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in cooperation with

Division of Cereal Crops and Diseases
Bureau of Plant Industry
United States Department of Agriculture

VELVON, A NEW SMOOTH-AWNED BARLEY[1]

by R. W. Woodward and D. C. Tingey[2]

VELVON, a new barley variety with smooth awns, with relatively stiff straw, and with a high degree of resistance to covered smut was developed at the Utah Agricultural Experiment Station through the cooperative efforts of the Station and the Division of Cereal Crops and Diseases, Bureau of Plant Industry, U. S. Department of Agriculture. This new variety resulted as a hybrid strain from a cross made in 1930 for the purpose of improving straw strength and the texture of awns.

A smooth-awned barley is especially desirable since a large portion of the straw produced on irrigated farms is used for feeding or bedding livestock. Since much of the grain is cut with a binder, shocked, stacked or hauled to a thresher, it requires considerable hand labor making a smooth-awned barley much less disagreeable.

Barley has been found to produce more feed units than other small grains in this area[3], which in part accounts for its rapid expansion in acreage. From 1924 to 1934 there was an average of 34,800 acres of barley grown in Utah. Since 1934 there has been a steady increase, the acreage in 1939 totaling 65,000 with an estimated production of two and one-half million bushels. More than one fifth of the farmers in the State of Utah grow barley. Since the farms are comparatively small the average acreage per farm is from 6 to 10 acres (table 1). It should be noted that acre yields in 1934 were considerably below average.

How Velvon Was Produced

VELVON was selected from a Colorado selection 3063 x Trebi cross. The Colorado selection 3063 (from a Coast x Lion cross) was one of a number obtained from D. W. Robertson of the Colorado Agricultural Experiment Station. Trebi, the other par-

1. Contribution from the Department of Agronomy and Soils, in cooperation with the Division of Cereal Crops and Diseases.
2. Assistant agronomist, Division of Cereal Crops and Disease, Bureau of Plant Industry, and research associate professor of agronomy and soils, Utah Agricultural Experiment Station, respectively.
3. Utah Agr. Exp. Sta. Bul. 263. 1935.

*Table 1. Average acreage, percentage of farms growing barley, and average acreage per farm devoted to barley in each county of the state, 1929 and 1934**

County	Acreage		Farmers growing barley			Average acreage per farm		
	1929	1934	1929	1934	Avg.	1929	1939	Avg.
	acres			*percent*			*acres*	
Beaver	443	187	23	8.7	15.9	5	4.8	4.9
Box Elder	5,197	4,424	30	24.3	27.2	9	7.8	8.4
Cache	4,399	4,176	25	25.4	25.2	7	6.9	6.95
Carbon	180	72	10	5.6	7.8	6	3.1	4.6
Daggett	178	69	37	9.9	23.5	9	8.6	8.8
Davis	1,309	850	18	13.7	15.9	5	3.8	4.4
Duchesne	1,050	273	24	6.0	15.0	4	3.8	3.9
Emery	617	129	15	5.2	10.1	6	2.7	4.4
Garfield	860	382	17	13.2	15.1	10	5.9	8.0
Grand	20	10	6	.6	3.3	20	10.0	15.0
Iron	361	456	13	15.6	14.3	5	5.0	5.0
Juab	640	223	22	9.2	15.6	66	4.6	5.3
Kane	...	28	..	3.5	...	..	3.1	...
Millard	1,497	1,277	16	14.3	15.2	7	6.9	6.95
Morgan	958	1,021	62	64.2	64.1	6	6.2	6.1
Piute	395	527	29	33.3	31.2	6	6.2	6.1
Rich	1,004	295	30	13.1	21.6	12	8.2	10.1
Salt Lake	1,632	1,502	11	9.4	10.2	5	4.5	4.8
San Juan	704	134	8	1.0	4.5	20	22.3	21.2
Sanpete	2,797	1,810	27	17.3	22.2	6	6.0	6.0
Sevier	2,888	2,239	43	38.2	40.6	6	5.6	5.8
Summit	1,084	569	33	18.1	25.6	7	5.7	6.4
Tooele	780	450	24	10.1	17.1	8	6.3	7.2
Uintah	1,047	592	22	9.2	15.6	5	4.6	4.8
Utah	3,600	4,022	20	21.6	20.8	5	4.7	4.9
Wasatch	805	498	32	29.0	30.5	6	3.5	4.8
Washington	613	815	15	15.2	15.1	6	4.4	5.2
Wayne	1,080	767	40	30.5	35.3	11	8.6	9.8
Weber	1,931	1,419	24	16.8	20.4	4	4.1	4.1
State	38,069	28,916	22.2	16.8	19.5	6.3	5.6	6.0

*Data based on U. S. Census Reports, 1930 and 1935.

ent, has been a leading commercial barley variety grown in Utah for many years. It is a high yielding variety, but is weak-strawed with rough awns, is resistant to loose smut, but susceptible to covered smut.

Velvon was one of a group of head selections made in 1932. In 1934 the more promising strains were entered into the yield nursery. Strain (B2-1), which later was named Velvon, showed a smooth awn and appeared homozygous for white aleurone, stiff straw, and other visible characters in the F_3 rows. Later studies showed this to be true in most details.

Yield Data

Nursery Tests

COMPARATIVE yield tests at Logan (tables 2 and 3) indicate the approximately equal value of Trebi and Velvon for grain production. Both varieties have been grown under similar condi-

Table 2. Comparative yields of Trebi and Velvon in nursery tests at Logan, 1934 *to* 1939

Year	Acre yield		Yield of Velvon in percent if Trebi equals 100
	Trebi	Velvon	
	bushels	*bushels*	*percent*
1934	102.4	100.2	97.9
1935	106.3	109.4	102.9
1936	102.3	90.7	88.7
1937	70.4	80.4	114.2
1938	86.2	89.9	104.3
1939	76.4	78.4	102.6
1940	72.2	85.9	119.0
Average	88.0	90.7	104.2

Table 3. Comparative 1/60 *acre plot yields of Trebi and Velvon at Logan,* 1935 *to* 1939

Year	Acre yield		Yield of Velvon in percent if Trebi equals 100
	Trebi	Velvon	
	bushels	*bushels*	*percent*
1935	88.1	95.6	108.5
1936	83.7	92.4	110.4
1937	69.1	78.2	113.2
1938	94.9	95.6	100.7
1939	94.8	86.5	91.2
1940	66.7	72.6	108.8
Average	82.9	86.8	105.5

tions for a seven-year period. Velvon averaged 104.2 percent as compared with Trebi at 100 percent in the rod-row nursery.

Plot Tests

In 1935 Velvon was introduced into the drilled plot tests which averaged 1/60 of an acre in size. During the 6 years of comparative tests Velvon has averaged 86.8 bushels to 82.9 for Trebi. On a percentage basis with Trebi equalling 100, Velvon equals 105.5 percent.

State-wide Tests

Special nursery tests on high and low productive soils as well as comparisons of early and late seedings were also made during 1937 and 1938 in four counties of the state, namely, Cache, Salt Lake, Sevier and Iron. During the 5 years in which Trebi and Velvon were compared in these state-wide tests, which includes the special tests, the yields were slightly in favor of Velvon, although in 6 of the 20 single comparisons Trebi led by a small percentage. No significant yield differences appeared to exist in any of the counties during the years under observation. Average yields for Trebi and Velvon were 72.2 and 75.0 bushels, respectively. Velvon yielded 105.3 percent with Trebi equal to 100 (table 4).

Table 4, Average percentage yield comparisons of Trebi and Velvon in state-wide varietal tests, 1935 *to* 1939

Year	Counties	Acre yield		Yield of Velvon in percent if Trebi equals 100
		Trebi	Velvon	
		bushels		*percent*
1935	Cache	106.3	109.4	102.9
	Salt Lake	106.8	106.8	100.0
	Utah	63.3	68.0	107.4
	Iron	31.9	39.0	122.2
	Box Elder	103.8	98.0	94.4
			Average	105.4
1936	Cache	102.2	96.4	94.3
	Utah	86.0	87.2	101.4
	Iron	56.1	52.6	93.8
			Average	96.5
1937	Cache	45.0	43.0	95.6
	Salt Lake	61.0	62.0	101.6
	Sevier	62.0	73.0	117.7
	Iron	87.0	88.0	101.2
			Average	104.0
1938	Cache	59.0	69.0	117.0
	Salt Lake	43.0	57.0	118.6
	Sevier	28.0	35.0	125.0
	Iron	65.0	67.0	103.1
			Average	115.9
1939	Cache	81.9	78.4	95.7
	Salt Lake	84.5	99.4	117.6
	Sevier	81.5	88.2	108.2
	Iron	89.4	87.8	98.2
			Average	104.9
Average		72.2	75.0	105.3

Early seedings were made as soon as the soil could be properly tilled, while late plantings were made some 18 to 25 days

later. With early seeding the average yields of Trebi and Velvon were 65.9 and 67.0 bushels, respectively. Late seeding averages were 50.9 for Trebi and 55.8 bushels for Velvon.

Average yields on high productive soils were 79 and 73 bushels for Velvon and Trebi, respectively, while on low productive soils average yields were 48 and 43 bushels, respectively, for Velvon and Trebi.

In 1936 over 70 farmers grew Velvon and Trebi side by side in plots varying from 1 to 3 acres each. Yields were obtained by the farmers or county agricultural agents. The successful tests show an average for Trebi of 69.0 bushels compared with 73.8 bushels for Velvon. Many farmers reported losses from Trebi during harvest as a result of the weaker straw and dropping heads.

Available yield data from commercial fields show Velvon to yield as well under Utah conditions as does Trebi.

Comparative Yields of Trebi and Velvon in the Western and Central States

SINCE Velvon was released in 1935 it has been tested rather widely in adjoining states. It is not especially surprising to find that it resembles its one parent Trebi in being well adapted to a rather extensive area.

Comparative yields of Trebi and Velvon have been obtained from a number of agricultural experiment stations and are presented in table 5. No additional agromonic data are included since only yield comparison were requested. From a close inspection of the results, it appears that Velvon is equal in yield to Trebi in the areas represented by these tests. The average yield in bushels per acre for the 47 station years is 48.0 for Trebi and 50.5 for Velvon. When compared on a percentage basis with Trebi equalling 100, Velvon averages 112.1. Trebi leads in 14 of the 47 individual comparisons and in 2 of the 10 state averages.

Comparative Resistance to Loose and Covered Smut

THREE distinct smut species have been found to attack barley in the United States. The most common of these is covered smut (*Ustilago hordei*). It is usually found in the barley seed as lumps of smut at harvest time. A second species found in Utah is the loose smut or blow smut (*Ustilago nuda*), which is conspicuous at heading time but is soon blown about, leaving only the bare rachis at maturity.

*Table 5. Comparative acre yields of Trebi and Velvon in Western and Central States**

Location		Variety			Percentage of Velvon when Trebi equal 100
		Year	Trebi	Velvon	
			bushels	*bushels*	*percent*
Montana					
	Bozeman	1937	76.2	102.7	134.8
		1938	68.2	72.0	105.6
		1939	46.0	37.1	80.7
		Avg.	63.5	70.6	107.0
	Moccasin	1938	43.6	50.0	114.7
		1939	22.5	29.2	129.8
		Avg.	33.1	39.6	122.3
	Corvallis	1938	60.4	60.4	100.0
		1939	39.0	49.4	126.7
		Avg.	49.7	54.9	113.4
	Kalispell	1938	31.0	30.5	98.4
		1939	57.1	62.7	109.8
		Avg.	44.1	46.6	104.1
	State avg.		49.3	54.9	111.1
Washington					
	Pullman	1938	66.2	77.5	117.1
		1939	57.2	56.7	99.1
		1940	53.4	60.1	112.5
		Avg.	58.9	64.8	109.6
Oregon					
	Pendleton	1937	56.9	47.6	83.7
		1938	60.3	64.6	107.1
		1939	61.9	63.4	102.4
		1940	37.6	36.5	97.1
		Avg.	54.2	53.0	97.6
Idaho					
	Aberdeen	1936	102.5	96.4	94.0
		1937	103.9	107.5	103.4
		1938	115.3	113.1	102.5
		1939	112.8	103.2	91.5
		1940	106.7	103.8	97.3
		Avg.	108.2	104.8	97.7
Arizona					
	Flagstaff	1937	23.9	28.5	119.2
	Camp Verde	1938	57.3	66.5	116.1
		Avg.	40.6	47.5	117.7
Colorado					
	Ft. Collins	1937	58.4	63.4	108.6
		1938	58.4	57.7	98.8
		1940	59.9	63.3	105.7
		Avg.	58.9	61.5	104.4
Kansas					
	Hays	1937	13.8	24.8	179.8
		1938	40.0	49.6	124.0
		1939	6.8	14.8	217.6
		1940	35.3	40.5	114.7
		Avg.	24.0	32.4	159.0

Table 5. Comparative acre yields of Trebi and Velvon in Western and Central States, continued*

Location		Year	Variety		Percentage of Velvon when Trebi equal 100
			Trebi	Velvon	
Wyoming			*bushels*	*bushels*	*percent*
	Afton	1937	30.0	32.4	108.0
		1938	41.7	38.3	91.8
		1939	86.8	76.4	88.0
		1940	60.0	67.5	112.5
		Avg.	54.6	53.7	100.1
North Dakota					
	Fargo	1939-40	31.8	36.3	114.1
	Dickenson	1940	18.3	15.9	86.9
	Mandon	1940	15.0	17.8	118.7
	Langdon	1940	34.3	30.3	88.3
	Edgeley	1940	14.2	21.7	152.8
		Avg.	22.7	24.4	112.2
Nebraska					
	North Platte	1938	33.3	37.9	113.8
		1939	20.7	21.8	105.3
		Avg.	27.0	29.9	109.6
	Alliance	1938	45.6	37.5	82.2
		1939	18.3	20.1	109.8
		1940	4.0	5.9	147.5
		Avg.	22.6	21.2	113.2
	Lincoln	1938	41.6	45.7	109.8
		1939	8.9	11.4	128.1
		1940	18.9	21.1	111.6
		Avg.	23.1	26.1	116.5
State avg.			23.9	25.2	113.5
47 station years			48.0	50.5	112.1

*Tht tests in Montana were under the supervision of R. H. Bamberg; in Washington, O. E. Barbee; Oregon, J. F. Martin; Idaho, Harland Stevens; Arizona, A. T. Bartel; Colorado, D. W. Robertson; North Dakota, T. E. Stoa; Nebraska, K. S. Quisenberry; Kansas, A. F. Swanson, and Wyoming, R. J. Hyer.

Another species of smut (*Ustilago nigra*) has been found in other parts of the United States. It resembles the loose smut in appearance and the covered smut in its propagation. It has not thus far been found in Utah.

Until 1933 no data were available on the relative resistance of barley varieties to the various smuts described. It was, however, observed and reported that Trebi was especially susceptible to the covered smut.

Covered smut tests conducted over a four-year period showed that Velvon inherited a high degree of resistance from the Coast and Lion parental stock. The average percentage smut in all tests was 27.3 for Trebi and 0.5 for Velvon. Some of these tests were

conducted in other states. Although considerable variation in infection occurs from year to year, the comparative behavior of Trebi and Velvon to the covered smut organism has been consistent. Preliminary tests show Velvon to be resistant to *Ustilago nigra* while Trebi shows considerable susceptibility.

Trebi appears to be resistant to the common loose smut (*Ustilago nuda*). Many selections of Velvon appear to have this same resistance and are now being multiplied. Since Trebi was one of the parent varieties it is only natural that part of the progeny should inherit this resistance, which in a 3-year smut test they appear to have done. The best of those strains are being bulked as a new source of Velvon resistant to both the loose and covered smuts found in this area.

Agronomic Data

THE relative straw strengths of Trebi and Velvon for a 5-year period as shown by the amount of lodging are 25.4 and 8 percent, respectively. In years of severe lodging, however, both varieties may go down badly. Average test weights per bushel over a 5-year period for the two varieties are 48.0 and 48.6 pounds per bushel, respectively, for Trebi and Velvon. Trebi shows an average height of 37.7 inches to 38.5 inches for Velvon. Velvon heads approximately 2 days earlier than Trebi but the average ripening dates are about the same.

Present Status of Barley Breeding

VELVON has answered a long felt need for a smooth-awned barley variety adapted to the irrigated farms of Utah and adjoining states. It has shown some weak points which, however, may be improved by selection or by further hybridization. It is also possible that an even more desirable smooth-awned variety of barley may come out of crosses not involving Velvon or its parent varieties.

Most smooth-awned varieties of barley found in the Great Basin areas have poorly feathered styles which may reduce the fertility considerably in unfavorable seasons. Velvon is no exception in this respect, and is as deficient as are most other smooth-awned varieties. Nevertheless, crosses involving Velvon, which are much improved as far as feathered styles are concerned, have been isolated.

Summary

VELVON is a new smooth-awned variety of barley with relatively stiff straw and with a high degree of resistance to the races or strains of covered smut found in Utah. This variety was selected in 1934 from a cross of Colorado selection 3063 x Trebi made in 1930. It has now largely replaced Trebi in Utah. Comparative tests show it to be equal in yield, quality, and other agronomic characters to the better adapted varieties of this region.

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