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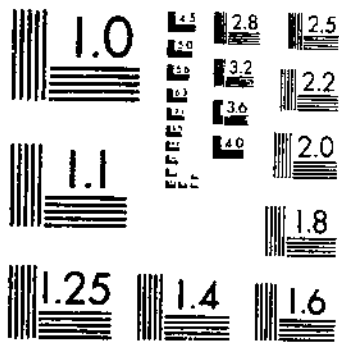
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COMPARATIVE WINTER HARDINESS OF BARLEY VARIETIES

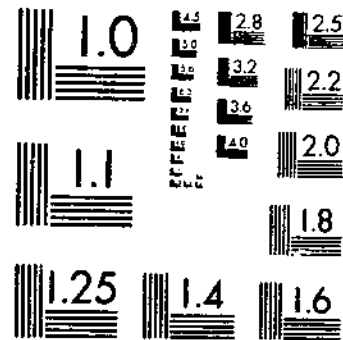
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COMPARATIVE WINTER HARDINESS OF BARLEY VARIETIES

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Technical Bulletin No. 1176

UNITED STATES DEPARTMENT OF AGRICULTURE

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COMPARATIVE WINTER HARDINESS OF BARLEY VARIETIES¹

By G. A. WIEBE and DAVID A. REID, *agronomists, Crops Research Division,
Agricultural Research Service*

INTRODUCTION

The first introduction of winter barley into the United States is not known, but the plant probably came from Switzerland or The Balkans to the mountain region of the Southeastern States where it has long been grown as Tennessee Winter and Union Winter barley.²

The principal areas of winter barley production in the United States lie south and east of a curved line extending from New York City through Kansas City and western Texas. Along this line, and particularly to the north of it and in higher altitudes, winter survival is the major factor in the successful growing of winter barley. Other important winter barley areas lie outside this principal region in New York, Michigan, Washington, and Oregon.

Low temperature is the principal cause of winterkilling, but several other factors, including heaving, alternating temperatures, smothering, disease, high winds, and unfavorable soil moisture conditions, also may contribute to winterkilling.

The uniform barley winter-hardiness nursery tests were begun in the fall of 1936 by the United States Department of Agriculture in cooperation with the State agricultural experiment stations to determine the relative winter hardiness of barley varieties known at that time. In the 20-year period since that time, these nurseries also have served as testing grounds for new breeding materials and have provided an opportunity for barley breeders to observe under local conditions new strains from many sources.

Annual mimeographed summaries, including survival of strains by stations, have been prepared and distributed to cooperators each year. This bulletin summarizes the results for the 20-year period, 1937-56.

¹ Cooperative investigations of the Crops Research Division, Agricultural Research Service, United States Department of Agriculture, and the various experiment stations listed in table 1. The authors are indebted to each of the cooperators listed who supplied data on the winter-hardiness nurseries grown on their respective stations.

² HARLAN, H. V., and MARTINI, M. L. PROBLEMS AND RESULTS IN BARLEY BREEDING. U. S. Dept. Agr. Yearbook 1936: 303-346, illus. 1936.

MATERIALS AND METHODS

The nurseries have been grown at 21 to 60 cooperating stations each year in the United States and Canada for a total of 963 station years, and differential killing occurred at as few as 10 and as many as 38 stations in a particular year. A total of 111 stations cooperated in these tests for periods ranging from 1 to 20 years. The location of the nurseries, the cooperators conducting the tests, the number of years the test was grown, and the percentage of years in which differential killing occurred at each location are listed in table 1. The location of the cooperating stations is shown on the map in figure 1.

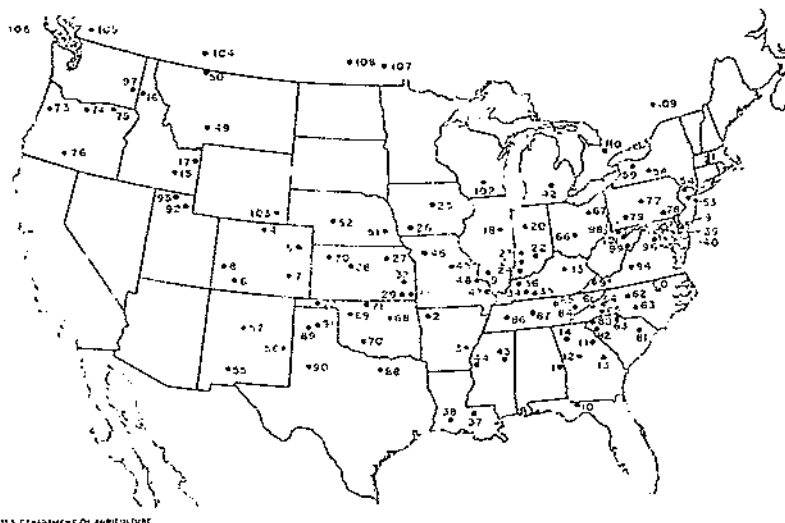


FIGURE 1.—Location of stations cooperating in uniform barley tests, 1937-56. Numbers refer to stations listed in table 1.

TABLE 1.—Location of barley winter-hardiness nurseries in the United States and Canada, cooperators conducting tests, and number of years grown, 1937-56

State or Province and station	Number on map	Cooperators ¹	Number of years					Years with differential killing
			No killing	Complete killing	Differential killing	Special conditions ²	Total	
Alabama:								Percent
Auburn.....	1	T. H. Rogers.....	2	0	0	0	2	0
Arkansas:								
Fayetteville.....	2	R. L. Thurman, W. J. Wisler, C. K. McClelland, T. Enslay.....	8	0	7	2	17	41
Illinois:								
Stuttgart.....	3	C. H. Adair.....	8	0	1	0	9	11
Colorado:								
Fort Collins.....	4	D. W. Robertson, J. J. Curtis.....	5	0	10	3	18	56
Ohio:								
Akron.....	5	D. W. Robertson, J. F. Brandou, T. E. Hous, S. F. Cushman, J. J. Curtis.....	6	1	13	3	17	76
Idaho:								
Hesperus.....	6	D. W. Robertson, W. H. Paulson, H. O. Mann, D. W. Koonce.....	2	1	13	1	17	76

See footnotes at end of table.

TABLE 1.—Location of barley winter-hardiness nurseries in the United States and Canada, cooperators conducting tests, and number of years grown, 1937-56—Con.

State or Province and station	Number on map	Cooperators ¹	Number of years					Years with differential killing
			No killing	Complete killing	Differential killing	Special conditions ²	Total	
Colorado—Con. Rocky Ford	7	H. Fauter, D. W. Robertson.	3	0	2	0	5	Percent 30
Northdale	8	R. E. Dubois	1	0	2	0	3	67
Delaware: Newark	9	F. D. West, F. B. Springer, Jr., F. B. Collins, R. S. Lindsey, C. E. Phillips.	3	0	10	0	13	77
Florida: Quincy	10	R. C. Bond, J. D. Warner	3	0	0	0	3	0
Georgia: Athens	11	A. R. Brown, C. C. Murray, E. James.	8	0	1	0	9	11
Experiment	12	U. R. Gore, R. P. Bledsoe, L. N. Skold.	8	0	1	0	9	11
Sandersville	13	T. W. Gilmore	2	0	1	0	3	33
Cartersville	14	M. W. H. Collins	1	0	1	1	2	0
Idaho: Aberdeen	15	H. Stevens	4	2	10	0	16	63
Moscow	16	K. H. Klages, G. O. Baker	6	1	6	1	14	43
Teton	17	P. J. Fitzgerald, H. Stevens, H. C. McKay.	0	1	1	1	3	33
Illinois: Urbana	18	R. O. Weibel, J. W. Pendleton, G. H. Dungan.	1	0	19	0	20	95
Carbondale	19	R. O. Weibel, E. Sullivan, D. P. Yavva.	2	0	2	0	4	50
Indiana: Lafayette	20	R. M. Caldwell, L. E. Compton, F. L. Patterson, J. F. Schafer.	0	0	19	1	20	95
Princeton	21	do	3	0	2	0	5	40
Bedford	22	R. M. Caldwell, L. E. Compton, J. F. Schafer.	1	0	5	0	6	83
Vincennes	23	do	1	0	2	0	3	67
Evansville	24	R. M. Caldwell, L. E. Compton.	0	0	2	0	2	100
Iowa: Ames	25	R. E. Atkins, L. C. Burdett.	1	3	11	1	16	69
Shenandoah	26	R. E. Atkins	0	1	3	0	4	75
Kansas: Manhattan	27	E. G. Heyne, A. J. Casady, W. L. Fowler, L. P. Reitz, J. H. Parker.	2	1	16	1	20	80
Hays	28	J. D. Miller, W. M. Ross, W. L. Fowler, A. F. Swanson.	3	1	11	5	20	85
Mound Valley	29	L. C. Jones	2	0	5	0	7	71
Colby	30	T. L. Walter, E. H. Coles, D. E. Crumbaker.	0	2	4	3	9	44
Columbus	31	M. E. Daykin	1	1	1	1	4	25
Theyer	32	F. E. Davidson, L. P. Reitz.	2	0	6	0	8	75
Kentucky: Lexington	33	V. C. Finkner, D. A. Reid, L. M. Josephson, E. J. Kluney.	6	0	12	0	20	60
Hopkinsville	34	R. Richards, V. C. Finkner, J. F. Shupe, D. A. Reid.	4	0	2	0	6	33
Allensville	35	D. A. Reid, L. M. Josephson.	3	0	2	0	5	40
Princeton	36	L. M. Josephson	0	0	1	0	1	100
Louisiana: Baton Rouge	37	J. P. Gray	4	0	0	0	4	0
Crowley	38	D. E. Black, N. E. Jordan	3	0	0	1	4	0
Maryland: College Park	39	R. O. Rothgeb	18	0	1	0	19	5
Beltsville	40	D. A. Reid, J. W. Taylor	12	0	1	0	13	8
Massachusetts: Feeding Hills	41	W. A. Rosenau	0	0	1	0	1	100
Michigan: East Lansing	42	J. E. Grafius, K. J. Frey	1	0	3	1	5	60

See footnotes at end of table.

TABLE 1.—Location of barley winter-hardiness nurseries in the United States and Canada, cooperators conducting tests, and number of years grown, 1937-56—Con.

State or Province and station	Number on map	Cooperators ¹	Number of years					Years with differential killing
			No killing	Complete killing	Differential killing	Special conditions ²	Total	
Mississippi:								Percent
State College.....	43	J. F. O'Kelly.....	4	0	1	0	5	20
Stoneville.....	44	P. W. Gull.....	2	0	1	0	3	33
Missouri:								
Columbia.....	45	J. M. Pochlman, B. M. King.....	2	0	18	0	20	90
Do. 3.....		J. M. Pochlman.....	0	0	2	0	2	100
Laturop.....	46	do.....	1	2	5	0	8	63
Sikeston.....	47	do.....	4	0	1	0	5	20
Perryville.....	48	do.....	1	0	0	0	1	0
Montana:								
Bozeman.....	49	R. F. Eslick, R. Warden, D. G. Smeltzer, S. G. Litzenberg & R. G. Newell.....	0	0	14	3	17	82
Cut Bank.....	50	R. G. Newell.....	0	2	1	0	3	33
Nebraska:								
Lincoln.....	51	O. J. Webster, C. F. Pulham, D. E. Wetbel, K. S. Quisenberry.....	1	3	16	0	20	50
Do. 3.....		K. S. Quisenberry.....	0	0	6	0	6	100
North Platte.....	52	M. S. Greenwood, O. J. Webster, D. E. Wetbel.....	0	1	7	0	8	85
New Jersey:								
New Brunswick.....	53	S. Lund, R. S. Snett, E. L. Spencer, H. B. Sprague, C. S. Garrison.....	5	0	10	0	15	67
Beermerville.....	54	S. Lund.....	0	0	1	0	1	100
New Mexico:								
State College.....	55	G. Staten, J. C. Overpeck, H. N. Watenpugh.....	5	0	0	0	5	0
Clavis.....	56	J. Carter.....	0	0	4	1	5	80
Albuquerque.....	57	G. Staten.....	1	0	0	0	1	0
New York:								
Ithaca.....	58	N. F. Jensen, H. H. Love, W. T. Craig.....	0	1	18	0	10	95
Honeoye Falls.....	59	H. H. Love, W. T. Craig.....	0	0	1	0	1	100
North Carolina:								
Raleigh.....	60	T. T. Hebert, G. K. Middleton.....	3	0	0	0	3	0
Waynesville.....	61	T. T. Hebert, G. K. Middleton, J. G. Moseman.....	3	0	9	0	12	75
Statesville.....	62	G. K. Middleton, W. H. Chapman.....	5	0	0	0	5	0
Salisbury.....	63	T. T. Hebert.....	1	0	0	0	1	0
Swannanoa.....	64	G. K. Middleton, W. H. Chapman.....	1	0	4	1	6	67
Hendersonville.....	65	G. K. Middleton.....	0	0	1	0	1	100
Ohio:								
Columbus.....	66	W. P. Byrd, C. A. Lamb, V. C. Finkner, P. P. Preston, J. B. Park.....	2	0	13	2	17	76
Wooster.....	67	W. P. Byrd, V. C. Finkner, C. A. Lamb.....	2	1	10	1	14	71
Oklahoma:								
Sullwater.....	68	A. M. Schlehuber, B. C. Curtis, B. R. Jackson, T. H. Johnston, C. B. Cross.....	8	0	4	0	12	33
Woodward.....	69	A. M. Schlehuber, B. C. Curtis, T. H. Johnston, V. C. Hubbard.....	4	0	12	0	16	75
Lawton.....	70	W. M. Osborne, R. G. Dahms.....	10	0	2	0	12	17
Cherokee.....	71	T. H. Johnston, A. M. Schlehuber.....	1	0	3	0	4	75
Goodwell.....	72	O. C. Ferry, M. McKee.....	1	1	1	0	3	33
Oregon:								
Corvallis.....	73	R. E. Fore, D. B. Hill.....	8	0	1	0	9	11
Moro.....	74	W. E. Hall, M. M. Oveson, L. Y. Hubbard, R. W. Henderson.....	4	1	10	2	17	59
Pendleton.....	75	G. A. Mitchell, C. A. Samsen, J. T. McDermid, J. F. Martin.....	7	0	2	0	9	22
Klamath Falls.....	76	A. E. Gross.....	0	0	1	0	1	100

See footnotes at end of table.

TABLE I.—Location of barley winter-hardiness nurseries in the United States and Canada, cooperators conducting tests, and number of years grown, 1937-56—Con.

State or Province and station	Number on map	Cooperators ¹	Number of years					Years with differential killing
			No killing	Complete killing	Differential killing	Special conditions ²	Total	
Pennsylvania:								Percent
University Park (State College)	77	C. S. Bryner, R. Schein, J. B. Washko, M. T. Henderson, J. K. Thornton, C. F. Noll.	2	0	17	1	20	85
Landsville	78	C. S. Bryner	1	0	3	0	4	75
Irwin	79	J. E. Yeagers	1	0	2	0	3	67
South Carolina:								
Cleason	80	W. P. Byrd, E. B. Eskew, W. R. Patten, H. W. Webb, G. B. Killinger.	13	0	2	1	16	13
Hartsville	81	S. J. Hadden, G. J. Wilds, R. S. Cathcart.	10	0	0	0	10	0
Westminster	82	H. W. Webb, S. J. Hadden	10	0	0	0	10	0
York	83	S. J. Hadden	1	0	0	0	1	0
Tennessee:								
Knoxville	84	N. I. Hancock, H. P. Ogden	15	0	5	0	20	25
Crossville	85	N. I. Hancock, J. A. Odum	2	0	5	0	7	71
Jackson	86	N. I. Hancock	6	0	0	0	6	0
Columbia	87	do	3	0	0	0	3	0
Texas:								
Denton	88	J. H. Gardenhire, I. M. Atkins.	11	0	5	1	20	25
Bushland	89	K. B. Porter, I. M. Atkins, D. A. Rehl.	2	0	12	1	15	80
Lubbock	90	A. W. Young, A. H. Lehigh	11	0	2	0	13	15
Amario	91	I. M. Atkins	1	0	1	0	2	50
Utah:								
Logan	92	R. W. Woodward	0	0	10	2	12	83
Clarkston	93	do	0	1	1	0	2	30
Virginia:								
Blacksburg	94	T. M. Starling, E. Shulkeim	5	0	7	0	12	38
Wise	95	J. H. Belcher	1	0	0	1	2	0
Arlington	96	J. W. Taylor	1	0	0	0	1	0
Washington:								
Pullman	97	R. A. Niles, R. S. Caldecott, L. Smith, S. P. Swenson, O. E. Barber.	5	1	12	0	18	67
West Virginia:								
Morgantown	98	C. Veatch, B. M. Ritter, G. G. Pohlman, R. O. Weibel.	3	0	14	0	17	82
Warrensburg	99	C. Veatch, B. M. Ritter	3	0	5	0	8	83
Kearneysville	100	C. Veatch, R. O. Weibel, J. W. Taylor.	1	0	5	0	6	100
Reedsville	101	C. Veatch, B. M. Ritter	0	0	2	0	2	100
Wisconsin:								
Madison	102	R. G. Shands	0	2	15	0	17	88
Wyoming:								
Cheyenne	103	R. P. Pfeiffer	0	1	1	0	2	50
Alberta:								
Lethbridge	104	S. A. Wells	0	1	0	0	1	0
British Columbia:								
Agassiz	105	D. K. Taylor	1	1	3	0	5	60
Saanichton	106	R. Turky, T. J. Woods.	3	0	2	0	5	40
Manitoba:								
Winnipeg	107	K. W. Shannon	0	1	2	0	3	67
do.	108	do	0	2	0	0	2	60
Brandon	108	W. H. Johnston	0	0	1	0	1	100
Ontario:								
Ottawa	109	A. E. Hannah, D. G. Hamilton.	0	0	5	0	5	100
Guelph	110	D. S. Huntley, E. Reinbergs.	0	0	5	0	5	100
Saskatchewan:								
Star City	111	J. B. Harrington	0	3	1	1	5	20
Totals			343	40	635	45	1063	

¹ Most recent cooperator listed first.² Special conditions include tests that were destroyed by drought, wind, insects, those not emerging until spring and other conditions where no data were obtained.³ Freezing chamber tests.

At most stations, the seeds were sown in single-row plots, and the percentage of survival was calculated from stand estimates made in the fall after emergence and again in the spring after danger of winter-killing was past. Single-row plots were used at most stations from 1937 to 1946. Plantings were made in 2 series of 5-foot rows in 1947 and 1948. The rows were lengthened to 8 or 10 feet in 1949 and succeeding years.

Tennessee Winter, C. I. 6034,³ has been used as a check variety in all nurseries. From 1937 to 1942 this variety was planted every fifth or sixth row, but since that time checks were seeded every tenth row. Averages of the survival of these checks were used in the annual summaries as a standard for comparing varieties.

Data from nurseries were used in computing averages for differential winterkilling if at least one variety in the test for a given year had a survival of 1 to 90 percent. If Trebi, which was used as a spring check variety since 1942, was the only one winterkilled in a given nursery, that test was considered as having little or no differential winterkilling for winter varieties, and data from the nursery were not used.

Three varieties, Tennessee Winter, Kentucky 1, and Missouri Early Beardless, were included in all the 535 tests in which there was differential killing. The average survival of these three was used as a base in the present summary, and a comparable percentage of survival was calculated for each of the 204 varieties tested (table 2). The percentage survival, together with the rank, gives a comparison of the relative winter hardiness of the varieties.

Most of the varieties included in these experiments in the early years were being grown commercially. New strains were included as rapidly as they became available from the winter barley breeding nurseries, and the proportion of new experimental strains has gradually increased. Seed of the entries was supplied each year by the originating station, uniformly packeted at the Plant Industry Station, Beltsville, Md., and distributed from there to the cooperators. A variety usually remains in the nursery until its level of winter hardiness has been determined or until the originating station withdraws it. New entries showing superior winter hardiness have usually been kept in the nursery several years, particularly when they have been named and distributed for commercial growing.

The origin or source and description of the 204 varieties and strains tested are listed in table 3, insofar as this information is available. The descriptions on the spike and kernel characters were obtained either from Wiebe and coworkers⁴ or from field data obtained on the world collection of barleys grown at Aberdeen, Idaho, in 1951.⁵ When descriptive data were not available from either of these sources, they were taken from the head specimens and grain samples of the world collection stored at the Plant Industry Station, Beltsville, Md.

³ C. I. refers to the accession number of the Cereal Crops Research Branch.

⁴ WIEBE, G. A., COWAN, P. R., and WELCH, L. R. YIELDS OF BARLEY VARIETIES IN THE UNITED STATES AND CANADA, 1937-41. U. S. Dept. Agr. Tech. Bul. 881, 83 pp. 1944.

⁵ The authors are indebted to D. J. Ward, Cereal Crops Research Branch, for making these data available.

TABLE 2.—Survival of winter barley varieties tested in uniform winter-hardiness nurseries, 1937-56

[Varieties arranged in order of C. I. No.]

Variety	C. I. No.	Average survival by years ²																			Average survival for years tested			Station years			
		1937 (10)	1938 (10)	1939 (10)	1940 (21)	1941 (27)	1942 (29)	1943 (33)	1944 (23)	1945 (24)	1946 (23)	1947 (35)	1948 (26)	1949 (23)	1950 (31)	1951 (36)	1952 (33)	1953 (19)	1954 (26)	1955 (37)	1956 (37)	Weighted average for variety	Compared with average of Tenn. Winter (C. I. 6034), Ky. 1, and Mo. Early Beardless		Number		
		Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.		Pct.			Rank	
Fayette	245					31.8	52.8	46.4	54.6	53.9														47.7	72.3	172	140
Orel	351	21.7	46.1	44.7																				39.2	68.0	178	39
Union Winter	683	29.5	61.0	62.4	58.6	48.0																		46.8	102.1	91	87
Winter Club	592	12.1																						65.6	88.3	136	115
Tenkov	646					36.2	53.2	48.2	59.4	56.0														50.3	75.7	166	139
Nu Er Ta	741						53.1																	55.1	85.0	146	29
Trebit	936						21.9	37.9	22.6	29.0	25.5	15.8	27.5	11.4	27.1	14.8	21.2	40.4	34.5	25.3	16.3			21.2	36.7	197	448
Khayyam	1117									73.0	70.5													72.1	102.4	90	52
Sabbat	1266									73.4	71.6													72.4	103.0	55	52
Michigan Winter	2630	41.9	73.9	64.1	58.1																			59.4	107.5	68	60
Wisconsin Winter	2159	32.3	63.5	60.6	60.3	46.0	63.5	68.1	71.2	72.8	68.5	74.6	77.7										66.3	101.4	97	293	
Black Russian	2202									58.3	49.1													53.3	75.5	164	52
Tennessee Beardless 6	2746	40.7	74.1	54.3	50.4	49.7	70.1	63.2	71.2															59.8	98.1	111	177
Polders	3213						43.9	67.0	62.7	71.3														61.2	95.2	121	116
Tennessee Beardless 5	3381	29.4	55.0	40.1	50.7	44.2																		46.6	88.5	135	86
Tennessee Winter 52	3543	28.5	69.6	59.9	55.0	47.9																		52.5	101.3	98	57
Tennessee Winter 66	3546	43.4	69.7	59.6	51.8	46.4																		52.8	101.3	94	37
Alaska	4166	39.9	74.7	55.4																				57.8	101.2	99	39
Pekitz	4202-2									73.3	67.9													70.4	100.0	100	52
Purdue 21	4681			72.6	65.7	55.9	81.4	78.2	84.7	78.9														74.1	117.1	25	180
Purdue 1101	4682		79.3	68.4	67.3	59.8	80.5																	70.0	119.5	13	103
Esaw	4690	27.9	50.5	53.2	41.2	47.4	63.2	56.8	60.0															52.7	85.6	146	175
Melini	5136									78.0	76.3													77.1	109.0	59	62
Kido	5145									70.8	85.7													83.0	118.0	19	62
Hokudo	5176									71.6	69.0													70.2	99.8	103	52
Zehra	5189						23.1																	23.1	35.3	198	38
Shonan	5255									78.0	82.6													80.5	114.4	38	52
Dickloo	5529									81.6	84.6													82.1	129.9	2	240
Marm	5562									78.3	70.3													74.0	105.2	81	52
Finley	5901	12.2	39.3	36.9	30.7	31.3										75.5	82.2	78.8	89.2	83.9	81.8			33.2	63.3	187	86
Ward	6007	48.3	82.1	68.6	68.8	55.2	83.8	76.1	81.7															71.8	117.9	20	177

See footnotes at end of table.

437500-58-2

WINTER HARDINESS OF BARLEY VARIETIES

TABLE 2.—Survival of winter barley varieties tested in uniform winter-hardiness nurseries, 1937-56—Continued

Variety	C. I. No.	Average survival by years ²																			Average survival for years tested			Station years		
		1937 (10)	1938 (10)	1939 (10)	1940 (21)	1941 (27)	1942 (29)	1943 (38)	1944 (23)	1945 (24)	1946 (28)	1947 (38)	1948 (26)	1949 (23)	1950 (31)	1951 (36)	1952 (33)	1953 (10)	1954 (26)	1955 (37)	1956 (37)	Weighted average for variety	Compared with average of Tenn. Winter (C. I. 6034), Ky. 1, and Mo. Early Beardless		Number	
		Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.		Pct.			Pct.	Rank
Kentucky 51-5752	10095																				64.3	64.3	113.9	41	37	
Ontario Agricultural College Strain 4 G. H. 1	10096																				71.9	71.0	127.4	3	37	
Ontario Agricultural College Strain 30 G. H. 10	10097																				68.5	68.5	121.4	9	37	
Ontario Agricultural College Strain 38 G. H. 14	10098																				66.1	66.1	117.2	24	37	
Utah B219-7	10099																				60.4	60.4	107.1	72	37	
Utah B219-93	10100																				64.6	64.6	114.6	35	37	
Purdue B466A7-7-6-4	10101																				61.6	61.6	109.2	62	37	
Purdue B466A7-7-7-2	10102																				67.8	67.8	120.2	10	37	
Purdue B466A1-14-7	10103																				67.1	67.1	118.9	15	37	
Tennessee Hooded 50-112-3S	10104																				59.5	59.5	105.5	79	37	
Tennessee Wong 2 ¹	10105																				57.6	57.6	102.1	91	37	
Kansas (Walden)		59.2	74.7																		67.0	67.0	115.8	29	20	
Smooth Awa 101				43.0	33.5																37.6	37.6	79.1	160	48	
Missouri B568										78.1	79.5										78.9	78.9	112.1	50	66	
Missouri B554										79.8	81.7										80.9	80.9	114.0	33	66	
Missouri B578										75.2											75.2	75.2	111.4	52	28	
74-sh-8 (spring type)																				13.9	13.9	18.9	202	26		
74-sh-8 (semiwinter)																				33.8	33.8	46.1	105	26		

¹ C. I. refers to accession number of the Cereal Crops Research Branch.² Number in parentheses under year indicates number of stations where differential winterkilling occurred in that year.³ C. I. 8063 used these 2 years. Purified seed given C. I. 9163 in 1952.

TABLE 3.—Description and origin or source of barley varieties tested in uniform winter-hardiness nurseries, 1937-56

[Explanation of descriptive terms: Rows: 6=6-rowed, 2=2-rowed. Kernel color: B=Blue, W=White, Bk=Black, BW or WB=Mixed, predominating color stated first. Lemma appendage: R=Rough-awned, S=Smooth-awned, SS=Semismooth-awned, H=Hooded, AI=Awnetted, A=Awless. Kernel cover: C=Covered, N=Naked. Rachilla hairs: L=Long, S=Short, LS or SL=Mixed, predominating type stated first. Superscripts (in italics) indicate number of times recurrent variety was used as a parent]

Variety	C. I. No.	Station No.	Description					Origin or source	
			Rows	Kernel color	Lemma appendage	Kernel cover	Rachilla hairs		Head density
Admire	6377		6	B	R	C	S	<i>Mm.</i> 3.9	Local farmer's strain in Kansas.
Aizu 6	9016		6	W	R	C	L	2.3	Introduced from Japan.
Alaska	1106		6	B	R	C	S		Introduced from Alaska.
Alpine	9558	Utah B219-70	6	W	R	C	L	2.7	(Colorado 3063 X Winter Club) Selection X Purdue 21.
Beltsville 771	8175		6	B	R	C	L	2.1	Sunrise X Hooded 16.
Beltsville Y419	8077		6	B	R	C	L	2.8	Sunrise X Bolivia.
Beltsville Dense 611	8076		6	W	H	C	L	1.9	Sunrise X Hooded 16.
Beta 40	9011		6	B	R	C	S	3.8	Introduced from Austria.
Black Russian	2202		6	Bk	R	C	S	3.8	Introduced from Russia.
Bozeman CC10-220	9175					C			Selection from Composite Cross, C. I. 6625. ³
Bozeman CC10-242	9176					C			Do.
Bozeman CC10-259	9514		6	B	R	C	S	3.5	Do.
Bozeman CC10-272	9177		6	B	R	C	S	3.6	Do.
Bozeman CC10-340	9529		6	W	AIR	C	S	3.5	Do.
Brier	7157	W. Va. 1-31-127	6	B	R	C	S	3.0	Selection from a farmer's field in West Virginia.
Calhoun	7120		6	W	AISS	C	L	2.7	Nakano Wase 38 X Borun.
Calhoun 3	7575		6	W	AIS	C	L		Selection from Calhoun, C. I. 7120.
Calhoun M1450-4	8065		6	B	AISS	C	L	2.5	Do.
Calhoun M1450-6	8066		6			C			Do.
Cascade	7146		6	B	R	C	S	3.3	Selection from Composite Cross, C. I. 5530. ⁴
Clemson Hooded	7012		6	BW	H	C	S	3.7	Clemson Agricultural College.
Colonial	7579	N. C. 2089	6	W	AIR	C	L	2.4	Davidson X Sunrise.
Colonial 2	8062		6	W	AIR	C	L	2.7	Selection from Colonial, C. I. 7570.
Composite Cross Selection		74-sh-S	6	B	S	H	S	2.9	Isogenic line from Composite Cross, C. I. 6619, spring type.
Do		74-sh-S	6	B	S	H	S	2.8	Isogenic line from Composite Cross, C. I. 6619, semi-winter type.
Cordova	7576	Texas 8-13-311	6	B	S	C	S	3.5	Wintex X Texan.
Davidson	6373	N. C. II-15	6	B	R	C	S	3.4	Selection from Composite Cross, C. I. 5461. ⁵
Davie	9170	N. C. 4038	6	W	AIR	C	L	2.6	Sunrise X Bolivia.
Dayton	9517	Ohio C1147-115	6	W	SS	C	S	3.4	Selection from Composite Cross, C. I. 6625. ³
Dicktoo	5529		6	B	R	C	L	3.2	History uncertain.
Dubois	8100		6	B	R	C	S	3.4	Local farmer's strain in Colorado.
Early Wong	9171		6	B	AIR	C	L	2.2	Mutant in Wong.
Esaw	4690	Ar1, 751-A	6	W	R	C	S	2.2	Selection from Nakano Wase.
Fayette	245		6	W	R	C	S	3.9	History uncertain.

TABLE 3.—Description and origin or source of barley varieties tested in uniform winter-hardiness nurseries, 1937-56—Continued

Variety ¹	C. I. ² No.	Station No.	Description						Origin or source
			Rows	Kernel color	Lemna append- age	Kernel cover	Ra- chilla hairs	Head den- sity	
Fayette 2-1	8098		6	W	R	C	S	Mm. 3.4	Selection from Fayette, C. I. 245.
Finley	5901	Texas 12576	6	B	R	C	S	3.7	Local farmer's strain in Texas.
Gollad	8099	Texas Sel. 110	6	B	R	C	S	3.5	Tullaca X Peatland.
Harbine	7524	Okla. 1-35-216	6	B	R	C	S	3.3	Selection from Composite Cross, C. I. 5530. ⁴
Harlan Hybrid 1-31-79	6351	Texas 1-31-79	6	B	R	C	S	3.2	Do.
Harlan Hybrid 1-32-103	6502	Texas 1-32-103	6	B	R	C	S	3.3	Do.
Harlan Hybrid 1-33-179	6500	Texas 1-33-179	6	B	R	C	S	4.0	Do.
Hokudo	5170		6	W	R	X	L	3.2	Introduced from Korea.
Hooded 10	6593		6	W	H	C	S	4.0	Selection from Tennessee Beardless 6.
Hooded N743	7329		6	W	H	C	S	3.8	Sunrise X Hooded 16.
Hudson	8097	N. Y. 563413-11-1	6	B	R	C	S	2.3	Michigan Winter X Wong.
Huga	6908	Ga. 11395-1-2-11-1	6	W	H	C	S	3.7	Greece X Tennessee Beardless 5.
Idaho Club	9178		6	W	R	C	L	2.2	Selection from White Winter.
Iredell	6571	N. C. 1-23	6	W	H	C	S	3.7	Selection from farmer's field of Tennessee Beardless 6 in North Carolina.
Jackson	6599	Tenn. B5 0(8)	6	W	S	C	S	4.0	Tennessee Winter 52 X Lion.
Jackson 1	7045	Tenn. 71B2-42	6	B	S	C	S	4.0	Do.
Kansas South Central	6376	Ks. 7177	6	BW	R	C	L	4.0	Local farmer's strain in Kansas.
Kansas Southeast strain	7970	Ks. 7176	6	BW	R	C	L	3.8	Do.
Kansas (Walden)									Do.
Kearney	7580	Nebr. 412400	6	B	R	C	L	3.0	Selection from Composite Cross, C. I. 5530. ⁴
Kenate	9570		6	B	S	C	S	3.1	Selection from Tuck, C. I. 7573.
Kenhar	7554	Ky. CC10-43	6	B	S	C	S	3.1	Selection from Composite Cross, C. I. 6625. ³
Kentucky 1	6050		6	B	R	C	S	3.5	Selection from a local barley in Kentucky.
Kentucky 2	615		6	B	R	C	S	3.7	Do.
Kentucky 3	6921		6	B	S	C	L	3.0	Smooth-awned Spring X Local Winter.
Kentucky 31-5752	10695		6	B	S	C	S		Pedigree 3S X Chevron 2X Bolivia 3X Dorsett 4X Purdue 21.
Kentucky CC10-64 5	8074		6	B	R	C	S	3.2	Selection from Composite Cross, C. I. 6625. ³
Khayyam	1117		2	B	R	C	S	3.8	Tennessee Winter X Black Arabian.
Kjdn	5145		6	B	R	C	L	3.5	Introduced from Korea.
Kirwin	7075		6	B	R	C	S	3.6	Local farmer's strain in Kansas.
Lafite	8289		6	B	R	C	L	4.1	Introduced from France.
Ludwig Selection	9516	Mo. B803	6	W	R	C	L	3.3	Selection from Ludwig, C. I. 7525.
Marceon	8107	Marett 11325-x-x-1-2	6	W		A & H	L	2.2	Hooded 4 X Wong.
Marett Awnless 1	7073		6	B	A	C	L	3.2	Marett Seed Co., Westminster, S. C.
Marett Hooded 4	7074		6	W	H	C	S	3.5	Do.

Marm.....	5662		6	W	R	C	7	3.8	Introduced from Russia.
Marnobarb.....	6120	Md. 13-6.....	6	W	S	C	SL	3.4	Velvet X Tennessee Winter.
Mcml.....	5136		6	W	R	C	1	2.1	Introduced from Korea.
Mercer.....	7071		6	B	R	C	%	3.5	Local strain from Ohio.
Michigan Winter.....	2036		6	B	R	C	%	3.9	Indiana Agricultural Experiment Station.
Mississippi S50-1-9.....	9566		6	W	SS	C	%	3.5	Wisconsin Barless X Chevron 2X Bolivia 3X Dorsett 4X Texan.
Mississippi S50-2-1.....	9567		6	B	R	C	%	3.6	Wisconsin Barless X Chevron 2X Bolivia 3X Chevron X Trebi 4X Texan.
Mississippi S50-2-2.....	9568		6	B	SS	C	%	3.8	Wisconsin Barless X Chevron 2X Bolivia 3X Chevron X Trebi 4X Texan.
Mississippi S50-2-7.....	9569		6	B	SS	C	%	3.6	Wisconsin Barless X Chevron 2X Bolivia 3X Chevron X Trebi 4X Texan.
Missouri B-100.....	7568	Mo. B546.....	6	W	R	C	L	3.6	Kentucky 5 X Missouri Early Beardless.
Missouri B-175.....	9168	Mo. B575.....	6	W	R	C	SS	3.3	Admire X Missouri Early Beardless.
Missouri B550.....	7531		6	B	R	C	%	3.7	Kentucky 5 X Missouri Early Beardless.
Missouri B554.....			6	B	R	C	%		Poland X Missouri Early Beardless.
Missouri B568.....			6	B	R	C	%		Admire X Missouri Early Beardless.
Missouri B574.....	7533		6	B	R	C	%	3.7	Do.
Missouri B578.....			6	B	R	C	%		Do.
Missouri B580.....	7567		6	B	R	C	%		Do.
Missouri B595.....	7532		6	B	R	C	%	3.6	Kentucky 5 X Missouri Early Beardless.
Missouri B637.....	7571		6	B	R	C	%	3.7	Michigan Winter X Missouri Early Beardless.
Missouri B640.....	7572		6	B	R	C	%	3.7	Ward X Missouri Early Beardless.
Missouri B699.....	8064		6	B	R	C	%	3.3	Admire X Missouri Early Beardless.
Missouri B705.....	9169		6	B	R	C	%	2.2	Kentucky 5 X Missouri Early Beardless.
Missouri B899.....	9576		6	B	R	C	%		Reno X Wong.
Missouri Early Beardless.....	6051	Mo. B288.....	6	W	H	C	%	3.7	Mass selection from a farmer's field in Missouri.
Mizohegyser 366.....	9056		6	B	R	C	%	3.3	Introduced from Austria.
Nakano Wase 59.....	6567		6	W	ALR	C	%	2.3	Selection from Nakano Wase, C. I. 754.
Nassau.....	7022	N. J. W B6-68.....	6	B	S	C	%	3.6	Selection from Composite Cross, C. I. 5530. 1
Nebraska 412486.....	7578		6	B	R	C	%	2.9	Do.
Nebraska 412488.....	7579		6	B	R	C	%	3.8	Do.
Nebraska 52434.....	9581		6	W	R	C	%	2.9	Selection from C. I. 7404.
Nebraska 53417.....	9580		6	W	R	C	%		Wong X Ludwig.
New Jersey 270.....	7581		6	B	S	C	%	3.8	Selection from Composite Cross, C. I. 5530. 1
New York 693a7-6-7.....	8071		6	W	R	C	%	2.1	Michigan Winter X Wong.
New York 503n2-0-6.....	8069		6	W	R	C	%	2.3	Do.
North Carolina 11.....	6564		6	B	R	C	%	3.4	Selection from Composite Cross, C. I. 5461. 1
North Carolina Hooded 1-26.....	7026	N. C. 1-26.....	6	WB	H	C	%	4.3	Selection from a farmer's field of Tennessee Beardless 0 in North Carolina.
Nu Er Ta.....	741		6	B	H	C	L	3.4	Introduced from China.
Ohio 1.....	7072		6	B	R	C	SS	3.5	Purified local strain in Ohio.
Ohio CH47-36.....	9518		6	B	SS	C	%	3.7	Selection from Composite Cross, C. I. 6625. 1
Ohio CH47-82.....	8101		6	W	R	C	%	3.7	Do.
Oklahoma 1-40-179.....	8061		6	B	R	C	%	3.8	Selection from Composite Cross, C. I. 5530. 1
Oklahoma 471922.....	9526		6	B	R	C	%	3.6	Do.
Oklahoma 472069.....	9527		6	B	R	C	%	3.8	Do.
Olympia.....	6107		6	B	R	C	%	3.9	Introduced from Germany.
Olympia X White Winter.....	9524		6	B	R	C	%	3.8	Olympia X White Winter.
Do.....	9522	Wash. Sel. 21.....	6	W	R	C	L	3.9	Do.

See footnotes at end of table.

TABLE 3.—Description and origin or source of barley varieties tested in uniform winter-hardiness nurseries, 1937-56—Continued

Variety ¹	C. I. # No.	Station No.	Description						Origin or source
			Rows	Kernel color	Lamina append- age	Kernel cover	Ra- chilla hairs	Head den- sity	
Olympia ² × White Winter.....	9525	Wash. Sel. 25.....	6	W	R	C	L	M.	Olympia ² × White Winter. Kenate × Wong.
Ontario Agricultural College Strain 4 G. H. 1.	10096	.....	6	B		C	S	3.2	
Ontario Agricultural College Strain 30 G. H. 10.	10097	6	B		C	S			Do.
Ontario Agricultural College Strain 38 G. H. 14.	10098	.....	6	B		C	S		Do.
Orel.....	351	.....	2	W	R	C	L	4.1	Introduced from Russia.
Peking.....	4202-2	.....	6	W	R	C	L	3.3	Introduced from China.
Piedmont.....	8073	N. C. 571.....	6	B	R	C	S	3.6	Davidson × Weider.
Poland.....	6280	.....	6	B	R	C	S	3.7	Introduced from Poland.
Polong.....	8068	N. Y. 565a2-1-18.....	6	W	AIR	C	L	2.6	Poland × Wong.
Polders.....	3213	.....	6	W	R	C	L	3.7	Introduced from Belgium.
Pueblo.....	8070	.....	6	B	R	C	S	3.5	Purified local farmer's barley in Colorado.
Purdue 21.....	4581	.....	6	B	R	C	SL	3.5	Mass selection from Tennessee Winter.
Purdue 1101.....	4582	.....	6	B	R	C	SL	3.8	Local farmer's strain in Indiana.
Purdue 1101 Selection.....	7523	.....	6	W	R	C	C	3.7	Selection from Purdue 1101, C. I. 4582.
Purdue 28156A3-2-2-2.....	6562	.....	6	B	S	C	L	3.7	Comfort × Purdue 21.
Purdue 28154A3-1-1-6.....	7067	.....	6	WB	S	C	SL	4.0	Comfort × Purdue 1101.
Purdue 28154A3-1-1-6-2.....	7119	.....	6	W	S	C	S	3.6	Selection from C. I. 7067.
Purdue 401A1-23-1.....	9519	.....	6	B	S	C	S	3.5	Comfort-Purdue 21 × Bolivia-Chevron.
Purdue 4027A1-4-3.....	9520	.....	6	B	SS	C	S	3.5	(Comfort-Purdue 1101) × Bolivia-Chevron.
Purdue 401A4-4-1-1.....	9521	.....	6	W	S	C	L	3.5	Comfort-Purdue 21 × Bolivia-Chevron.
Purdue 432A6-2-2-4.....	9572	.....	6	W	S	C	SL	3.4	(Comfort-Purdue 1101)-Wisconsin Barbless-Chevron- Bolivia × Kentucky 1-Purdue 400-17.
Purdue 433A3-50-6.....	9573	.....	6	W	S	C	S	3.4	Comfort-Purdue 1101-Wisconsin Barbless-Chevron- Bolivia × Kentucky 1-Purdue 400-17.
Purdue 466A1-12-16.....	9574	.....	6	W	R	C	L	3.9	Comfort-Purdue 21-Bolivia-Chevron-Kentucky 1-Pur- due 400-17 × Wong.
Purdue 466A1-14-4-5.....	9575	.....	6	B	R	C	L		Comfort-Purdue 21-Bolivia-Chevron-Kentucky 1-Pur- due 400-17 × Wong.
Purdue B466A7-7-6-4.....	10101	.....	6	W		C	S		Purdue 28156A3-2-2-2-Wisconsin H42-5-4-5-1-1-Ken- tucky 1-Purdue 400-17 × Wong.
Purdue B466A7-7-7-2.....	10102	.....	6	W		C	S		Purdue 28156A3-2-2-2-Wisconsin H42-5-4-5-1-1-Ken- tucky 1-Purdue 400-17 × Wong.
Purdue B466A1-14-7.....	10103	.....	6	W		C	S		Purdue 28156A3-2-2-2-Wisconsin H42-5-4-5-1-1-Ken- tucky 1-Purdue 400-17 × Wong.
Randolph.....	6372	N. C. 1-68.....	6	W	R	C	S	4.0	Selection from a farmer's field in North Carolina.
Reno.....	6561	Ks. Johnson C. E. 2701.....	6	B	R	C	SL	3.8	Purified local farmer's barley in Kansas.

Rogers.....	9174	Okl. 1005 Sel.	6	B	R	C	S	3.0	Selection from Composite Cross, C. I. 5530. 4
Rumanian 20.....	6276		6	B	R	C	S	3.6	Introduced from Germany.
Sabbaton.....	1266		6	B	R	C	L	3.9	Introduced from China.
Santiam.....	6367		6	W	R	C	SL	3.9	Selection from Composite Cross, C. I. 5530. 4
Shonan.....	5255		6	B	R	C	L	3.0	Introduced from Korea.
Smooth Awn 86.....	6265		6	W	S	C	SL	3.0	(Tennessee Winter X Smooth Awn) X Esaw.
Smooth Awn 101.....			6		S	C			History uncertain.
Smooth Awn 203.....	6267		6	W	S	C	LS	3.0	(Tennessee Winter X Smooth Awn) X Esaw.
Sunrise.....	6272	Nakano Wase 68...	6	W	AIR	C	L	2.2	Selection from Nakano Wase, C. I. 754.
Svalof 42-7.....	7187		6	W	R	C	L	3.3	Mansholt X Pomeranian Nordland.
Teukow.....	646		6	B	R	C	S	3.7	Tennessee Winter X Hankow.
Tennessee 4B17-640.....	7076		6	W	II	C	S	3.2	Selection from Tennessee Beardless 5.
Tennessee SA5-127.....	8103		6	B	S	C	S	3.7	Wong X Awalee X Kentucky 1.
Tennessee SA620-6.....	7583		6	B	R	C	S	3.0	Tennessee Agricultural Experiment Station.
Tennessee Awnless D22-5.....	7581		6			C			Do.
Tennessee Beardless 5.....	3384		6	W	H	C	S	3.6	Tennessee Winter X Hooded spring type.
Tennessee Beardless 6.....	2746		6	W	II	C	L	4.0	Do.
Tennessee Hooded 1-57.....	8102		6	W	II	C	L	3.3	Wong X Missouri Early Beardless.
Tennessee Hooded 7-57.....	9173		6		II	C			Wong X Hooded 17-640.
Tennessee Hooded 50-27-3.....	9542		6		II	C			Wong X Early Smooth Awn 2X Tennessee Hooded 6.
Tennessee Hooded 50-112-38.....	10101		6	W	II	C	S		Wong X Jackson 1 X Hooded 6.
Tennessee Upright 60-97-10.....	9543		6	W	SS	C	SL	2.5	Wong X Jackson 1 X Kentucky 1.
Tennessee Upright 50-106-11.....	10092		6	W		C	SL		Do.
Tennessee Upright 236-3-46.....	9571		6	B	S	C	L	2.4	Wong X Jackson 1 X Hooded 6.
Tennessee Winter 52.....	3543		6	B	R	C	S	3.5	Selection from local farmer's strain in Tennessee.
Tennessee Winter 66.....	3546		6	B	R	C	S	3.6	Do.
Tennessee Winter (Johnson).....	6034		6	B	R	C	S	3.9	Virginia Seed Service.
Tennessee Winter.....	6126	Texas 18561.....	6	B	R	C	L	3.0	Local farmer's strain in Texas.
Tennessee Winter X Smooth Awn 203.....	6565		6	B	S	C	L	3.9	Tennessee Winter X Smooth Awn.
Tennessee Winter Smooth Awn.....	6570	Tenn. B5-14.....	6	W	S	C	S	4.3	Tennessee Agricultural Experiment Station.
Tennessee Wong 22.....	10105		6	B	A1-	C	S		Wong X Jackson 1 X Kentucky 1.
Texan.....	6499	Earlan Hyb. Tex. 1-33-7.	6	B	S	C	S	3.8	Selection from Composite Cross, C. I. 5530. 4
Texas 8-43-76.....	8076		6	W	II	C	L	2.3	Wintex X Texan.
Texas 9-43-05.....	7977		6	B	II	C	S	3.0	Wintex X Missouri Early Beardless.
Texas 10-43-135.....	9528		6	B		C	S		Missouri Early Beardless X Texan.
Texas 10-47-84.....	9564		6	B	S	C	S	3.5	Do.
Texas 10-47-125.....	10094		6	W		C	S		Do.
Texas 10-47-136.....	9565		6	B	S	C	S	3.5	Do.
Tokak.....	10093		2	W	R	C	L		Introduced from Turkey.
Trebl.....	936		6	B	R	C	S	3.6	Selection from a barley obtained from south shore of Black Sea.
Tschermak.....	7585		2	B	R	C	L	3.4	Introduced from Austria.
Tuck.....	7573	Ky. CC10-S.....	6	B	SS	C	S	3.1	Selection from Composite Cross, C. I. 6625. 3
Tucker.....	7039	W. Va. I-35-274.....	6	W	II	C	S	3.5	Selection from local farmer's field in West Virginia.
Union Winter.....	583		6	W	R	C	S	3.7	Introduced from Canada.
Utah B120-30-2.....	7569		6	W	R	C	S	2.4	Winter Club X Colorado 3063.

See footnotes at end of table.

TABLE 3.—Description and origin or source of barley varieties tested in uniform winter-hardiness nurseries, 1937-56—Continued

Variety ¹	C. I. ² No.	Station No.	Description						Origin or source
			Rows	Kernel color	Lemna append- age	Kernel cover	Ra- chilla hairs	Head den- sity	
Utah B219-7	10099		6	W	R	C	S	Mm.	(Colorado 3063 × Winter Club) Selection × Purdue 21. Do.
Utah B219-27	9577		6	W	R	C	S	3.5	
Utah B219-93	10100		6	W	R	C	S		Do.
Utah B3500-9	9579		6	W	R	C	S	2.4	Purdue 21 × Winter Club.
Ward	6007		6	B	R	C	S	3.9	Local farmer's strain in Oklahoma.
Watauga	9172	Tenn. Upright 11-172	6	B	S	C	S	3.4	Wong × Early Smooth Awn 977-10-1 2× Polders.
West Virginia CC10-1-15-22	7582		6	B	R	C	S	3.7	Selection from Composite Cross, C. I. 6625. ³
White Winter ⁴ × Keiroku	9523		6	W	R	C	L	3.6	White Winter ⁴ × Keiroku.
White Winter ⁴ × Triple Bearded Mariout.	9179		6	W		C	L		White Winter ⁴ × Triple Bearded Mariout.
Winter Club	592		6	W	R	C	L	2.0	Introduced from Europe.
Wintex	6127	Texas S31-62	6	B	R	C	S	3.7	Selection from local farmer's strain in Texas.
Wisconsin Winter	2150		6	B	R	C	S	3.5	Selection from Wisconsin Winter, C. I. 519.
Wong	6728	Nanking 24	6	B	AlR	C	L	2.3	Orel × a Chinese variety.
Woodwin	7033	Woodward 2150	6	B	R	C	S	3.9	U. S. Southern Great Plains Field Station.
Zehra	5189		6	W	R	N	L	2.0	Introduced from Korea.

¹ Varieties arranged alphabetically by name or station number.

² Refers to accession number of Cereal Crops Research Branch.

³ Composite Cross C. I. 6625 was made up of the following parents: Polish, C. I. 6280; Admire, C. I. 6377; Winter Club, C. I. 592; Marnobarb, C. I. 6120; Kentucky 11, C. I. 6021; Tennessee Winter, C. I. 6034; Harlan Hybrid, C. I. 6351; Olympia, C. I. 6107; Smooth Awn 203, C. I. 6267; Missouri Early Beardless, C. I. 6051; Tennessee Winter 52, C. I. 3543; Park, C. I. 3513-1; Han River, C. I. 296; Nakano Wase, C. I. 754; Black Russian, C. I. 2202; Wisconsin Winter, C. I. 2159; Tennessee Beardless 6, C. I. 2746 and Abate, C. I. 3920-1.

⁴ Composite Cross C. I. 5530 was made up of the following parents: Winter Club, C. I. 592; Everest, C. I. 4105; Golden Pheasant, C. I. 2488; Orel; Esaw, C. I. 4690; Nakano Wase; "Row 3"; Trebl, C. I. 936; Tennessee Winter 66, C. I. 3546; Tennessee

Winter 52, C. I. 3543; Tennessee Beardless 6, C. I. 2746; Smooth Awn and Wisconsin Winter, C. I. 2159.

⁵ Composite Cross C. I. 5461 was made up of the following parents: Horn, C. I. 626; Bonnehen, C. I. 531; Wisconsin Winter, C. I. 2159; Orel, C. I. 351; Arequipa, C. I. 1256; Algerian, C. I. 1179; Lion, C. I. 923; Atlas, C. I. 4118; Soudrel, C. I. 937; Maison Carre, C. I. 3387; Club Mariout, C. I. 201; California Mariout, C. I. 3925; Good Delta, C. I. 3801; Minia, C. I. 3556; White Smyrna, C. I. 910; Palmeira Blue, C. I. 2609; Trebl, C. I. 936; Multan, C. I. 3401; Lyallpur, C. I. 3403; Everest, C. I. 4105; Manchuria, C. I. 2330; Oderbruecker, C. I. 4666; Han River, C. I. 206; Flynn, C. I. 1311; Glabron, C. I. 4577; Alpha, C. I. 959; Golden Pheasant, C. I. 2488; and Meloy, C. I. 1176.

EXPERIMENTAL RESULTS

A total of 963 tests were grown during the 20-year period. There was no winterkilling in 343 of these tests and complete killing of all varieties occurred in 40 tests. These 40 tests were all located in areas where low temperatures or sudden temperature changes are likely to occur. No data were obtained from 45 nurseries, because the plants did not emerge until spring, or were destroyed by drought, disease, or insects.

The data in table 2 are from the remaining 535 tests in which there was differential winterkilling among the varieties.

The amount of winterkilling varied considerably between stations and years, as would be expected over such a wide range of conditions. The best comparison of hardiness between two varieties occurs when they are both grown in the same years at the same stations. Since this is not always possible, the alternative method was used, in which each variety was compared with the average survival of the 3 varieties (Tennessee Winter, Kentucky 1, and Missouri Early Beardless) that were included in all tests.

In the 1942-43 season, more than 700 varieties with winter-growth type from the world collection of barleys were grown at 6 State experiment stations where differential winterkilling occurred. The results of these tests were reported by Wiebe.⁶ From these tests 10 of the most winter-hardy varieties (Khayyam, Sabbaton, Black Russian, Peking, Meimi, Kido, Hokudo, Shonan, Dicktoo, and Marm) were chosen and tested in the uniform nurseries in 1945 and 1946. All of these varieties except Dicktoo were foreign introductions, and only Dicktoo appeared to have more hardiness than Kentucky 1 and nearly as much as Reno, which were the most winter hardy of the varieties then being tested. Kido was the best of the introductions from the standpoint of winter hardiness.

Assuming that varieties in the world collection at that time were a fair sample of the world's winter barleys, it is evident that methods other than introduction must be used if varieties with more winter hardiness are to be obtained.

The two varieties having the best record of winter hardiness in the uniform tests are Kearney (C. I. 7580) and Dicktoo (C. I. 5529). The history of Dicktoo is uncertain, but it is believed to be of hybrid origin. The exact parentage of Kearney is not known, since it came from a composite cross of 13 varieties. The parent varieties ranged in hardiness from such varieties as Wisconsin Winter and Tennessee Winter with only fair hardiness to such tender sorts as Orei, Winter Club, Esaw, and Trebi.

The belief that more winter-hardy varieties can be produced by hybridization is further strengthened by the fact that 17 of the 30

⁶ WIEBE, G. A. WINTER BARLEY VARIETIES. U. S. Dept. Agr., Plant Industry Station, Beltsville, Md. 20 pp. 1943. (Processed.)

top-ranking varieties in table 2 were of hybrid origin and 16 of the 17 were first grown in the tests in 1947 or later. Twelve of the 30 varieties were local strains or selections, and 9 of these strains were first grown in the nurseries during the first 10 years of the uniform test. Kido is the only foreign introduction ranking among the hardiest 30 varieties. The 17 hybrid selections in this group originated in 7 States or Provinces, all of which were in areas where severe winter-killing usually is encountered.

In general, stations having the most frequent differential winter-killing are located in the central and northern areas (table 1). Southern stations, except for a few at high altitudes, rarely have had differential killing, and the winter-hardiness tests have been discontinued at many southern locations. Tests at several stations in the more arid regions have often failed because of drought or poor emergence in the fall.

It seems desirable to continue some nurseries on both sides of the belt of optimum differential winterkilling because of the seasonal variation in weather conditions. More stations in the northern area have grown tests in recent years, many of these completely outside the regions of commercial winter barley production. Some of the best differential killing data have been obtained at these locations.

SUMMARY

Two hundred and four varieties of barley were tested in uniform winter-hardiness nurseries for one or more years at various experiment stations in the United States and Canada during the 20-year period, 1937-56. A total of 111 different stations participated in the tests for 1 to 20 years in growing a total of 963 nurseries. Differential winterkilling between varieties occurred in 535 of these tests. The percentage of survival of each variety was calculated and compared with the average survival of the 3 varieties that were included in all 535 tests. On this basis, Kearney had the highest survival, and was closely followed by Dicktoo. In general, the hardiest of the barleys from the world collection have not been any more hardy than commercial varieties grown in the United States. Only 1 variety was a foreign introduction among the 30 varieties with the highest relative survival, while 17 were selections from hybrids and 12 were local strains or varietal selections. It appears that increased hardiness can be obtained by breeding and selection methods under environments conducive to differential killing.

END