OUTLINE OF AGRICULTURE IN HOKURIKU DISTRICT AND RESEARCH AT THE HOKURIKU AGRICULTURAl EXPERIMENT STATION

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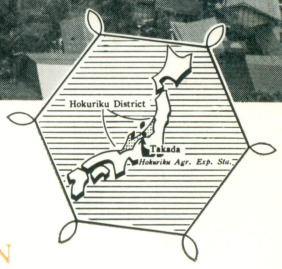
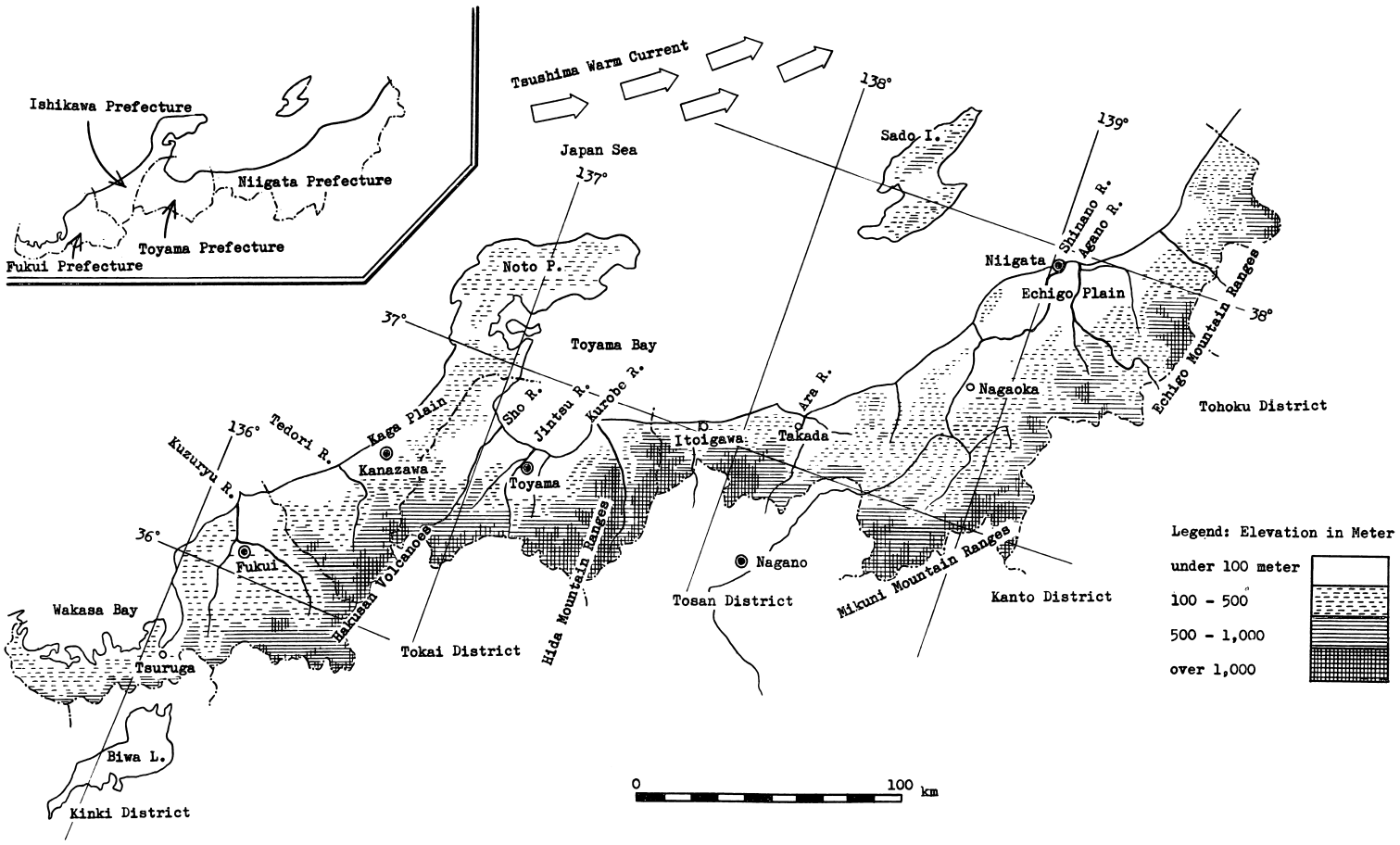


— March 1968 —

HOKURIKU AGRICULTURAL EXPERIMENT STATION
MINISTRY OF AGRICULTURE AND FORESTRY
GOVERNMENT OF JAPAN

Kami-inada, Takada, Niigata, JAPAN

TOPOGRAPHY IN HOKURIKU DISTRICTT



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Outline of Agriculture in Hokuriku District

1. Geographical Position and Topography

Hokuriku District is located in the Japan Sea side of the central part of the main island of Japan, extending from Long. 135°30′ to 140° E and from Lat. 35°30′ to 38°30′ N. There are four prefectures in the District, Niigata, Toyama, Ishikawa and Fukui covering approximately 2,525,100 hectares which constitute about 6.8 percent of the total land area of Japan.

This District is separated from other districts by several mountain ranges and hills streching generally in a northeast-southwest direction. In the northern part the Echigo and the Mikuni Mountain Ranges border Tohoku District. In the southern pat the Hida Moutain Ranges, the so-called North Japan Alps embracing mountains higher than 3,000 meters border Tokai and Kanto-Tosan Districts and in the south western part the Hakusan Volcanoes border Kinki District.

Several rapid rivers, Shinano, Agano, Kurobe, Jintsu, Sho, Tedori, Kuzuryu, etc. rise in those mountain-ranges and pour themselves into the Japan Sea.

The cultivated land in the District is mostly found in the plains which are formed in wide alluvial cones and on the lower reaches of rivers facing the Japan Sea. In general, all river-beds are raised.

The largest plain is the Echigo Plain formed by the Shinano River which is the longest in Japan and by the River Agano. There is an open, low and moist delta downstream, forming extremely moist paddy fields. Drainage is a very important segment of agriculture and is continuously being carried out. Across the Higashi-kubiki Hills in the south direction Takada Plain extends in the basin of the Ara River. Farther across the Nishikubiki Hills and the northern edge of the Hida Mountain Ranges lies the Toyama Plain, which is different from the Echigo Plain and is an alluvial fan with fairly steep slope at the back.

The Kaga Plain is an alluvial fan formed by the Tedori River. Fukui Plain is found in the basins of the River Kuzuryu and other adjoinning small rivers. And the Plain is low and moist, very similar to the Echigo Plain.

A line linking Itoigawa of Niigata Prefecture with Shizuoka is a structural zone traversing central Honshu (main island of Japan), which is known as the Fossa Magna.

The coast line of the District runs generally from north-east to south-west, practically straight in the upper part but irregular in the lower part with Noto Peninsula salient far out to sea, forming Toyama and Wakasa Bays.

In parallel to the coast line, belt-like dunes are found. Practically all the

plains are used as paddy fields and very small part of them, intermountainous areas and a part of coast dunes are used as upland fields.

II. Climate

The climate of Hokuriku District is same as that of other districts, mild and humid and is influenced by monsoon. That is, temperature, precipitation and sunshine hours for the summer crop from May to October are extremely favorable for rice cultivation. (see Table 1) And because of that about 85.7% of the total cultivated land is devoted to paddy rice cultivation.

Table 1. Climatic Comparison of Various Places

Meteorological Station	Latitude ° ′	Temperature (°C)			Precipitation (mm)			No. of Hours with Sunshine (h)		
		Mean.Ann. Temp.	Jan.	Aug.	Ann. Total	May ~Oct.	Nov. ~Apr.	Ann. Total	May ~Oct.	Nov. ~Apr.
Sappora	43 03	7.4	−5.9	21.7	1119	581	538	1873	1127	746
Akito	39 43	10.5	−1.6	24.4	1786	1087	699	1690	1144	546
Sendai	38 16	11.1	−0.2	23.9	1216	860	356	1910	940	970
Niigita	37 55	12.8	1.4	26.1	1743	792	951	1907	1246	661
Takaba	**37 06**	**12.7**	**1.3**	**25.9**	**3036**	**958**	**2078**	**1838**	**1147**	**691**
Toyama	36 42	13.0	1.5	25.8	2299	1050	1249	1835	1156	679
Kanazawa	36 33	13.3	2.2	26.0	2486	1088	1398	1854	1186	668
Fukui	36 03	13.6	1.9	26.5	2374	990	1384	1862	1177	685
Tokyo	35 41	14.3	3.2	26.4	1568	1064	504	2094	1043	1051
Osaka	34 39	15.3	4.1	27.7	1274	844	430	2222	1242	980
Hiroshima	34 22	14.6	3.7	26.9	1527	1056	471	2311	1284	1027
kagoshima	31 34	16.6	6.4	27.1	2170	1478	692	2234	1232	1002
Peking	39 56	11.9	−4.6	24.9	599	531	68			
Hong Kong	22 18	22.6	15.4	27.9	2265	1909	356			
Jakarta	6 11	26.6	25.9	26.7	1799	529	1270	2326	1339	987
Manila	14 31	27.3	25.4	27.4	1791	1551	240	2103	937	1166
Saigon	10 47	27.0	25.8	27.1	1808	1553	255			
Bangkok	13 44	28.0	26.1	28.2	1492	1267	225			
Calcutta	22 32	26.8	20.2	29.1	1582	1437	145	2605	1042	1563
Colombo	6 54	26.9	26.2	27.2	2397	1336	1061	2507	1132	1375

On the other hand, the climate during the winter crop from November to April is characterized by a remarkably heavy snowfall and extremely short sunshine hours because dry monsoon from Siberia absorbs moistures from the Tsushima Warm Current and hits frequently mountain ranges forming water-shed in Honshu. In other words, whereas the heaviest precipitation in other parts of Japan occurs in June-July or September-October while the same occurs in

December or January in this District.

Snow-fall in the District is the heaviest in Japan. It reaches over 200 cm in the mountainous areas and 70 to 80 cm even in the plains. Takada has so far continuously marked the highest record exceeding 200 cm on an average. The period of continuous snow-cover in the District is in general somewhat shorter than that of the Tohoku District. However, it extends 60 to 80 days in coastal areas, 100 to 120 days in the plains and over 140 days in the mountainous areas.

Excessive precipitation and too long and continuous snow-cover are the factors which prevent the increase in the utilization rate of cultivated land, especially of paddy field. The utilization rate of paddy field for double cropping during the winter season in the District is only 5.0%, being less than a quarter of the national average. (see Table 2)

Table 2. Area of Paddy Field by Use, 1965

Item / District		PaddyField Planted by Rice		Planted by Other Crops	Total
		Singl-planted Paddy Field	Double-croping Paddy Field		
Hokuriku	Area(ha)	324,607	17,044	828	342,479
	(%)	94.7	5.0	0.3	(100)
Whole Country	Area(ha)	2,267,308	665,100	10,470	2,942,878
	(%)	77.1	22.6	0.3	(100)

Table 3. Total Area Planted, 1965

Crop / District	Hokuriku (C) (ha)	Ratio C/D (%)	Whole Country (D) (ha)
Total Area Planted (A)	490,100	6.7	7,367,000
Rice	366,100	11.3	3,255,000
Wheat, Barley, Naked Barley, Oat, & Rye	3,372	3.4	960,800
White Potato	8,958	4.2	212,500
Sweet Potato	6,624	2.6	256,900
Miscellaneous Cereals	1,743	2.1	83,500
Pulses	24,650	5.1	485,800
Vegitables	34,650	5.5	627,900
Fruits & Nuts	7,892	2.2	351,200
Industrial Crops	10,021	2.9	347,700
Crops for Green Manure & Forage	19,647	3.2	610,800
Mulberry	5,745	3.5	163,800
Nursery[1)]	691	6.1	11,300
Cultivated Land Area (B)	404,325	7.3	5,555,171
Ratio A/B (%)	121		133

Planted Area of Winter Crops[2] (ha)	Total	33,884	2.9	1,559,000
	Paddy Field	17,044	2.6	665,100
	Upland Field	16,840	1.9	893,800

1) Nursery area is total of those which are used for pulses, vegetables, green manuring crops, and forage crops
2) In winter crops are included wheat, barley, naked barley, oat, rye, potato planted in early spring, peas, kindny boan, spinach, onion, rape, mat rush, and renge

Such weather conditions as excessive moisture and extremely short sunshine hours restrict the kinds of crops for cultivation and 90% of total planted acreage used for second-crop is devoted to the culture of Renge (*Astragalus sinicus* L.)

In addition, phenomenon called Fohn blowing down from the mountain ranges in late spring is a dry wind salient in the District. The wind causes a sudden rise in temperature.

III. Geology and Soil.

As stated above, high and steep mountain ranges divide the District from other districts.

The geology of these mountainous areas is Chichibu palaeozoic strata, palaeozoic granites, Hida metamorphic rocks, granodiorite, jurassic strata and others. Tertiary strata is widely distributed in most of the hills. Rocks of the tertiary

Table 4. Area of Degraded Soils in Hokuriku District, by Kind (ha)

(1) Paddy field

Prefecture	Total Area (ha)	Acidic soil area	(%)	Inferior volcanic ash soil area	(%)	Peaty soil area	(%)	Heavy clay soil area	(%)	Over-humus soi area	(%)
Niigata	174,061	7,872	4.5	7,856	4.5	9,958	5.7	1,320	0.7	3,108	1.8
Toyama	73,267	7,026	9.6	—	—	475	0.6	66	0.1	1,511	2.1
Ishikawa	50,168	3,514	7.0	—	—	83	0.2	797	1.6	—	—
Fukui	44,463	1,887	4.3	575	1.3	23	0.1	3,447	7.6	95	0.2

Prefecture	Iron deficient soil area	(%)	Sandy soil or soil rich in gravel area	(%)	Elements deficient soil area	(%)	Soil containing harmful ingredient area	(%)	Total area	(%)
Niigata	4,965	2.9	2,030	1.2	—	—	—	—	37,109	21.3
Toyama	15,821	21.6	—	—	—	—	—	—	24,899	34.0
Ishikawa	5,794	11.5	328	0.7	40	0.1	—	—	10,556	21.0
Fukui	4,248	9.6	2,135	4.8	614	1.4	31	0.1	13,055	29.4

(2) Upland field

Prefecture	Total Area(ha)	Acidic soil area	(%)	Inferior volcanic ash soil area	(%)	Heavy clay soil area	(%)	Overhums soil area	(%)
Niigata	45,080	21,590	48.0	7,800	17.3	110	0.2	—	—
Toyama	6,211	3,091	49.8	—	—	34	0.5	288	4.6
Ishikawa	11,245	3,801	33.8	—	—	200	1.8	—	—
Fukui	6,431	1,566	24.3	232	3.6	186	2.9	20	0.3

Prefecture	Sandy soil or soil rich in gravel area	(%)	Elements deficient soil area	(%)	Total area	(%)
Niigata	7,814	17.3	1,500	3.3	38,814	86.1
Toyama	—	—	—	—	3,413	54.9
Ishikawa	971	8.6	508	4.5	5,480	48.7
Fukui	—	—	—	—	2,233	34.7

strata are shale, mudstone, sandstone, conglomerate and igneous rock. Adjoining the tertiary strata there is the diluvium, generally forming table-land. Diluvial tablelands are mostly used as upland field. Alluvial strata are distributed in fans or delta formed by deposition of soil and by rivers. Upland fields are distributed in coastal dures and naturally formed banks of alluvial strata beside diluvial table-lands, tertiary hills and gently-sloping hillsides of volcanoes. Considerable differences in soil properties are found in upland fields according to the variation in geological derivation and parent materials. Upland soil in diluvial table-lands and tertiary hills are acidic in most cases. However, calcareous mudstone soil of tertiary strata shows alkali reaction, though its distribution is small. Parent rocks of soils from volcanic ashes are mostly augite andesite, double-augite andesite, etc. With soil surfaces being rich in humus in general. Most of the clays in these soils are allophane. Such volcanic ash soils were formed by deposition of volcanic ashes erupted from the end of Tertiary period to Quarternary period. In these soils bases eluviate to a great extent, and soils are acidic with strong phosphoric acid absorbing capacity. In broad sense soils of coastal dunes belong to Lithosols and the development of soil profile is not found. Moreover, content of clay and silt is small and absorbing and holding capacities of nutrition and water are very weak.

Paddy fields in most cases spread in fan and delta. Those in fan are low in ground water table and are good in drainage because of sandy loam or loam.

In the end of fan, however, paddy fields are ill drained because of springing water. Paddy fields in delta are low above the sea level and are consequently high in ground water table. And most of paddy fields are poor in drainage

because of clay or clay loam soil. As much as 60% of total paddy fields or 3,425 km² of the District is ill drained.

Nearly all soils of ill drained paddy fields have gley horizon. In low land surrounded by lagoons and in valleys soils with peat or muck horizon are often found. Black volcanic ash soil is distributed in low land along the borders of table-land although the acreage thereof is small. And such ill drained paddy fields are all rich in soil fertility, yet are disadvantageous to carry out the intensive utilization and to increase the productivity. To drain such paddy field large scale drainage projects are being carried out with the Government investments

IV. Land Use

Approximately 3,996 km² constituting 15.8 % of the total land area of the District is used for crop oultivation with very small acreage for grazing and mowing. And over 85% of the total cultivated land or about 3,425km² are paddy field. (see Table 5)

Table 5. Land Use in Hokuriku District, 1965

Item / Land Area	Hokuriku District (A) (km²)	Whole Country (B) (km²)	Ratio A/B (%)
Total Land Area	25,251	369,766	6.8
Agricultural Land Area	4,043	55,552	7.3
Cultivated Land Area	3,996(100)	50,912(100)	7.9
Paddy Field	3,425(85.7)	29,429(57.8)	11.6
Upland Field	492(12.3)	17,554(34.5)	2.8
Land for Growing Tree, Vines & Shrubs	79(2.0)	3,929(7.7)	2.0
Pasture Land & Meadow	48	4,640	1.0
Forest Land	3,947	53,902	7.3
Cultivated Land Area / Total Land Area	15.8 %	13.8 %	

Rice is by far the most important crop in Japan. And greater part of farm land in Japan is used as paddy field. The same is true in Hokuriku District, particularly because of abundant water from heavy snow and favorable climate for rice cultivation.

Upland fields are scattered in coastal dunes and in high place of flat plain and along slopes of the bases of steep mountains. Such upland fields would have been converted into paddy field if cheaper water is available.

As far as the economic state in Japan up to now is concerned, on profitable

agriculture other than rice culture has so far existed in this District. By the consecutive efforts having been done since the ends of the Meiji Era (about 1910), about 1,100 km² of paddy fields or 33% of the total were improved to be able to make double cropping and in part of those forage crops for dairy farming are grown. Vegetables are grown in the suburbs of cities as cash crops and in dunes and at bases of mountains fruit trees are grown. Besides, other crops such as mulberry, tea and flower bulbs, and such a special crop as scallion are grown but are not important farm products of the District.

V. Size of Farming.

There are 427,842 farm households in the District cultivating 4,043 km² in 1965. That is, average holding per farm household is less than 1 ha. To make a living mainly by the income obtained from rice production an average of 2 ha of paddy field is needed. And only 7% of the farmers in the District have a holding of over 2 ha of paddy field. The others are part-time farmers working in forestry, fisheries, hired labor and small shop, etc. The percentage of part-time farmers of the District is very high compared with the national average, reaching as high as 80% in Fukui and Ishikawa Prefectures. The increasing tendency in part-time farmer is a phenomenon salient in Japan in recent years. Many families are divided into a group to carry on agriculture and other in nonagriculture work. Such status on labor front of the District creates a difficulty in rice culture which requires so much hand labor during transplanting and harvesting time.

VI. Livestock.

Few domestic animals have been kept by farmers in the District compared with other districts. Present livestook production unit per farm household is 0.43 while that for the nation is 0.97. (see Table 6) Not only dairy and meat cattles are few but there are not enough draft animals.

Table 6. Number of Livestock in Hokuriku District, by Kind,

Item	Year	Niigata	Toyama	Ishikawa	Fukui	Hokuriku District	Whole Country
Milk Cow	1950	3,367	1,264	1,779	880	7,290	203,825
	55	6,840	2,320	3,020	1,240	13,420	421,110
	60	11,125	3,808	3,909	2,226	21,068	749,310
	65	15,730	5,650	6,650	5,050	33,080	1,288,950
Dual-purpose Cattle	1950	67,308	8,749	21,611	11,131	108,798	2,254,913
	55	86,950	13,400	20,880	13,520	134,750	2,636,490
	60	72,196	8,710	14,528	11,567	107,001	2,282,785
	65	45,430	3,900	8,170	3,740	61,240	1,885,810

Hog	1950	17,456	8,852	6,738	3,375	36,421	623,277
	55	31,930	8,390	7,660	1,200	49,180	825,160
	60	59,177	11,097	7,439	1,690	79,403	715,152
	65	148,400	40,320	21,000	6,420	216,140	3,975,960
Hen	1950	480,475	185,145	154,319	129,492	949,431	16,633,700
	55	989,000	464,000	295,000	247,000	1,995,000	45,715,000
	60	896,587	484,827	369,883	292,008	2,043,305	46,844,700
	65	1,752,000	926,000	853,000	781,000	4,312,000	132,501,000
Livestock Production Unit der 100 Farm*	1950	38	29	29	22	32	52
	55	53	36	32	27	42	69
	60	49	29	28	26	38	66
	65	53	39	35	29	43	97

* Livestock production unit per 100 farm houeshold is calculated by the following rate

Kind	Unit	Kind	Unit
1 Milk Cow	1.00	1 Calf for Beef-use	0.34
1 Beef cattle	0.75	1 Hog	0.27
1 Breeding Cattle	0.74	100 Hens	1.38
1 Calf for Milk-use	0.44		

In this District dairy cows were firstly introduced in the suburbs of Kanazawa and Komatsu cities in Ishikawa Prefecture around 1910 and afterwards in the west of Toyama and Fukui Prefectures.

Number of domestic animals increased sharply in the last 10 years. At present there are 33,000 dairy cows, 61,000 meat cattles, 216,000 hogs, 16,000 goats and 5,200 sheep and over 4 million hens.

VII. Farm mechanization.

As sufficient number of draft animals has not been raised in the District, power tiller was used from earlier time. The order in which machinery was introduced in agriculture in Japan was firstly pump, secondly machinery for threshing, hulling, winnowing, separating, thirdly power-driven tiller and lastly machinery for disease and insect control. However, in this District, machinery for threshing, hulling, winnowing, separating, etc. were first introduced and were followed by power-driven tiller. The reason for that is because threshing, hulling, and packing had to be finished in an extremely short period to expedite the marketing of rice in betwee season. The ratio of the number of tiller to the cultivated land is as shown in Table 7. There are about 60 large tractors in the District. However, because of the increasing farm labor shortage farm mechani-

Table 7. Number of Agricultural Machinery Introduced per 100 ha in Hokuriku District, by Kind

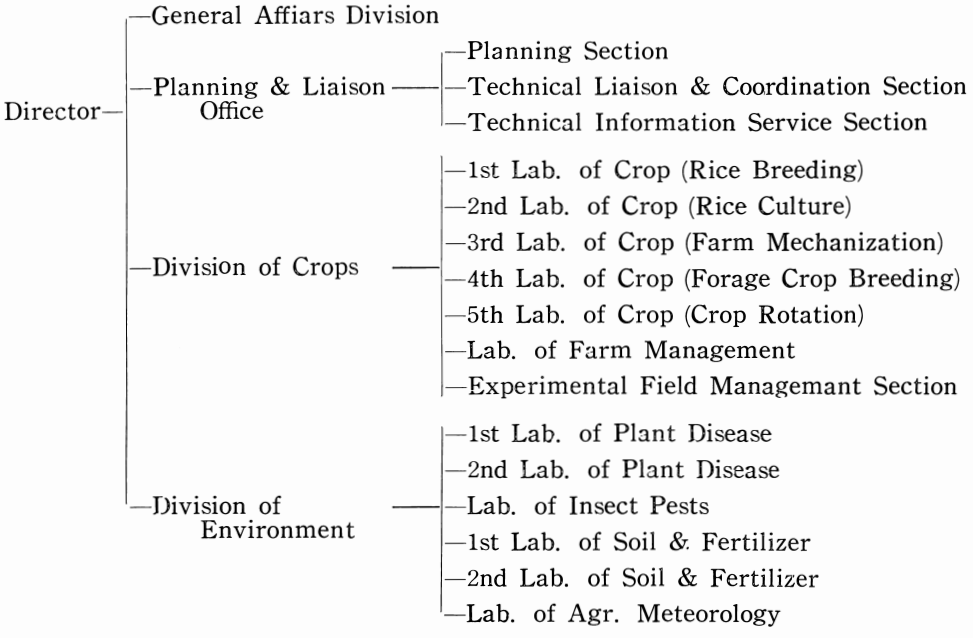
Item	Year	Oil Engine	Electric Moter	Tiller	Power Thresher	Power Huller	Power Sprayer	Power Duster	Power Cutter	Power Pump	Truck & Auto-tricycle	Grain Dryer
Whole Country	1955	16.6	14.8	1.1	29.1	10.4	1.0	0.2	1.7	0.3	0.8	
	60	28.0	18.6	8.5	40.9	13.9	4.3	2.4	6.0	4.2	1.7	
	65	30.0	22.6	41.8	50.2	13.8	10.0	4.8	10.8	6.8	6.3	12.1
Hokuriku District	1955	4.2	38.6	1.7	43.6	23.5	0.2	0.3	0.6	0.2	0.3	
	60	7.4	51.7	14.9	56.6	32.6	2.3	4.8	3.0	1.2	1.4	
	65	5.0	61.9	46.2	64.0	35.7	3.5	10.2	5.0	1.2	5.1	14.7
Niigata	1955	5.8	42.7	1.8	46.6	26.6	0.2	0.2	1.1	0.2	0.3	
	60	9.2	52.6	16.7	58.3	35.4	2.7	6.2	4.9	1.7	1.8	
	65	6.3	54.2	40.9	56.5	32.8	4.3	7.5	7.0	1.8	4.7	17.5
Toyama	1955	4.0	37.2	2.8	48.4	24.4	0.3	0.4	0.3	0.3	0.4	
	60	7.1	54.0	16.2	60.1	33.0	1.5	4.4	2.4	0.6	0.6	
	65	3.6	65.4	41.2	68.9	37.3	2.2	10.7	4.6	0.6	4.0	14.9
Ishikawa	1955	2.7	30.6	1.1	32.9	16.9	0.3	0.4	0.1	0.3	0.5	
	60	5.3	43.8	12.0	47.1	25.1	2.7	2.7	0.5	0.9	1.7	
	65	2.8	71.7	47.3	71.6	38.2	3.9	10.1	0.6	0.6	9.0	4.2
Fukui	1955	1.8	38.2	0.6	41.8	21.7	0.2	0.4	0.2	0.3	0.2	
	60	4.6	55.6	11.0	58.7	33.0	1.4	3.7	0.8	0.6	0.5	
	65	4.0	78.2	52.2	79.4	42.9	1.3	18.8	2.3	0.7	3.8	14.5

zation with the introduction of larger tractor is one of the urgent necessity for the District together with the time saving cultivation technique and cooperative drying facilities wihch number 59 in the District.

Organization and Object of the Hokuriku Agricultural Experiment Station

The Hokuriku agricultural Experiment Station is one of the eight Regional Agricultural Experiment Stations established throughout the country by the Ministry of Agriculture and Forestry, to carry out the agricultural experiment and research for the Hokuriku District covering four prefectures of Niigata, Toyama, Ishikawa and Fukui as well as for other regions with similar conditions.

The Station consits of 3 divisions and 1 offiice as shown below.



The Division of Crops carry out the studies and experiments on breeding and growing technique of rice and forage crops, mechanization of rice growing, farm management. The Division of Environment carry out the studies and experiments on soil and fertilizer, ecology and control of insect pests and disease and agricultural meteorology.

The Planning and Liasion Office takes charge of liaison and coordination of experiment and research being conducted at the research organs within the District, the investigation of agricultural management and the collection of publications and documents.

Personnel

Director	1
Chief of Division	3
Chief of Planning & Liaison Office	1
Chief of Section	2
Chief of Laboratory	12
Subsection Chief	6
Researcher	46
Clerk	7
Technical Official	20
Technical Assistant	24
Laborer	6
Total	128

Land and Buildings

1. Land

Item	Experimental Farm			Buildings' Sites	Waste Land	Water Channel & Road	Others	Total
	Paddy Field (m^2)	Upland Field (m^2)	Total (m^2)	(m^2)	(m^2)	(m^2)	(m^2)	(m^2)
Inada, Head Quarter	64,664	0	64,664	41,451	0	7,642	900	114,657
Motoshiro, Upland Experimental Farm	0	10,909	10,909	1,926	33,277	3,680	0	49,792
Meiji, Paddy Fxperimantal Farm	45,054	0	45,054	11,066	0	5,664	476	62,260
Total	109,718	10,909	120,627	54,443	33,277	16,986	1,376	226,709

2. Buildings

Item	General Affairs (m^2)	Researches (m^2)	Manging Experimental Farm (m^2)	Official Residence (m^2)	Total (m^2)
Inada, Head Quarter	2,629	3,761	931	2,144	9,465
Motoshiro, Upland Experimental Farm	219	585	76	134	1,014
Moiji, Paddy Experimental Farm	0	802	0	45	847
Total	2,848	5,148	1,007	2,323	11,326

Brief History of the Station

1944 : The former Joetsu Branch of Niigata Prefectural Agricultural Experiment Station was transferred from Niigata Prefecture to the Ministry of Agriculture and Forestry as the Hokuriku Branch of the National Agricultural Experiment Station of the same Ministry.

1950 : The Station became independent as the Hokuriku Agricultural Experiment Station consisting of the Agronomy Division with 7 Laboratories and General Affairs Section.

1951 : With the absorption of Nagaoka, Yamagata and Asaka Agricultural Improvement Experiment Stations, the Station's organization was changed and became 2 Divisions (Division of Crops with 6 Laboratoiios and Division of Environment with 5 Laboratories) and 1 Section.

1956 : The two-story ferro-concrete main building was newly established.

1957 : The Technical Liaison and Coordination Office was established to have closer liaison with other national and prefectural agricultural experiment stations and also to collect and examine various information and data.

1960 : The Agricultural Meteorology Laboratory was established.

1963 : The General Affairs Section was reformed to the Division of General Affairs. The 1st Crop Lab. became Rice Breeding Center covering Tohoku and Hokuriku.

1965 : The second main building was newly established

Outline of Research

Basic studies on breeding of widely adaptable varieties, short and lodging resistant varieties, short term period fixed varieties and disease resistant varies have been inprogress, referring to acceleration of hybrid generation, heading and ripening of each variety respectively. (1st Lab. of Crop)

On the other hand basic studies have been in progress referring to the breeding of forage turnips, which are superior in disease resistance, feeding value and storability, as well as the breeding of Italian ryegrasses, which are resistant to snow-damage and of higher yield, in connection with the resistance to snow-damage of herbage, hereditability of useful characters of "RENGE" (*Astragalus sinicus* L). (4th Lab. of Crop)

In Hokurku district approximately 60 % of the total peddy fields (3,425 km^2) consists of ill-drained or semi ill-drained paddy fields, on which the landimprovement is being applied. However, there are some examples of drained paddy fields, which do not make any increase of the yield. To investigate changes of various characterisics of soil brought about on drainage of the ill-drained paddy field, and to establish a sort of the soil management, irrigation control and cultivation method as the countermeasures, the basic investigations are carried out utilizing a large lysimeter. (1st Lab. of Soil & Fertilizer)

While analyzing techniques for producing maximized rice yield, researches on collective composition of each technique, and utilization of nitrate nitrogen fertilizer, minor elements and special components to be applied to the rice crop, are also in progress. (2nd Lab. of Soil & Fertilizer)

In Hokoriku district, principal hazardous problems are said to be the insect pest, i.e., rice stem borer, planthopper, leafhopper, etc., the plant diseases, i.e., rice blast, sheath blight of rice plant as well as rice bacterial leaf blight. Referring to the plant disease and insect pest, except the rice bacterial leaf blight, the basic studies on ecology of outbreak and forecasting method of outbreak as well as the labor-saving disease control, and testing on effects of new agricultural chemicals are being studied. (Lab. of Insect Pests & 2nd Lab. of Plant Disease)

At the same time, the basic studies are being carried on resistance of the rice plant against rice blast and rice bacterial leaf blight, referring to the respective inspection methods. Especially the field resistance of the variety has been brought to light for further studies, since recently contraction of the disease resistant varieties is being discussed in connection with varying distribution of pathogenic races of the rice blast. (1st Lab. of Plant Disease)

The rice cultivation in Hokuriku district tends to decrease a percentage of bearing tillers on account of luxurious growth at an early stage in growth. It is very important to control such tendency and have the sound growth at hed later stage in growth for better ripening. Investigations are, therefore, being made into analysing the growing phase of rice plat, and classifying them in accordance with their characteristics as per districts and species. Studies on the possibility of plant growth by chemical treatment have also been initiated. (2nd Lab. of Crop)

Recently due to the lack of labor power, implification of transplanting by machines has been necessitated. In this experiment station, various experiments have been carried on prevention of rooting damage after transplanting by nursery rice plant puller raising seedlings by the soil stick seedling dropper, and infant seedling etc. Control of the soil and seedling conditions are also being investigated. (3rd Lab. of Crop)

To simplify the rice cultivation, the ecology of weeds, activiteis and effects of new herbicides are being studied. (2nd Lab. of Crop)

In this district, on account of much rain fall in autumn, it requests a great deal of the labor power for reaping and drying of rice, being approximately 52 hours per 10 are, compared with the all Japan-average of approximately 39 hours, which is the main cause of raising the production cost of the rice. In consideration of the higher productivity by mechanization in future, drying method of rice plant before harvesting, threshing method and utilization of drying facilities are called in question. For the time being, effective drying and storage of rough rice in big quantities are being discussed. (3rd Lab. of Crop)

The winter crop on paddy field in Hokuriku district (approximately 15 %) is extremely low compared with other districts. To improve the management of single-planted paddy field, drainage in ill-drained papdy field, cultivation of forage crop, etc. adoption of diverse farming management with self-supply of feeds is being considered. For such purpose as to constantly increase yield of the forage crop as winter crop on paddy fields in the heavy-snow district, first many experiments have to be carried and on the other hand basic studies on physiology and ecology should be made. (5th Lab. of crop)

Tests are being carried on feeds production plan all the year round, and constant yield increase of the forage crop in the converted upland field from the low land paddy, as a part of crop rotation program. (5th Lab. of Crop)

In Hokuriku district, on account of the heavy snow fall in winter, snow injury of the winter survival crop is veery sevre. In this experiment station, in the observation field for snow damage, snow injury tests of the winter survival crops and observation of various meteorological elements are carried out, besides

the field survey on snow damage of the breaking shoot with fruit trees as well as basic studies of the countermeasures. (Lab. of Agr. Meteorology)

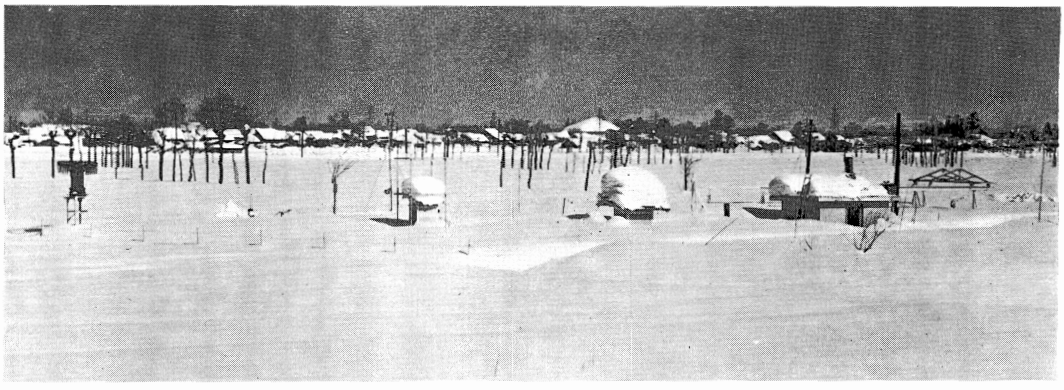
Late thawing is a big trouble in the farm work in early spring. Therefore, to promote quick melting of snow, airplanes and snowmobiles are used, besides comparative investigations of promoting snow-melting are being performed utilizing melting agents, such as black powder (carbon black), etc., suitable to the respective district. (Lab. of Agr. Meteorology)

As the basic study for utilization of meteorological conditions in the district of rice crop, an investigstion has been carried on incoming and outgoing of energies by radiation, and sensible and latent heat flux in the rice plant canopies. (Lab. of Agr. Meteorology)

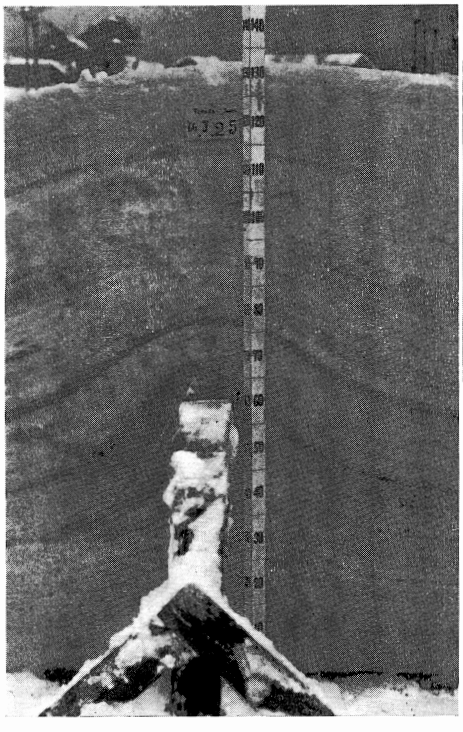
For development of paddy field management, modern agricultural facilities are being introduced and equipped. Since it is important to investigate on establishment of new agricultural management as well as to cope with such situation as an individual farmer, studies are carried out on roles played by modern mechanical facilities for agricultural industries, such as tractors, rice center and mechanization of crop process, etc. (Lab. of Farm Management)

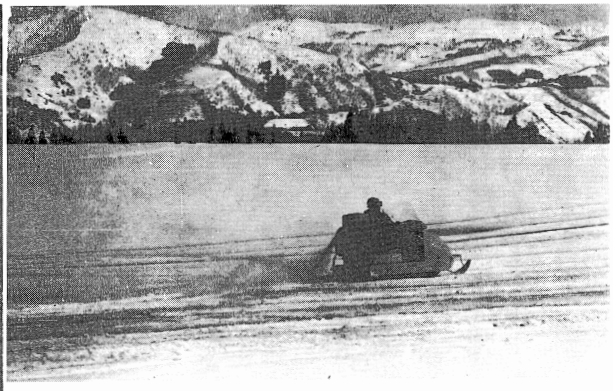
As one of the ways of improving and developing the singleplanted paddy field, dominated in the Hokuriku district, a diverse farming and diverse crops a year is planned and researches are being continued on conditions of development as well as districtive structure of the development on the diversified farming with paddy field rice crop and dairy farming. (Lab. of Farm Management)

▲ General view of the experiment station in winter



▲ Observation field for experiment of snow damage

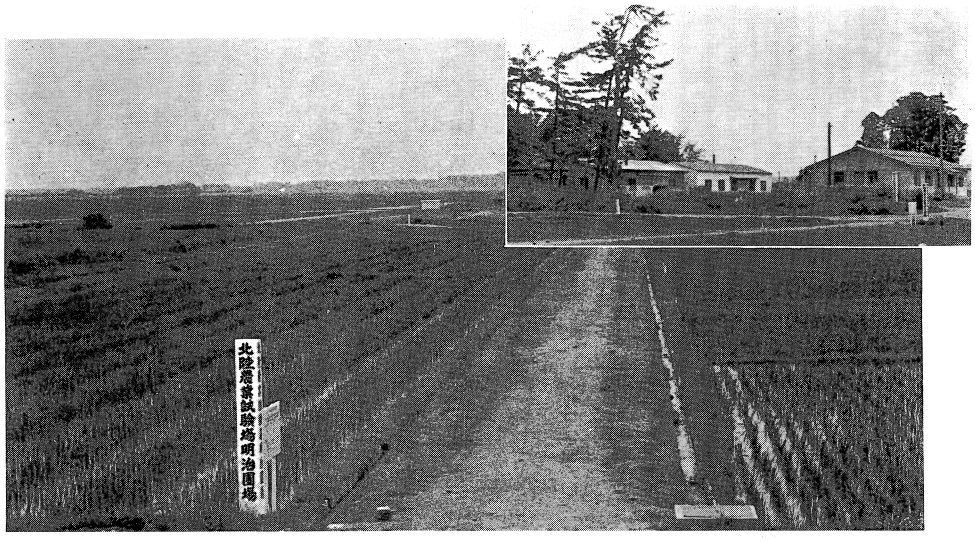




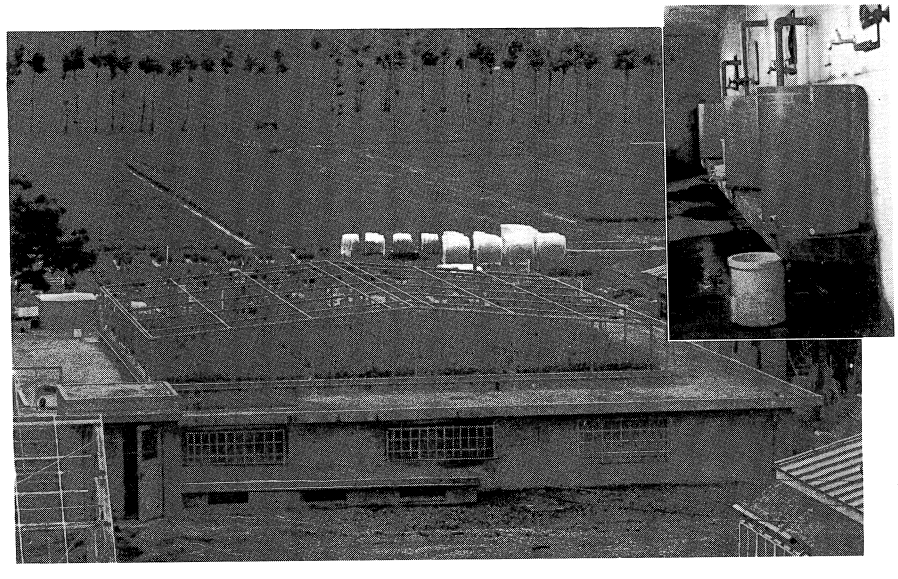
△ A study on the promotion of thawing. The photograph shows the dusting of black powder by snow-mobile (ski-doo)

◀ A fundamental experiment on the snow damage of fluit tree. The photograph shows snow profile on the horizontal beam

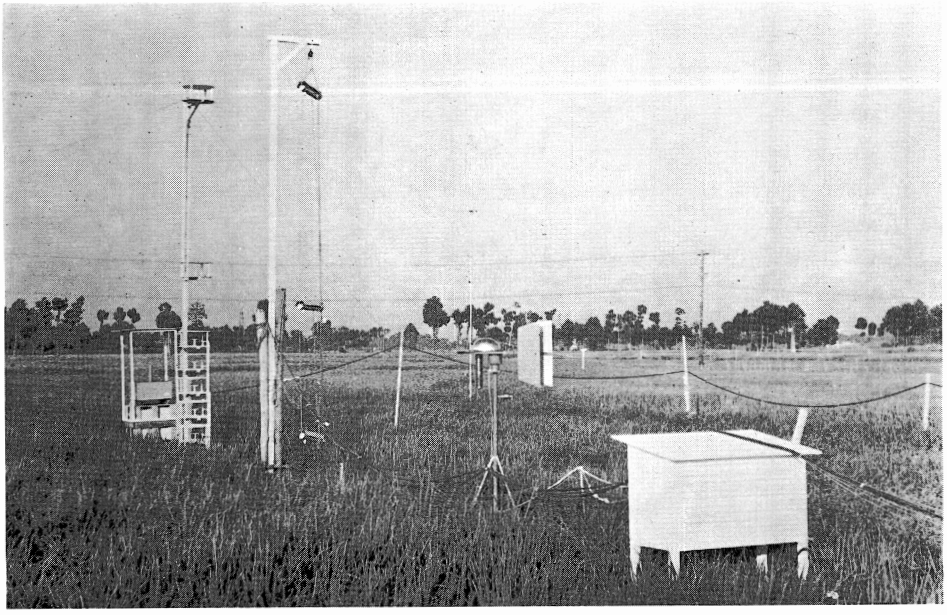
▲ A glasshouse for accelerating the hybrid generation



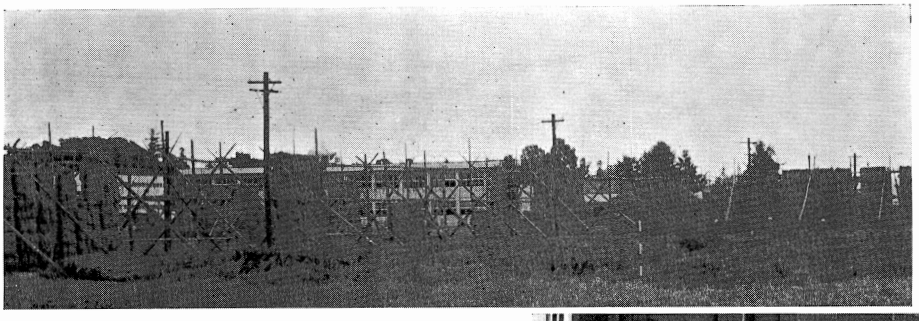
▲ Meiji paddy experimental farm



◀ Lysimeter

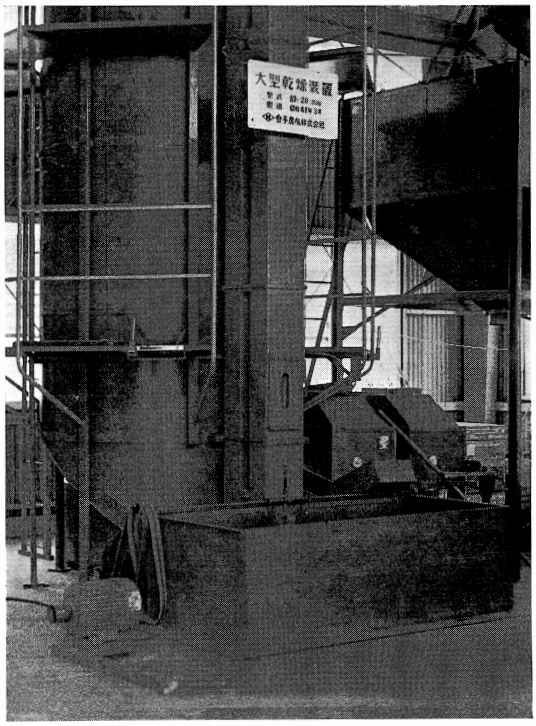


▲ Field for the investigation of blast fungus spore dispersion in the atomosphere



▲ General view of the experimental farm in harvesting time

Grain dryer ▶



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Bulletin of the Hokuriku Agricultural Experiment Station

(in Japanese with English Summary, one or more issus a year, free exchange)

No. 1 (Mar., 1960)

Suetsugu, I, : Historical Investigaton on the Name of Renge Plant. (*Astragalus sinicus* L.) pp., 1–20

Suetsugu, I., & Tanaka, T. : Development of Floral Orgaus in Renge Plant. pp., 21–30

Suetsugu, I., & Tanaka, T. : Responses of Daylength and Temperature in Relation to Flower Formation in Renge Plant. pp. 31–44

Suetsugu, I., & Ueki, C. : Studies on the Fertilization of Renge Plant. pp. 45–72

Suetsugu, I., & Ueki, C. : Development of the Embryo in Renge Plant. pp. 73–88

Suetsugu I., & Ueki, C. : On the Hardcoatedness in Renge Plant. pp. 89–121

No. 2 (Jan., 1961)

Yamasaki, T., & Yoshizawa, T. : Concretion of Ferrous Carbonate (Siderite) in Paddy Soils in Japan (1). pp. 1-16

Yamasaki, T., Seino, K., & Ito, J. : Influence of continued Calcium Cyanamide Dressing upon Some Chemical Properties of Paddy Soils. pp. 17–24

Yamasaki, T., Seino, K., Aoba, K., & Adachi, M., : Molybdenum Content of Phosphate Rocks, Serpentine, Fused Phosphate and Superphosphate. pp. 25–40

Konishi, C., & Seino, K. : Studies on the Maintenance-Mechanism of Paddy Soil Fertility in Nature. pp. 41–136

No. 3 (Aug., 1962)

Kinebuchi, M. : Ecological and Physiological Studies on the Sterility of Lower Spikelets of Barley. pp. 1–88

Suetsugu, I., Anaguchi, I., Saito, K., & Kumano, S. : Developmental Process of the Root- and Top-Organs in the Soybean Varieties. pp. 89–96

Hashimoto, T., Kumano, S., & Saito, K. : Growth Habit of Soybean Varietis Sown through the Year with Special Regards to the Relationship Between Flowering, Maturing and Temperature, Daylength. pp. 97–116

Suetsugu, I., Watanabe, S., Kawakami, J., Kanai, D., & Koyama, K. : Description on the New Bred Varieties of Rice. pp. 117–156

I. *Akiminori*

II. *Tarehonami*

III. *Yomohikari*

No. 4 (Feb., 1963)

Ono, K., & Suzuki, H. : Saprophytic Multiplication of the Rice Blast Fungus in the Paddy Field. pp. 1–16

Iiba, W. : Physiological and Ecological Studies on the Efficacy of Fungicides. pp. 17–108

Iwata, T. : Ecological Studies on the Local Variations in the Seasonal History of the Rice Stem Maggot, *Chlorops oryzae* MATSUMURA. pp. 109–189

No. 5 (May, 1963)

Saito, M. : A Study on Diseases of Renge (*Astragalus sinicus* L.) ——Kinds of diseases

occurring in Hokuriku District and their seasonal fluctuation. pp. 1-26

Yoshimura, S.: Diagnostic and Ecological Studies of Rice Bacterial Leaf Blight, Caused by *Xanthomonas oryzae* (Uyeda et Ishiyame) Dowson. pp. 27–182

No. 6 (June., 1963)

Yamasaki, T., Koyama, T., & Kosuge, N.: Eeffctive Drainage During Growing Stage of Rice in Ill-Drained Paddy Field. pp., 1–18

Aoba, K., Yamasaki, T., & Arai, S.: Radioactive Contamination Research on the Crops, Soils and Rain Water by Fission Products in Hokuriku District. pp. 19–28

Seino, K., Yamasaki, T., Nakazawa, K., & Arai, S.: Studies of the Molybdenum Deficiency in Upland Field Soils. pp. 29–40

Arai, S., Yamasaki, T., & Seino, K.: Influence of Continued Calcium Cyanamide Dressing upon Some Chemical Properties of Upland Field Soils. pp. 41–48

Yoshizawa, T.: Studies on the Classification of Ill-Drained Paddy Field Soils in Hokuriku District ——Proposed classification based on the morphological, physical and chemical characteristics. pp. 49–150

Nakayama, H.: An Excessive Growth of Rice Culms in Ill-Drained Paddy Field. pp. 151–160

Nakayama, H.: A Method of Diagnosis on the Developmental Habit of Rice Culms by Changing of Vascular Bundles Number in the Elongated Internodes. pp. 161–164

No. 7 (Oct., 1964)

Nakamura, S.: Study on the Heat Balance at a Snow Surface in the Thawing Season. pp. 1–28

Aota, S., Kinebuchi, M., Hashimoto, T., & Mizuno, S.: The Factor of Yield Decrease of Paddy Rice and the Yielding Capacity in the Late Seasonal Culture in Hokuriku District. pp. 29–60

Tamura, I., & Suzuki, T.: Inflence of the Early-Transplanting Practice in Rice Culture upon Development of the Rice Stem Borer, *Chilo suppressalis* Walker. pp. 61-94

Tamura, I., & Kegasawa, K.: Effect of Some Chemical Treatment on Recovery of Soybeans and Rice Plants which Injured Artificially by Cutting Off Their Leaves. pp. 95–110

Hashimoto, T., Yoshida, K., & Saito, T.: Growth Habit of Ladino Clover During Its Growth Period in Hokuriku District. pp. 111–128

Saito, T., & Yoshimura, S.: On the Two New Diseases of Red Clover and Hairy Vetch Caused by *Botorytis cinerea* Per. ——Red clover flower rot and hairy vetch gray mould disease. pp. 129–144

Seki, S., & Minami, T.: Agriculture in the Fukui Plain During the Period of Textile Industry Development. pp. 145–185

Saito, H., Kamagata, I., & Seki, S.: Research on the Rice and Hog Diversified Farming System in Hokuriku District. pp. 187–231

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