

3

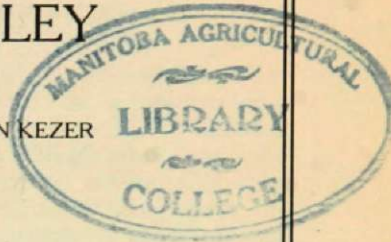
1) Colorado
2) Agricultural Experiment Station

3) 4)
Bulletin 303

October, 1925

COLSESS BARLEY

By
D. W. ROBERTSON AND ALVIN KEZER



Colsess Barley

COLORADO EXPERIMENT STATION
Agricultural Division
Fort Collins

COLSESS BARLEY

By D. W. ROBERTSON and ALVIN KEZER

Colorado has many problems in agriculture arising from the varied climatic factors naturally encountered in a mountainous state. Perhaps one of the most important of these is the production of a grain feed for our high-altitude farms. Much work has been done in testing varieties in our higher altitudes. Adaptable corn varieties have been found for many parts of the State where the altitude is not too high. In fact, the corn acreage of the State has been increased from 420,000 acres in 1913 to 1,643,000 acres in 1925.

But even with this increase no variety commercially adapted for the higher altitudes has been found. However, experimental results show that at altitudes over 6,000 feet barley outyields corn.

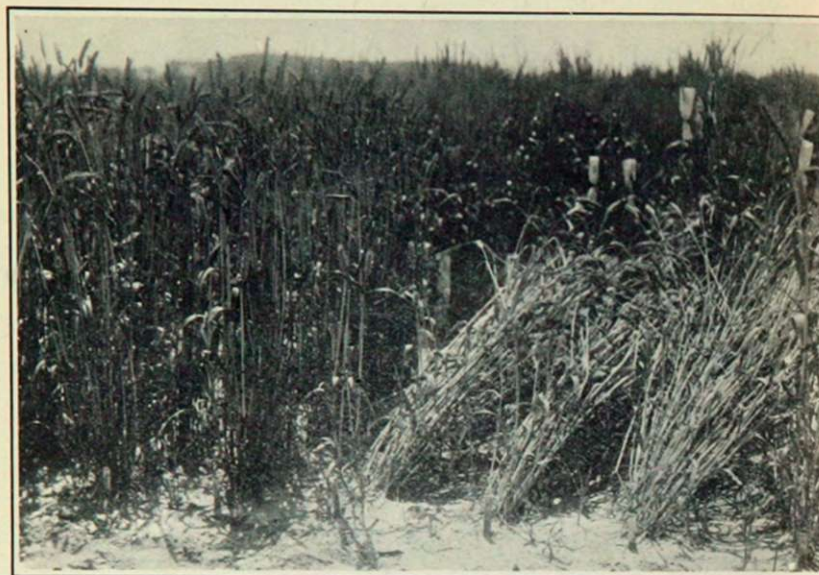
One difficulty with barley has been that we have no high-yielding beardless variety. The bearded varieties while outyielding the beardless varieties are not considered the best for feed, due to the presence of the awn in the threshed grain and straw. The production of a high-yielding beardless barley seemed to be the best means of solving the feed-grain situation for the higher altitudes. With this objective the Agronomy Department started breeding barley in 1911 and has finally produced a high-yielding beardless (hooded) barley called Colsess.



Grain of Colsess Showing Hood.

COLSESS DESCRIPTION

Colsess is a hooded six-rowed barley of hybrid origin. It was produced from a cross between Coast and Success. The heads are more compact and darker in color than the Success parent. In color Colsess more closely resembles the Coast parent. It has a bluish green tinge due to the grain which has a bluish aleurone layer. The base of the hood has a rather distinct saw edge similar to that of Success. But in some cases it is more marked. The head is less brittle than either the Coast or Success parent and therefore shatters less. The straw is stiffer and stands up better under wet conditions than either parent. Table No. VI, which gives the straw data for a six-year period at the Colorado Experiment Station clearly shows this.



Colsess Selections—Two head rows at left stiff strawed. The three head rows at right are weak strawed and lodged. The weak strawed strains were rejected.

ORIGIN

Colsess is a selection from a cross between Coast, C. I. No. 2791, and Beardless made at the Colorado Experiment Station in 1911 by D. W. Frear,* who was then connected with the Agronomy Department. Beardless is a strain of the variety commonly called Success, also known as Horsford. Several crosses were made at this time to improve the various barleys grown at the Station. As Coast, our highest-yielding strain, has a very persistent barbed awn which makes it undesirable for feeding, an attempt was made to combine the high yield of Coast with the hood of the Beardless. Crossing Coast with Beardless gave a number of plants in the second generation which afterwards bred true for the hooded habit. These plants and their progenies were tested for yield and the highest-yielding strain was finally selected.

A detailed account of the procedure and number of individuals used is given below. In 1912 ten seeds were planted from the cross made in 1911. In 1913 one thousand eight hundred thirty-four plants were harvested. One thousand four hundred two were hooded and four hundred thirty-two were bearded. From the hooded plants

*The production of Colsess is the successful result of continued work of a changing group of men in the Agronomy Department.

From 1911 to 1925 inclusive three men have been associates directly responsible for the conduct of the breeding work. Mr. D. W. Frear made the crosses in 1911 and looked after the first two generations of the progenies. Mr. Breeze Boyack cared for the work from 1913 to June, 1920. Since July, 1920, Mr. D. W. Robertson has been immediately responsible.

one hundred sixty-four plants were selected and planted in 1914. By this time sufficient seed of the strains had been obtained to replicate the rows. In 1915 seven hundred fifty-six rows were planted and yield tests made. Many of the plants were discarded this year and only a small number of strains which bred true for the hooded habit were planted in replicated rows and tested in 1916. In 1917 and 1918 only eighteen of the original strains were left. These were planted in replicated plats each year and yield tests were made as in the previous years. In 1919 only nine of the original strains were left and from these the highest yielder was obtained in 1920. This selection yielded better than the other strains for a period of five years. See Table I. Since 1921 Colless has been included in the variety tests with other standard varieties. The total number of plats or rows used in producing Colless was one thousand five hundred thirty-seven.

Table I gives the yields of some of the best selections from the cross between Coast C. I. 2791 and Beardless. Yields were taken first in 1916. The final selection was made in 1920. Table I shows that cross 30-0-2-5-x outyielded all the other selections three years out of five, while no other selection had the highest yield for more than one year. For this reason cross 30-0-2-5-x was selected and placed in the variety test.

Table I—Yields of the different strains of Colless selected from cross 30. Cross 30-0-2-5-x is Colless, Colorado No. 259. The yields in 1916 and 1917 are given in grams per plat and the yields for 1918, 1919 and 1920 are given in bushels (48 pounds) per acre with the probable error of the yields.

Cross	Y E A R S G R O W N							
	Yield	Probable	Yield	Probable	Yield	Probable	Yield	Yield
	Bushels per acre 1920	Error 1920	Bushels per acre 1919**	Error 1919	Bushels per acre 1918	Error 1918	Grams per plt 1917	Grams per plt 1916
30 0-2-5-x	84.8	±2.1*	53.1	±1.2*	82.8	±2.2*	937	535
30-0-2-21-x	80.6	±2.0	51.8	±1.2	81.8	±2.0	906	409
30-0-54-2-x	73.9	±1.9	50.6	±1.1	76.1	±1.8	896	435
30-0-43-32-x	73.0	±1.8	52.5	±1.2	74.7	±1.8	900	622
30 6-9-1-x	70.5	±1.8	52.7	±1.2	72.5	±1.8	895	447
30-0-43-10-x	70.3	±1.8	52.6	±1.2	67.8	±1.6	918	422
30-0-59-15-x	67.8	±1.7	46.2	±1.0	76.5	±1.8	978	450
Coast	78.1	±2.0	60.1	±1.4				
Beardless	60.8	±1.5	39.8	±0.9				

*Probable errors obtained by the pairing method of T. B. Wood and F. J. M. Stratton, in *Journal Agri. Sci.* 3, 415-440, 1910, and A. C. Arny and F. H. Steinmetz, *Journal Amer. Soc. Agron.*, V. 2, No. 3, pp. 81-106.

**1919 one of the driest years ever recorded in Colorado

PARENTS







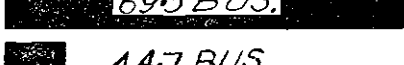

Coast.—This barley, known as California Feed, Bay Brewing and Blue, is probably of North African origin. In bulletin 312 of the University of California, Coast is described as possibly coming to this country through the agency of the Spanish conquerors. The original parent of all the Coast strains at this Station came from Mr. Neff of Greeley, Colo., in 1906. The original type is that of the Coast parent C. I. No. 2791, Colorado No. 120. The other Coast strains are selections from the Centgener tests made at this Station between the years 1912 and 1917 inclusive. The head is slightly lax. The awns are heavy, coarse and rough. These qualities make it rather

hard to handle. The awn is tough, which makes it hard to thresh from the grain. This latter quality makes it a poor feed barley as stock are often injured by the awns. However, its high-yielding ability under Colorado conditions has made it one of the most widely grown varieties.

Success.—The original type of Beardless, Success or Horsford barley was produced by Mr. F. H. Horsford of Charlotte, Vt., in 1879 or 1880. He crossed Nepal on a six-rowed, bearded, hulled barley and obtained a six-rowed, hooded, hulled variety. From this original cross several selections have been made. Undoubtedly not all of the Success type are from Mr. Horsford's original cross, but, as stated by Mr. Harlan*, "they undoubtedly have been produced by crossing Nepal with barleys of the Manchuria type." Success is a low-yielding sort. It is very weak-strawed, lodging easily. The head is very brittle, causing it to shatter badly. These habits reduce the yield because a large amount of the grain falls to the ground where it cannot be harvested with machinery.

DISCUSSION OF YIELDS

Colsess yields favorably with our highest-yielding standard strains when tested under various conditions found in Colorado. In our irrigated sections it yields well and is much stiffer strawed than the varieties commonly grown. In the higher altitudes it has out-

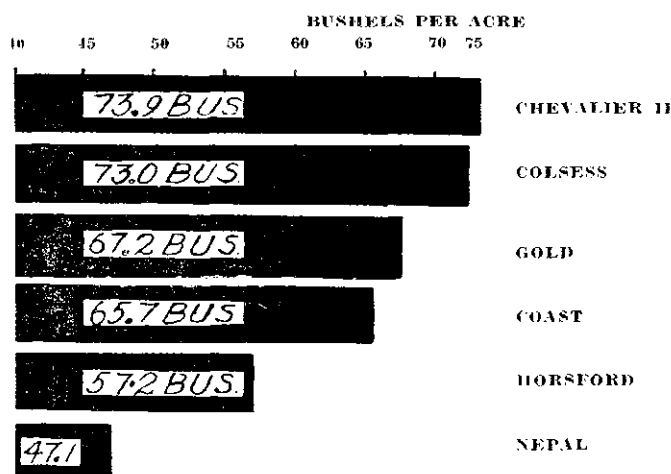
BUSHELS PER ACRE						
45	50	55	60	65	70	75
						
75.0 BUS.						
COAST NO. 8						
						
74.6 BUS.						
COLSESS						
						
72.0 BUS.						
COAST NO. 120						
						
71.6 BUS.						
HANNA						
						
71.3 BUS.						
COAST NO. 35						
						
71.2 BUS.						
COAST NO. 120						
						
69.5 BUS.						
COAST NO. 18						
						
44.7 BUS.						
HORSFORD						

Comparison of Colsess Barley Yields with Standard Barleys Grown at the Colorado Experiment Station for a Six-Year Period, 1918 to 1923 Inclusive. Yields Given in Bushels Per Acre (48lbs.).

* Unpublished data

yielded the common Coast strain, and all hooded barleys with which it has been tested.

Results Under Irrigation.—In Table II the yields of Colsess are compared with the highest-yielding Coast and Hanna strains, at Fort Collins, for a period of six years. Colsess is the second highest yielder. It is only outyielded by Coast C. I. No. 2785 by four-tenths of a bushel. This is less than the probable error of the Coast strain. Hanna C. I. No. 2784, the heaviest-yielding two-rowed barley at Fort Collins yields slightly less than Colsess. In some years it will be seen that Hanna outyields Colsess. In 1921 and 1922 it outyielded Colsess but Colsess outyields it four years out of six. The highest-yielding hooded barley, Beardless, has an average yield of 57.2 bushels for a six-year period, which is 17.4 bushels less than Colsess. While Horsford or Success yields 29.9 bushels less. Colsess has an average of 74.6 bushels per acre for six years.



Barley Yields for a Three-Year Period at Fort Lewis Substation, Hesperus, LaPlata County, Colorado. Altitude 7,610 Feet.

At Fort Lewis Colsess has an average yield of 73 bushels for a period of three years. Success, the highest-yielding hooded barley, yielded 15.8 bushels less; while Nepal, a hooded, hulless (bald) barley, yielded 25.9 bushels less. Coast, the highest-yielding six-rowed barley, has a yield of 7.3 bushels less. Chevalier II and Gold, two-rowed barleys, yield well but have the disadvantage of lodging under irrigation. If left to over-ripen they shatter very badly.

For a one-year test at Meeker, Colorado, at an altitude of about 6,200 feet, Colsess outyielded all hooded barleys and stood up well with Coast. At this altitude Colsess and Coast received no irrigation. Yields are given in Table IV. At Walden, where a similar test was made for one year, Colsess again outyielded the hooded barleys and stood up well with Coast.

COLORADO EXPERIMENT STATION

Table II.—Comparison of Colseess barley yields with standard high-yielding barleys grown at the Colorado Experiment Station for the six-year period, 1918 to 1923 inclusive. Yields are given in bushels (48 pounds) per acre.

Variety	C. I. No.	Other Identification Numbers	Yields in Bushels per Acre					Six-Year Aver.
			1918	1919	1920	1921	1922	
Coast	2785	8	78.8	67.5	81.8	79.7	72.4	69.8
Colseess	2792	Colo. 259	82.8	53.1	84.8	73.1	73.9	80.0
Coast	2791	Colo. 120		60.1	78.1	65.5	74.5	82.0
Hanna	2784		73.1	50.0	76.5	83.1	82.1	60.0
Coast	690	25	69.2	64.2	77.9	63.8	69.6	83.3
Coast	2789	Colo. 120	70.0	53.0	78.9	73.3	70.2	76.8
Coast	2790	18	69.8	62.9	78.0	72.4	61.8	72.3
Beardless*			62.7	43.6	53.0	51.5	71.0	62.2
Horsford	1271		32.2	28.2	50.5	56.3	51.1	50.5

* Beardless barley was grown in single plats until 1923 when it was included in the variety test.

PROBABLE ERRORS

Variety	C. I. No.	Other Identification Numbers	Probable Errors					Six-Year Aver.
			1918	1919	1920	1921	1922	
Coast	2785	8	±3.4	±2.6	±1.4	±2.1	±1.7	±2.1
Colseess	2792	Colo. 259	±2.2	±1.2	±2.1	±1.9	±1.7	±2.4
Coast	2791	Colo. 120		±1.4	±2.0	±1.7	±1.7	±2.4
Hanna	2784		±3.1	±2.3	±1.3	±2.2	±1.9	±1.7
Coast	690	25	±3.0	±2.5	±1.3	±1.7	±1.6	±2.5
Coast	2789	Colo. 120	±3.0	±2.3	±1.3	±1.9	±1.6	±2.3
Coast	2790	18	±3.0	±2.5	±1.3	±1.9	±1.4	±2.1
Beardless								±1.8
Horsford	1271		±1.4	±1.1	±0.8	±1.5	±1.2	±1.5

Table III.—*Barley yields for a three-year period at the Fort Lewis Sub-Station, Hesperus, La Plata County, Colorado. Altitude 7,610 feet.

Variety	Colo. No.	C. I. No.	1921 Bu. per Acre	1922 Bu. per Acre	1923 Bu. per Acre	3-year Average bu. per Acre
Chevalier 11	125	200	78.4	72.5	70.8	73.9
Colseess	259	2792	84.2	68.4	66.5	73.0
Gold	327	1145	76.0	52.2	72.4	67.2
Coast	120	2789	48.1	67.5	81.6	65.7
Success	324	1271	51.8	55.3	64.4	57.2
Nepal	112		30.2	57.4	53.6	47.1

Note: All bushel yields are calculated as 48 pounds per bushel.

* The tests at Fort Lewis were made by L. R. Quinlan and Harrison D. Horton, Assistants in Agronomy.

Table IV.—*Yield of Colseess compared with other barleys in different sections of Colorado in 1923.

Meeker, Colorado, Altitude About 6,200 Feet.			
Variety	Date Planted	Date Harvested	Yield Bu. per acre
Colseess	May 25	August 20	49.8
Nepal	May 12	August 20	42.8
Coast	May 25	August 20	50.2

The Colseess and Coast were planted on fallow and received no rain until August 1. The rate of seeding was 60 pounds per acre.

Nepal planted on fall-plowed alfalfa land was irrigated on June 15, and had abundant rainfall in August.

Walden, Colorado, Altitude About 8,200 Feet.				
Variety	Colo. No.	Source of seed	Yield bu. per Acre	Probable Error
Colseess	259	College	47.8	±3.5
Coast	120	College	41.3	±3.2
Success		Local	33.1	±2.4
Success	324	College	30.2	±2.4

Plats were planted side by side on a sandy loam soil.

Plats were irrigated on August 24 and harvested on September 10.

Forty-eight pounds was used in calculating bushel yields.

* Yields from demonstration fields. Courtesy R. W. Shafer, District Extension Agent, and Waldo Kidder, Extension Agronomist.

Considering the variety tests at Fort Collins and Fort Lewis and the demonstrations at Meeker and Walden it is clearly shown that Colseess outyields all strains of Horsford and Nepal grown in Colorado. It is further shown that it yields well, equalling Coast at all four places where tests have been made.

LENGTH OF STRAW

Where Colseess is grown as a hay crop the length of straw is an important factor. Table V gives the length of straw in inches at Fort Collins for a four-year period, 1920 to 1923 inclusive. It will be seen from this table that Colseess averages 36.9 inches, which ranks well with the Coast and Hanna strains under test.



Field of Colseess Barley at Fort Collins.

At Fort Lewis (Table VI) the straw is shorter than at Fort Collins. In comparing the length of the straw of the several varieties grown at Fort Lewis it will be seen that Colseess is as tall as Coast and Chevalier. Gold is shorter and Success is slightly longer.

Table V.—Length of straw in inches of varieties under test at Fort Collins, Colo.

Variety	C. I. No.	Other Identifi- tion Nos.	Years Grown				4-year Average Height in inches
			1920 Height in inches	1921 Height in inches	1922 Height in inches	1923 Height in inches	
Coast	2785	8	33.3	36.7	34.2	39.5	35.8
Colseess	2792	Colo. 259	34.5	39.1	34.8	39.5	36.9
Coast	2791	Colo. 120	31.4	38.8	34.7	37.6	35.6
Hanna	2784		34.2	38.0	35.4	39.5	36.8
Coast	690	25	33.9	38.7	34.8	38.4	36.4
Coast	2789	Colo. 120	33.0	37.1	33.1	37.6	35.2
Coast	2790	18	32.8	37.9	33.0	39.3	35.8
Beardless			37.8	44.0	42.0	45.1	42.2
Horsford	1271		39.3	44.0	40.1	44.9	42.1

Note: Length is the average of ten different measurements.

Table VI.—Length of straw in inches of Barley Varieties tested at Fort Lewis for the years 1921 and 1923.

Variety	Colorado No.	C. I. No.	1921 Height in inches	1923 Height in inches
Chevalier II	125	200	33	28
Colsess	259	2792	37	27
Gold	327	1145	32	26
Coast	120	2780	37	28
Success	324	1271	30	31
Nepal	112		35	31

The strength of straw is given in Table VII. From Table VII it is shown that for a six-year period Colsess stands up under varying weather conditions. Even in 1923, with over ten inches of rain in June and July, only a few plats of Colsess went down, while all other barleys under test lodged to some extent. The stiffest-strawed Coast, C. I. No. 2790, stood upright four years out of six. While Colsess stood up five out of six years, Beardless and Success lodged to some extent each year except in 1919 and 1920. Hanna lodged each year except in 1919 when practically all strains were upright, although the yields were low. This was one of the driest years in the history of Colorado and all crops were short strawed.

When comparing Table V with Table VII it will be seen that length of straw is not the determining factor in lodging. Short-strawed crops often have a tendency to lodge.

No data are available on strength of straw at Fort Lewis in 1921 and 1922. In 1923 Chevalier II and Gold lodged badly. Coast lodged slightly and Colsess and Success stood up.

Table VII.—Character of Straw of Colsess Barley compared with other standard varieties at the Colorado Experiment Station for the six-year period, 1918 to 1923, inclusive.

Variety	C. I. No.	Other Identification Nos.	Years Grown					
			1918 Character of Straw	1919 Character of Straw	1920 Character of Straw	1921 Character of Straw	1922 Character of Straw	1923 Character of Straw
Coast	2785	8	Stiff	Medium	Medium	Lodged	Lodged	Lodged*
Colsess	2792	Colo. 259	Stiff	Stiff	Stiff	Stiff	Medium	Medium*
Coast	2789	14	Stiff	Stiff	Medium	Lodged	Medium	Lodged
Coast	690	25	Stiff	Stiff	Medium	Medium	Lodged	Lodged
Coast	2791	23	Stiff	Stiff	Medium	Medium	Medium	Lodged
Coast	2790	18	Stiff	Stiff	Stiff	Lodged	Stiff	Lodged
Horsford	1271		Stiff	Stiff	Lodged	Medium	Lodged	Lodged
Hanna	2784		Medium	Stiff	Lodged	Lodged	Lodged	Lodged
Beardless			Medium	Medium	Stiff	Lodged	Medium	Lodged

Stiff—Stiff upright straw.

Medium—Partly lodged straw or when a part of the plat is lodged.

Lodged—When the entire plat is down.

* Some plats lodged; not all of the ten plats in the test.

NUMBER OF DAYS TO MATURE

Colsess is a medium-season barley. This makes it particularly desirable for high altitudes where barley is grown for grain. At Fort Collins, Colsess ripens about the same time as Coast and Success. The difference of two days in the four-year average does not hold each year. In no year has Colsess taken longer to mature than any of the other barleys under test. Hanna is slightly later than the others. At Fort Lewis (Table VIII) the difference is much more marked. Colsess and Success ripened earlier, with Nepal third and the other barleys from five to thirteen days later.

Table VIII.—Days to Mature Barley Varieties Tested at Fort Lewis.

Variety	Colorado No.	C. I. No.	Years Grown		1923 Days to Mature	3-year Average Days to Mature
			1921 Days to Mature	1922 Days to Mature		
Chevalier II	125	200	113	114	125	117
Colsess	259	2792	105	101	106	104
Gold	327	1145	113	114	114	114
Coast	120	2789	105	101	121	109
Success	324	1271	105	101	107	104
Nopal	112		105	111	107	108

Table IX.—Days to Mature Barley Varieties Tested at Fort Collins.

Variety	C. I. No.	Other No.	Years Grown		1923 Days to Mature	1919-23 Average Days to Mature
			1919 Days to Mature	1920 Days to Mature		
Coast	2785	8	Early	118	120	116
Colsess	2792		Medium	112	118	116
Coast	2789	14	Medium	118	119	116
Coast	690	25	Medium	118	125	116
Coast	2791	23	Late	118	120	116
Coast	2790	18	Medium	113	118	113
Horsford	1271		Early	113	115	103
Hanna	2784		Medium	119	124	122

1919 data—Early—July 6 to 9.
 Medium—July 11 to 14.
 Late—July 17 to 20.

SUMMARY

Colsess is a new six-rowed, hulled, hooded barley produced by the Agronomy Department of the Colorado Experiment Station, as the result of a cross between Coast (a bearded sort) and Success (a beardless or hooded sort).

From the tests at the Experiment Station, it shows several advantages over other Colorado grown barleys:

1. It outyields all other hooded varieties tested under irrigation.
2. To date it yields as high as Coast and Hanna, our best six-rowed and two-rowed barleys.
3. It stands up better under irrigation than any other variety under test and far excels the other hooded barleys in this respect.
4. It is one of the earliest, high-yielding barleys we have.
5. Colsess shatters less than Coast or Success, thus reducing a serious loss.
6. Colsess is well adapted to mountain agriculture. It can be grown as a hay crop, as grain and pea mixtures for forage and can be grown for grain.

It takes time to produce a new barley from a cross. After the cross is made three or four years must pass before selection begins, because the cross splits into different forms. The selections must then be tested in comparison with existing varieties to see which is best. This takes from three to five years. After a selection is proved it takes from two to three years to increase the seed sufficiently to commence to distribute to farmers. In all it takes from ten to twelve years to originate a variety by crossing and to commence to distribute it.

