

## Rice Agricultural Region in Northeast Japan seen from the Distribution of Rice Varieties

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雑誌名	The science reports of the Tohoku University. 7th series, Geography
巻 号	11 1
ページ	1-12
発行年	1962-03
URL	<a href="http://hdl.handle.net/10097/44830">http://hdl.handle.net/10097/44830</a>

# Rice Agricultural Region in Northeast Japan seen from the Distribution of Rice Varieties

Hideo FUKUI

## I. Introduction

The rice agriculture in Northeast Japan has greatly developed in the last seventy years and the region has lately become the principal rice producing area in Japan.<sup>1)2)3)4)</sup> Particularly, the improvement of the cultivation techniques suited to colder districts has greatly contributed to the quick expansion of rice-field into the colder district, and the stabilization of the farm management. Besides, the improvement of rice variety has fairly been useful to avoid the severe cold-weather-damages, which have happened at least twelve times during the last seventy years and have handicapped the development of rice agriculture in Northeast Japan. The rice raised as a crop is grouped into two or three types,<sup>5)</sup> and the type prevailing in Japan has such general characters as shorter and stronger stems, more numerous shootings, less disease-resistance, preference to fertile land and richer yield. The names of the varieties ordinarily grown in Japan have not depended on the physiological and ecological classification, but rather on the practical features such as head sprouting or maturing season, the strength of stem, the sensibility to light and temperature, a resistance to fertilizers or diseases etc. The kinds of the varieties raised in Japan come to several thousands at least, and there are more than 150 different varieties recommended by the specialists in various prefectures. The scientific improvement of rice variety has been carried on since 1904. The pure-strain-selection method had prevailed till about 1921, and after that time the interbreeding (crossing) method has been widely adopted. The conscientious farmers have often contributed to the improvement before the War, but

- 1) H. Fukui (1958): Areal Difference and its Yearly Change of Cold Disaster on the Rice Cultivation of Northeast Japan. *Sci. Rep. Tohoku Univ.*, 7th Seri. No. 7, pp. 29-38.
- 2) H. Fukui (1959): Some Geographical Problems on Development of Agriculture in Tohoku District (in Japanese). *Collection of Treatises on "Geographical Problems of Economic Development"* pp. 150-156.
- 3) H. Fukui (1960): Rice Agriculture of Tohoku District seen from Yield per Unit Area. *Sci. Rep. Tohoku Univ.*, 7th Seri., No. 9, pp. 11-23
- 4) H. Fukui (1961): Recent Changes in the Distribution of Rice Farming in Hokkaido. *Sic. Rep. Tohoku Univ.*, 7th Series No. 9, pp. 9-22
- 5) "Commentary on Variety of Crop" (in Japanese) edited by Assoc. Agri. Technique, 1955, pp. 3-15.

since the foundation of the National Experimentary Stations of Agriculture in 1927, many specialists have actively studied on the improvement and created many new excellent varieties such as the "Norin No. 1-93" in 1955, cooperated with the Prefectural Experimental Stations. Generally speaking, the main aim of the improvement was to increase the resistance to cold climate, and to get higher yield per area. However, it gradually changed to aim at stronger stems and greater disease-resistance, in response to the increased use of chemical fertilizer after the War. In the cold and single crop regions as Tohoku and Hokkaido, there has been the strong requirement for cold-resistant and disease-resistant varieties. However these resistance and the rice yield did not always go together, until the new varieties have appeared after the War. Though the varieties raised by farmers have greatly changed by the appearance of many new varieties, there has been many problems that prevented their diffusion. For example, the early-maturing-variety is much better to avoid the cold-weather damage, but the yield is inevitably lower in a normal year than the late-maturing varieties. Usually a variety showing a very rich yield at some place in a certain year, is extensively adopted beyond the areas to which it is fitting, and the menace of cold disaster has become greater. Generally, the distribution of a desirable variety depends not only on the climate, but also on the quality of land. Besides the farmers have to select some differently maturing varieties in order to scatter the peak of their labour, and the use of irrigation water even under the same physical conditions. Often the scale of farm management or the enterprise spirits of farmers as well as the convenience of the communication, have influenced the diffusion of new varieties.

This is a report on the yearly change and distribution of rice varieties raised in Northeast Japan, and is an attempt to analyse the localization of the rice agriculture in the districts of colder climate.

## II. Hokkaido District

### 1) Yearly changes of improvement and diffusion of variety

In 1872, the acreage of rice fields was no more than 200 ha, and its distribution was limited to the southwestern part of Hokkaido<sup>4)</sup> (the southern part of Oshima Peninsula). The varieties known till that time were the "Akaine", "Jimai" and "Shirahige" which were introduced from the northern districts of the Main Island (Hokuriku and Tohoku districts). They belonged to the late-maturing kind, and under the cold climate of Hokkaido could be raised only in its southernmost parts.<sup>6)</sup> However, aided by the increase of the immigrants from the main-

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6) National Agricultural Experimental Station of Hokkaido (1950): History of the Improvement of Agriculture in Hokkaido. pp. 17-26.

land, the expansion of rice field to the north and to the east, started after the discovery of the new varieties as "Akage" and their improvements. The beginning of the second period (1893-1919) in which the acreage had fairly increased,<sup>7)</sup> corresponds to the time when the new varieties as the "Bozu" and the "Sakigake" were produced mainly by the pure-strain-selection method. Furthermore, the beginning of the next quick increase corresponds to the time when the new varieties such as the "Bozu No. 2", the "Bozu No. 6" and the "Hashiri-Bozu" were created by the interbreeding method among the varieties coming from Hokkaido. Since the fourth period, it has been the period of the interbreeding between the varieties from Hokkaido and the Main Island. In the recent years, the systematic study of the improvement by the Experimental Stations has been fruitful. The figure 1 shows the yearly change of the acreage due to the diffusion of varieties from

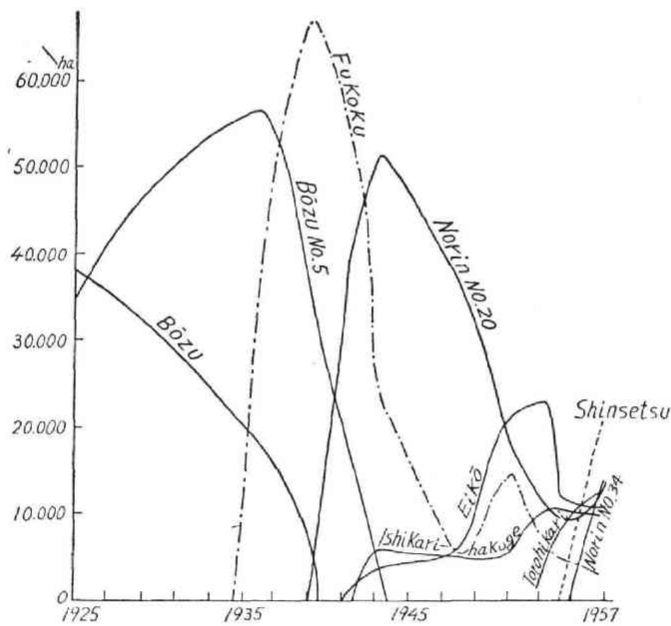


Fig. 1. Yearly Change of Diffusion Acreage of Rice Varieties in Hokkaido.

1925 to 1957.<sup>6)</sup> By the figure, we can recognize the two periods in which the acreage of the dominant varieties was very changeable; the first period is the eight years from 1936 to 1943, and the second period is after 1950. The first changeable

7) The first-second periods depend on his previous paper. "Recent Changes in the Distribution of Rice Farming in Hokkaido. Sci. Rep. Tohoku Univ. (Geography) No. 10, 1961, pp. 9-10.

period coincides with the time just after when the severe cold disaster had successively happened, namely in 1931, 1932, 1934 and 1935. The second changeable period is the recovering or developing time of rice agriculture after the War, and it was also the time when many new excellent varieties have replaced the old varieties. Secondly, before the War, there were few major varieties with large cultivated acreage of over 40,000 ha, like the "Bozu" (over 40,000 ha before 1925), the "Bozu No. 5" (57,000 ha in 1936)\*; the "Fukoku" (66,000 ha in 1939) and the "Norin No. 20" (52,000 ha in 1943). After the War, however, the excessive diffusion of some specific variety is gone. In other words, many new varieties have the tendency to be distributed in the areas to which they are fitting.

## 2) Distribution of Varieties in 1957

The figure 3 and 4 show the distribution of varieties raised, classified by the



Fig. 2. Index Map 1-Ishikari Branch, 2-Sorachi Branch, 3-Kamikawa Branch, 4-Shiribeshi Branch, 5-Hiyama Branch, 6-Oshima Branch, 7-Iburi Branch, 8-Hidaka Branch, 9-Tokachi Branch, 10-Nemuro Branch, 11-Kushiro Branch, 12-Abashiri Branch, 13-Soya Branch, 14-Rumoe Branch.

\* The year when it was produced.

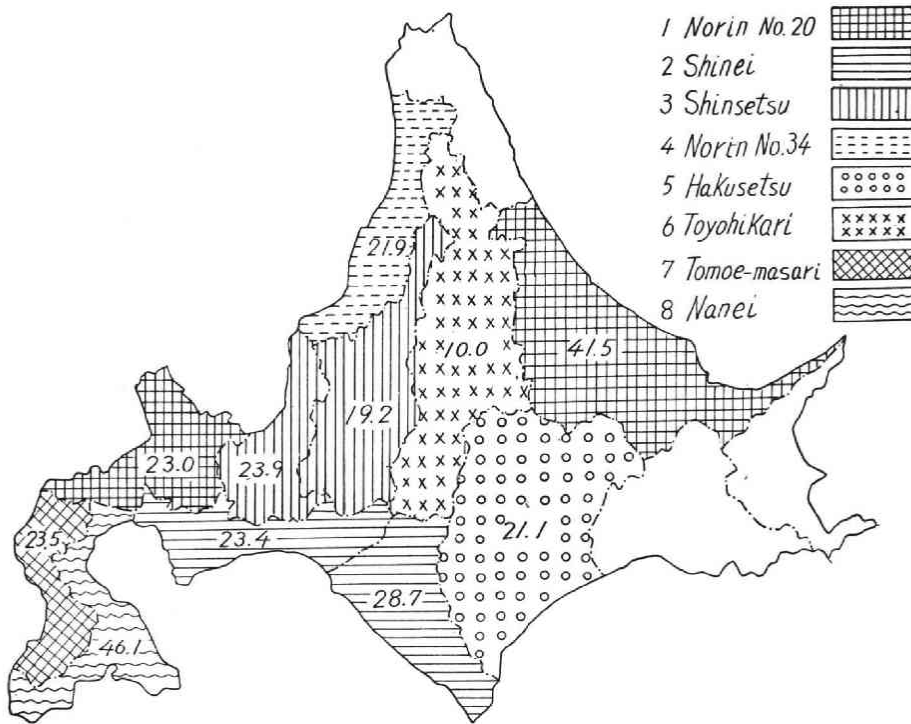


Fig. 3. Distribution of First Principal Variety in 1957. (Number shows a diffusion rate %)

diffusion rate\* in 1957<sup>8)</sup>. The statistics of rice farming in Hokkaido are published according to the divisions of the eleven administrative branches, excepting the Soya, Kushiro and Nemuro branches where the acreage of rice-field is less than 50 ha. The kinds of the leading variety in each of the eleven branches are eight in number. Three of them are at the top in two branches respectively; those are the "Shinsetsu" in the Ishikari and Sorachi branches, the "Norin No. 20" in the Abashiri and Shiribeshi branches, and the "Shinei" in the Hidaka and Ibari branches. In the other branches, leading varieties are different each other. The kinds of the varieties of the second importance in these branches reach to nine. There is only one variety which is common in two branches, and it is the "Norin 20" in the Tokachi and Ibari branches. To analyse the proportion of varieties of the first and second importance in each branch, let us take the case of the colder region of east Hokkaido. The most widely spread variety in the Abashiri branch

\* The percentage of diffusion acreage to total acreage of rice field.

8) Data collected by the Hokkaido Prefecture.

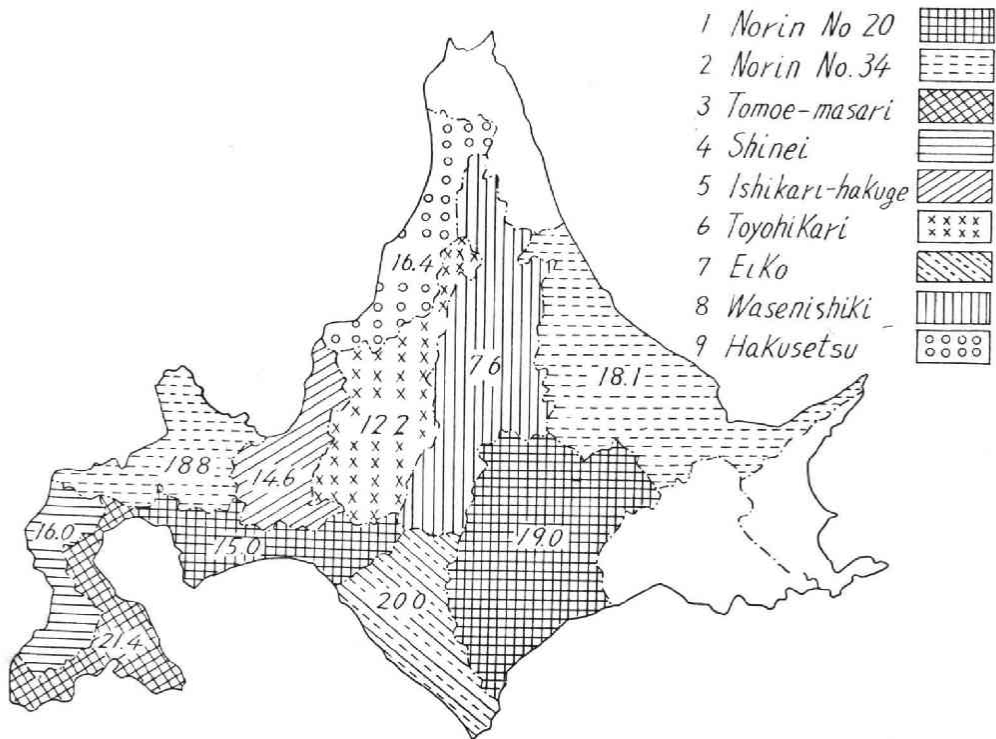


Fig. 4. Distribution of Second Principal Variety in 1957. (Number shows a diffusion rate %)

is the "Norin No. 20" (34.5%)\* and the second is the "Norin No. 34" (18.1%).<sup>9)</sup> Though both of them are early-maturing varieties, the former is, if anything, rather richer in yield, the latter is stronger in cold and disease resistance. The major varieties in the Tokachi branch are the "Shirayuki"\*\* (21.1%) with stronger cold resistance and the "Norin No. 20" (19.0%). In the Oshima and Hiyama branches which are in the southern part of Hokkaido, the late-maturing-varieties with high yield under abundant fertilizer are prevailing. The "Nanci" (46.1%) and the "Tomoe-Masari" (21.4%) are the principal varieties in the former branch, and the "Tomoe-masari" (23.5%) and "Shinei" are those in the latter branch. As the "Shinei" belongs to the early-maturing variety within the late maturing varieties, and it is more cold-resistant than the "Tomoe-masari," it is chosen as the first principal variety even in the Hidaka and Iburi branches (respectively

\* diffusion rate.

\*\* The other name is the "Norin No. 42".

9) Ministry of Agriculture: Rice Varieties. (in Japanese) pp. 4-131.

23.4% and 28.7%). The second variety in the Hidaka branch is the "Eiko" (20.0%) being a medium-maturing and disease-resistant variety. That of the Iburi branch is an early-maturing variety, the "Norin No. 20" (15%). The leading variety in the Ishikari and Sorachi branches is the "Shinsetsu" (respectively 23.9% and 19.2%) being a medium-maturing and disease-resistant variety fitting to the fertile land. The second variety is the "Ishikari-hakuge" (14.6%), a medium-maturing variety fitted to less fertile soil, in the former branch, and in the latter branch it is the "Toyohikari" (12.2%), a medium-maturing variety, which is the leading variety in the Kamikawa branch (10.0%). In other word, the latest-maturing varieties like the "Nanei" are dominant in the Oshima branch, the warmest district of Hokkaido, and the earliest-maturing varieties like the "Norin No. 20" are dominant in the Abashiri branch, the coldest district. Besides, the medium-maturing varieties like the "Shinsetsu" are prevailing in the central district, where there are the sorts of numerous varieties cultivated<sup>10)</sup>. The diffusion acreage of the "Norin No. 20" has lately decreased to about 10,000 ha from about 50,000 ha within the last ten years or so. The change was caused by the spread of the new varieties as the "Shinsetsu", the "Ishikari-hakuge," the "Eiko" and the "Toyohikari" in the central district. This is showing the recent progress of the areal differentiation on the distribution of varieties.

### III. Tohoku District

#### I) Changes in the Diffusion of Varieties

The changes in the diffusion of varieties in the Tohoku district will be analysed taking Aomori, Iwate and Yamagata Prefectures as examples. As was reported in the cases of the Aomori and Iwate Prefectures in the author's previous paper<sup>3)</sup>, a certain specific variety or two were dominant before the War, and after the War, many new varieties have been replacing them. This is the tendency seen in the case of the Yamagata Prefecture (Fig. 5). The representative varieties before the War are the "Kamenoo", the "Rikuu No. 132" and the "Norin No. 16" in the Aomori Prefecture, the "Kamenoo" and the "Rikuu No. 132" in the Iwate Prefecture and the "Kamenoo", the "Fukubozu", the "Hinomaru" in the Yamagata Prefecture. The characteristics of the main representative varieties before and after the War are as follows.

The changes in the diffusion of varieties before the War were mainly for the varieties with a cold-resistance and a disease-resistance in the Aomori and

10) This will be understood by the fact that the diffusion rate of the first principal variety is lower in the central district than those of the southern and eastern districts.



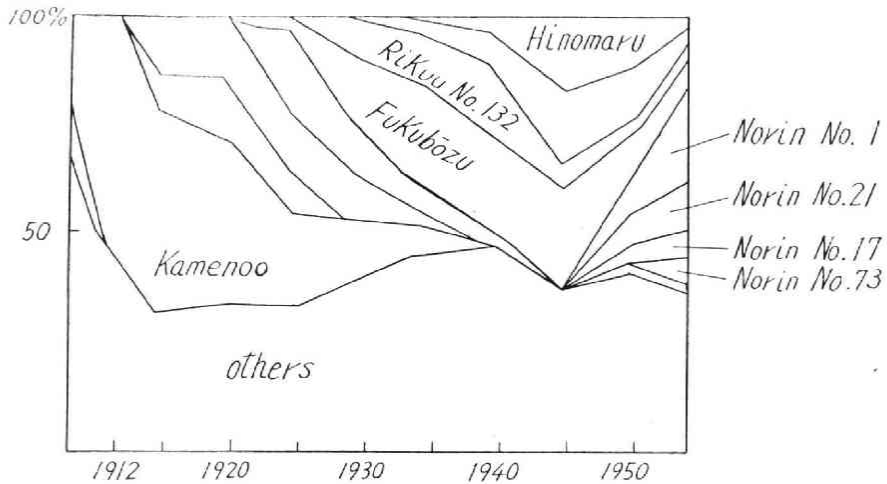


Fig. 5. Yearly Change of Diffusion Acreage of Rice Variety in Yamagata Prefecture.

Variety	Producing Year	Maturing time	Resistance to fertilizer	Resistance to cold	Resistance to disease	Strongness of stem	Yield
Kamenoo	1900	7-8	weak	weakest	weakest	weak	poor
Rikuu No. 132	1920	7-8	weak	middle	middle	middle	middle
Fukubōzu	1915	8	strong	weak	weak	middle	rich*
Norin No. 1	1931	6	middle	middle	middle	middle	middle*
Norin No. 17	1940	7	weak	strong	middle	strong	rich
Norin No. 21	1942	8	strong	weak	weak	weak	rich*
Fujisaka No. 5	1949	4	strong	strongest	strong	strongest	rich

\* shows a good rice quality. 1-3 show early-maturing. 4-6 show middle maturing, 7-9 late-maturing.

Iwate Prefectures. These are the prefectures where the severe cold-disasters had most frequently happened in the Tohoku district. In recent years, however, the yields of rice in the both prefectures have gone up to the higher class from the lowest class of the prefectures, accompanied with the diffusion of the new excellent varieties as the "Fujisaka No. 5". In the Yamagata Prefecture situated on the west side of the Oou Central Mountain Range and with less frequent cold disasters, the stress of the change has been put on the varieties with high yield and disease resistance.

## 2) Patterns of Diffusion of Varieties in 1939 and 1951

The change in the distribution of the varieties will be considered in the years of 1939 and 1951<sup>11)</sup> (Fig. 7 and 8). The number of the leading varieties are only

11) Data are offered by the offices of Agricultural Statistics in each prefecture.

five in 1939. Particularly, the "Rikuu No. 132" was dominant not only in the Iwate Prefecture where it was originated, but also in the Akita Prefecture and some parts of the Yamagata, Fukushima and Aomori Prefectures. Though the variety proved its excellent merit in the Iwate Prefecture at the time when the severe cold-disaster had happened in 1934, we must say that it was spread too far beyond the range of its adaptability. Besides, in 1939, the dominant area of the "Fukubozu" was distributed extensively in the three prefectures. In 1951, the kinds of the first representative varieties increased to the twenty-one varieties. The diffusing areas of the old representative varieties has been remarkably reduced since 1939. For instance, the "Rikuu No. 132" was limited to the Iwate Prefecture and other small areas, and its diffusion rate went down. The tendency resulted from the appearance of many new varieties as a series of the "Norin"

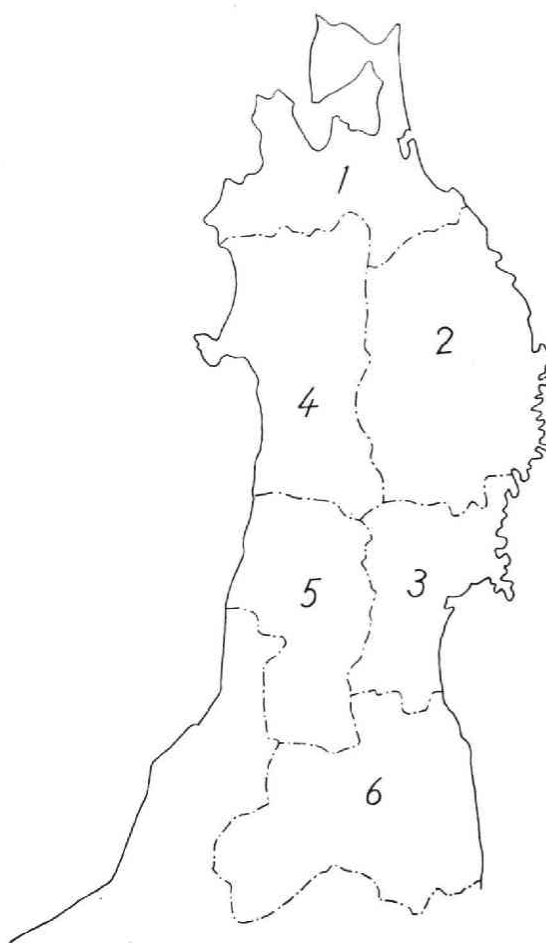


Fig. 6. Index Map of Tohoku District

- |                   |                    |
|-------------------|--------------------|
| 1- Aomori Pref.   | 2- Iwate Pref.     |
| 3- Miyagi Pref.   | 4- Akita Pref.     |
| 5- Yamagata Pref. | 6- Fukushima Pref. |

varieties. Further, the varieties second in importance in respective district increased their number to thirty-one, in much the same way as in the case of the leading varieties. Comparing the distribution maps of 1939 and 1951, it is clear that the areal differentiation in the distribution of the varieties progressed still more. Especially, the varieties in the Miyagi Prefecture are now more numerous than in other prefectures. This shows the Miyagi Prefecture possesses the nature as an interme-

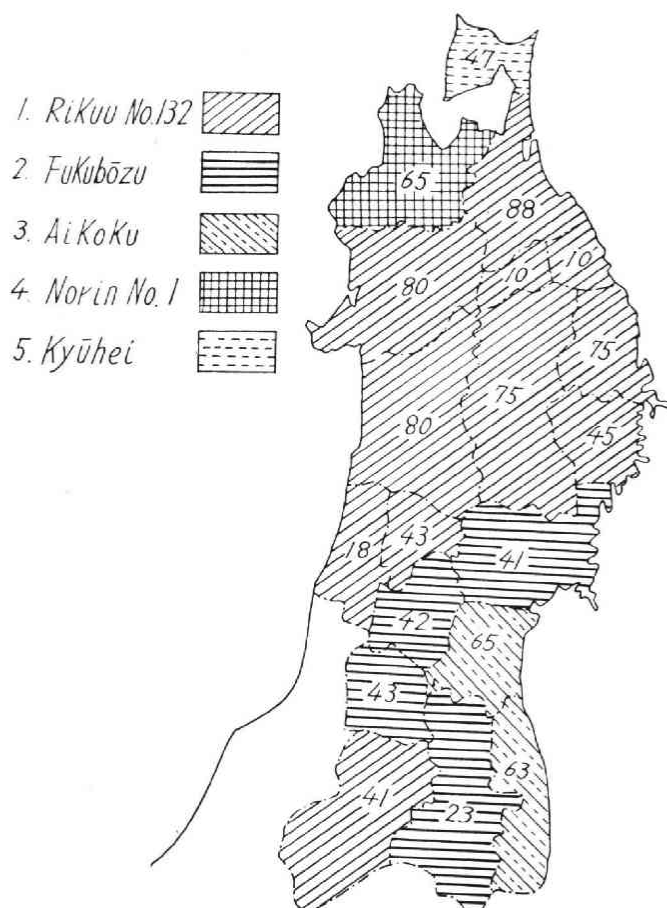


Fig. 7. Distribution of First Principal Variety in Tohoku District in 1939.

diate region in the Tohoku district. In other words, the varieties fitted to the warmer climate are dominant in the Yamagata and Fukushima Prefectures, and the varieties fitted to the colder climate are dominant in the Aomori and Iwate Prefectures. The distribution in Akita Prefecture also shows the transitional feature, but it is not so clear as in the Miyagi Prefecture.

#### IV. Conclusion

Lately, as the fruitful results of the improvement, many excellent varieties of rice in the Northeast Japan are created and diffused into the fittest land, and the correlation between the varieties and the climate and soil has come closer. When

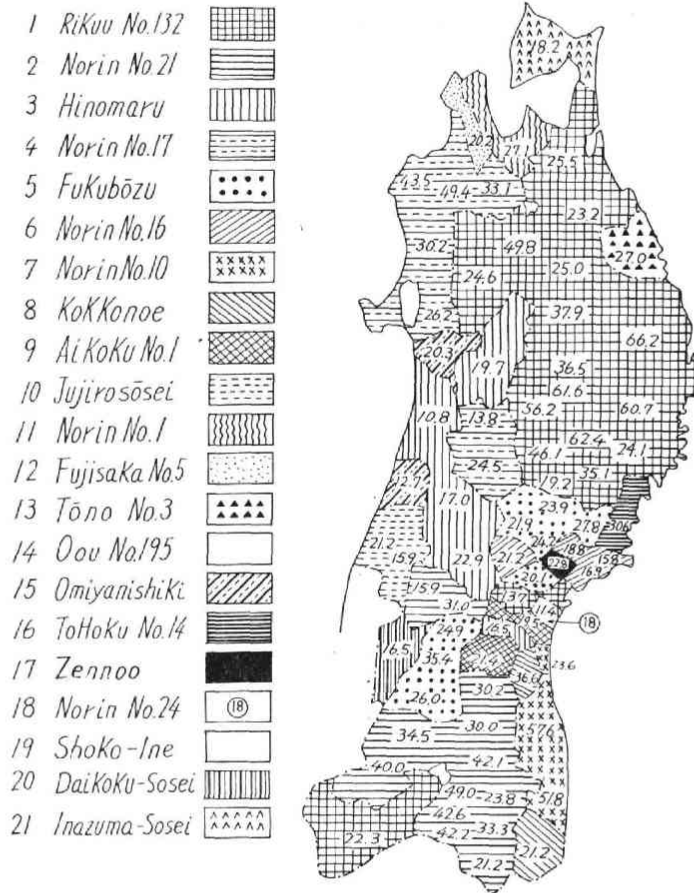


Fig. 8. Distribution of First Principal Variety in Tohoku District in 1951.

the low temperature, equivalent to that of 1934, attacked the Northeast Japan in the summer of 1956, the severe cold disaster happened in the Hokkaido district, but the Tohoku district did not suffer much from it. In future, the improvement of rice will be still necessary for the cold resistant varieties in the Hokkaido district, but in the Tohoku district the effort will be concentrated to produce varieties with high quality cereals.