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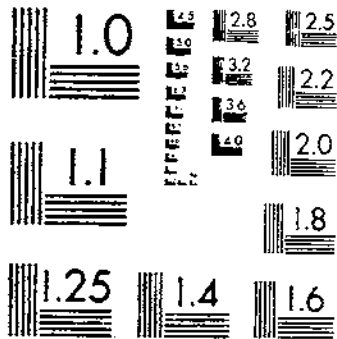
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EVALUATION OF VARIETIES AND SELECTIONS OF BARLEY FOR DISEASE RESISTANCE

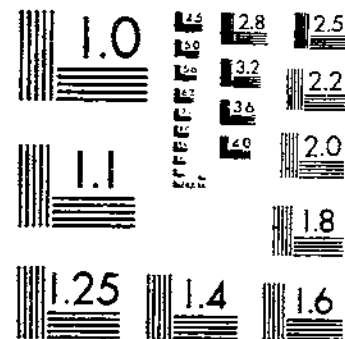
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MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A



MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A

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**EVALUATION  
OF...**

REFERENCE  
DO NOT LOAN

VARIETIES AND SELECTIONS OF

**BARLEY**

FOR DISEASE RESISTANCE

AND WINTER HARDINESS

IN SOUTHEASTERN UNITED STATES

DEPOSITORY

MAR 25 1957

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by J. G. MOSEMAN

*Plant pathologist*

TECHNICAL BULLETIN NO. 1152

UNITED STATES DEPARTMENT OF AGRICULTURE  
in cooperation with the

North Carolina Agricultural Experiment Station

## CONTENTS

	Page
Introduction.....	1
Material and methods.....	2
Presentation of data.....	3
Source or origin.....	23
Description of entries.....	23
Habit of growth.....	23
Time of heading.....	24
Winter survival.....	24
Reaction to powdery mildew.....	25
Reaction to leaf rust.....	26
Reaction to eastern soil-borne viruses.....	27
Reaction to scald.....	27
Entries outstanding for more than one characteristic.....	27
Attributes of entries from various areas of the world.....	29
Discussion.....	31
Summary.....	31
Literature cited.....	32

The author expresses his appreciation to D. J. Ward, for furnishing the seed; to R. W. Earhart, H. E. Reed, D. A. Reid, R. G. Shands, and T. M. Starling, for the readings they obtained on the entries included in this bulletin; to Wilbert Byrd, for assisting with the readings on the entries grown in North Carolina; and to G. A. Wiebe, for his encouragement and guidance in this study and the preparation of the manuscript.

Washington, D. C.

Issued December 1956

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# EVALUATION OF Varieties and Selections of BARLEY for Disease Resistance and Winter Hardiness in Southeastern United States<sup>1</sup>

By J. G. MOSEMAN, *plant pathologist, Field Crops Research Branch, Agricultural Research Service*

## INTRODUCTION

The world collection of barley varieties is maintained by the United States Department of Agriculture to evaluate the entries for use in barley improvement work. The collection was started in 1900, when varieties from older barley-producing areas of the world were introduced into the United States by the Plant Introduction Section, Horticultural Crops Research Branch. By 1955 the collection consisted of more than 7,000 entries. The collection is maintained by the Cereal Crops Section, Field Crops Research Branch, which cooperates with the agricultural experiment stations in the United States and with other countries in evaluating the entries.

Entries from the collection have been grown for trial purposes in various parts of the world. A considerable number of the early introductions have been grown commercially in the United States. All or part of the collection has been tested at the experiment stations in most of the leading barley-producing States.

In recent years the collection has served as a reservoir of germ plasm to aid in meeting problems that arise in barley production. The collection should be valuable for locating resistance to any new plant pathogen or insect that may suddenly become very destructive. Data on the collection are being summarized as an aid in seeking additional sources of resistance to plant pathogens that vary in pathogenicity. Although the collection has been grown at several locations, more data are needed on all the entries. The collection often has been grown for 1 or 2 years at a given location without the data being summarized.

The entire collection was grown in North Carolina, which is in the winter barley-producing area of Southeastern United States. Each year some of the less desirable entries were eliminated. The entries listed in this bulletin were grown in all 4 years (1950-54) of the study. Data collected in other States in Southeastern United States on the final group of 372 varieties are included. The primary basis for retaining varieties was their resistance to powdery mildew (*Erysiphe graminis* f. sp. *hordei* Em. Marchal). However, some entries were saved because they appeared to be outstanding for other characteristics, such as resistance to leaf rust (*Puccinia hordei* Oth), winter hardiness, or general adaptation.

<sup>1</sup> Submitted for publication May 11, 1956. Cooperative investigations of the Field Crops Research Branch, Agricultural Research Service, United States Department of Agriculture, and the North Carolina Agricultural Experiment Station.

## MATERIAL AND METHODS

In the fall of 1950 seed of each of the 6,273 entries then in the world collection of barley were obtained from the Cereal Crops Section. The 1,012 entries in the collection listed by P. I.<sup>2</sup> numbers had been grown in quarantine at Sacaton, Ariz., in 1949-50, and were from a bulk population. Some of them varied in kernel color, growth habit, reaction to diseases, and head type. Seed from 10 to 12 spikes of plants of the predominant plant type were harvested each year for sowing in subsequent tests. In the collection as it is now maintained, seed from a spike of a plant with the predominant plant type in each bulk plant introduction has been increased and given a C. I.<sup>3</sup> number. Since seed of the bulk population is no longer available, the entries beginning with C. I. 8118 or P. I. 170939 are listed by both C. I. and P. I. numbers in table 1 and by C. I. number only in the other tables.

Nurseries were grown at 4 locations in North Carolina. One of these, the McCullers Station near Raleigh, is located on the fall line between the Coastal Plain and the Piedmont. Two others, Statesville and China Grove, are in the Piedmont, the main barley-producing area in North Carolina. The fourth location, Waynesville, is in the Smoky Mountains in western North Carolina.

Eight to ten seeds of each of the 6,273 entries in the collection were removed before sowing in the fall of 1950. These were used to test each entry for seedling reaction to a composite of powdery mildew, races 4, 9, and a new race, 14, from Ottawa, Canada.

The entire collection was sown at the McCullers Station in the fall of 1950. The weather from the time of sowing until March was about normal. There was no snow cover, and the lowest temperature during that period was 10° F. There was considerable killing of the less winter-hardy varieties. The rainfall was below normal during March, April, and May, and there was little development of leaf spotting diseases. Some spot blotch (*Helminthosporium sativum* Pam., King, & Bakke) was present, but it was impossible to distinguish the leaf spotting symptoms from physiological leaf spots as described by Christensen (2).<sup>4</sup> Notes were taken on winter survival, growth habit, and mature plant reaction to powdery mildew in the part of the nursery where it was possible to differentiate the resistant from susceptible entries. All the data collected in 1950-51 were sent to D. J. Ward for inclusion in a summary of data on all entries in the world collection of barley.

In the fall of 1951 the 1,460 entries saved from the original collection were sown at McCullers and Statesville. The temperature at both locations was about 3° below normal during November, and above normal in December and January. This resulted in severe winterkilling and early development of leaf rust and powdery mildew. At McCullers notes were taken on growth habit, winter survival, and reaction to powdery mildew and leaf rust. The same notes, excluding growth habit, were taken at Statesville.

<sup>2</sup> P. I. refers to accession number of the Plant Introduction Section.

<sup>3</sup> C. I. refers to accession number of the Cereal Crops Section.

<sup>4</sup> Italic numbers in parentheses refer to Literature Cited, p. 32.

The 550 entries saved the previous spring were sown in the fall of 1952 at 3 locations in North Carolina. The nursery at China Grove was sown on land known to be infested with soil-borne viruses (*Marmor tritici* var. *typicum* McK. and *M. tritici* var. *fulvum* McK.) (9). The reaction to the viruses and the growth habit of the entries were obtained in this nursery. A second nursery was sown at Statesville on September 1, or 1 month earlier than the usual date of seeding. The reactions of the entries to leaf rust and powdery mildew and growth habit were obtained in this nursery. The third nursery was sown at Waynesville where the most severe winterkilling in the State usually occurs. Notes on the survival of entries in each of 2 replications were taken in this nursery.

In the fall of 1953, 5 grams of seed each of 372 entries saved that spring was distributed to a barley breeder in each of several States in Southeastern United States. All entries were sown at Statesville where readings were obtained on their reaction to powdery mildew. The entries that had shown some winter hardiness in earlier tests were sown at Waynesville, N. C., and by D. A. Reid at Lexington, Ky., where notes were taken on winter survival. H. E. Reed obtained the data on the reaction of the entries to scald (*Rhynchosporium secalis* (Oud.) J. J. Davis) at Knoxville, Tenn. The reactions of the entries to the races of powdery mildew and leaf rust that occurred at Gainesville were recorded by R. W. Earhart. T. M. Starling obtained readings of the field reaction of the entries to leaf rust at Warsaw, Va., and the seedling reaction to race 4 in the greenhouse at Blacksburg, Va.

## PRESENTATION OF DATA

This bulletin includes data on only the 372 entries that were grown in North Carolina all 4 years. These are listed in table 1. Additional data available on special groups of entries are shown in tables 2, 3, and 4. Details are given on each characteristic studied. The data collected on the entire collection in 1950-51 are on file in the barley collection records maintained by the Cereal Crops Section.



TABLE 1.—Agronomic characteristics and reaction to diseases of 372 entries from the barley world collection grown in North Carolina from 1950 to 1954, and for scald in Tennessee, 1954

C. I. No.	P. I. No.	Variety or selection	Origin	Description <sup>1</sup>					Habit of growth <sup>2</sup>	Winter survival <sup>3</sup>	Time of heading <sup>4</sup>	Reaction <sup>5</sup> to—											
												Powdery mildew					Leaf rust at—		Viruses, <sup>6</sup> at China Grove, 1953		Scald, in Tennessee, 1954		
												In field at—					On seedlings, races 4, 9, and 14	McCullers, 1952	Statesville			Var. <i>typicum</i>	Var. <i>salinum</i>
												McCullers		Statesville					1952	1953			
				1951	1952	1952	1953	1954				Rating 2-3	Type	Type	Type	Type	Type	Type					
				30		Hanna	Germany	2				W	R	C	L	S	54	E	R	IR	IR	IR	IR
170		Mensury	Manchuria	6	B3	R	C	L	SW	100	L	R	IR	IR	IR	IR	S	IR	R	R	R	R	R
192		Hankow	Central Asia	6	B1	R	C	L	SW	98	M	R	IR	IR	IR	IR	S	IR	R	R	R	R	R
194		Telli	North Africa	6	B1	R	C	L	SW	90	M	R	IR	IR	IR	IR	S	IR	R	R	R	R	R
206		Han River	China	6	B2	R	C	L	SW	100	M	R	S	S	IR	IR	S	IR	R	R	R	R	R
221		Greece	Greece	6	B2	R	C	L	SW	94	M	R	R	R	IR	IR	S	IR	R	R	R	R	R
223		Argentine	Greece	6	B2	R	C	L	SW	94	M	R	R	R	IR	IR	S	IR	R	R	R	R	R
277		Scottish Pearl	Europe	6	B2	R	C	L	SW	95	L	IS	IS	IS	IR	IR	S	IR	R	R	R	R	R
662		Tenarab	Hybrid	6	B1	R	C	L	W	85	M	R	IR	IR	R	R	S	IR	R	R	R	R	R
704		Popeline	Caucasus	6	B1	R	C	L	W	95	M	R	R	R	R	R	S	IR	R	R	R	R	R
705		Black Russian	Russia	6	Bk	R	C	L	SW	91	M	R	IR	IR	IR	IR	S	IR	R	R	R	R	R
737		Niver	China	6	B2	R	C	L	SW	98	E	IR	IS	IR	IS	IS	S	IR	R	R	R	R	R
864		Rapur	North Africa	6	B1	R	C	L	SW	98	E	IS	IS	IR	IS	S	IR	R	R	R	R	R	R
870		Tennessee Winter	Europe	6	B2	R	C	L	SW	97	M	R	S	S	IR	IS	S	IR	R	R	R	R	R
895		Cusado	Hybrid	6	W	R	C	L	W	97	M	IR	R	IR	R	IR	S	IR	R	R	R	R	R
906		Hanna	Germany	2	W	SS	C	L	SW	61	M	IR	R	R	R	R	S	IR	R	R	R	R	R
928		Goldfoil	Plant sel	2	W	SS	C	L	SW	58	M	R	R	R	R	R	S	IR	R	R	R	R	R
936		Trebi	Asia	6	B2	R	C	L	SW	75	M	R	R	R	R	R	S	IR	R	R	R	R	R
979		Ghest	Russia	6	Bk	R	C	L	W	97	L	R	IR	IR	IR	IR	S	IR	R	R	R	R	R
1009		Wofut	do	6	Bk	R	C	L	W	91	M	R	R	R	R	R	S	IR	R	R	R	R	R
1014		Eremo	India	6	W	R	C	L	SW	71	M	R	R	R	R	R	S	IR	R	R	R	R	R
1015		Ederle	do	6	B2	R	C	L	SW	71	E	R	R	R	IR	IR	S	IR	R	R	R	R	R
1016		Kwan	do	6	B1	R	C	L	SW	60	E	R	R	R	R	R	S	IR	R	R	R	R	R
1017		Monte Cristo	do	6	B2	R	C	L	SW	41	E	R	R	R	R	R	S	IR	R	R	R	R	R
1021		Wedder	Australia	6	W	R	C	L	SW	41	E	R	R	R	R	R	S	IR	R	R	R	R	R
1024		Quinn	do	6	W	R	C	L	SW	53	E	R	R	R	R	R	S	IR	R	R	R	R	R
1050		Wansnipe	China	6	B1	R	C	L	SW	82	M	R	R	R	R	R	S	IR	R	R	R	R	R
1054		Cadmus	do	6	B1	R	C	L	SW	88	M	R	R	R	R	R	S	IR	R	R	R	R	R
1063		Koran	do	6	B1	R	C	L	SW	96	M	R	R	R	R	R	S	IR	R	R	R	R	R



TABLE 1.—Agronomic characteristics and reaction to diseases of 372 entries from the barley world collection grown in North Carolina from 1950 to 1954 and for scald in Tennessee, 1954.—Continued

C. I. No.	P. I. No.	Variety or selection	Origin	Description <sup>1</sup>					Hbtl. of growth <sup>2</sup>	Winter survival <sup>3</sup>	Time of heading <sup>4</sup>	Reaction to—			
				(1)	(2)	(3)	(4)	(5)				On roots and leaves	Leaf rust at—	Viruses <sup>5</sup> at China Grove, 1953	Scald, in Tennessee, 1954
3390		Carre 180	Algeria	6	B2	R	C	L	SS	Al	1951	IR	IR	IS	
3395		Lyalpur 18	India	6	B1	R	C	L	SS	E	1951	IR	IR	IS	
3396		Hoshiarpur	do.	6	B2	R	C	L	SS	E	1951	IR	IR	IS	
3408		Kabi	do.	6	B2	R	C	L	SS	E	1951	IR	IR	IS	
3400		Mlanweil	do.	6	B1	R	C	L	SS	E	1951	IR	IR	IS	
3401		Multan	do.	6	B3	R	C	L	SS	E	1951	IR	IR	IS	
3405		Babogistan	do.	6	B2	R	C	L	SS	E	1951	IR	IR	IS	
3407		Black BS.	do.	2	P	R	C	L	SS	E	1951	IR	IR	IS	
3512			China	6	B2	R	C	L	SS	E	1951	IR	IR	IS	
3527-1			Spain	6	B2	R	C	L	SS	E	1951	IR	IR	IS	
3527-2		Villa	do.	6	B2	R	C	L	SS	E	1951	IR	IR	IS	
3528			do.	6	B2	R	C	L	SS	E	1951	IR	IR	IS	
3530-3		Alagon	do.	6	B3	R	C	L	SS	E	1951	IR	IR	IS	
3543		Tennessee Winter 52	Plant sel.	6	B3	R	C	L	SS	E	1951	IR	IR	IS	
3552			Marya, Egypt	6	B2	R	C	L	SS	E	1951	IR	IR	IS	
3600		Palmetta 110	Maribou, Egypt	2	B2	R	C	L	SS	E	1951	IR	IR	IS	
3614			do.	2	B2	R	C	L	SS	E	1951	IR	IR	IS	
3623			do.	2	B1	R	C	L	SS	E	1951	IR	IR	IS	
3644			do.	6	B2	R	C	L	SS	E	1951	IR	IR	IS	
3725			do.	2	B1	R	C	L	SS	E	1951	IR	IR	IS	
3725		Radi	do.	2	B2	R	C	L	SS	E	1951	IR	IR	IS	
3852			Kashmir	6	B2	R	C	L	SS	E	1951	IR	IR	IS	
3855			do.	6	B2	R	C	L	SS	E	1951	IR	IR	IS	
3857			do.	6	B2	R	C	L	SS	E	1951	IR	IR	IS	
3857			Tun.	6	B1	R	C	L	SS	E	1951	IR	IR	IS	
3859-2				6	B1	R	C	L	SS	E	1951	IR	IR	IS	
3813		Vagabond	Ethiopia	6	B1	R	C	L	SS	E	1951	IR	IR	IS	
3833			India	6	B1	R	C	L	SS	E	1951	IR	IR	IS	
3841-1			Ethiopia	6	B3	R	C	L	SS	E	1951	IR	IR	IS	
4108		Alaska		6	B3	R	C	L	SS	E	1951	IR	IR	IS	



TABLE 1.—Agronomic characteristics and reaction to diseases of 372 entries from the barley world collection grown in North Carolina from 1950 to 1954 and for scald in Tennessee, 1954—Continued

C. I. No.	P. I. No.	Variety or selection	Origin	Description <sup>1</sup>					Habit of growth <sup>2</sup>	Winter survival <sup>3</sup>	Time of heading <sup>4</sup>	Reaction <sup>5</sup> to—										
												Powdery mildew					Leaf rust at—			Viruses, <sup>6</sup> at China Grove, 1953		
				In field at—								On seedlings, races <sup>7</sup> , and 14	McCullers, <sup>8</sup> 1952	Statesville		Var. <i>typicum</i>	Var. <i>fulvum</i>	Scald, in Tennessee, 1954				
				McCullers		Statesville								1952	1953				1954	1952	1953	
				1951	1952	1952	1953	1954				Rate <sup>9</sup>	Type	Type	Type	Type	Type	Type	Type	Type	Type	
5366		C. C. sel. C. I. 4116	Plant sel.	6	B1	R	C	S	S	84	M	IR	Type	R	IR	4	R			R	R	IR
5372		do.	do.	6	W	R	C	S	S	70	M	IS	IR	IR	IR	1.4	R	IS	IR	R	IS	S
5429		do.	do.	2	W	R	C	S	S	75	M	IR	R	IR	IR	3-4	R	S	R	R	IR	S
5447		Spray, from C. I. 4116.	do.	6	W	II	C	S	S	75	M	IR	R	IR	IR	1.4	R	IR	R	R	IR	IR
5449		do.	do.	6	B2	II	C	S	W	74	L	IR	R	IR	IS	4	S	S	S	IR	R	S
5520		Dicktoo	North Dakota	6	B3	R	C	S	W	100	M	IS	R	IR	IR	4	IS	IS		R	R	R
5557		Aphson	Baku	6	B2	R	C	S	W	74	M	R	R	R	IR	1-2	IS	IS		R	IR	IR
5559		Gonzall	Gonzall, U. S. S. R.	6	Bk	R	C	S	W	98	M	R	R	R	R	2	IS	S		R	IR	IR
5560		Muller	Asafute	6	W	R	C	S	W	90	M	IR	R	IS	S	4	R			R	R	IR
5585		do.	N.E. Turkey	6	B1	R	C	S	S	98	M	IS	IS	IS	S	4	R			R	R	R
5587		do.	do.	6	B3	R	R	C	S	76	E	R	R	R	R	0-1	S	R		R	R	R
5631		do.	Kuban	6	B2	A	C	S	SW	80	M	R	R	R	IR	1-2	S			IR	IS	R
5644		Caspian	do.	6	W	R	C	S	SW	58	M	R	R	R	R	1.4	R	R		R	IR	R
5645		Tradak	do.	6	Bk	A	C	S	SW	89	E	R	R	R	R	1	S			IR	IS	R
5647		do.	do.	6	W	R	C	S	SW	73	M	R	R	R	R	1.4	R	R		R	R	R
5812		Marco	Ethiopia	6	W	R	C	S	S	52	L	R	IR	R	R	1-2	S	S	S		R	R
5825		do.	do.	6	P	R	C	S	S	52	E	R	IR	R	IR	1-2	S	S	S		IR	IR
5862		do.	do.	D	B2	R	R	S	S	52	E	IR	R	R	R	0-1	S	S	S			IS
5863		do.	do.	D	B2	R	R	S	S	52	M	IR	R	R	R	0-1	S	S	S			
5890		Vavilov College	do.	6	B2	R	R	S	S	92	M	IR	R	R	R	4	S	S	S		R	R
5899		Murasaki Mochi	Japan	6	P	R	R	S	S	70	M	IR	IS	S	IS	4	S	S	S		S	R
5912		Peruvian 1, from C. I. 935.	Plant sel.	6	B1	R	C	S	S	70	M	IR	R	R	IS	2	IS	R		R	R	IS
6011		Commander	Australia	6	B3	R	C	S	S	90	E	R	IS	IR	S	4	S	S	S		R	R
6051		Mo. Early Beardless.	Missouri	6	B3	II	C	S	SW	97	E	R	S	S	S	4	S	S	S		R	IR
6103		do.	Wisconsin	6	B1	R	C	S	SW	90	L	R	R	R	R	2	S	S	S		R	IR
6104		do.	do.	6	B1	R	C	S	SW	90	M	R	IR	R	IR	2	S	S	S			IS
6121		do.	India	6	B2	R	C	S	SW	93	M	S	IR	R	IR	0-1	IS	S	S		IS	IS

6140	Danne 113	Oklahoma	D	Bk	R	C	L	S	50	M	R	IR	R	S	2	S	S	IR	R	IS
6168	Long Glumes	Hybrid	2	W	B2	R	L	S	48	M	R	R	R	S	0-1	S	S	IR	R	R
6170	Weak Two Rowed	do	2	W	B2	R	L	S	50	M	R	R	R	S	0-1	S	S	IR	R	R
6182	Belli Barley	do	2	W	B1	R	L	S	72	L	IR	IR	IR	IR	1-2	IR	R	IR	R	IS
6193	Cebada Capa	North Africa	6	Bk	Bk	SS	L	W	88	L	IR	S	S	IR	1-2	IR	R	IR	R	IS
6208	do	Turkey	2	W	Bk	SS	L	W	88	L	IR	S	S	IR	1-2	IR	R	IR	R	IS
6225	do	do	2	W	Bk	SS	L	W	88	L	IR	S	S	IR	1-2	IR	R	IR	R	IS
6268	Smooth Awn 86	Virginia	6	W	W	S	L	SW	03	E	IR	S	S	IR	3-4	IR	R	R	R	IR
6269	Nakano Wase 33	do	6	U	W	R	L	W	04	E	IR	S	S	IR	3-4	IR	R	R	R	IR
6273	Poltawa (Russia 14)	Russia	6	W	W	R	L	W	06	L	IR	S	S	IR	4	IR	R	R	R	IR
6270	Rumanian 20	Rumania	6	B2	R	C	S	W	100	L	IR	IR	IR	R	4	S	S	R	R	R
6305	Psaknon	Australia	6	B1	SS	C	S	W	56	L	R	R	R	R	1-2	S	S	R	R	R
6306	Ricardo	Uruguay	2	B1	R	C	S	W	67	L	IR	IR	IR	R	0-1	R	R	R	R	R
6313	Spanische	Germany	2	B2	R	C	S	W	67	L	IR	IR	IR	R	0-1	R	R	R	R	R
6314	Australische 22	do	6	W	R	C	S	W	57	M	IR	IR	IR	R	4	R	R	R	R	R
6318	Durani	Afghanistan	6	B1	R	C	S	W	80	E	IR	IR	IR	R	1	S	S	R	R	R
6330	do	do	6	W	R	C	S	W	89	M	IR	IR	IR	R	0-1	S	S	R	R	R
6372	Randolph	North Carolina	6	W	R	C	S	W	90	M	IR	IR	IR	R	1-2	S	S	R	R	R
6373	Davidson	do	6	B1	R	C	S	W	97	M	IR	IR	IR	R	4	S	S	R	R	R
6402	do	do	6	B1	R	C	S	W	97	M	IR	IR	IR	R	4	S	S	R	R	R
6448	do	Poland	2	W	R	C	S	W	70	M	IR	IR	IR	R	0-1	R	R	R	R	R
6459	do	do	6	B1	R	C	S	W	79	M	IR	IR	IR	R	4	R	R	R	R	R
6471	do	do	6	Bk	R	C	S	W	66	M	IR	IR	IR	R	1-2	R	R	R	R	R
6478	Brugh	Virginia	6	W	H	C	S	W	85	E	IR	IR	IR	R	4	R	R	R	R	R
6490	Bere	Orkney Islands	6	W	R	C	S	W	97	L	IR	IR	IR	R	1	R	R	R	R	R
6498	Schladener	Portugal	6	B2	R	C	S	W	85	L	IR	IR	IR	R	4	R	R	R	R	R
6491	Brugh 23	Virginia	6	B3	H	C	S	W	97	M	IR	IR	IR	R	4	R	R	R	R	R
6574	Hooded 16	Plant sel	6	W	H	C	S	W	97	M	IR	IR	IR	R	4	R	R	R	R	R
6620	Triple-Awn Lemma	Australia	2	B2	R	C	S	W	99	M	IR	IR	IR	R	1	R	R	R	R	R
6660	do	Iran	6	W	R	C	S	W	92	L	IR	IR	IR	R	4	R	R	R	R	R
6685	do	Asafute	6	B2	R	C	S	W	92	L	IR	IR	IR	R	2	R	R	R	R	R
6703	do	Kuban	6	W	R	C	S	W	92	L	IR	IR	IR	R	1	R	R	R	R	R
6717	do	Egypt	6	W	R	C	S	W	92	L	IR	IR	IR	R	4	R	R	R	R	R
6728	Wong	Hybrid China	6	U	W	C	S	W	72	M	IR	IR	IR	R	1-2	R	R	R	R	R
6980	Lion x Minia	Hybrid	6	B2	S	C	S	W	99	M	IR	IR	IR	R	4	R	R	R	R	R
6998	Huga	Georgia, U. S.	6	W	H	C	S	W	99	M	IR	IR	IR	R	1	R	R	R	R	R
7021	Queens, from C. J. 5461	New Jersey	6	W	H	C	S	W	99	M	IR	IR	IR	R	1	R	R	R	R	R
7028	do	do	6	W	H	C	S	W	99	M	IR	IR	IR	R	1	R	R	R	R	R
7123	Sel. from C. I. 5461	do	6	W	H	C	S	W	99	M	IR	IR	IR	R	1	R	R	R	R	R
7157	Bolton	Wisconsin	6	B2	R	C	S	W	56	M	IR	IR	IR	R	2-3	R	R	R	R	R
7193	Brier	West Virginia	6	B3	R	C	S	W	80	E	IR	IR	IR	R	4	R	R	R	R	R
7197	do	Ethiopia	6	W	R	C	S	W	80	E	IR	IR	IR	R	1	R	R	R	R	R
7207	do	do	6	W	R	C	S	W	47	E	IR	IR	IR	R	1-2	R	R	R	R	R
7207	do	do	6	W	R	C	S	W	47	E	IR	IR	IR	R	1	R	R	R	R	R
7224	do	do	6	W	R	C	S	W	47	E	IR	IR	IR	R	1	R	R	R	R	R
7232	do	do	6	B1	R	C	S	W	42	M	IR	IR	IR	R	2	R	R	R	R	R
7282	do	do	6	Bk	R	C	S	W	42	M	IR	IR	IR	R	1	R	R	R	R	R
7282	Lignee 185	Belgium	6	B1	R	C	S	W	93	M	IR	IR	IR	R	4	R	R	R	R	R
7303	Aizu No. 6	Japan	6	W	R	C	S	W	100	E	IR	IR	IR	R	2	R	R	R	R	R
7306	Stromugi	do	6	W	R	C	S	W	100	M	IR	IR	IR	R	2-3	R	R	R	R	R

See footnotes at end of table.

TABLE 1.—Agronomic characteristics and reaction to diseases of 372 entries from the barley world collection grown in North Carolina from 1950 to 1954 and for scald in Tennessee, 1954—Continued

C. I. No.	P. I. No.	Variety or selection	Origin	Description <sup>1</sup>					Habit of growth <sup>2</sup>	Winter survival <sup>3</sup>	Time of heading <sup>4</sup>	Reaction <sup>5</sup> to—											
												Powdery mildew					Leaf rust at—		Viruses, <sup>6</sup> at China Grove, 1953		Scald, in Tennessee, 1954		
				In field at—								On seedlings, races <sup>4</sup> , <sup>9</sup> , and <sup>14</sup>	Statesville		Var. <i>typicum</i>		Var. <i>fulvum</i>						
				McCullers		Statesville							1952	1953	1954	McCullers, 1952	Statesville		Type	Type		Type	Type
				1951	1952	1952	1953	1954									1952	1953					
7320			Sweden	6	W	R	C	L	SW	93	L	IS	IR	IR	IR	IR	IR	IR	R	R		R	
7323		Atlas 46	California	6	W	R	C	L	SW	67	M	R	R	R	R	0-1	S	S	S	IR	IR	IR	
7330		Tenwase	Beltsville, Md	6	W	R	R	L	W	96	M	IR	IS	IR	IR	2-3	S	S	S	IR	IR	IR	
7332		Aizu Hadaka No. 3	Japan	6	W	R	N	L	SW		M	R	R	IR	IR	S	S	S	IS	IS	IS		
7336		Hadaka Rikuu No. 1	do.	6	W	R	N	L	SW		M	R	IR	IR	IR	2-3	S	S	S	IR	IR	IR	
7364		Aizu	do.	6	W	R	C	L	SW		L	R	R	IR	IR	2	S	S	S			R	
7372		Hosomugi	do.	6	B2	R	C	L	SW		M	R	IR	IR	IR	2-2	S	S	S	IR	IR	IR	
7381		Miyagi No. 12	do.	6	W	R	R	L	W	99	M	R	R	R	R	1-2	S	S	S	R	R	R	
7411		Chc Chan No. 5	do.	6	W	R	R	L	SW	95	M	IR	S	IR	IS	3-4	S	S	S	S	S	IS	
7418		Kyo-baa No. 35	do.	6	W	R	R	L	SW		M	R	IS	IS	IS	2	S	S	S	IS	IS	IS	
7420		Mammol	do.	6	W	R	R	L	W	99	M	IS	S	S	S	3	S	S	S	S	S	IS	
7434		Suwon No. 6	do.	6	W	R	R	L	SW	100	M	IS	S	S	S	3-4	R	R	R	IR	IR	IR	
7451		Suwon No. 29	do.	6	W	R	R	L	W	98	M	IS	S	IS	IS	4	R	R	R	R	R	R	
7482		Blanqueta A	Spain	6	W	R	R	L	W	70	M	R	IR	IR	IR	1, 4	R	R	R	R	R	R	
7503			Mexico	6	B2	R	C	L	W	70	M	IR	IR	IS	IS	1-2	R	R	R	R	R	IR	
7528		Vina	Holland	6	B3	R	S	S	W	99	M	IR	IR	IR	IS	3	R	R	R	IR	IR	IR	
7544		Lico 1	Colorado	6	W	S	C	L	W	56	M	IR	R	R	R	2-3	R	R	R	IR	IR	IR	
7560			Minnesota	6	W	S	S	L	SW	88	E	R	R	R	R	1-2	S	S	S	IR	IR	IR	
7568		B-400	Missouri	6	W	R	R	L	W	98	M	IR	IS	R	IS	4	S	S	S	IS	IR	IR	
7573		Tuck	Kentucky	6	B2	R	R	L	W	100	M	R	R	R	R	0-1	R	R	R	IR	IR	IR	
7574		Kenbar	do.	6	B2	R	R	L	W	106	M	R	R	R	R	1, 4	R	R	R	IR	IR	IR	
7599		Donari	Austria	2	W	R	R	L	W		M	R	R	R	R	2	S	S	S	R	R	R	
7610			India	6	B2	R	R	L	W	85	E	IR	IR	R	R	1	R	R	R	R	R	R	
7611			do.	6	B3	R	R	L	W	60	E	R	IR	R	R	1	R	R	R	R	R	R	
7618			do.	6	B2	R	R	L	W	72	E	R	R	R	R	1, 4	R	R	R	IR	IR	IR	
7619			do.	6	B2	R	R	L	W	69	E	IR	R	R	R	1	R	R	R	R	R	R	
7620			do.	6	B1	SS	R	L	W	71	E	IR	IR	R	R	1, 4	R	R	R	IR	IR	R	
7672			do.	6	W	R	R	L	W		M	R	R	R	R	0-1	S	S	S	IS	IS	IS	
7673			do.	6	W	R	R	L	W		M	R	R	R	R	0-1	S	S	S	IS	IS	IS	
7682			do.	6	W	R	R	L	W	64	E	R	IR	R	R	2	S	S	S	IS	IS	IS	

EVALUATION OF BARLEY

7684		do	6	B2	R	C	L	N	---	E	IR	R	IS	R	R	IS	R	IS	0	1	R	IS
7714		do	6	B1	R	C	L	N	78	E	IR	R	IS	R	IS	R	IS	R	1	3	0	IS
7728		do	6	B1	R	C	L	N	67	E	IR	R	IS	R	IS	R	IS	R	0	1	1	IS
7730		do	6	W	R	C	L	N	---	E	IR	R	IS	R	IS	R	IS	R	0	0	1	IS
7746		do	6	W	R	C	L	N	---	E	IR	R	IS	R	IS	R	IS	R	0	0	1	IS
7748		do	6	W	R	C	L	N	57	M	IR	R	IS	R	IS	R	IS	R	0	0	1	IS
7755		do	6	W	R	C	L	N	---	M	IR	R	IS	R	IS	R	IS	R	0	0	1	IS
7758		do	6	W	R	C	L	N	57	M	IR	R	IS	R	IS	R	IS	R	0	0	1	IS
7765		do	6	W	R	C	L	N	---	M	IR	R	IS	R	IS	R	IS	R	0	0	1	IS
7766		do	6	W	R	C	L	N	57	M	IR	R	IS	R	IS	R	IS	R	0	0	1	IS
7786	Aizu No. 4	Japan	6	W	R	C	L	N	---	M	IR	R	IS	R	IS	R	IS	R	0	0	1	IS
7803		Turkey	6	B1	R	C	L	N	66	M	IR	R	IS	R	IS	R	IS	R	0	0	1	IS
7807		do	6	B2	R	C	L	N	93	M	IR	R	IS	R	IS	R	IS	R	1	2	4	IS
7811		do	6	B2	R	C	L	N	63	E	IR	R	IS	R	IS	R	IS	R	1	4	4	IS
7822		do	6	B2	R	C	L	N	72	E	IR	R	IS	R	IS	R	IS	R	1	4	4	IS
7845		do	6	B3	R	C	L	N	88	E	IR	R	IS	R	IS	R	IS	R	1	3	1	IS
7847		do	6	B2	R	C	L	N	---	E	IR	R	IS	R	IS	R	IS	R	1	3	1	IS
7856		do	6	B2	R	C	L	N	96	E	IR	R	IS	R	IS	R	IS	R	2	4	4	IS
7882		do	6	B2	R	C	L	N	73	E	IR	R	IS	R	IS	R	IS	R	1	4	4	IS
7890		do	6	B2	R	C	L	N	---	E	IR	R	IS	R	IS	R	IS	R	1	4	4	IS
7905		do	6	W	R	C	L	N	---	M	IR	R	IS	R	IS	R	IS	R	1	4	4	IS
7939		do	2	W	R	C	L	N	---	M	IR	R	IS	R	IS	R	IS	R	1	4	4	IS
7952		do	6	B2	R	C	L	N	99	E	IR	R	IS	R	IS	R	IS	R	2	3	3	IS
7960		do	2	W	R	C	L	N	95	M	IR	R	IS	R	IS	R	IS	R	2	4	4	IS
7969		do	2	W	R	C	L	N	93	M	IR	R	IS	R	IS	R	IS	R	1	4	4	IS
8036		do	2	Bk	R	C	L	N	---	M	IR	R	IS	R	IS	R	IS	R	1	4	4	IS
8051	Stephan	Germany	2	W	R	C	L	N	---	M	IR	R	IS	R	IS	R	IS	R	1	4	4	IS
8063		Hybrid	6	B1	R	C	L	N	100	M	IR	R	IS	R	IS	R	IS	R	0	1	4	IS
8068	Polong	do	6	W	R	C	L	N	100	L	IR	R	IS	R	IS	R	IS	R	1	4	3	IS
8073	Piedmont	do	6	B2	R	C	L	N	---	M	IR	R	IS	R	IS	R	IS	R	1	4	3	IS
8079	Mo. B576	do	6	B2	R	C	L	N	98	M	IR	R	IS	R	IS	R	IS	R	1	4	3	IS
8103		do	6	B3	R	C	L	N	---	M	IR	R	IS	R	IS	R	IS	R	1	4	3	IS
8118	170939	Turkey	2	W	R	C	L	N	90	L	IR	R	IS	R	IS	R	IS	R	1	4	1	IS
8136	170957	do	2	W	R	C	L	N	---	M	IR	R	IS	R	IS	R	IS	R	1	4	1	IS
8152	170973	do	2	W	R	C	L	N	98	M	IR	R	IS	R	IS	R	IS	R	1	4	1	IS
8158	171950	Forrajera R. M. 85	6	B3	R	C	L	N	96	M	IR	R	IS	R	IS	R	IS	R	0	1	1	IS
8172	172510	Argentina	6	B1	R	C	L	N	76	M	IR	R	IS	R	IS	R	IS	R	3	4	4	IS
4188	172525	Turkey	2	W	R	C	L	N	96	M	IR	R	IS	R	IS	R	IS	R	1	4	4	IS
8191	173240	do	2	W	R	C	L	N	79	M	IR	R	IS	R	IS	R	IS	R	2	4	4	IS
		Holland	2	W	R	C	L	N	---	M	IR	R	IS	R	IS	R	IS	R	2	4	4	IS
8265	174428	Mansholt's Sverlyge	6	B3	R	C	L	N	93	M	IS	R	IS	R	IS	R	IS	R	4	3	3	IS
8271	174431	Ile de Re, France	6	W	R	C	L	N	67	M	IR	R	IS	R	IS	R	IS	R	4	4	4	IS
8274	174435	Pourettes	6	B3	R	C	L	N	99	M	IR	R	IS	R	IS	R	IS	R	4	4	4	IS
8276	174439	Derenburger	6	B3	R	C	L	N	65	M	IR	R	IS	R	IS	R	IS	R	4	4	4	IS
8278	174439	Berg	6	B3	R	C	L	N	97	M	IR	R	IS	R	IS	R	IS	R	1	4	4	IS
8279	174440	Kalkreuter	6	B3	R	C	L	N	99	L	IR	R	IS	R	IS	R	IS	R	1	4	4	IS
8283	174444	Peragis	6	B2	R	C	L	N	99	L	IR	R	IS	R	IS	R	IS	R	1	4	4	IS
8289	174450	Lafite	6	B3	R	C	L	N	99	L	IR	R	IS	R	IS	R	IS	R	1	4	4	IS
8323	174484	Schribaux	6	W	R	C	L	N	---	E	IR	R	IS	R	IS	R	IS	R	1	4	4	IS
8329	174490	Marocaine 017	6	B1	R	C	L	N	---	M	IR	R	IS	R	IS	R	IS	R	1	4	4	IS
8331	174492	Marocaine 024	6	B1	R	C	L	N	---	M	IR	R	IS	R	IS	R	IS	R	2	4	4	IS

See footnotes at e.i.d. 1 table.





8704	180652	H265	Germany	6	B3	R	R	R	C	L	W	00	M	IR	IR	R	R	IS	4	IS	IR	S	S	IR	IR	R
8800	180658	479/43	do	6	B2	R	R	R	O	L	W	00	L	IR	IR	R	R	S	4	IS	IR	S	S	IR	IR	R
8802	180660	562/46	do	6	W	R	R	R	O	L	W	00	L	IR	IR	R	R	S	4	IS	IR	S	S	IR	IR	R
8806	180664	4039/38	do	6	B2	R	R	R	O	L	W	00	L	IR	IR	R	R	S	4	IS	IR	S	S	IR	IR	R
8808	180666	930/48	do	6	B3	R	R	R	O	L	W	00	L	IR	IR	R	R	S	4	IS	IR	S	S	IR	IR	R
8809	180667	Wedlim	do	6	W	R	R	R	O	L	W	00	L	IR	IR	R	R	S	0-1	IS	IR	S	S	IR	IR	R
8810	180668	1281/48	do	6	B3	R	R	R	O	L	W	93	M	R	R	R	R	S	0-1	IS	IR	S	S	IR	IR	R
8811	180669	Franger	do	6	B2	R	R	R	O	L	W	98	M	R	R	R	R	S	0-1	IS	IR	S	S	IR	IR	R
8814	180672	H2247	do	6	B3	R	R	R	O	L	W	40	M	IR	IR	R	R	S	0-1	IS	IR	S	S	IR	IR	R
8821	180680	H269	do	6	B1	R	R	R	O	L	W	71	E	IR	IR	R	R	S	3	IS	IR	S	S	IR	IR	R
8826	180685	6229/37	do	2	W	R	R	R	O	L	W		M	R	R	R	R	S	4	IS	IR	S	S	IR	IR	R
8832	180691	828/45	do	2	W	R	R	R	O	L	W		M	R	R	R	R	S	0	IS	IR	S	S	IR	IR	R
8838	181093	India	do	6	B2	R	R	R	O	L	W		E	R	R	R	R	S	0	IS	IR	S	S	IR	IR	R
8846	181101	do	do	6	W	R	R	R	O	L	SW	09	M	R	R	R	R	S	1,4	IS	IR	S	S	IR	IR	R
8805	182357	Turkey	do	2	W	R	R	R	O	L	W	09	M	R	R	R	R	S	3	IS	IR	S	S	IR	IR	R
8872	182368	do	do	2	W	R	R	R	O	L	SW	09	E	IR	IR	R	R	S	3	IS	IR	S	S	IR	IR	R
8897	182394	do	do	6	W	R	R	R	O	L	W	72	E	IR	IR	R	R	S	2	IS	IR	S	S	IR	IR	R
8925	182590	Aizu No. 4	Japan	6	B2	R	R	R	O	L	SW	01	M	R	R	R	R	S	1	IS	IR	S	S	IR	IR	R
8963	182639	Iwate	do	6	B2	R	R	R	O	L	SW	97	M	R	R	R	R	S	2-3	IS	IR	S	S	IR	IR	R
8966	182642	Blizenwase Saitama 4	do	6	W	R	R	R	O	L	SW	97	M	IR	IR	R	R	S	4	IS	IR	S	S	IR	IR	R
9009	182884	Turkey	do	2	W	R	R	R	O	L	W		L	R	R	R	R	S	3-4	IS	IR	S	S	IR	IR	R
9013	183370	Japan	do	6	W	R	R	R	O	L	W		M	R	R	R	R	S	3	IS	IR	S	S	IR	IR	R
9014	183371	Aizu Hadaka 3	do	6	W	R	R	R	O	L	SW	81	M	IR	IR	R	R	S	2,4	IS	IR	S	S	IR	IR	R
9015	183372	Aizu Hadaka 4	do	6	W	R	R	R	O	L	SW		M	R	R	R	R	S	2	IS	IR	S	S	IR	IR	R
9015	183372	Aizu Hadaka 5	do	6	W	R	R	R	O	L	SW		M	R	R	R	R	S	2	IS	IR	S	S	IR	IR	R
9042	183623	Beta 6	Austria	6	B2	R	R	R	O	L	W	00	L	R	R	R	R	S	4	IS	IR	S	S	IR	IR	R
9044	183625	Beta 40	do	6	B2	R	R	R	O	L	W	05	L	R	R	R	R	S	4	IS	IR	S	S	IR	IR	R
9056	183637	Mizohogysyer	do	6	B2	R	R	R	O	L	W	97	M	R	R	R	R	S	4	IS	IR	S	S	IR	IR	R
9070	184057	Yugoslavia	do	2	W	R	R	R	O	L	W		L	R	R	R	R	S	0,4	IS	IR	S	S	IR	IR	R
9076	184063	do	do	2	W	R	R	R	O	L	W	73	E	IR	IR	R	R	S	1,4	IS	IR	S	S	IR	IR	R

<sup>1</sup> Column 1-6=six-rowed; 2=two-rowed; D=deficiens; U=intermedium; I=irregular.

Column 2—Kernel color: B=blue; W=white; Bk=black; P=purple.

Column 3—Awn type: R=rough; SS=semismooth; S=smooth; A=awnless; H=hooded.

Column 4—Kernel type: C=covered; N=naked.

Column 5—Rachilla hairs: L=long; S=short.

<sup>2</sup> W=winter; SW=semiwinter; S=spring.

<sup>3</sup> Average percent five readings: McCullers 1950-51, 1951-52; Statesville 1951-52; Waynesville, 2 replications 1952-53.

<sup>4</sup> E=early; M=midseason; L=late.

<sup>5</sup> Field reaction: R=resistant; IR=intermediate to resistant; I=intermediate; IS=intermediate to susceptible; S=susceptible. Seedling reaction: 0=immune; 1=highly resistant; 2=moderately resistant; 3=moderately susceptible; 4=susceptible; 1-4=mesothetic; 0, 1, 2, or 4—comma indicates there were plants within that entry that gave those reactions.

<sup>6</sup> Eastern soil-borne viruses *Marmor tritici* var. *typicum* and *M. tritici* var. *fuleum*.

TABLE 2.—Varieties or selections of barley outstanding for winter hardiness

C. I. No.	Variety or selection	Origin	Description <sup>1</sup>					Survival <sup>2</sup> at—			
			(1)	(2)	(3)	(4)	(5)	North Carolina		Lexington, Ky., 1954	Other locations, average, 1943
								Average, 1951-53	Waynesville, 1954		
170	Mensury	Manchuria	6	B3	R	0	S	100	100	100	91
206	Han River	China	6	B2	R	0	S	100	100	100	87
221	Greece	Greece	6	B2	R	0	S	96	90	97	33
223	Argentine	Greece	6	B2	R	0	S	94	100	97	25
277	Scottish Pearl	Europe	6	B2	R	0	S	95	95	97	90
704	Popeline	Caucasus	6	Bk	R	0	S	95	100	95	58
737	Niver	China	6	B2	R	0	L	98	90	100	41
876	Tenn. Winter	Europe	6	W	R	0	S		100	100	90
895	Gusada	Hybrid	6	W	R	0	S	97	100	100	87
1063	Koran	China	6	B1	R	0	L	96	100	97	55
1266	Sabbaton	do	6	B2	R	0	L	95	90	100	86
2159	Wis. Winter	do	6	B2	R	0	S	99	100	100	91
2420		California	6	B3	R	0	L	94	100	100	93
2460	Loehink	China	2	B2	R	0	L	99		100	73
2491	Old Ambster	Holland	6	W	R	0	L	95	100	100	83
3195	Sapporo	Japan	6	B2	R	0	S	100	100	100	
3348		Caucasus	6	B3	R	0	S	97	80	100	75
3543	Tenn. Winter 52	Plant sel	6	B3	R	0	L	98	100	100	
3882		Kashmir	6	W	R	0	S	97		100	65
4106	Alaska	do	6	B3	R	0	L	99	70	100	
4202-2		China	6	W	R	0	L	99	80	100	84
4678		do	6	W	R	0	S	99	100	100	
4686	Little Ben	Oregon	6	B3	H	0	S	97		100	
4966		Russia	2	W	S	0	S	95	100	100	70
5010		Caucasus	6	W	R	0	L	99	100	100	85
5012		do	6	B3	R	0	L	99		100	83
5062	Tiflis	do	6	W	R	0	L	94	100	95	78
5145	Kido	Korea	6	B1	R	0	L	99	100	100	85
5173	Chusi	do	6	W	R	0	L	98	90	95	56
5225	Denral	do	6	B2	R	0	L	99		100	85
5233	Dabaku	do	6	W	R	0	L	99		100	73
5239	Rang Ubori	do	6	W	R	0	L	97	100	100	75
5529	Diektoo	North Dakota	6	B3	R	0	L	100	90		95
5559	Gonzali	Gonzali, U. S. S. R.	6	Bk	R	0	S	98	90		45
5560		Asafute	6	W	P	0	L	99	100	100	78

5885	Muller	Northeast Turkey	11	6	11	08	100
5931	O. G. Early Bearless	Missouri	13	6	13	97	100
5935	Smooth Awn 86	Virginia	W	6	W	03	100
6213	Poltava (Lupinus 14)	Russia	W	6	W	96	100
6270	Romanian 20	Rumania	B2	6	B2	100	80
6272	Bandolop	North Carolina	R	6	R	95	100
6275	Yavuzsarı	do	R	6	R	97	100
6107	Stough	Virginia	B1	6	B1	90	83
6109	Selhadaner	Portugal	B2	6	B2	97	85
6211	Brugh 25	Virginia	B3	6	B3	97	75
6093	Hooded 16	Plant Sci	B3	6	B3	90	78
7095	Flood	Georgia, U. S.	W	6	W	100	100
7203	Sel from C. I. 561	New Jersey	W	6	W	100	100
7220	Maz No. 6	Japan	W	6	W	100	100
7281	Penwisk	Delaware, Md.	W	6	W	100	100
7291	Miyagi No. 12	do	W	6	W	96	100
7301	Manabai	do	W	6	W	90	100
7311	Suwai No. 6	do	W	6	W	90	100
7313	Suwai No. 29	do	W	6	W	90	100
7328	Yima	Holland	W	6	W	100	100
7368	Y-100	Missouri	W	6	W	100	100
7373	Tuck	Kentucky	B2	6	B2	100	100
7374	Konbar	do	W	6	W	100	100
7393	do	Turkey	B2	6	B2	100	100
7399	do	do	W	6	W	95	100
8060	do	Hybrid	Bk	6	Bk	100	100
8063	do	do	B1	6	B1	100	100
8068	Polonia	do	W	6	W	100	100
8070	Mo. B-76	do	B2	6	B2	98	100
8118	do	Turkey	W	6	W	90	97
8142	do	do	W	6	W	95	95
8188	Foreign R. M. 85	Argentina	W	6	W	95	95
8271	Doornburger	Turkey	B1	6	B1	96	90
8274	Kalkreuter	France	B3	6	B3	90	60
8283	Leeds	do	B2	6	B2	87	67
8280	Leeds	do	B3	6	B3	99	66
8320	Leeds	Turkey	B3	6	B3	99	99
8306	do	do	W	6	W	99	100
8340	do	do	W	6	W	99	92
8376	do	do	W	6	W	99	95
8417	do	do	W	6	W	80	100
8522	do	do	W	6	W	90	100
8585	do	do	W	6	W	97	100
8607	do	do	W	6	W	90	100
8700	do	do	W	6	W	90	100
8730	do	do	W	6	W	90	100
8731	do	do	W	6	W	90	100
8734	do	do	W	6	W	90	100
8735	do	do	B2	6	B2	90	90

See footnotes at end of table.

TABLE 2. Varieties or selections of barley outstanding for winter hardiness—Continued

U. I. No.	Variety or selection	Origin	Description 1						Strawed 2 at—		Other locations, average, 1913
			(1)	(2)	(3)	(4)	(5)	North Carolina		Washington, D. C., 1931	
								Average, 1931-33	Waynes, 1919, 1931		
8701	V1995	Germany	B	B3	R	C	L	50	80	100	Percent
8800	175-10	46	B	B2	R	C	L	30	100	100	Percent
8803	425-10	46	B	W	R	C	L	50	80	100	Percent
8806	425-10	46	B	B2	R	C	L	99	80	100	Percent
8809	Wiedma	46	B	W	R	C	L	99	80	100	Percent
8811	Wiedma	46	B	B3	R	C	L	99	80	100	Percent
8813	Frangier	46	B	B3	R	C	L	99	94	95	Percent
8817	Wiedma	46	B	W	R	C	L	99	80	95	Percent
8822	Wiedma	46	B	W	R	C	L	97	80	95	Percent
8823	Wiedma	46	B	B2	R	C	L	97	100	100	Percent
8826	Wiedma	46	B	B2	R	C	L	97	100	97	Percent
8829	Wiedma	46	B	B2	R	C	L	97	100	97	Percent
8830	Wiedma	46	B	B2	R	C	L	97	100	97	Percent
8835	Miszegyser	Austria	B	B2	R	C	L	97	100	90	Percent

1 Column 1—6: Silver-earled; 2: Two-rowed; D: deficient; C: intermediate; L: 4-rowed.  
 Column 2: Kernel color: B: blue; W: white; BK: black; P: purple.  
 Column 3: Awn type: R: purple; S: semi-smooth; S: smooth; A: awless.  
 B: bearded.  
 Column 4: Kern. type: C: covered; N: naked.  
 Column 5: Beak-like base: L: long; S: short.

2 North Carolina average, 1931-33; average of percentage grown for 5 seedlings. All seedlings from U. I. 191-32; Salisbury 1911-32; Waynesville, 2 replications, 1932-33; Waynesville, N. C., 1931; Washington, D. C., 1931; average of percentage of 2 replications—seedlings at Washington made by D. A. Reid.  
 Average under conditions, 1913; average percentage at Deaton, Tex.; Raleigh, N. C.; Columbia, Mo.; and Hays, Kans., in 1913, from Winter Barley Varieties, compiled by G. V. Vail, U. S. Dept. Agr., Agr. Res. Admin., Bur. Plant Indus., Soils & Agr. Engin., 14 month, Feb. 20 pp., 1943. [Processed.]

TABLE 3.—Varieties or selections of barley outstanding for field resistance to powdery mildew

C. I. No. 1	Variety or selection	Origin	Description					Reaction in—												
													Field 2 at—					Seedling 4		
													McCullers, N. C.		Statesville, N. C.			Tenn. 1954 †	Races 4, 9, 14	Race 9
													1951	1952	1952	1953	1954			
			(1)	(2)	(3)	(4)	(5)	Type	Type	Type	Type	Type	Type	Rating	Rating					
								R	R	R	R	R	R							
221	Greece	Greece	6	B2	R	C	S	R	R	R	R	R	R	4	4					
223	Argentine		6	B2	R	R	S	R	R	R	R	IS	IR	4	4					
662	Tenarab	Hybrid	6	B1	R	R	L	R	IR	R	R	R	R	1-2	1-2					
704*	Popeline	Caucasus	6	Bk	R	R	L	R	R	R	R	R	R	1-2	1-2					
900*	Hauna	Germany	2	W	R	R	L	R	IR	R	R	R	R	0-1	0-1					
928*	Goldfoil	Plant sel.	2	W	SS	R	L	R	R	R	R	R	R	0-1	0-1					
1009*	Wofut	Russia	6	Bk	R	R	L	R	IR	R	R	R	R	0-1	0-1					
1014*	Eromó	India	6	W	R	R	L	R	R	R	R	R	R	0-1	0-1					
1016*	Kwan	do	6	B1	R	R	L	R	R	R	R	R	R	2-3	2-3					
1017*	Monte Cristo	do	6	B2	R	R	L	R	R	IR	R	IR	R	0	0					
1021	Weider	Australia	6	W	R	R	L	IR	R	IR	R	R	R	1-2	1-2					
1050	Wanshpo	China	6	B1	R	R	L	R	R	IR	R	IR	R	2-3	2-3					
1354	Cadmus	do	6	B1	R	R	L	R	R	R	R	R	R	2-3	2-3					
1077	Pandora	Iran	2	B2	R	R	L	IR	R	R	R	R	R	2-3	2-3					
1079	Chinerme	China	6	Bk	R	R	L	R	R	R	R	IS	R	0, 4	0, 4					
1091*	Gopal	India	2	P	R	R	L	R	R	IS	R	R	R	0-1	0-1					
1179*	Algerian	Algeria	6	B1	R	R	L	R	R	R	R	R	R	0	0					
1277	Bolivia	N. Africa	6	B1	R	R	L	R	R	R	R	R	R	4	4					
1263	Fleche	Crimea	2	W	R	R	L	R	R	R	R	R	R	2	2					
1264*	Donjon	Mexico	6	Bk	R	R	L	R	IR	R	R	R	R	1-2	1-2					
1556	Minsturdll	Hybrid	6	W	R	R	L	IR	R	R	R	IR	R	2-3	2-3					
1614*	Fleche	Crimea	6	W	R	R	L	R	IR	R	R	R	R	1-2	1-2					
1803	Hoodless Beardless		6	B3	R	A	L	R	R	R	R	R	R	1-2	1-2					
2045*	Rialto	Iran	2	B2	R	R	L	R	R	IR	R	R	IS	2	2					
2192	Abyssinia		6	B2	R	R	L	IR	R	R	R	R	R	2	2					
2202*	Black Russia	Tiflis, U. S. S. R.	6	Bk	R	R	L	R	R	R	R	R	R	2	2					
2270*	Purple Nudum	India	2	P	R	R	L	IR	R	R	R	R	R	1-2	1-2					
2318*	Kcharsila	do	6	W	R	R	L	R	IR	R	R	R	R	1	1					
2441	Peruvian	N. Africa	6	B2	R	R	L	IR	IR	IR	R	R	R	2-3	2-3					
2444	Nigrate	China	6	Bk	R	R	L	IR	R	R	R	R	R	4	4					
2478	Ramadan	Algeria	6	B2	R	R	L	IR	IR	R	R	R	R	2-3	2-3					
2453*	Modia	N. Africa	6	B2	R	R	L	IR	R	R	R	R	R	0-1	0-1					
2524	Ariann	Tunis	6	W	R	R	L	IR	R	R	R	R	R	2	2					

See footnotes at end of table.

TABLE 3.—Varieties or selections of barley outstanding for field resistance to powdery mildew—Continued

G. I. No. 1	Variety or selection	Origin	Reaction in—														
			Description					Field 2 at—					Seedling 4				
								McCallers, N. C.		Statesville, N. C.			Tenn. 1954 4	Races 4, 9, 14	Race 9		
			(1)	(2)	(3)	(4)	(5)	1951	1952	1952	1953	1954	Type	Rating	Rating		
2538	Forjara	Chile	6	B1	R	R	C	S	R	Type	Type	Type	Type	Type	Type	Rating	Rating
2742	Bari	Italy	6	W	R	R	C	S	R	R	IR	R	R	R	R	4	4
2746	Milost	do	6	W	R	R	C	S	R	R	IS	R	R	R	R	4	4
3198	Sapporo	Japan	6	B2	R	R	C	S	R	R	R	R	R	R	R	2-3	2
3238	Serira	Algeria	6	W	R	R	C	S	R	R	R	R	R	R	R	2	2
3375-1	do	do	6	B2	R	R	C	S	R	R	IR	R	R	R	R	1	1
3397*	Lyalpur B.S.	India	6	B1	R	R	C	S	R	R	R	R	R	R	R	0-1	0-1
3396*	Hashiarpur	do	6	B2	R	R	C	S	R	R	R	IR	R	R	R	0-1	0-1
3598*	Kulu	do	6	W	R	R	C	S	R	R	IR	R	R	R	R	1	1
3400*	Manwali	do	6	B1	R	R	C	S	R	R	R	R	R	R	R	0-1	0-1
3401*	Multan	do	6	B3	R	R	C	S	R	R	R	R	R	R	R	0-1	0-1
3465*	Balouchistan	do	6	B2	R	R	C	S	R	R	R	R	R	R	R	0	0
3407*	Black B.S.	do	2	P	R	R	C	S	R	R	IR	R	R	R	R	1	1
3727-2*	Villa	Spain	6	W	R	R	C	S	R	R	R	R	R	R	R	1	1
3728	do	do	6	W	R	R	C	S	R	R	R	R	R	R	R	1	1
3730-2*	Algon	do	6	B3	R	R	C	S	R	R	R	R	R	R	R	1-2	1
3669*	Palmetta Blue	Marlout, Egypt	2	B2	SS	R	C	S	R	R	IR	R	R	R	R	1	1
3623*	do	do	2	B1	R	R	C	S	R	R	IR	R	R	R	R	0-1	0-1
3724*	do	do	2	B1	R	R	C	S	R	R	IR	R	R	R	R	1	1
3726*	Retu	do	2	B2	SS	R	C	S	R	R	IR	R	R	R	R	1	1
3598-2	do	Tunis	6	P	R	R	C	S	R	R	R	R	R	R	R	4	4
3913	do	Abyssinia	6	P	R	R	C	S	R	R	R	R	R	R	R	2-3	2
3941-1	do	do	6	B1	R	R	C	S	R	R	R	R	R	R	R	4	4
4243-1	do	China	6	B1	R	R	C	S	R	R	R	R	R	R	R	2	2
4201-2	do	Transcaucasia	6	Bk	R	R	C	S	R	R	R	R	R	R	R	1-2	1-2
4312	do	do	6	B2	R	R	C	S	R	R	R	R	R	R	R	4	4
4314*	do	do	6	Bk	R	R	C	S	R	R	IR	R	R	R	R	1	1
4316	Gandja	do	6	B2	R	R	C	S	R	R	R	R	R	R	R	4	4
4356*	do	Abyssinia	1	W	R	R	C	S	R	R	R	R	R	R	R	1-2	1-2
4624	do	India	6	B1	R	R	C	S	R	R	R	R	R	R	R	1-2	1-2
4965*	do	Iraq	2	B1	SS	R	C	S	R	R	IR	R	R	R	R	0-1	0-1
4968-2*	do	do	2	B2	S	R	C	S	R	R	IR	R	R	R	R	1-2	1-2
4970*	Rabat	Morocco	6	B1	R	R	C	S	R	R	R	R	R	R	R	0-1	0-1





TABLE 3.—Varieties or selections of barley outstanding for field resistance to powdery mildew—Continued

C. I. No. <sup>1</sup>	Variety or selection	Origin	Description <sup>2</sup>					Reaction in—								
								Field <sup>3</sup> at—					Seedling <sup>4</sup>			
													McCullers, N. C.			Statesville, N. C.
								(1)	(2)	(3)	(4)	(5)	1951	1952	1953	1954
8323	Schribeau	France	6	W	R	C	L	IR	Type R	Type R	Type R	Type R	Type R	Type R	Rating 1	Rating 1-2
8377	-----	India	6	Bk	R	C	L	R	IR	R	R	R	R	R	2	2
8403	-----	do.	6	W	R	C	L	R	R	R	R	R	R	R	2	4
8407	-----	do.	6	Bk	R	C	L	R	R	R	R	R	R	R	2	4
8427	-----	do.	6	Bk	R	C	L	R	R	R	R	R	R	R	1-4	3
8477	-----	do.	6	Bk	R	C	L	R	R	R	R	R	R	R	1-4	3
8808*	930/48	Germany	6	B3	R	N	L	R	R	R	R	R	R	R	3	3
8809*	Wedlm	do.	6	B3	R	C	L	R	R	R	R	R	R	R	0-1	0
8810*	1281/48	do.	6	W	R	C	S	R	R	R	R	R	R	R	0-1	0
8811*	Franger	do.	6	B3	R	C	L	R	R	R	R	R	R	R	0-1	0
8814	H2247	do.	6	B3	R	C	S	R	R	R	R	R	R	R	0-1	0
8821	H260	do.	6	B2	R	C	S	IR	R	R	R	IR	R	R	3	4
8826*	6220/37	do.	6	B1	R	C	S	IR	R	R	R	IR	R	R	4	4
8832*	828/45	do.	2	W	R	C	L	R	R	R	R	R	R	R	0	0
8838	-----	do.	2	W	R	C	L	R	R	R	IR	R	R	R	0	0
8846	-----	India	2	B2	R	C	L	R	R	R	R	IR	R	R	1,4	2
8925	-----	do.	6	W	R	C	L	R	R	R	R	R	R	R	3	0-1
9013	Alzu No. 4	Japan	6	W	R	C	L	R	R	R	R	R	R	R	1	2
9014	Alzu Hadaka 3	do.	6	W	R	C	L	R	R	R	R	R	R	R	3	1-2
9070	Alzu Hadaka 4	do.	6	W	R	C	L	IR	R	R	R	R	R	R	2-4	4
9076	-----	Yugoslavia	2	W	R	C	L	R	R	R	R	R	R	R	0,4	4
	-----	do.	2	W	R	C	L	IR	IR	R	R	R	R	R	1,4	4

<sup>1</sup> Asterisk (\*) following the C. I. No. indicates the seedling reaction of that variety to eight races of powdery mildew has been determined (11).

<sup>2</sup> Column 1—6=six-rowed; 2=two-rowed; D=deficient; U=intermedium; I=irregular.

Column 2—Kernel color: B=blue; W=white; Bk=black; P=purple.

Column 3—Awn type: R=rough; SS=semismooth; S=smooth; A=awnless; H=hooded.

Column 4—Kernel type: C=covered; N=naked.

Column 5—Rachilla hairs: L=long; S=short.

<sup>3</sup> Field reaction: R=resistant; IR=intermediate to resistant; I=intermediate; IS=intermediate to susceptible; S=susceptible.

<sup>4</sup> Readings at Knoxville, Tenn., made by H. E. Reed.

<sup>5</sup> Field reaction: R=resistant; IR=intermediate to resistant; I=intermediate; IS=intermediate to susceptible; S=susceptible. Seedling reaction: O=immune; 1=highly resistant; 2=moderately resistant; 3=moderately susceptible; 4=susceptible; 1-4=mesothetic; 0,1,2,4=comma indicates there were plants within that entry that gave those reactions.

TABLE 4.—Varieties or selections of barley outstanding for field resistance to leaf rust

C. I. No.	Variety or selection	Origin	Description 1					In North Carolina				In Wis-consin, 1942	In Florida, 1951	To Race 4, 1954		
			(1)	(2)	(3)	(4)	(5)	Statesville		Type	Type				Percent	Rating
								McCollers, 1952	1952							
102	Hankov.	Central Asia	G	B1	R	C	L	R	R	R	R	0	0			
104	Telli.	North Africa	G	B1	R	C	L	R	R	R	R	0	0			
864	Rapar.	do	G	B1	R	C	L	R	R	R	R	0	0			
1024	Quinn.	Australia	G	W	R	C	L	R	R	R	R	0	0			
1237	Bolvin.	North Africa	G	B1	R	C	L	R	R	R	R	0	0			
1365	do.	do	G	Bk	R	C	L	R	R	R	R	0	0			
2346	do.	do	G	B2	R	C	L	R	R	R	R	0	0			
2441	Peruvian.	North Africa	G	B2	R	C	L	R	R	R	R	0	0			
2479	Bongia.	Algeria	G	B1	R	C	L	R	R	R	R	0	0			
2483	Moula.	North Africa	G	B2	R	C	L	R	R	R	R	0	0			
2524	Artana.	Tunis.	G	W	R	C	L	R	R	R	R	0	0			
2525	do.	do	G	B3	R	C	L	R	R	R	R	0	0			
2526	do.	do	G	B1	R	C	L	R	R	R	R	0	0			
2538	Forjore.	Chile.	G	B1	R	C	L	R	R	R	R	0	0			
2542	Barl.	Italy	G	W	R	C	L	R	R	R	R	0	0			
2546	Milnst.	do	G	W	R	C	L	R	R	R	R	0	0			
2549	do.	do	G	W	R	C	L	R	R	R	R	0	0			
2674	Gordon.	do	G	B1	R	C	L	R	R	R	R	0	0			
3382	do.	Algeria.	G	B1	R	C	L	R	R	R	R	0	0			
3387	Carre 42.	do	G	B1	R	C	L	R	R	R	R	0	0			
3390	Carre 160.	do	G	B2	R	C	L	R	R	R	R	0	0			
3527-1	Villa.	Spain.	G	W	R	C	L	R	R	R	R	0	0			
3527-2	do.	do	G	B3	R	C	L	R	R	R	R	0	0			
3590-2	Alagon.	do	G	B1	R	C	L	R	R	R	R	0	0			
3801	do.	Tunis.	G	B1	R	C	L	R	R	R	R	0	0			
4219	do.	Ethiopia.	G	B2	R	C	L	R	R	R	R	0	0			
4220-1	do.	do	G	B2	R	C	L	R	R	R	R	0	0			
4316	Gandja.	Transcaucasia.	G	B2	R	C	L	R	R	R	R	0	0			
4327	do.	do	G	B2	R	C	L	R	R	R	R	0	0			
4973	Rabal.	Morocco.	G	B2	R	C	L	R	R	R	R	0	0			
4979	Lanslalo.	Algeria.	G	B1	R	C	L	R	R	R	R	0	0			
5055	Tiflis.	Caucasus.	G	W	R	C	L	R	R	R	R	0	0			
5092	do.	do	G	W	R	C	L	R	R	R	R	0	0			
5230	Rangubori.	Korea.	G	W	R	C	L	R	R	R	R	0	0			
5330	O. C. sel. C. I. 4116.	Plant sel.	G	B3	R	C	L	R	R	R	R	0	0			
5447	Spray, from C. I. 4116.	do	G	W	R	C	L	R	R	R	R	0	0			

See footnotes at end of table.

TABLE 4.—Varieties or selections of barley outstanding for field resistance to leaf rust—Continued

C. I. No.	Variety or selection	Origin	Description <sup>1</sup>											Reaction <sup>2</sup>			
								In North Carolina			In Virginia, 1954 <sup>3</sup>	In Wis- consin, 1942 <sup>3</sup>	In Florida, 1954 <sup>3</sup>	To Race 4, 1954 <sup>2</sup>			
			(1)	(2)	(3)	(3)	(5)	Me- Cullers, 1952	Statesville								
								Type	Type	Type	Type	Type	Percent	Rating			
5585	Muller.....	NE. Turkey.....	6	B1	R	O	S	R	R	R	R	R	R	0	0		
5644	Caspian.....	Kuban.....	6	W	R	R	L	R	R	R	R	R	R	20	0		
5644	Marco.....	do.....	6	W	R	R	L	R	R	R	R	R	R	0	0		
5912	Peruvian 1 fr. C. I. 935.....	Plant sel.....	6	B1	R	C	S	R	R	R	R	R	R	25	0		
6193	Cebada Capa.....	N. Africa.....	6	B1	R	C	L	R	R	R	R	R	R	0	0		
6306	Ricardo.....	Uruguay.....	2	B1	R	C	L	R	R	R	R	R	R	0	1		
6313	Spanische.....	Germany.....	6	B2	R	C	L	R	R	R	R	R	R	0	0		
6448	.....	Poland.....	6	B1	R	C	L	R	R	R	R	R	R	0	1		
6459	.....	do.....	6	B1	R	C	L	R	1S	R	R	R	R	0	0		
7123	Bolron.....	Wisconsin.....	6	B2	R	C	S	R	R	R	R	R	R	5	0		
8172	.....	Turkey.....	6	B1	R	C	L	S	R	R	R	R	R	0	0		
8191	Mansholt's Sverylge.....	Holland.....	2	W	S	C	L	R	1S	1R	R	R	R	0	0		
8268	Ille de Re.....	France.....	6	B3	R	C	L	S	R	R	R	R	R	0	0		
8271	Tourettes.....	do.....	6	W	R	C	L	R	R	R	R	R	R	0	0		
8283	Peragis.....	do.....	6	B2	R	C	S	S	R	R	R	R	R	0	0		
8323	Schribaux.....	do.....	6	W	R	C	J	R	R	R	R	R	R	0	0		
8320	Marocaine 017.....	do.....	6	B1	R	C	S	R	R	R	R	R	R	0	0		
8331	Marocaine 024.....	do.....	6	B1	R	C	S	R	R	R	R	R	R	0	0		
8538	.....	Turkey.....	6	B	R	C	S	R	1R	R	R	R	R	0	0		

<sup>1</sup> Column 1—6=six-rowed; 2=two-rowed; D=deficiens; U=intermedium; I=irregular.

Column 2—Kernel color: B=blue; W=white; Bk=black; P=purple.

Column 3—Awn type: R=rough; SS=semismooth; S=smooth; A=awnless; H=hooded.

Column 4—Kernel type: C=covered; N=naked.

Column 5—Rachilla hairs: L=long; S=short.

<sup>2</sup> Reaction type; R=resistant; 1R=intermediate to resistant; I=intermediate; IS=intermediate to susceptible; S=susceptible. Reaction percent: Percentage of plants susceptible. Reaction 0-4: 0=immune; 1=highly resistant; 2=moderately resistant; 3=moderately susceptible; 4=susceptible.

<sup>3</sup> Readings at Gainesville, Fla., were made by R. W. Earhart; data from Madison, Wis., were made available by R. G. Shands; data from Blacksburg, Va., were made available by T. M. Starling.

### Source or Origin

The source or origin of the entries in this bulletin was obtained from the records maintained by the Cereal Crops Section, Field Crops Research Branch. For the hybrids and plant selections the State in the United States in which the final selection was made is listed when that information is available.

### Description of Entries

The entries are described by five characteristics of the spike and kernel. The descriptions were checked when the world collection of barley was grown at Aberdeen, Idaho, in 1951.

The arrangement of rows of kernels on the spike were separated into the following categories. Six-rowed barley (*Hordeum vulgare* L., emend. Lam.) includes the typical six-rowed type, in which the lateral kernels are slightly smaller than the central ones, and the intermedium type, in which the lateral kernels are markedly smaller than the central ones. Two-rowed barley (*H. distichum* L., emend. Lam.) includes the typical two-rowed type, with lateral florets consisting of lemma, palea, rachilla, and reduced sexual parts, and the deficiens type, in which the lateral florets have been reduced and consist of lemma and rarely palea and rachilla, but with no sexual parts. In irregular barley (*H. irregulare* E. Åberg & Wiebe) the central florets are fertile and the lateral florets variable; some reduced to rachilla, others are fertile, sterile, or sexless.

The gross color of the kernel was classified as blue, white, black, or purple. In the environment in Idaho, where the grain was grown under irrigation, it was possible to divide the blue-colored group into three classes for intensity of color. It is difficult to make these classifications in more humid climates.

The awn types were divided into five classes. The awned types were separated into rough, semismooth, and smooth. The other two classes were awnless and hooded.

The kernels were divided into two groups, covered and naked, on the basis of adherence of the lemma and palea to the caryopsis.

Two types of rachilla hairs were distinguished: The long-haired type, in which the hairs were straight, unbranched, and tend to lie in a parallel pattern; and the short-haired type, in which the hairs were short, crooked or forked, and tend to overlap each other.

### Habit of Growth

Barleys grown in North America are referred to as either winter or spring varieties, depending on their habit of growth. The distinction between the two growth types can be observed best when the plants are between the seedling and shooting stages. In the winter type the rosette stage is prolonged and the leaves tend to be prostrate to semierect, and, from spring seeding, the plants may not head or they head only sparingly and late in the season. In the spring type there is no prolonged rosette stage and the leaves usually are erect or occasionally semierect, and this type heads readily and matures early from spring seeding.

The readings for habit of growth were made about February 10. This was when the winter types were still in the rosette stage and

stem elongation was just beginning. Since the demarcation between the rosette and upright type growth is not always clear, the plants were classified in three categories: W (winter); SW (semiwinter); and S (spring).

The data on habit of growth in table 1 are the average of the readings made at McCullers in 1950-51 and 1951-52 and at Statesville in 1951-52. The habit of growth of some entries sown the first week of September 1952 at Statesville differed from that when sown a month later. Therefore, the data from the early seeding are excluded. Several entries from Turkey sown the first of September had an upright spring-type growth and were heading in December, but they had a rosette winter-type growth when sown the first of October. Likewise, the Trebi variety grew like a spring barley when sown on September 1, but like a winter variety when sown October 1. Trebi has been grown from fall seeding in British Columbia, Canada, but has been widely grown as a spring barley in the North Central States, the Intermountain States, and in the Prairie Provinces of Canada. Several of the recent introductions from Turkey were mixed as to type of growth. Other entries had a semiprostrate winter-type growth when sown in September, but developed an upright spring-type growth when sown in October. Most of these latter entries originated from India.

### *Time of Heading*

The heading date recorded was the stage at which 50 percent of the plants in the row were headed. The entries were separated into three categories: Early, midseason, and late. Most of the entries listed as early were 50 percent mature by May 14. Those listed as late matured after May 24. The majority of the entries fell into the midseason maturity class. Most of the commercial varieties grown in North Carolina were 50 percent mature by May 20. Heading notes were taken only during the first growing season. In the bulk populations that were mixed the readings were based on the predominant type plant.

### *Winter Survival*

The winter hardiness required for crops grown in North Carolina is not so great as in some other areas where winter barley is grown. Plants in which the winter dormancy is broken by the first period of warm weather in the spring often are killed during the next cold snap. Some varieties adapted to the colder areas of the winter barley region often are injured when their winter dormancy is broken by mild weather in January and February. Winterkilling is often severe, since there is seldom a snow cover to protect the plants. Some years the cold period is too short or too mild to fulfill the cold requirements of the more winter-hardy types.

Winter survival is recorded as the percentage of plants that survived the cold weather. The data in table 1 are the averages of the five readings taken at McCullers in the spring of 1951 and 1952, at Statesville in 1952, and in two replications at Waynesville in 1953. These readings were taken in late January or February before the plants had completely recovered from their winter dormancy. Entries outstanding for winter hardiness are listed in table 2. The average survival

of two replications at Lexington, Ky., as observed by D. A. Reid, and at Waynesville, N. C., in the spring of 1954 is included, in addition to the data in table 1. Also included is the average survival of certain entries at Denton, Tex., Raleigh, N. C., Columbia, Mo., and Hays, Kans., in 1943 as compiled by G. A. Wiebe. More killing occurred at Waynesville than at Lexington in the spring of 1954. Most of the varieties listed as winter hardy in Missouri by Pöehlman (14) were found to be very hardy. The killing in North Carolina and Kentucky in 1954 was not so severe as in Pöehlman's tests in Missouri.

Differential killing of spring varieties was observed in the nurseries each year. Data taken on the entire world collection of barley during the 1950-51 season, when differential killing was very striking, may be obtained from the Cereal Crops Section, Field Crops Research Branch. These data suggest the existence of genes for hardiness in certain spring varieties and the possibility of using spring varieties to increase the hardiness of our present winter varieties. Such varieties as C. I. Nos. 1077, 3236, 4343-1, 5043, and 7847 may be of value in breeding for winter hardiness.

### *Reaction to Powdery Mildew*

The primary basis for the selection of entries from the collection to be saved for further study was their reaction to powdery mildew. A survey of all known germ plasm for resistance to powdery mildew was made, since this is one of the major diseases of winter barley in the United States.

The data on the field reaction to powdery mildew in table 1 were obtained at McCullers in the spring of 1951 and 1952, and at Statesville during the spring of 1952, 1953, and 1954. Readings were made only when resistant and susceptible entries could be distinguished.

The seedling tests with the composite of races 4, 9, and 14 were made in the greenhouse in the fall of 1950. The 6,273 entries in the world collection of barley were tested with this composite of races. The seedling readings were on the basis of: 0=immune, no visible signs of infection; 1=highly resistant, a slight development of mycelium; 2=moderately resistant, moderate development of mycelium with a slight production of conidia, necrosis but little chlorosis; 3=moderately susceptible, moderate to abundant development of mycelium accompanied by moderate sporulation, little necrosis, some chlorosis; 4=highly susceptible, large pustules, abundant sporulation, no necrosis; 1-4=mesothetic, highly resistant type 1 reaction and highly susceptible type 4 reaction on same leaf; 1, 2, 4=mixture of types, plants with different reaction types in one entry.

The C. I. accessions selected from the bulk introductions (P. I. accessions) that were tested with the composite of races 4, 9, and 14 were tested again in the seedling stage with race 9 in 1954. All selections from bulk P. I. accessions that were highly resistant to the composite of races were likewise highly resistant to race 9. The reactions of the remainder of the selections from the P. I. accessions to race 9 not included in table 3 may be obtained from Cereal Crops Section, Field Crops Research Branch.

Several collections of powdery mildew were made each year from the barley nurseries in North Carolina. These collections were tested

with the six varieties used by Mains and Deitz (10), Tidd (17), and Newton and Cherewick (18) to differentiate races. Race 9 was the predominant race, but occasionally race 6 was found early in the fall. A new race biotype was present at Statesville in 1954. Several varieties in the world collection as well as commercial varieties previously resistant to powdery mildew in the field were susceptible to the new biotype in this nursery. On the basis of tests with the six differential varieties only races 6 and 9 were present in that nursery. A new race biotype might be identified by increasing the number of differential varieties.

The varieties outstanding for their field reaction to powdery mildew are listed in table 3. The reactions of the entries tested at Knoxville, Tenn., by Reed, are included in this table. Collections of powdery mildew from the nursery in Tennessee were found to be predominantly race 9 with an occasional race 4 or 8 when tested with the standard differential varieties.

The entries with asterisks following their C. I. numbers had been tested to eight races of the *Erysiphe graminis* f. sp. *hordei* in the seedling stage (11). Most of those entries were resistant to all eight of the races in the seedling stage.

### Reaction to Leaf Rust

Leaf rust is a major disease of barley in the southeastern portion of the winter barley-growing area in the United States. Fields have been observed in North Carolina in which the yield has been reduced at least 50 percent. Although total losses from this disease may not be large, fields can be found every year where losses occur.

The data in table 1 are the field reactions of entries at McCullers in 1951 and at Statesville in 1951 and 1952. Readings were made only when the level of infection was adequate to permit differentiation of resistant and susceptible entries. The race of the organism was not determined, but races 4, 37, and 47 (8) were most prominent in the area.

The entries outstanding for their field reaction to *Puccinia hordei* are listed in table 4. Included in that table are data collected by R. W. Earhart at Gainesville, Fla., and the results obtained by R. G. Shands when the world collection was grown at Madison, Wis., in 1942. T. M. Starling furnished the data on the field reaction at Warsaw, Va., and the seedling reaction to race 4.

Most of the entries resistant in North Carolina were resistant at the other locations. All the entries but C. I. Nos. 5056, 5644, and 5912 listed in table 4 were resistant in Florida, and all but C. I. 4316, which gave a mixed reaction, were resistant in Virginia. The race or races of leaf rust present in North Carolina must have had the same genes for pathogenicity as those in Virginia, Florida, and Wisconsin.

Levine and Cherewick (4) reported the results of tests with several races of leaf rust on selected varieties in the seedling stage. They found the following entries listed on table 4 to be resistant to five or more physiological races: C. I. Nos. 194, 1024, 2549, 3390, 3527-2, 4219, 4220-1, 4979, 5644, 5647, 6193, 6306, and 7123.

### *Reaction to Eastern Soil-Borne Viruses*

The eastern soil-borne viruses *Marmor tritici* var. *typicum* and *M. tritici* var. *fulvum* (12) have been known in United States since 1919, when they were identified in Illinois (8). They were first identified in States in Southeastern United States as follows: Virginia before 1925 (6); North Carolina, 1930 (7); Maryland, 1927 (7); and South Carolina, 1944 (1). In recent years when wheat varieties susceptible to these pathogens were released, large losses have resulted in North Carolina (12) and Virginia (16).

These viruses attack all cereal species in the tribe *Hordeae* (7). The effects of the viruses were severe on some varieties of barley, especially Sunrise. All the varieties in the United States Department of Agriculture uniform barley winter hardiness nursery in 1952-53 were resistant.<sup>5</sup>

The 372 barleys from the world collection were tested for their reaction to these viruses in the field at China Grove in 1952-53. Readings from each of two replications are included in table 1. The distribution of the viruses in the nursery was uniform and the level of infestation was high.

### *Reaction to Scald*

Scald has become a very important disease in the winter barley area of United States. It has been one of the major diseases in California for many years (5). In recent years it has become so destructive in Eastern United States where winter barley is grown that varieties susceptible to the disease are no longer recommended for commercial production.

In the fall of 1953 seed of the entries used in this study were sent to H. E. Reed in Tennessee to test their field reaction to this disease. He sowed the seed early in the fall and spread diseased plant material in the nursery to start an epidemic. A uniform and severe epidemic was obtained. Some of the more susceptible varieties were so severely injured that they failed to produce seed.

The results from this test are given in table 1. In this group 124 entries were found to be resistant. Most of the Tennessee winter types were found to have some resistance, which is in agreement with the results obtained by Riddle and Suneson (15) and Poehlman (14).

### *Entries Outstanding for More Than One Characteristic*

The 32 varieties and selections outstanding for more than one characteristic are listed in table 5. The three characteristics used for selecting entries in this table were winter survival and reaction to powdery mildew and leaf rust. Other information included on each entry is the habit of growth, time of heading, and reaction to scald and the eastern soil-borne viruses.

<sup>5</sup> Data submitted by J. G. Moseman in the Uniform Barley Winter Hardiness Nursery report for 1953, compiled by G. A. Wiebe and D. A. Reid. U. S. Dept. Agr., Agr. Res. Service, Field Crops Res. Branch. (Unnumb. Pub.) 8 pp. 1953. [Processed.]



TABLE 5.—Varieties or selections of barley outstanding for more than one characteristic

C. I. No.	Variety or selection	Origin	Description <sup>1</sup>					Habit of growth <sup>2</sup>	Winter survival <sup>3</sup>	Time of heading <sup>4</sup>	Type of reaction <sup>5</sup> to —										
											Powdery mildew at —					Leaf rust at —			Viruses <sup>6</sup> at China Grove, N. C., 1953		Scald in Tennessee, 1954
			McCullers, N. C.		Statesville, N. C.						McCullers, N. C.	Statesville, N. C.		Var. <i>typicum</i>	Var. <i>fulvum</i>						
			1951	1952	1952	1953	1954				19 2	1952	1953								
221	Greece	Greece	0	B2	R	R	CCCCCCCC	SW	Percent	M	R	R	R	R	IR	S			R	IR	S
223	Argentine		0	B2	R	R	CCCCCCCC	W	96	M	R	R	R	R	IR	S			R	IR	S
704	Popeline	Caucasus	0	Bk	R	R	CCCCCCCC	W	94	M	R	R	R	R	R	S			R	IR	S
1257	Bolivia	North Africa	0	B1	R	R	CCCCCCCC	SW	95	M	R	R	R	R	R	R			R	IR	S
2441	Peruvian	do	0	B2	R	R	CCCCCCCC	S	51	M	R	R	R	R	R	R			R	IR	S
2483	Modia	do	0	B2	R	R	CCCCCCCC	S	74	L	R	R	R	R	R	R			R	IR	S
2524	Arlana	Tunis	0	W	R	R	CCCCCCCC	S	77	L	R	R	R	R	R	R			R	IR	S
2538	Porjara	Chile	0	B1	R	R	CCCCCCCC	S	47	M	R	R	R	R	R	R			R	IR	S
2542	Bari	Italy	0	W	R	R	CCCCCCCC	SW	66	M	R	R	R	R	R	R			R	IR	S
2546	Milust	do	0	W	R	R	CCCCCCCC	SW	75	L	R	R	R	R	R	R			R	IR	S
3527-2	Villa	Spain	0	W	R	R	CCCCCCCC	SW	63	L	R	R	R	R	R	R			R	IR	S
3530-2	Alagon	do	0	B3	R	R	CCCCCCCC	W	100	M	R	R	R	R	R	R			R	IR	S
3198	Sappora	Japan	0	B2	R	R	CCCCCCCC	W	66	L	R	R	R	R	R	R			R	IR	S
4316	Gandja	Transcaucasia	0	B2	R	R	CCCCCCCC	W	100	L	R	R	R	R	R	R			R	IR	S
4970	Rabat	Morocco	0	B1	R	R	CCCCCCCC	W	94	L	IR	IS	IS	IS	IS	R			R	IR	S
5062	Tills	Caucasus	0	W	R	R	CCCCCCCC	W	97	M	IS	IS	IS	IS	IS	R			R	IR	S
5239	Rangubori	Korea	0	W	R	R	CCCCCCCC	W	98	M	IS	IS	IS	IS	IS	R			R	IR	S
5555	Muller	Turkey	0	B1	R	R	CCCCCCCC	SW	58	M	R	R	R	R	R	R			R	IR	S
5644	Caspian	Kuban	0	W	R	R	CCCCCCCC	SW	73	M	R	R	R	R	R	R			R	IR	S
5647	Marco	do	0	W	R	R	CCCCCCCC	SW	98	M	R	R	R	R	R	R			R	IR	S
5559	Gonzall	Gonzall, U. S. S. R.	0	Bk	R	R	CCCCCCCC	W	67	L	R	R	R	R	R	R			R	IR	S
6306	Ricardo	Uruguay	2	B1	R	R	CCCCCCCC	W	56	E	IR	R	R	R	R	R			R	IR	S
7123	Bolron	Wisconsin	6	B2	R	R	CCCCCCCC	W	99	M	R	R	R	R	R	R			R	IR	S
7381	Mayagi No. 12	Japan	6	W	R	R	CCCCCCCC	W	100	M	R	R	R	R	R	R			R	IR	S
7573	Tuck	Kentucky	6	B2	R	R	CCCCCCCC	W	100	M	R	R	R	R	R	R			R	IR	S
7574	Kenbar	do	6	B7	R	R	CCCCCCCC	W	100	L	IR	R	R	R	R	R			R	IR	S
8068	Polong	Hybrid	0	W	R	R	CCCCCCCC	W	98	M	R	R	R	R	R	R			R	IR	S
8079	Mo. B576	do	0	B2	R	R	CCCCCCCC	W	99	M	R	R	R	R	R	R			R	IR	S
8253	Peragis	France	0	B7	R	R	CCCCCCCC	W	99	E	IR	R	R	R	R	R			R	IR	S
8323	Schribaux	do	0	W	R	R	CCCCCCCC	W	99	L	R	R	R	R	R	R			R	IR	S
8809	Wedlin	Germany	0	W	R	R	CCCCCCCC	W	99	E	IR	R	R	R	R	R			R	IR	S
8811	Franger	do	0	B3	R	R	CCCCCCCC	W	98	M	R	R	R	R	R	R			R	IR	S

<sup>1</sup> Column 1—6=six-rowed; 2=two-rowed; D=deficiens; U=intermedium; I=irregular.

<sup>2</sup> Column 2—Kernel color: B=blue; W=white; Bk=black; P=purple.

<sup>3</sup> Column 3—Awn type: R=rough; SS=semismooth; S=smooth; A=awnless; H=hooded.

<sup>4</sup> Column 4—Kernel type: C=covered; N=naked.

<sup>5</sup> Column 5—Rachilla hairs: L=long; S=short.

<sup>6</sup> W=winter, SW=semiwinter, S=spring.

<sup>7</sup> Average percentage of 5 readings: McCullers 1950-51, 1951-52; Statesville 1951-52; Waynesville, 2 replications, 1952-53.

<sup>8</sup> E=early; M=midseason, L=late.

<sup>9</sup> R=resistant; IR=intermediate to resistant; I=intermediate; IS=intermediate to susceptible; S=susceptible.

<sup>10</sup> Eastern soil-borne viruses *Marmor tritici* var. *typicum* and *M. tritici* var. *fulvum*.

*Attributes of Entries From Various Areas of the World*

In table 6 the entries in this study are divided into eight groups, according to the area of the world from which they were obtained. The eight areas are Europe, Middle East, Far East, Russia (now U. S. S. R.), Africa, South America, Australia, and North America. This is not a representative sample from all the countries, but it gives an indication of what can be expected from barley collected from each area.

The winter-hardy entries were restricted to a few areas. Some winter-hardy entries were from Germany, France, and neighboring countries, but almost no winter types were received from northern Europe. Turkey was the main source of winter-hardy barley from the Middle East. Apparently mixtures of winter and spring types are grown in Turkey. Japan, Korea, and China (excluding Manchuria) also had some winter types. Only nine winter-hardy entries from Russia were saved.

Varieties or selections resistant to powdery mildew were received from all eight of the areas. The chief source of resistant entries in Europe was Germany, where considerable research has been done on this disease. Several resistant entries, all with the spring habit of growth, were obtained from India. Resistant entries were received from each of the African countries listed.

TABLE 6.—*Attributes of varieties of barley from various areas of the world and number from each area*

Country where collected	Total	Winter Hardy	Resistant to—			Susceptible to viruses
			Powdery mildew	Leafrust	Scald	
	Number	Number	Number	Number	Number	Number
Europe (other)	56	17	20	16	29	1
Austria	1	1	0	0	3	0
Belgium	1	0	0	0	1	0
France	10	4	1	6	5	0
Germany	17	6	9	1	10	0
Greece	1	1	1	0	0	0
Holland	3	2	0	1	0	0
Italy	3	0	2	3	3	0
Orkney Island	1	0	0	0	1	0
Poland	1	0	1	2	1	0
Portugal	1	0	0	0	1	0
Rumania	1	1	0	0	1	0
Spain	5	0	4	3	1	0
Sweden	1	0	0	0	1	0
Yugoslavia	2	0	2	0	0	0
Middle East:						
Iran	4	0	2	0	1	3
Iraq	4	0	2	0	1	0
Turkey	38	23	5	3	16	1
Afghanistan	2	0	1	0	0	0
India	47	0	32	0	2	3
India (Kashmir)	3	1	0	0	1	0
Total	108	21	42	3	21	10

TABLE 6.—Attributes of varieties of barley from various areas of the world and number from each area—Continued

Country where collected	Total	Winter hardy	Resistant to—			Susceptible to viruses
			Powdery mildew	Leaf rust	Scald	
	Number	Number	Number	Number	Number	Number
<b>Far East:</b>						
Ash.....	2	0	0	1	0	0
China.....	13	6	5	0	0	2
Manchuria.....	1	1	0	0	1	0
Tibet.....	1	0	0	0	1	0
Korea.....	10	5	0	1	2	6
Japan.....	22	7	7	0	4	8
Total.....	49	19	12	2	8	23
<b>Russia (now U. S. S. R.) (other):</b>						
Crimea.....	2	0	2	0	0	1
Caucasus.....	7	5	2	1	6	2
Caucasus (Daghestan).....	2	0	0	1	1	0
Caucasus (Kubanska).....	5	0	5	2	4	2
Transcaucasia.....	8	0	4	2	3	3
Transcaucasia (Georgia, Tiflis).....	1	0	1	0	1	0
Transcaucasia (Azerbaijan, Baku).....	1	0	1	0	1	1
Transcaucasia (Armenia, Gorzalli).....	1	1	1	0	0	0
Transcaucasia (Armenia, Assafute).....	2	1	0	0	1	0
Turkestan.....	1	0	0	0	0	0
Total.....	41	9	17	5	20	14
<b>Africa (other):</b>						
Algeria.....	7	0	3	7	2	0
Egypt.....	10	0	4	6	3	0
Ethiopia.....	8	0	4	1	1	1
Morocco.....	15	0	9	2	4	2
Tunisia.....	1	0	1	1	0	0
Tunis.....	5	0	2	4	2	0
Total.....	46	0	23	20	12	3
<b>South America:</b>						
Argentina.....	1	1	0	0	1	0
Chile.....	1	0	1	1	0	0
Uruguay.....	1	0	1	1	1	0
Total.....	3	1	2	2	2	0
<b>Australia:</b>						
Total.....	6	0	2	1	3	0
<b>United States and Mexico:</b>						
California.....	2	1	1	0	2	0
Colorado.....	1	0	0	0	0	0
Georgia.....	1	1	0	0	0	0
Kentucky.....	2	2	2	0	1	0
Maryland.....	1	1	0	0	0	1
Minnesota.....	1	1	1	0	0	0
Missouri.....	3	2	0	0	2	1
North Carolina.....	2	2	0	0	2	0
North Dakota.....	1	1	0	0	0	0
Oklahoma.....	1	0	0	0	0	0
Virginia.....	4	3	0	0	3	0
West Virginia.....	1	0	0	0	0	0
Wisconsin.....	3	0	2	1	1	0
Oregon.....	1	1	0	0	1	1
New Jersey.....	2	1	0	0	1	0
Mexico.....	2	0	1	0	0	0
Total.....	27	16	7	1	13	4
<b>Plant selection:</b>						
Hybrid.....	14	2	3	3	6	1
Unknown.....	10	4	7	0	7	1
Total.....	12	4	3	1	3	1
Total.....	36	10	13	4	16	3
<b>Grand total</b> .....	<b>372</b>	<b>96</b>	<b>138</b>	<b>55</b>	<b>124</b>	<b>58</b>

Entries resistant to leaf rust were not found in all parts of the world. Few of the varieties or selections from the Middle East, Far East, or Russia were resistant to leaf rust. Twenty of the 46 varieties saved from Africa were resistant to leaf rust. Some of the leaf-rust-resistant varieties from France had the winter-type growth.

The sources of resistance to scald were well distributed throughout the world. There were 10 and 16 entries resistant to scald from Germany and Turkey, respectively. All 3 of the entries from Italy and 11 of 14 entries from the Caucasus area were resistant to this disease.

Of the 198 entries from Middle East, Far East, and Russia, 187 were susceptible to leaf rust and 47 were susceptible to soil-borne viruses. Only 11 varieties and selections from other countries were susceptible to these viruses and the ancestry of some of those may trace back to areas where susceptibility to viruses is prevalent.

## DISCUSSION

Information is needed on the most desirable varieties for use in barley improvement. Numerous studies have been made in which outstanding varieties for special characteristics have been found. Hamilton<sup>6</sup> listed the varieties outstanding for resistance to 15 plant pathogens and insects that attack barley, for tolerance to drought, and for good malting quality, good lodging resistance, and early maturity.

## SUMMARY

A summary of results from tests of the entries in the world collection of barley maintained by the Cereal Crops Section, Field Crops Research Branch, during 4 years in the winter barley-producing area of South-eastern United States is presented in this bulletin. The characteristics studied were winter survival, habit of growth, and reaction to powdery mildew, leaf rust, eastern soil-borne viruses, and scald. Possible sources of varieties or selections outstanding for each of these characteristics are discussed.

The 6,273 entries in the world collection of barley in 1950 were tested for their reaction to powdery mildew. The entire collection was tested in the seedling stage to a composite of powdery mildew races 4, 9, and 14. Readings were obtained each year on the portion of the collection grown in the field in North Carolina and Tennessee. Some of the entries resistant to powdery mildew in the seedling stage failed to survive the winter in North Carolina, and thus no data on powdery mildew were obtained in the field. The varieties outstanding for resistance to powdery mildew in the seedling stage have been reported (11).

<sup>6</sup> Canadian genetic stock collection of barley, compiled by D. G. Hamilton, Cereal Crops Division, Central Experimental Farm, Ottawa, Canada. [Unanumb. Pub.] 33 pp. 1955. [Processed.]

The entries listed as having some tolerance to cold weather were tested in the colder areas of Southeastern United States. The winter survival at other locations is given for some of the entries.

The field reactions of the varieties and selections resistant to leaf rust in North Carolina in 1951 and 1952 are compared with those tested in Florida and Virginia in 1954 and in Wisconsin in 1942. There was good agreement in the results obtained in these widely separated areas and tests. Thirteen entries resistant in these field tests have been reported to be resistant to at least five races of the organism in the seedling stage.

Forty-seven of the 58 entries susceptible to the eastern soil-borne viruses originated in the Middle East, Far East, or Russia. Varieties from this area previously have been reported to be susceptible.

The reaction of entries to scald was tested only 1 year, and 124 entries were resistant. The varieties reported by Riddle and Suneson (15) and Poehlman (14) as being resistant also were resistant in this test.

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**END**