaptability.

The breeding of these legumes has been carried out to find out new excellent varieties especially in the Hokkaido Prefectural Tokachi Agricultural Experiment Station.

And the selection of suitable variety, establishment of high-yielding cultivation technics and mechanized cultivation technics have been studied recently by the Hokkaido National Agricultural Experiment Station aiming at the cultivation of kidney bean and Azuki bean in the dry fields converted from paddy fields, and the crops are desired to attain 2.5-3.0 tons for kidney bean and 2.5 tons for Azuki bean per hectare respectively.