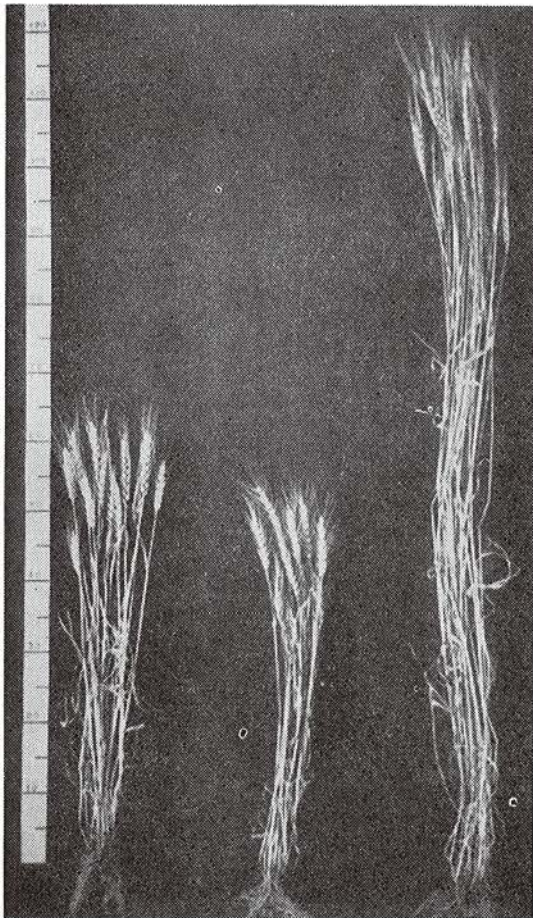


Norin 10 .. A Dwarf Winter Wheat Variety

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Nōrin 10 Fultz-Daruma Turkey Red

In the last 10 years, many dwarf wheat varieties have been bred in Mexico and India as well as in U. S. A.. And the fact that all of those wheats are the progenies of Japanese dwarf varieties, Nōrin 10 or other

dwarf ones descended from it, attracted breeders' attention so much that our laboratory received many inquiries and visits for Nōrin 10 from foreign countries for the past 3 or 4 years. The history and characteristics of Nōrin 10 will be outlined in this paper for breeders' information.

History

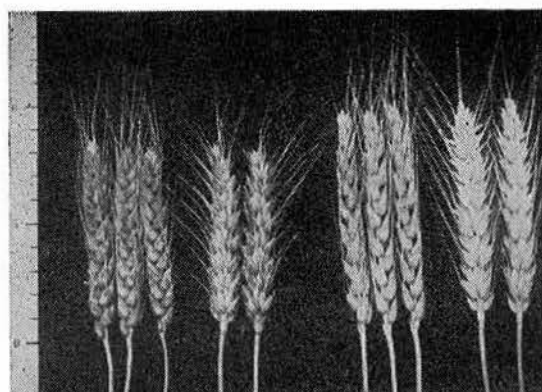
According to "New Varieties of Wheat" published in No.11 (March, 1935) of the Data for Improvement of Agriculture issued by the Bureau of Agriculture, Ministry of Agriculture and Forestry, Nōrin 10 originated from an artificial crossing, Turkey Red \times Fultz-Daruma, secured in the Agricultural Experiment Station (Kōnosu), Ministry of Agriculture and Commerce in 1925. The seeds of its F_4 generation were apportioned to the Iwate Prefectural Agricultural Experiment Station for the local wheat experiment entrusted to the station by the Ministry. Selection and purifying were continued for this material at that station, finally obtaining a strain which was named Nōrin 10 and registered in October, 1935, after the ecological adaptation test. The breeding in those days aimed to obtain rust-resistant, dwarf and early maturing varieties by means of crossing combination. The object has been nearly attained by the breeding of Nōrin 10 which was especially dwarf, though somewhat late in maturity.

Parents of Norin 10

Turkey Red was a variety which had been

introduced from U. S. A. in those times. The history of Fultz-Daruma is unknown, though some say that it descended from a hybrid between an American variety and a Japanese land sort. This was an opinion of the expert who examined segregation of the

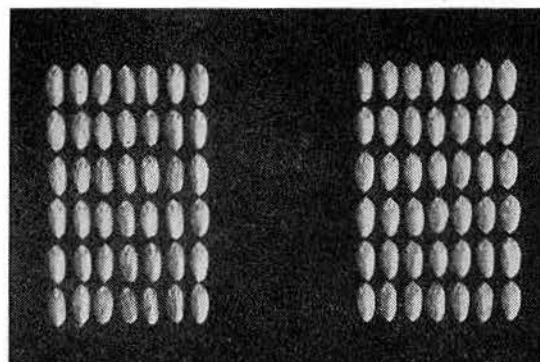
dwarf character of wheat. The Japanese land sort which was used for the combination is said to be Ojima-Wase, Shiro-Daruma or Sōshū, but the details are unknown because of the loss of the record.



Nōrin 1

Nōrin 10

hybrid population at that time. It is learned that he supposed 3 recessive genes for the



Nōrin 1

Nōrin 10

Characters and productivity of Nōrin 10

- 1) Records at the time of registration
Nōrin 10 is a cold- and snow-resistant

Table 1. Characters and yield of Nōrin 10 (Product-test at Iwate Pref. Agr. Exp. Stat.)

	Norin 10	Norin 1
Species	Vulgare	Vulgare
Habit of Growth	Winter	Winter
Winter-killing (Surv. indiv.)	84	68
Earing, Date	6. 4	5. 29
Ripening Date	7. 13	7. 7
Stem-length	52	67
Spike-length	9.2	7.3
Effective tillering (50 cm ² row)	121	90
Resistance to Lodging	Very high	Very high
Spike-shape	Fusifiform	Oblong
Awn-length	Medium	Medium
Glume-color	White	White
Seed-color	Red	Red
Reaction to		
: Powdery mildew	Semi Resist	Susc.
Leaf rust	Resist	Semi Resist.
Speckled leaf blotch	Semi Resist	Semi Resist.
Grain-weight	736	753
1,000 kernel-weight	25	30
Glassiness	76	68
Flour-yield	72.5	68.0
Gluten	28.2	26.8
	10.1	10.0
Kernel grade	Medium-high	Medium-high
Shattering	Medium	Medium
Yield of Grain	3.042	2.373
	4.33	3.13

Note: 1931-1933 test, but flour yield & gluten; 1932.

Nōrin 1; Recommended var. in Iwate pref. in those days.

variety of superior quality. Its vertical and short stem is a character favorable for sowing of the second crops between the rows. It was adaptable to the climate of the Tōhoku district, and a recommended variety of Iwate Prefecture. The result of experiments carried out at that Prefectural Agricultural Experiment Station are summarized in Table 1.

2) Examination of characters by culture at Kōnosu

Many Japanese and foreign wheat varieties were cultured and examined for their characters at Kōnosu for 4-5 years since 1947. According to the results of the examinations, the characters of Nōrin 10, its parental varieties and Nōrin 61, a Japanese leading variety, are shown in Table 2.

Table 2. Characters of Nōrin 10 and its parent plants comparing with Nōrin 61, leading variety, at Kōnosu. (Averaged datas of 4~5 years test since 1947)

	Nōrin 10	Nōrin 61	Turkey Red	Fultz-Daruma
Growth habit in young plant	Medium	Erect	P - M	prostrate
Stem length cm	61	93	145	127
Spike length cm	10	10	11	13
Spike shape	Oblong-fusiform	Oblong-fusiform	Oblong-fusiform	Oblong-fusiform
Awn length	Medium	Medium	Medium	Long
Glume color	White	Brown	White	White
Seed color	Red	Red	Red	Red
Seed shape	Medium	Medium	Long	Long
Seed size	Medium	Medium	Large	Medium
Sprouting	Medium	Low	Low	High
Grade of winter habit	IV	II	Vb	Va
Earing date	5.8	4.28*	5.12	5.16
Ripening date	6.22*	6.16*	6.22	6.23*

* Comparatively variable. Seed shape; Long...longer than 2.2 times as width of seed, Medium... seed length: between 1.9 and 2.2 times as width.

3) Kernel texture of Nōrin 10 cultured and harvested at Kōnosu

One hundred and seventeen representative Japanese wheat varieties including all the ones, registered at the Ministry of Agriculture

and Forestry, were examined for their characters pertaining to yield, grain, flour and dough for 3 years from 1965 to 1967. The results are summarized in Table 3.

Table 3. Grain, Flour and Dough-characters by Brabender-test at Kōnosu (Averaged values of 1965-1967 test)

	Nōrin 10	Nōrin 61	Average of 117 vars. used
Ripening date	6.20	6.13	6.16
Grain yield kg/a	23.8	31.9	29.4
Grain weight g/l	694	692	707
Glassiness %	68.5	16.3	38.9
Flour yield %	58.5	58.0	58.7
Ash %	0.48	0.44	0.47

D ₄₅₅ —D ₅₅₄		0.112	0.117	0.125
Kb		0.46	0.49	0.45
Rough protein	%	10.2	8.5	9.1
Sedimentation value		28.1	24.9	21.4
Valorimeter value		50	42	45
Absorption of flour	%	55.8	56.3	56.8
Development time	minute	4.3	1.9	2.5
Stability	minute	4.6	4.6	3.5
Weakness	B. U.	115	88	109
Max. viscosity	B. U.	687	833	757

4) Characters and productivity of Nōrin 10 and the recommended wheat varieties at present in Japan

The systematic breeding of wheat was put in practice in Japan in the 1920's. The number of the wheat varieties which have been registered until now (1968) is 109 in total. Local varieties were cultured until 1950 or so, but they are entirely out of use at present. Nearly all the wheat acreage is now covered with registered varieties. Even the varieties brought up in the early days of the systematic breeding, including Nōrin 10, have been replaced by Nōrin 61 and other new productive ones. Nōrin 10 suitable to the Tōhoku district was recognized there by its superiority in such characters as short and strong stem, disease resistance, cold resistance and productivity in comparison with other varieties at the time of its debut in 1935. Many new superior varieties have been bred since. Nōrin 10 occupied one third of the wheat acreage at the maximum in Iwate and Yamagata Prefectures in 1940-1955. It, however, has been replaced by Kokeshi-Komugi even in those areas. The latter is the progeny of Nōrin 10 and dwarf and more productive than the parent. There are, nevertheless, few varieties which are shorter in stem-length and longer in spike-length than Nōrin 10 among the Japanese wheats, showing that the hereditary traits of Nōrin 10 are very valuable.

Contribution of Nōrin 10 to the breeding of wheat

The dwarfing gene of Nōrin 10 attracted breeders' attention as early as the beginning

of its breeding. At that time, selection was carried out for two sister lines, long-stemmed and short-stemmed, originated from the same crossing. The short-stemmed line was named Nōrin 10 and the long-stemmed one Nōrin 14 later on, and registered at the same time. In those days, a researcher supposed combinations of 3 genes for the expression of the recessive dwarfness and tried to ascertain the stem length corresponding to each of the combinations. It is to be regretted that he could not have an opportunity for reporting his results.

On the basis of the knowledge mentioned above, many crossing combinations, however, were examined thereafter using Nōrin 10 as a parent, and superior varieties, as Susono-Komugi (Nōrin 77), Kokeshi-Komugi (Nōrin 89) and Miyagino-Komugi (Nōrin 102), have been obtained and registered. Among those, Kokeshi-Komugi is a representative dwarf, cold-resistant and productive variety in the Tōhoku district, being recommended in place of Nōrin 10. But in the areas other than Tōhoku, any productive and early maturing wheat variety has never been obtained from the progeny of Nōrin 10.

After the world war II, seeds of Nōrin 10 were brought to U.S.A., and winter wheat varieties, Gaines and Nugaines, were bred successively there using it as a parent. Then, spring varieties Lerma Rojo 64, Sonora 64, Nainari 60, and Pitic 62 and Mayo 64 were obtained in the same way in Mexico. Those improved varieties and other strains descended from Nōrin 10, as S. 227, S. 307, S. 308 and S. 331, were introduced to India as materials for breeding, and many dwarf wheat varieties, Kalyan Sona, Sonalika, Safed Lerma, Chhoti Lerma

and Sharbati Sonora were obtained there through the breeding by separation, breeding by hybridization and mutation breeding by isolation from gamma ray treated seeds, rendering great services for the improvement of the food situation in this country. It was informed that the memorial stamp was made in 1968 in celebration of the rapid progress in wheat production.

From the above-mentioned facts, it seems that the dwarfing genes of Nōrin 10 will be increasingly utilized for wheat breeding in future. So additional data on the characters of Nōrin 10 from the results of examinations carried out in the other stations than ours are shown in Table 4.

Additional memo

Table 4. (Reaction to some diseases of Nōrin 10, reproduced by Japanese reports.)

	Nōrin 10	Researcher	Reported year
Leaf rust resistance	High resist.	Asuyama	1951
Reaction to leaf rust races	Resist. to; 1 A, 1 B, 1 C, 2, 45 Susc. to; 37A, 37B, 9 A, 9 B, 5 A, 5 B, 6 A, 6 B, 21A, 21B	Yamada	1958
Yellow rust resist.	High resist.	Handbook published by Yōkendō.	1956
Reaction to powdery mildew	Mod. Susc.	Hirata	1947
Sclerotinia resist.	High resist.	Handbook published by Yōkendo	1956
Reaction to Yellow Mosaic	Immune	Chūgoku National Agr. Exp. Stat.	1951~1953
Resistance to Selonophoma leaf blight	High	Tottori Pref. Agr. Exp. Stat.	1957