DEVELOPMENT OF UPLAND FIELD CROPPING IN JAPAN, PARTICULARLY IN HOKKAIDO

Dr. TAKUMA GEMMA, Professor
Dr. TOHRU SHIMADA, Assoc. Professor
Mr. AKIO HONGO, Research Associate

Department of Grassland Science,
Obihiro University of Agriculture and
Veterinary Medicine

. Crops

Farmland in Japan is customarily divided into irrigated nd dry fields. The former covers slightly more than half of he total and is kept flooded during the rice growing season. ore irrigated land is found in the south where it can be rained after the rice harvest and a second crop planted. ice accounted for 57% of the total crop area in 1977. ther important cereal crops include wheat, barley and others hich are grown on dry fields. Both sweet (Ipomaea Batatas) nd white(Solanum tuberosum) potatoes are important food rops. Soybeans, peanuts and pulses, e.g. kidney beans and zuki beans (Phaseolus radiatus L. var. aurea Prain) are rown widely. Other important crops include daikon(Raphanus ativus), taro(Colocasia antiquorum), onions, lettuce, various inds of cabbage, watermelons, tomatoes and cucumbers.

Owing to active crop breeding and selection, modern ethods and heavy use of fertilizer, Japan has high crop ields, especially of the staple food, irrigated rice. he yield for the 3 years 1977-79 averaged 486 kg/10a. ince 1978 there has been a surplus of rice again. Upland ield cropping accounts for more than 11% of the total rice ield area (Table 1 and 2).

Table 1. Total area planted (ha) and farmland utilization (%) (1977)

otal area planted (ha)	Rice	Wheat and barley	Sweet potatoes	White potatoes	Misc. cereals
,707,000	2,757,000	172,100	64,400	124,900	21,000

Table 1 cont'd.

Beans	Orchard	Vegetables	Industrial crops	Mulberry	Forage crops	Farmland utilization
232,000	415,100	630,200	248,900	136,000	906,000	103.5

Table 2. National production of upland field crops (1977)

Crop	Area planted (ha)	Yield (t)	Yield/10a(kg)
Wheat	86,000	236,400	275
Barley	63,000	167,100	265
Naked Barley	14,800	38,700	261
Sweet potatoes	64,400	1,431,000	2,220
White "	124,900	3,420,000	2,740
Soybeans	79,300	10,800	140
Azuki beans	65,600	87,100	133
Peanuts	35,000	68,000	197
Rapeseed	2,590	4,540	175
Tobacco	64,517	173,249	270
Tea	51,300	441,220	860
Cabbage	41,600	1,532,000	-
Cucumbers	25,400	1,068,000	-
Taro	30,600	429,900	-
Tomatoes	18,100	974,200	-
Onions	29,500	1,120,000	-
Daikon	72,700	2,758,000	-
Green onions	24,100	555,600	-
Carrots	24,100	585,300	-
Egg plant	21,400	658,000	-
Lettuce	15,400	322,800	-
Green peppers	4,370	158,600	-
Chinese cabbage	40,500	1,743,000	-
Grapes	26,300	326,500	-
Japanese pears	17,300	518,300	-
Apples	46,600	958,800	-
Peaches	15,300	273,200	-
Oranges	153,900	3,539,000	-

Crop	No. of farm households	Area planted (ha)
Roses	1,440	217
Bulbs		
Lilies	3,180	228
Tulips	2,290	400
Chrysanthemums	29,000	3,410
Carnations	3,140	292

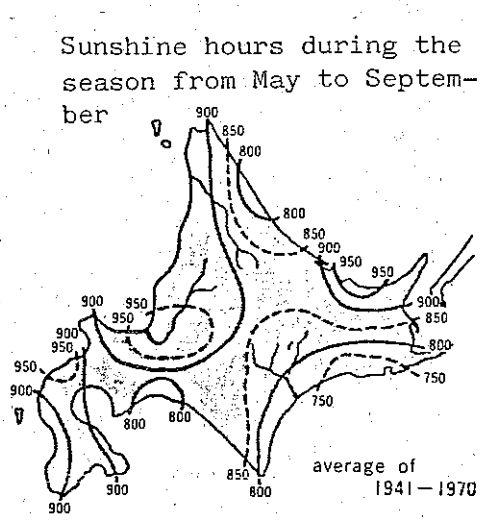
2. The History of Upland Field Cropping

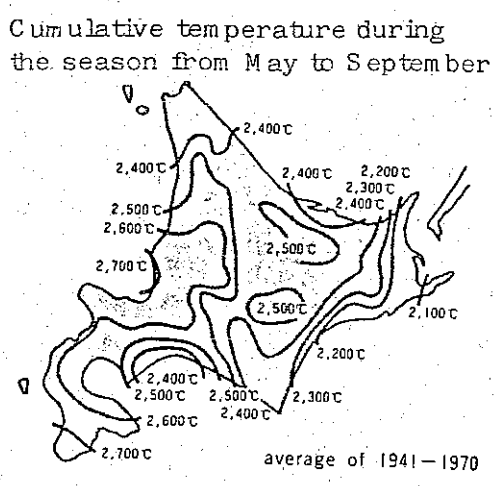
1) Hokkaido

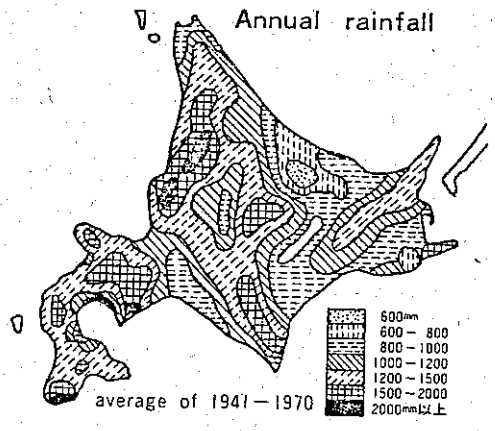
Hokkaido is the northernmost of the four main islands. It is distinct culturally and historically, having been settled later and still having a comparatively smaller population. It has long cold winters with considerable snow. The mean frost-free period varies from 120 days in the mountains inland to 145 days on the coast. The annual precipitation of 900 to 1,300 mm is distributed throughout the year. The soils are volcanic ashes of various ages, clays and peat (Fig. 1).

In Hokkaido the farmhouses are scattered over the plains in contrast to other parts of Japan, where they are usually grouped into villages. Farms are also larger than the national average (Fig. 2). On the north-eastern plains it is not possible to grow rice, so the chief crops are wheat, white potatoes, sugar beets, soybeans, kidney beans, azuki beans and silage corn (Fig. 3). As shown in Table 3, Hokkaido is a most important food supply area in Japan.

Agriculture in Hokkaido was started with trials of many kinds of crops by farmers; 43 crops were tested in the Tokachi district by the first settlers in 1883. In 1901, the Hokkaido Agricultural Experiment Station was set up in Sapporo, and all the experiment stations scattered throughout Hokkaido were brought under the supervision of the Hokkaido Agricultural Experiment Station. Fig. 4 illustrates the expansion of upland cropping areas and the establishment of agricultural experiment farms and stations.







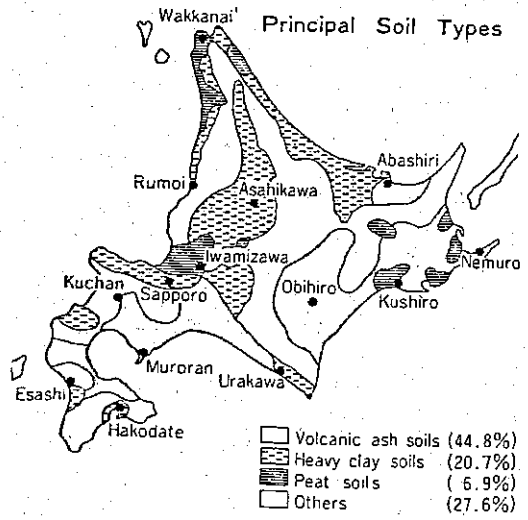


Fig. 1 Climate and soils in Hokkaido

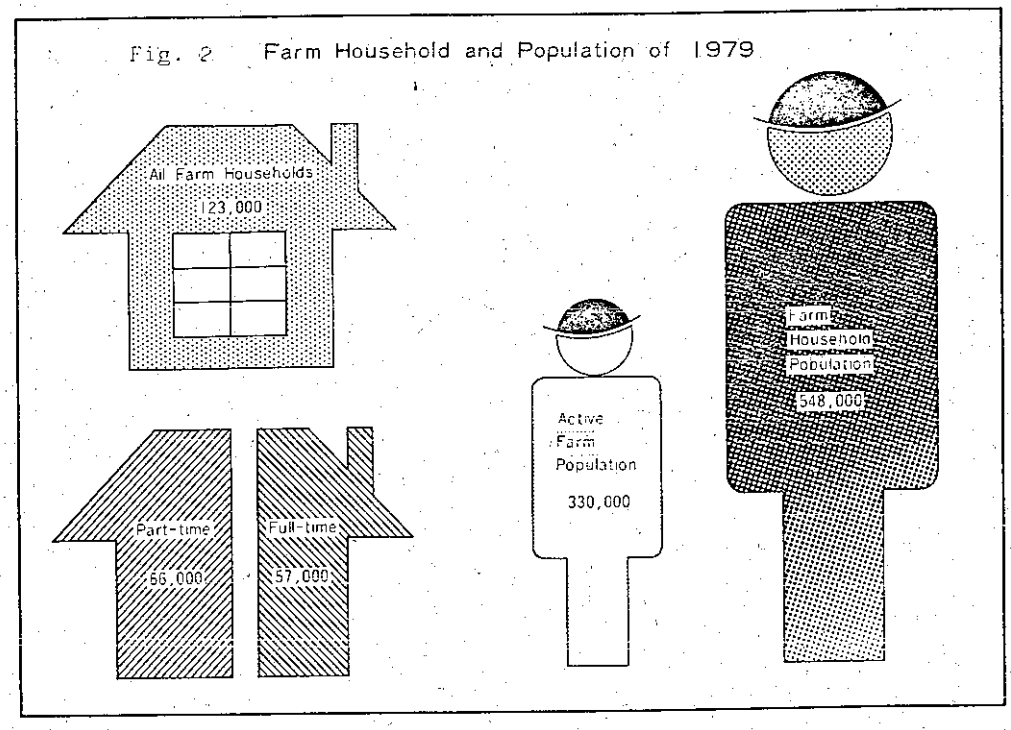


Fig.3 Crop planted area for 1979

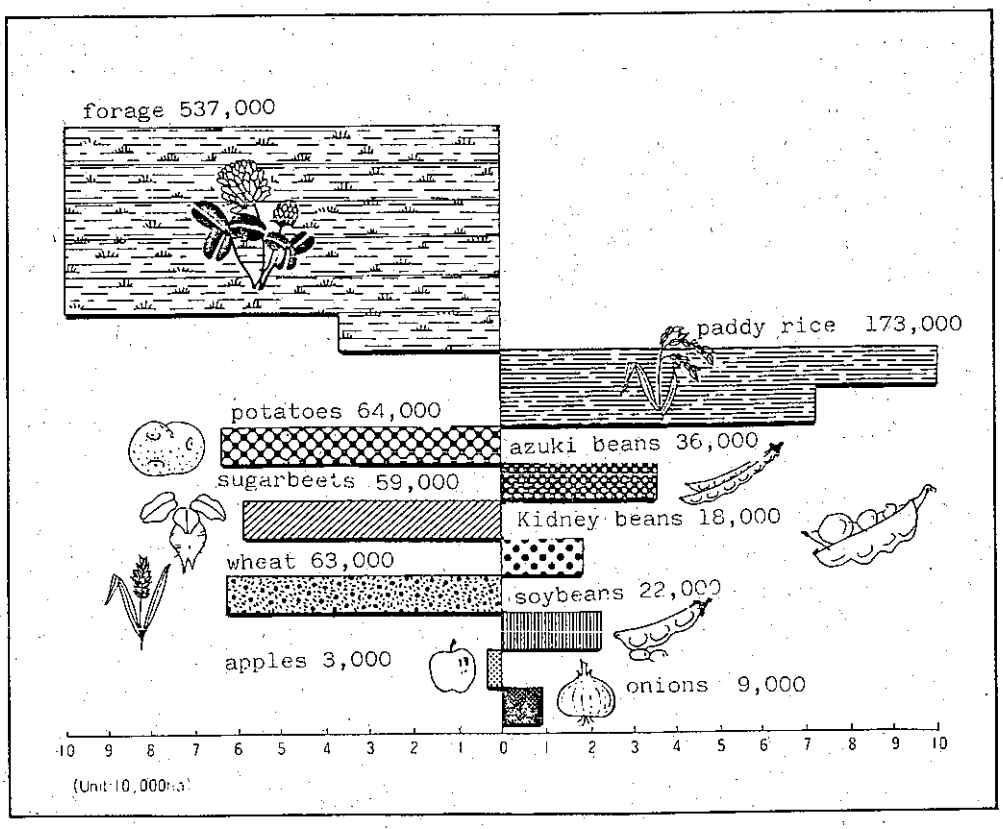
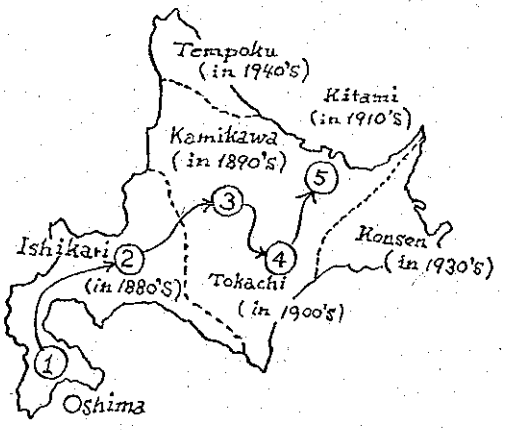


Table 3. **Agricultural Share of Hokkaido in Japan**

	Unit	Hokkaido		Nation		(A)/(B)	Source	
		Number (A)	Percentage	Number (B)	Percentage		Year of survey	Reference
			%		%	%		
Land								
Whole land area	1,000ha	8,351	(100.0)	37,764	(100.0)	22.1	53	Ministry of Construction
Arable land	〃	1,125	(13.5) 100.0	5,474	(14.5) 100.0	20.6		
Paddy field	〃	270	24.0	3,081	56.3	8.8		MAFF (Ministry of Agriculture, Forestry and Fishery.)
Upland farming field	〃	400	35.6	1,234	22.5	32.4	54	
Orchard	〃	5	0.4	592	10.8	0.8		
Grass land	〃	450	40.0	567	10.4	79.4		
Farm household	1,000 households	123	100.0	4,742	100.0	2.6	54	Prime Minister's Office
full time	〃	53	43.1	595	12.6	8.9		
Whole population	1,000 people	5,555	100.0	115,931	100.0	4.8	54	MAFF
Farm population	〃	553	10.0	21,946	18.9	2.5	54	
Workers	〃	2,462	—	53,141	—	4.6	50	Prime Minister's Office
Farm workers	〃	260	—	6,754	—	3.8	54	MAFF
Net national (Prefectural) product	100 million yen	74,170	100.0	1,655,242	100.0	4.5	53	Hokkaido, Economic Planning Agency, MAFF
Agricultural net product	〃	4,849	6.5	54,350	3.3	8.9	53	
Agricultural gross product	〃	8,978	100.0	103,670	100.0	8.7		
Crops	〃	5,513	61.4	71,916	69.4	7.7		
Rice	〃	2,613	29.1	36,781	35.5	7.1	53	MAFF
Livestock and dairy farming	〃	3,463	38.6	29,307	28.3	11.8		
Milk	〃	1,734	19.3	6,229	6.0	27.8		
Quantity of product	1,000 t							
Rice	〃	939	—	12,546	—	7.5		
Wheat	〃	142	—	367	—	38.6		
potatoes	〃	2,194	—	3,205	—	68.5		
Soybeans	〃	56	—	190	—	29.6	53	MAFF
Azuki beans	〃	74	—	96	—	76.9		
Kidny beans	〃	48	—	52	—	93.0		
Sugarbeets	〃	2,884	—	2,884	—	100.0		
Milk	〃	1,903	—	6,117	—	31.1		
Livestocks	1,000 heads							
Milk cows	〃	727	—	2,067	—	35.2		
Beef cattles	〃	164	—	2,083	—	7.9	54	MAFF
Hogs	〃	547	—	9,491	—	5.8		
Layers	〃	6,947	—	166,222	—	4.2		
Agricultural machinery tractors	1,000 units	95	—	1,096	—	8.7	54	MAFF
Farm economy								
Agricultural gross income	1,000 yen	7,986	—	2,399	—	332.9		
Managing expense	〃	4,345	—	1,202	—	361.5		
Agricultural net income	〃	3,641	—	1,197	—	304.2	53	MAFF
Non-agricultural income	〃	1,068	—	3,025	—	35.3		
Farm household income	〃	4,709	—	4,221	—	111.6		
Household expense	〃	3,708	—	3,421	—	108.4		

Fig 4. Expansion of Upland Cropping in Hokkaido



Note: Principal research stations in 1870-1907

(1)	Nanae Station	(1870)
(2)	Sapporo Government Farm	(1871)
	Niikappu Ranch	(1872)
	Makomanai Ranch	(1876)
	Sapporo Agricultural School	(1876)
(3)	Kamikawa Experimental Farm	(1889)
(4)	Tokachi Experimental Farm	(1895)
(5)	Kitami Branch, Hokkaido Agr.Exp.Sta.	(1907)

Crop varieties from other districts in the country were tested for their local adaptability at each station. The adaptability tests were continued until 1911, followed by attempts at breeding new varieties. During the period from 1912 to 1925, the breeding of new varieties using the pure line selection method appeared. New varieties bred by the artificial crossing method (beginning in 1912) came to be available from about 1926. There had also been some varieties bred by immigrant farmers, but these varieties came to be replaced by varieties bred at the experiment stations.

Table 4. Upland crop breeding, by year

Crop	Planted area in 1960	Breeding by adaptability tests (before 1911)	Breeding by pure line selection method (1)	Breeding by artificial crossing method (2)
Wheat	15,100 ha	(Winter), Martinsamber (Spring), Green mountain	Martin No. 8 (1919)	Akasabi-Shirazu (Brown rust-free No.1(1927)

Table 4. Upland crop breeding by year (cont'd)

Crop	Planted area in 1960	Breeding by adaptability tests (before 1911)	Breeding by pure line selection method (1)	Breeding by artificial crossing method (2)
Oats	73,100	Race horse	Sapporo spring No.9 (1915)	Norin No. 3 (1930)
Maize (seed)	13,500	Long fellow	Victory No.1(1932)	Early cat No.1(1934)
Dent corn	32,500	Yellow dent	-	By using F_1 hybrid (after 1944)
Soybeans	68,600	Akasaya	Oyachi No. 2(1930)	Nagaha-hadaka (1930)
White potatoes	90,000	Early rose	Hokuno No.2 (1918)	Benimaru (1938)
Sugar beets	46,100	Klein-wanzleben	Hon-iku No.48 (1927)	Hon-iku No.190 (1935)
Flax	12,000	Belgium	Belgium No.1(1924)	Nansho (1939)

Note: The above varieties show only a few examples from among the many varieties tested. Varieties cited in the columns (1) and (2) are those which appeared first. Some of the present ones have been further improved.

By the late 1920s fundamental cultural methods according to crops and areas in Hokkaido were established based on the experiences of farmers as well as a great many experiments.

(1) Wheat

Wheat was introduced into Hokkaido when the island was first colonized. Recently the planted area of wheat has increased remarkably, owing to the need to become more nearly self-sufficient in food production resulting from the tight situation in the world food supply markets. The planted

area in 1975 was 23,100 ha and the total output was 35,000t (Fig.5). The crop rotation system is shown in Fig. 6.

Fig.5 Planted area and production of wheat

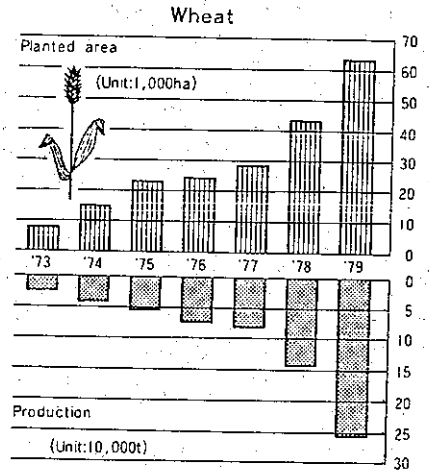
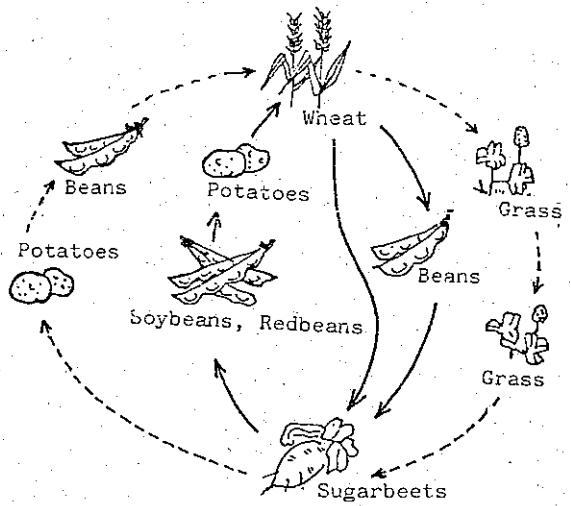


Fig.6 Typical crop rotation system in Hokkaido

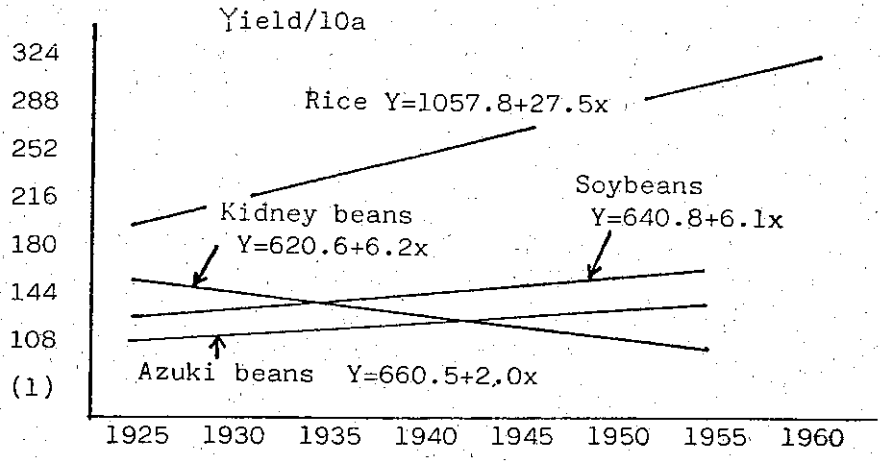


Regarding wheat breeding, selection of varieties was the main emphasis from 1903 to 1914 at the Hokkaido Agricultural Experiment Station. Successively, the pedigree test was introduced after 1923, and many leading varieties have appeared.

Breeding by hybridization was initiated in 1919. One of the purposes of hybridization was to breed varieties resistant to leaf rust (Puccinia recondita Roberge) and to lodging.

With respect to the improvement in cultural methods, soil fertility conservation and crop rotation have been dealt with as most important problems.

Fig. 8 Yield increase compared



The history of soybean research in Hokkaido is divided into six stages:

(i)	1869-1886	Domestic varieties tested.
(ii)	1887-1920	Varieties selected and cultural method established.
(iii)	1921-1936	Cultural methods improved; suitable varieties increased.
(iv)	1937-1945	Bean fields shifted to other crops necessary for wartime. Soil fertility depleted.
(v)	1946-1955	Breeding system reconstructed. Cultural methods changed to mechanical and chemical.
(vi)	1956-	Bean quality improved. Labor force reduced.

Early soybean breeding was initiated by means of natural selection, followed by pure line selection. In the second stage, the agricultural stations endeavored to compare the characters among many varieties which had been planted and newly introduced. Until 1937, the main emphasis had been on pure line selection. Since then many superior varieties having characters such as early maturity, high yield and high quality were segregated.

Breeding by means of artificial crossing was started from 1927 at the Tokachi Agricultural Experiment Station. One objective in early breeding attempts by the use of artificial crossing was to breed varieties resistant to

soybean pod borer attack. Thus Dairyu-hadaka was bred as a result of the combining of a glabrous and a high yielding, high quality variety. Tokachi-nagaha was derived from the crossing of To-iku No. 65 and Daizu-hon No. 326 in 1933 at the Tokachi Agricultural Experiment Station. Tokachi-nagaha accounted in 1955 for more than half of the area planted in soybeans. Thereafter, Isuzu, Kitami-shiro and Karikachi were found to be more stable for worse climatic and soil conditions and came to replace Tokachi-nagaha. At present Toyosuzu and Kitamusume are leading in the Tokachi district.

Since 1955, imported soybeans began to surpass the amount of domestic production. Domestic soybeans, now reduced to only 4% of national consumption, are used as the base for traditional Japanese foods. Recent soybean breeding aims at the improvement of the characters including bean size, hulum color, and protein content. In addition to the above, tolerance to low temperatures and resistance to cyst nematode are also considered important.

Regarding methods of soybean culture, a large volume of experimental studies has been accumulated. Since 1949, tests for increasing the yield were encouraged. Thereafter, dense plantings for mechanization were tested. It was demonstrated that there were marked differences in adaptability for plant density according to variety.

The concept of fertilizer application on soybeans has changed remarkably as compared to other crops. Experiments concerning fertilizer are divided into four stages:

(i) Phosphorus only was tested until about 1920.
(ii) As soil fertility depletion became apparent, the amount of commercial fertilizers applied increased.
(iii) Commercial fertilizers became scarce during wartime.
(iv) Fertilizer availability returned to prewar level. Additionally the effect of manure on reducing cyst nematode injury, and the effects of Mg, Mn and Na in relation to the depletion of minor elements in the soil were tested (1946-47).

To increase nitrogen in the soil, inoculation of nitrogen-fixing becteria (Rhizobium Japonicum) was recommended and the inoculm was distributed to farmers without charge by the government in 1940. Owing to government aid, the area planted in soybeans increased to 7,000 ha in 1951.

The Tokachi Federation of Agricultural Cooperatives has distributed noculized seeds* to farmers since 1975. Consequently almost 30% of soybean seeds planted in the Tokachi district are renewed with processed seeds every year.

The relatively slow early growth of soybeans necessitates early weed control by cultivation and herbicide application. Tests on herbicides have been carried out since 1954. Currently, pre-emergence application of premerge (DNEP) and weeding with cultivators are the most popular practices. The most efficient soybean cultural method in Japan is shown in Table 5.

Table 5. Standard cultural method for soybeans in eastern Hokkaido

Machine	Type		Efficiency (ha/hr)
Bottom plow (with rakes)	14" x 2 sets		3.1
Disc harrow	18" x 24 disk		1.0
Spike-tooth harrow			0.6
Bean planter	4 row		2.5
Sprayer	450 l	Herbicide	1.5
		Pesticide	2.3
Cultivator	4 row		1.0
Combine			2.0

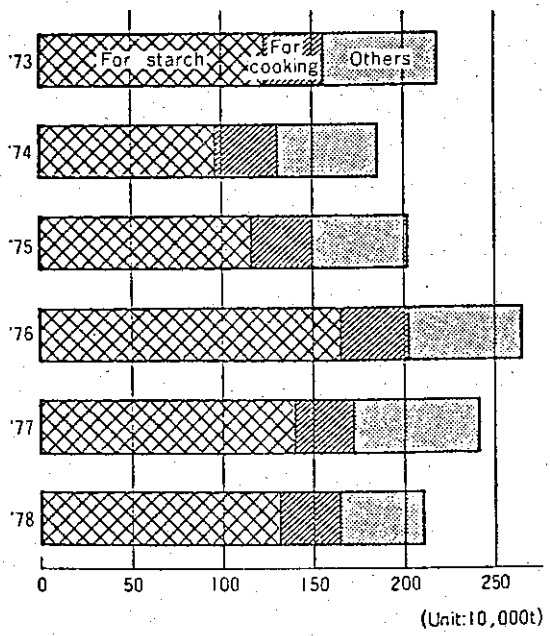
* The noculization process was developed in the United States in 1958. It involves the application of bacteria to seed in a liquid culture. The air is then removed from the seeds in a vacuum. It is reported that when the vacuum is released the bacteria are drawn under the seed coat where, it is claimed, they remain viable for a long period of time.

(3) White potatoes

The history of white potato planting in Hokkaido goes back 260 years. Today they are widely planted in Hokkaido and used as food, seed and as raw material for starch. In 1975, the total planted area of potatoes was 71,400 ha. The output amounted to 2,090,000 t (Fig.9) and the yield per hectare rose to 29.3 t. The increase in potato yield resulted from the renewing of seed potatoes, the proportion renewed being more than 50% for the whole country and 90% for Hokkaido.

The potato is a cool weather plant, making its best growth where the mean July temperature is about 21° C or lower. The young sprouts develop best at soil temperatures of about 24° C, although tuber growth is best at temperatures of 15.5 to 18° C. Tuber production is retarded at soil temperature above 20° C, second growth may occur at 27° C, and growth is completely inhibited at 29° C, above which point the carbohydrates consumed by respiration exceed those produced by photosynthesis. Potatoes grown in the southern part of Japan are planted in the fall so that growth takes place while the weather is cool.

Fig. 9 Consumption of potatoes



Long days, high temperatures, and high amounts of nitrogen favor a heavy growth of plants, and prolong the growing season. Short days, cool temperatures, or a deficiency of nitrogen favor early tuberization. Days of intermediate length, cool temperatures, and ample nitrogen favor maximum tuberization.

The early history of potato growing in Hokkaido is vague; an old record shows that potatoes were planted in the southern part of Hokkaido as early as 1706. Modern potato cultivation was initiated by the introduction of many varieties from the United States. The adaptability of those varieties was compared in 1975 by Louis Boemer, an invited agronomist, who stated that the growth of potato plants in Hokkaido was better than that in the United States. He additionally gave warnings against potato pests and diseases.

Irish Cobbler, referred to in Japanese as the Danshaku-imo after the importer Baron (Danshaku) Kawata, is the most famous variety. It has been grown for more than a hundred years. Danshaku-imo currently comprises 45% of potato production in Japan.

For the purpose of potato breeding, the Shimamatsu Experimental Farm in Hokkaido was set up in 1938. There Norin No. 1 was bred in 1943, following which more than 20 varieties have been bred.

Due to virus diseases, the expansion of superior varieties could not be carried out with the degree of success achieved in other crops. To meet the requirements for increased food production in the postwar years, the stock seed farm organization was systematized, and in 1946, seven government operated farms for the production of seed potatoes were set up, four in Hokkaido and one each in Aomori, Gumma and Nagano prefectures. Thus the mass production of immune foundation seed potatoes was launched.

Further, breeding for resistance to potato blight, and for high starch content has continued. Recently, breeding of varieties suitable for processed foods such as mashed potatoes, French Fries and potato chips is being carried out.

Early cultural experiments were made on the size of seed pieces, depth of plowing, planting time, planting spaces, the application of manure and time of harvest. The effect of lime Bordeaux mixture on potato blight was examined

from 1912 to 1915.

Tests of sprouting inhibitors and the effect on tuber quality were carried out in the post-war years. Thereafter, imported herbicides such as Cl-IPC were tested on potato fields.

To reduce difficulties from clogging of potato diggers with vines and leaves, various chemicals were tried in 1963 to kill the vines. Killing the vines before harvest stops growth, hastens maturity, reduces the spread of blight and virus disease infection from the vines to the tubers. The tubers ripen quickly, the skins thicken, and digging is easier after the vines are killed. Chemical sprays including gramoxone, sodium chlorate and reglox have been used for vine killing.

Sprouting of potato tubers during transportation from producer to consumer occurs at temperatures higher than 5°C after completion of a rest period. For best keeping quality it is desirable to keep potatoes from sprouting for an indefinite period after curing. Many chemicals and plant hormones have been tried to inhibit sprouting. Recently irradiation of γ-rays on harvested potato tubers with Co 60 has been practiced in the Tokachi district.

Table 6 shows a standard cultural method for starch potatoes.

Table 6. Standard cultural method for starch potatoes in Hokkaido

Procedure	Date	Machine/Process	Remarks
Preparation of seed tubers (cutting, treatment with disinfectants)	mid-April		
Planting	4.25-5.10	Planter 66 cm x 30-38 cm	N10, P1 K10kg/10a
Weeding	5.5-8.20	Blind cultivation (3times,) hoeing (twice), net harrow	
Inter-tillage	5.25-6.25	Cultivator(4 times)	

Table 6. (cont'd)

Procedure	Date	Machine/Process	Remarks
Ridging	6.20-7.5	Ridger (once)	
Disease control	6.25-8.20	Sprayer (5 times)	
Harvest	8.20-10.20	Harvester	

(4) Corn

Corn was introduced from the United States to Hokkaido in about 1867. Dent and dent-flint hybrid corn for silage is raised for cattle. After World War II, new sweet corn varieties have been bred for food and for the canning industry.

The history of corn breeding in Hokkaido is divided into four stages.

(i) New varieties were introduced and their adaptability tested (1867-1938).
(ii) Corn breeding system was established (1939-1945).
(iii) F-1 hybrids were popularized (1939-1945).
(iv) Corn breeding system was reconstructed (1953-present).

The establishment of a corn breeding system in the second stage includes the improvement of ordinal varieties by means of ear to row method, tests of inter-varietal hybrids, propagation of inbred lines and selection of inbred lines.

To improve cultural methods, tests on plowing depth were begun from 1917, followed by tests of soil fertility conservation. Tests of N, P, K-fertilizer application were initiated in 1910 along with tests for volcanic ash and peat soils following the extension of corn cultivation to these special soils. In the third stage, the use of corn silage for cattle was evaluated in response to the deficiency in soybean meal imported from Manchuria during the China Incident. Therefore, fundamental experiments on corn breeding and cultural methods were completed before the war. Hybrids of inbred lines were used for these experiments because of their high degree of heterosis, ease in elimination of bad characteristics during the propagation of inbred lines, stability of genetic characters and ease in hybridization.

Experimental methods progressed remarkably with the introduction of modern statistical analysis after World War II. As a result, field tests were dealt with scientifically, and

the standards of experiments, including experimental design, size of plots and replications were established in 1951.

In the fourth stage, reconstruction of the breeding system was accomplished under the aid of the United States Department of Agriculture (USDA); more than 120 inbred lines were introduced and performance tests on their hybrids were continued from 1935 to 1959. Of these hybrids, three-way crossed varieties having more productive characters such as early maturity and resistance to cold weather, were brought into practical use for farmers in Hokkaido.

Experimentation was done on herbicides for corn fields and the use of 2・4-D and MCP was established by 1955. The low rate of seed germination caused by low soil temperatures had become a serious problem when attempting to spread the adoption of new hybrids. Although the problem was solved later, chlorosis of seedlings due to cold injury remains unsolved.

With the extension of hybrid corn planting, the standard of corn cultivation had to be revised. The revised standard for corn cultivation in Hokkaido is summarized in Table 7.

Table 7. Standard cultural method for corn in Hokkaido

Procedure	Machines	Remarks
Seedbed preparation	Tractor with plow, harrow	
Fertilizer application, seeding	Tractor with corn planter	Planting time: mid-rate N:P 0 :K 0 =12:18:15 10g/10a 4,000-6,000plts/10a

Table 7. (cont'd)

Procedure	Machines	Remarks
Weeding	Sprayer cultivator	atrazine
Harvesting	Hand picking Forage harvester Sweet corn harvester	Grain: 230kg/10a Silage: 4.5t/10a

(5) Sugarbeets

Sugarbeet cultivation in Hokkaido has played an important role in upland farming. Sugarbeets are one of the main crops in cold regions and also one of the main raw materials for sugar in Japan. The method of transplanting sugarbeet seedlings was developed and extended since 1962 and new varieties were introduced; thereafter sugarbeet yield was almost doubled. Sugarbeet seeds are planted in paper pots and seedlings are grown in a shelter(nursery) for about 5 weeks and then transplanted by a transplanter into the field. There are 8 sugarbeet factories in Hokkaido. The production of beetsugar furnishes 13% of national consumption. (Fig. 10)

Fig 10 Sugarbeet production

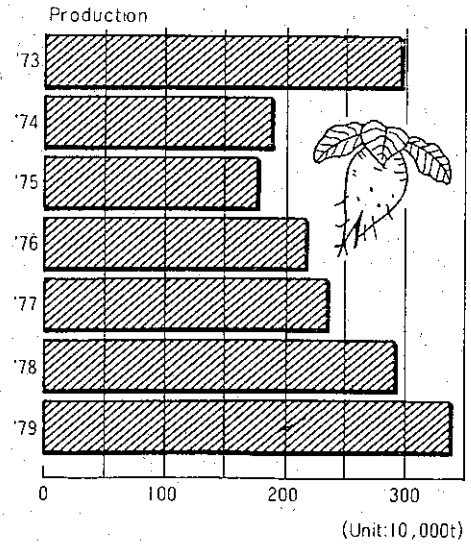
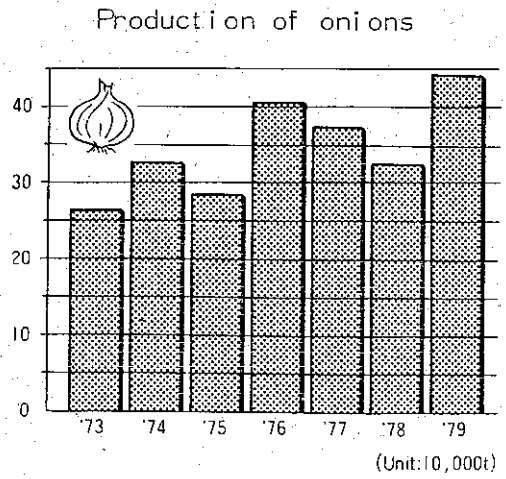


Fig. 11 Onion production



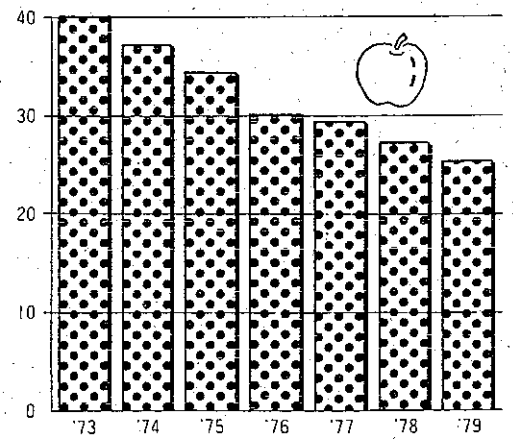
(6) Vegetables

Vegetable production is behind in comparison with other crops. However, in keeping with the increasing demand caused by the recent growth of city populations and because of a higher living standard, planted areas have been centered around the consuming large cities and production is on the increase. Most of the vegetables produced in Hokkaido are for consumption in Hokkaido itself. Onions (Fig. 11), carrots, yams, (Dioscorea balatas Decne), canned asparagus and canned sweet corn, however, are important special crops for shipment to markets outside of Hokkaido. Vegetable growing in Hokkaido is carried out on a comparatively large scale and mechanization is now making advances.

(7) Fruits

Fruits produced in Hokkaido are apples(Fig. 12), grapes, pears, chestnuts, cherries, peaches and others. The planted area for fruits totaled 5,090 ha in 1979.

Fig. 12 Apples: Area harvested



Unit: 100 ha

2) Honshu

In the northern half of Honshu, the summers are warm and humid, and the winters are cool and relatively dry. The mean annual rainfall is 1,000-3,000mm, but higher on the mountain slopes. South Honshu has slightly higher summer temperatures.

The farms here are very small, often less than 1 ha. They have intensive tillage systems with the land almost continuously in crops (Fig. 13). They are usually dominated by rice growing, but some more progressive farmers are branching out into livestock production.

Certain areas near large cities have developed dairying. Each tiny farm keeps only a few head of cattle, however they feed no forage crops, only commercial feeds.

FIELD No.	AREA (ha)	1957 JAN. APR. JUL. OCT.	1958 JAN. APR. JUL. OCT.	1959 JAN. APR. JUL. OCT.
1	.03	ONIONS CABBAGE / WHEAT WITH CHINESE CABBAGE	SWEET POTATOES* W/ DENT CORN	WHEAT / NURSERY BED
2	.08	RICE	DENT CORN / ITALIAN RYEGRASS* RICE	OAT AND ITALIAN RYEGRASS*
3	.04	RICE	OATS WITH VETCH* RICE	OATS AND ITALIAN RYEGRASS*
4	.03	MISC. VEGETABLES NURSERY BED FOR RAPE SEED	TEOSINTE*	MISC. VEGETABLES FOR HOME USE / WHEAT
5	.011	SUDAN GRASS* WHEAT WITH CHINESE CABBAGE	JAPANESE* JOHNSON GRASS	MISC. VEGETABLES
6	.13	RICE	OATS* GREEN PEAS RICE	WHEAT RICE BARLEY / OATS*
7	.13	RICE	OATS* BARLEY RICE	CABBAGE CHINESE CABB. ONIONS RICE
8	.17	RICE	WHEAT RICE	ITALIAN RYE* W/ VETCH RICE BARLEY W/VETCH
9	.17	RICE	BARLEY RICE	RAPE SEED RICE R.SEED
10	.12	RICE	RAPE SEED RICE	RAPE SEED RICE BARLEY
11	.13	RICE	WHEAT RICE	VETCH* RICE VETCH*
12	.04	SWEET POTATOES* BEETS*	WHEAT WITH CHINESE CABBAGE TEOSINTE* BEETS*	TOMATOS DAMAGED BY FLOOD UNDER REHABILITATION
13	.05	LADINO CLOVER*	RICE WHEAT	RICE RAPE SEED POTATOES

*denotes fodder crops

Fig. 13 Crops grown by field on a Japanese farm in 1957 1958 and 1959. (Source: F.A.O. 1962)

3) Shikoku and Kyushu

These parts of Japan are semi-tropical with a crop season of 12 months. The rains in the wet season (June-July) and the typhoon season (September-October) are very heavy; typhoons also can cause considerable damage to crops. Crops for livestock can be grown all year round. Although it is not common practice, three or four crops a year are possible. Otherwise farming is similar to that described above for sections of southern Honshu.