the canes be mowed to ground level during the winter months. This has the advantage of avoiding selective cane removal and tends to promote an earlier primocane crop. Moreover, it avoids the possibility of winter injury to the canes and lessens the chances of diseases or insects affecting the canes.

'Heritage' was released in 1969 by D. K. Ourecky and G. L. Slate from Cornell University's New York State Agricultural Experiment Station breeding program at Geneva. The cultivar, which was tested as New York 696, originated from a cross between New York 463 ('Milton' x 'Cuthbert') x 'Durham' and was selected in 1960 from a population of 32 seedlings. After its release, it soon replaced older primocane fruiting cultivars such as 'September' and 'Fallred.' In the intervening years 'Heritage' has been used extensively in various breeding programs and is a parent of several recent releases including 'Ruby,' from the New York program and 'Redwing,' from the University of Minnesota program.

There have been attempts to find cultivars which might be superior to 'Heritage.' Of particular concern in many environments is the possibility of earlier ripening to ensure a more complete overlap with late season floricane cultivars and, as already indicated, to ensure a greater portion of the potential crop ripening before unfavorable fall weather conditions. In addition, there is a desire for cultivars with larger fruit with a more intense raspberry flavor and a brighter color. Some of the recently released cultivars, such as 'Malling Autumn Bliss,' from the Horticulture International program in England, and 'Amity' and 'Summit,' both from the Oregon State University-United States Department of Agriculture program, as well as 'Redwing' and 'Ruby' are being planted because of one or more the aforementioned traits. To date none of the newer cultivars has proved to be as widely adapted as 'Heritage.' Therefore, it appears unlikely that any one will completely replace 'Heritage' in a particular production region and the cultivar will remain important into the 21st century.

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'Tohoku 2' Apple

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Abstract

The Japanese apple cultivar 'Tohoku 2' has been recently released in Norway following good performance in variety trials at several locations. The cultivar produces high yields of attractive red fruit having excellent eating quality and good disease resistance. The small fruit size and low acidity following cold storage for a period of 2 months are the only weaknesses of this cultivar.

Introduction

In 1975 and 1976, a collection of cultivars and selections obtained from various countries around the world, including Japan, were planted at the Agricultural University of Norway in Aas, at a latitude of approximately 60°N. The Japanese collection was

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obtained from the Aomori Apple Experiment Station and the Ministry of Agriculture and Forestry Morioka Branch Fruit Tree Research Station, both located in the northern part of Japan. The choice of Japanese cultivars and selections was based on descriptions written by Yoshida and Mink (5).

From the first year of cropping 'Tohoku 2' was one of the most promising cultivars for fruit quality. In 1983 'Tohoku 2' was planted in trials in six locations in southern Norway to study cropping potential, disease resistance, and winter hardiness (3).

Origin

'Tohoku 2' is derived from a 'McIntosh' x 'Worcester Pearmain' cross made at the Ministry of Agriculture and Forestry Morioka Branch Fruit Tree Research Station located near Morioka City in Iwate Prefecture, Japan. This selection has not been released in Japan, however it is maintained as a genetic resource. In cooperation with the breeder, Dr. Yoskio Yoshida, the cultivar has recently been released in Norway under the name 'Tohoku 2.' The designations 'Tohoku No 2' or 'Tohoku #2' have been used previously. "**To**" means east, while "**hoku**" means north, thus indicating the northeast part of Japan where the cultivar originated.

Description and Performance

Trees of 'Tohoku 2' are medium in size and slightly smaller than trees of the standard cultivar 'Summerred' (Table 1). Growth is upright, unless branches are bent down. It is compatible with, and well-suited to, propagation on M.26 and MM.106 rootstocks.

Table 1. Yield and fruit size (mean values for the years 1986-1988) and tree size (six year old trees, in 1988) for 'Tohoku 2' and 'Summerred.' Mean values for several locations in southern Norway.

Cultivar	Annual yield, (kg/tree)	Fruit weight, (grams)	Trunk circumference, (cm)
Tohoku 2	12.7	103	12.5
Summerred	10.4	110	13.5
P (F)	<0.05	<0.05	<0.05

Table 2. Ratings of 'Tohoku 2' and 'Summerred.'

	% respondents		
	Tohoku 2 rated superior[1]	Tohoku 2 rated equal to Summerred[1]	Tohoku 2 rated inferior[1]
Winter Injury	20	80	0
Disease susceptibility	80	20	0
Tree Habit	20	40	40
Fruit quality	40	0	60
Keeping ability	40	60	0
Response from the consumers	100	0	0
Total impression	40	0	60

[1]Based on personal interviews with the hosts of five planting trials.

Flowering seems to be regular, early to mid season, and overlaps with 'Carroll,' 'Julyred,' 'Quinte,' 'Summerred' and 'Yellow Transparent,' which are all recommended pollenizers. According to recent findings (4) 'Tohoku 2' flowers release a satisfactory amount of pollen (8.8 mg from 10 flowers at the beginning of petal fall compared with 3.6 mg for 'Summerred') and 'Tohoku 2' pollen has shown a fairly good pollen germination in *in vitro* tests (43% or more and comparable to the figures for 'Summerred').

When grown in the southern part of Norway fruit is ready for harvest in the last part of September, about one week later than 'Summerred.'

The optimal period of consumption is from picking time until the end of November when stored in cold storage at 4°C. During the month of October, this cultivar has obtained higher flavor ratings in controlled sensory evaluation tests than any of the other cultivars

tested (1, 2). In this month 'Tohoku 2' obtained the rating 6.4 (mean value for the years 1977-1984) while the corresponding figure for 'Summerred' was 5.8.

'Tohoku 2' is a heavy cropper, and without fruit thinning the fruit size is rather small (Table 1). Thinning is necessary to obtain satisfactory fruit size.

Fruit has a uniform conic shape and is 60% to 70% attractive red. The skin is smooth and of medium thickness, with a tendency to become greasy when fully ripe. Flesh is creamy white, firm, crisp and juicy, sweet (13.3% soluble solids content), and slightly acid (0.62% titratable acids) when optimally ripe (1, 2).

'Tohoku 2' has some degree of field resistance to apple scab (*Venturia inaequalis* (Cke.) Wint.) and powdery mildew (*Podosphaera leucotricha* (Ell. and Ev.) Salm.). Infection has been observed only sporadically, even on trees with reduced fungicide control.

The partial disease resistance and the popularity among the consumers are the main advantages of 'Tohoku 2' compared with the standerd 'Summerred' (Table 2). The fact that 'Tohoku 2' was characterized as comparable to 'Summerred' as regards total impression (rated as superior by 40% and inferior by 60% of the growers), indicate that 'Tohoku 2' should have good possibilities, when taking into consideration that 'Summerred' in a few years has developed to be one of the major apple cultivars in Norway.

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Peach Quality and Shade During Final Swell

A report from Virginia on the influence of artificial shade applied to 'Biscoe' peach 44 days before harvest had the greatest negative effect on fruit weight and quality. Shading 40 to 20 days before harvest did not affect fruit weight or quality. Fruit on girdled branches generally responded to shade more than fruit on non girdled branches. Girdling results indicated that fruit weight and soluble solids content partially depended on photosynthesis from non shaded portions of the canopy, whereas fruit redness, days from bloom to harvest and ground color depended on light level in the vicinity of the fruit. (From R. P. Marini et al. 1991. J. Amer. Soc. Hort. Sci. 116:383-389)

Assessment of Apple Rootstock and Scion Hardiness

No differences in root survival were detected at -8° C. At -11° C MM.111 rated better than the others while regrowth was higher on M.26, MM.111 and M.7A than on MM.106 or M.7 EMLA. Root survival did not differ for the scions at either temperature, but regrowth was greater for 'Gravenstein' than 'Wealthy' at both temperatures. Trunk tissue survival at -25° C was consistently lowest for scions on M.7 EMLA and regrowth was less than on M.26 and MM.111. At -35° C there was no significant rootstock effect. From Embree and McRae. 1991. *HortScience* 26:1523-1525.