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Acme Wheat

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SOUTH DAKOTA STATE COLLEGE OF AGRICULTURE AND MECHANIC ARTS
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ACME WHEAT

by

Manley Champlin and Edgar McFadden

HISTORY OF ACME WHEAT

Acme wheat, S. D. No. 284 (C. I. No. 5284) was developed by selective breeding at the Highmore experiment farm. Acme is a selection from Kubanka, a tested wheat for South Dakota. Comparative results with Kubanka may be found in South Dakota bulletin 146. This bulletin also quotes the history of Kubanka wheat as follows:

"It has medium or short heads that are white with occasionally a slight bluish bloom, and have rather long beards. The grain is large, yellowish white and very hard. The variety is much grown by the Kirghiz and Turghai people on the Siberian border, where it is absolutely impossible to grow ordinary wheats of any kind because of extreme drouth, the rainfall being as low as 10 inches per annum. It is cultivated throughout the entire Volga River region from Kazaii to the Caspian Sea, and eastward into the Kirghiz steppes and Turkestan. It is the most popular bread wheat of the lower Volga region. (B. P. I. Bul. No. 3).

So also the best Kubanka is found east of the Volga on the Siberian border. (B. P. I. Bul. 3).

Kubanka (S. D. 75) From U. S. Dept. Agr., B. P. I. (C. I. No. 1440) From East Russia, probably same as C. I. 1516.

Kubanka (S. D. 73) (C. I. 1516)

Two other similar strains are S. D. 356 and S. D. 152."

Milling and baking experiments conducted at the South Dakota Experiment Station showed these strains of wheat to have superior milling and baking qualities. Our Kubanka S. D. No. 75 (C. I. 1440) became the leading durum wheat of the state. In the hope of further improving the wheat crop of South Dakota by securing a variety having greater rust resistance, a more uniform kernel and greater producing power than the mother variety, the breeding work was started. To begin with, 60 head selections were made in 1909 by the senior author of this bulletin from each of the two Kubanka strains, S. D. 73 (C. I. 1516) and S. D. 75 (C. I. 1440). In 1910, 20 seeds from each head were planted in separate 5 foot rows 1 foot apart and spaced 3 inches apart in each row. These rows were grown in comparison with similar rows of bulk Kubanka, and their behavior carefully studied during 1910. The seed from the most promising selections was saved for further testing.

In 1911, one thousandth acre rows of the better selections were planted but sufficient seed of each was reserved to replant in case of crop failure. This was fortunate as the drouth of 1911 destroyed the crop that year. The remaining seed of the better selections was again planted in short rows in 1912 by J. D. Morrison who succeeded Professor Champlin in charge of cooperative cereal breeding at the Highmore experiment farm. That year, sufficient seed was saved to make a good increase in the size of the plats devoted to each selection in 1913. At the close of 1913, all but a few of the most promising selections were discarded. Those saved were tested in comparison with leading standard varieties, some being dropped each year until finally, at the close of 1915, it was decided to increase Selection No. 7, and to name and register it as Acme S. D. 284, (C. I. 5284).

DESCRIPTION

Acme is a bearded spring durum, or macaroni wheat, with smooth, golden chaff, and a short, plump, amber kernel. In appearance, it closely resembles its parent, Kubanka, but has a slightly narrower head, narrower glumes, a shorter, plumper kernel and a finer straw immediately below the head.

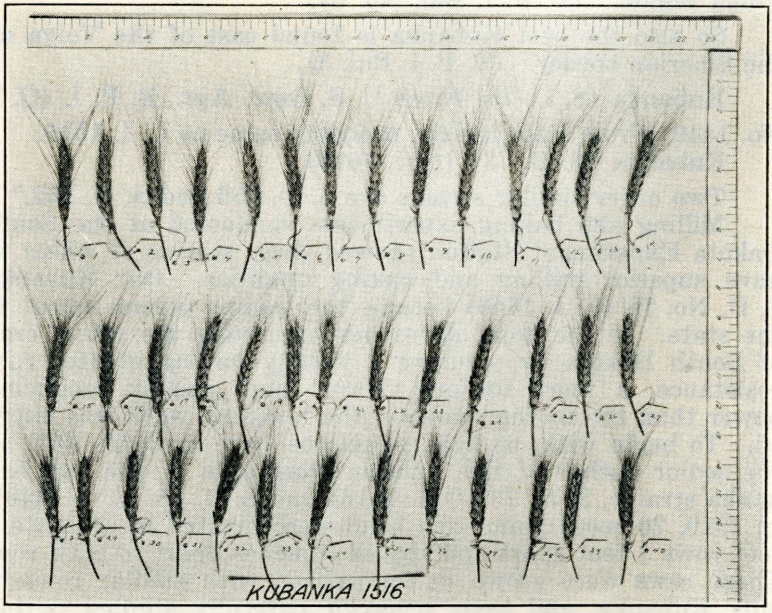

Fig. 1—Forty of the head selections made in 1909 from Kubanka, S. D. 73 (C. I. No. 1516). Selection 7 is the parent of the variety which has been named Acme, S. D. 284.

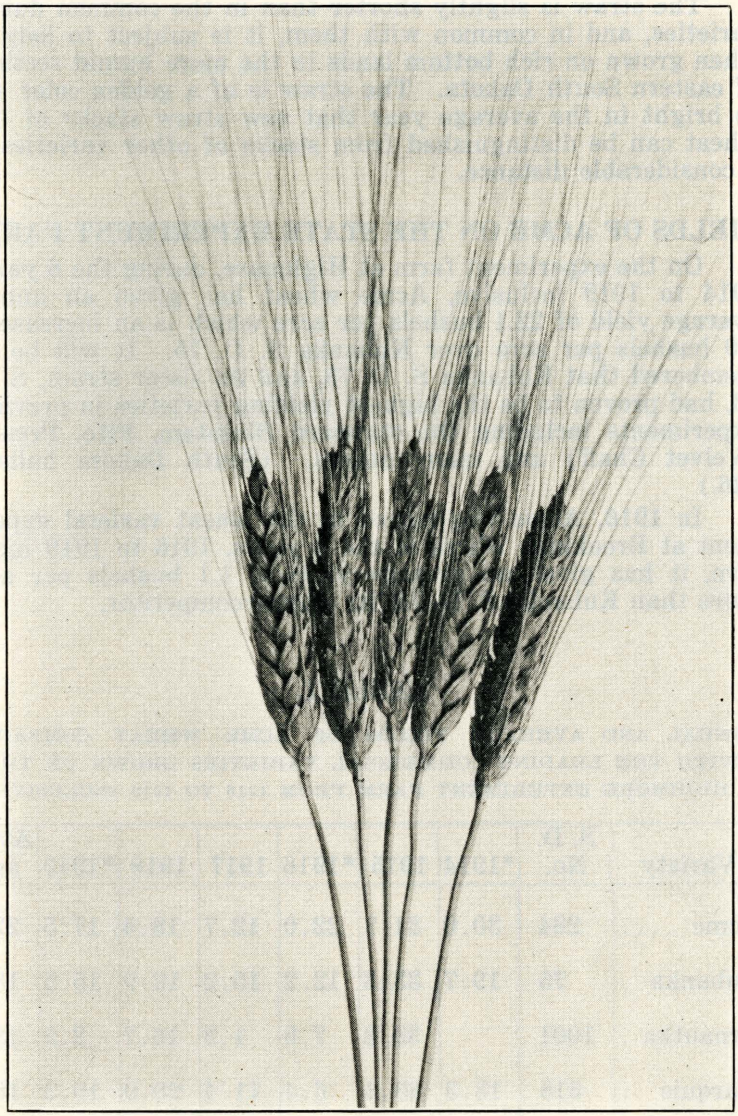

Fig. 2.—Typical heads of Acme wheat, S. D. 284. These heads were picked in 1919 from a field in the eastern part of South Dakota in a locality where black rust severely injured the common varieties of wheat. Note the well filled heads and healthy appearance of the straw.

The straw is slightly shorter than in the common durum varieties, and in common with them, it is subject to lodging when grown on rich bottom lands in the more humid sections of eastern South Dakota. The straw is of a golden color and so bright in the average year that new straw stacks of this wheat can be distinguished from stacks of other varieties at a considerable distance.

YIELDS OF ACME ON THE STATE EXPERIMENT FARMS

On the experiment farm at Highmore, during the 6 years, 1914 to 1919 inclusive, Acme wheat has given an annual average yield of 22.1 bushels per acre which is an increase of 4.0 bushels per acre over Kubanka S. D. 75. It will be remembered that Kubanka S. D. 75, and its sister strain, S. D. 73, had proven to be the highest yielding varieties in previous experiments including the standard Bluestem, Fife, Preston (Velvet Chaff) and many others. (South Dakota bulletin 146.)

In 1916, Acme was placed in the wheat varietal experiment at Brookings where in the 4 years, 1916 to 1919 inclusive, it has given an average yield of 1.1 bushels per acre more than Kubanka S. D. 75, its closest competitor.

TABLE 1.

ANNUAL AND AVERAGE YIELDS OF ACME WHEAT COMPARED WITH THE LEADING COMMERCIAL VARIETIES GROWN ON THE HIGHMORE EXPERIMENT FARM FROM 1916 TO 1919 INCLUSIVE

Variety	S. D. No.	*1914	1915	*1916	1917	1918	*1919	Average
Acme	284	30.0	31.7	22.0	12.7	18.4	17.5	22.1
Kubanka .	75	19.7	33.3	12.2	15.2	12.9	15.5	18.1
Arnautka .	1001		38.3	7.5	1.3	16.7	2.5	13.3
Marquis .	515	13.3	33.3	6.4	11.4	20.9	10.3	15.9
Preston ..	67	12.0	35.8	7.0	9.7	20.0	7.8	15.4
Bluestem .	169	7.5	18.3	1.7	9.7	18.4	1.1	9.5
Power Fife	1039	6.7	15.0	5.0	10.8	16.7	2.2	9.4

TABLE 2.

ANNUAL AND AVERAGE YIELDS OF ACME WHEAT COMPARED WITH THE LEADING COMMERCIAL VARIETIES GROWN ON THE BROOKINGS EXPERIMENT FARM FROM 1916 TO 1919 INCLUSIVE

Variety	S. D. No.	1916	1917	1918	1919	Average
Acme	284	13.1	19.3	33.3	8.3	18.5
Kubanka .	75	11.4	17.4	30.8	10.0	17.4
Arnautka	1001	11.1	10.1	25.8	1.6	12.2
Marquis ..	515	7.2	14.7	23.3	3.3	12.1
Preston ..	67	7.5	12.8	15.4	0.8	9.1
Bluestem .	169	0.6	10.1	10.0	0.4	5.3
Power Fife	1039			15.0	1.2	8.1

* 1914, 1916 and 1919 were bad black rust years at Highmore, and 1919 was also extremely dry in the latter part of the growing season.

TABLE 3.

AVERAGE YIELDS OF ACME WHEAT COMPARED WITH THE LEADING COMMERCIAL VARIETIES OF SPRING WHEAT GROWN AT FOUR EXPERIMENT STATIONS IN SOUTH DAKOTA

Experiment Station	Number of Years Grown	Acme	Kubanka	Arnautka	Marquis	Preston	Bluestem	Power Fife
Brookings	4	18.5	17.4	12.2	12.1	9.1	5.3	8.1
Cottonwood	2	18.8	17.4		13.1	9.9		
Eureka ..	2	10.4	9.1		6.9	4.3		
Highmore	6	22.1	18.1	13.3	15.9	15.4	9.5	9.4

In 1918, Acme wheat was placed in the wheat varietal experiments at Cottonwood and Eureka. In the 2 year average, 1918 and 1919, it has outyielded Kubanka by 1.4 bushels at Cottonwood and 1.3 bushels at Eureka.

The results of the experiment station tests are presented in Tables 1 to 4.

It is noteworthy that in the black rust years of 1914, 1916 and 1919 Acme led over all other varieties grown on the Highmore farm. This is clearly due to the peculiar rust resistance of the Acme. It should also be noted that in 1915 and 1917 at Highmore, and in 1919 at Brookings, Acme was outyielded by Kubanka. This was apparently due in 1917 and 1919 to the fact that the wheat varieties were grown on low land which early in the season of those two years, was too wet for the dry-land requirements of the Acme.

The year 1915 (an abnormal year) was an ideal one for wheat production at Highmore. An abundance of moisture was available throughout the greater part of the growing season, and black stem rust and other diseases did but little damage to the crops. Under those ideal conditions the Acme was outyielded by several of the other varieties. Even the Arnautka which, in the average year is usually considered below other durums in yield, in that year was the highest yielding variety grown. It would appear from the results of that single year that Acme wheat may not give as good results as certain other varieties in years when ideal conditions prevail. However, it must be borne in mind that ideal conditions are the exception rather than the rule in most sections of the spring wheat belt of South Dakota, and the farmer who succeeds in growing reasonably good crops in the poor years when prices are usually high, in the end will be ahead of his neighbor who grows "bumper" crops in the good years.

RUST RESISTANCE OF ACME WHEAT

The black rust years of 1916 and 1919 offered splendid opportunities for determining the resistance of Acme wheat to stem and leaf rust. In 1916, Acme wheat was grown on the experiment farms at Highmore and Brookings and on commercial farms at Webster and Wolsey. At all points where it was grown it was reported to have been remarkably free from stem rust in spite of the severe epidemic of that disease which swept over the spring wheat belt that year. Other varieties of wheat grown alongside of the Acme under similar conditions were badly infested with rust while the Acme was practically free from the disease.

In 1919, another severe rust epidemic visited the spring wheat belt, and, although not as general as in 1916, it struck most of the localities where Acme wheat was grown, and again offered an opportunity to study its rust resistance. That year it was grown on all of the state experiment stations where cereal experiments are conducted, and in addition on not less than 100 farms throughout the state. In all cases reported it was either entirely free from stem rust or showed only a trace of the disease.

Figure 3 shows the effect of stem rust on the quality of the grain of several different varieties grown on the Highmore experiment farm in 1919.

Table 4 gives the annual and average yields of Acme wheat compared with the leading commercial varieties grown on the Highmore experiment farm in the three black rust years, 1914, 1916 and 1919. In average yield for those three years, the Acme gave 7.4 bushels more than Kubanka, its closest competitor; and 19.8 bushels more than Bluestem, formerly one of the most widely grown varieties in South Dakota.

TABLE 4.

ANNUAL AND AVERAGE YIELDS OF ACME WHEAT COMPARED WITH THE LEADING COMMERCIAL VARIETIES GROWN ON THE HIGHMORE EXPERIMENT FARM IN THE THREE BLACK RUST YEARS, 1914, 1916 AND 1919.

Variety	S. D. No.	1914	1916	1919	Average
Acme	284	30.0	22.0	17.5	23.2
Kubanka ...	75	19.7	12.2	15.5	15.8
Arnautka ...	1001		7.5	2.5	5.0
Marquis	515	13.3	6.4	10.3	10.0
Preston	67	12.0	7.0	7.8	8.9
Bluestem ...	169	7.5	1.7	1.1	3.4
Power Fife ..	1039	6.7	5.0	2.2	4.6

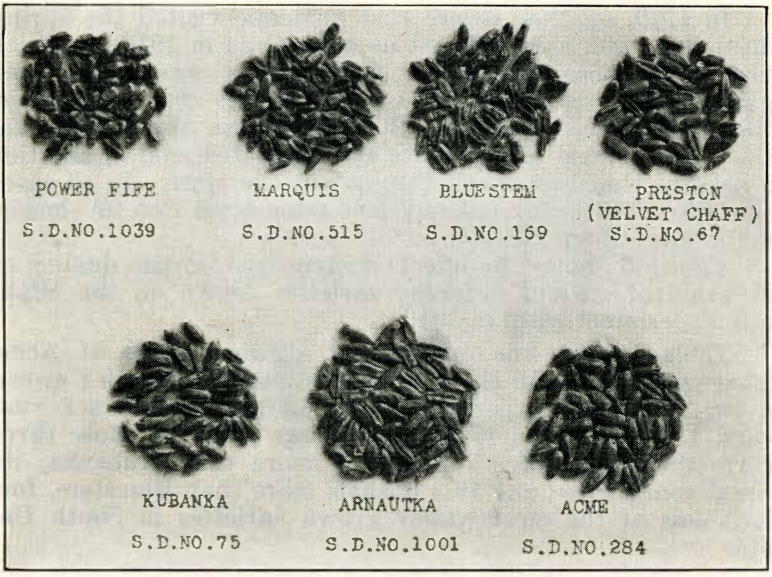

Fig. 3.—Acme wheat compared in quality with the leading commercial varieties of South Dakota. These varieties were all grown under similar conditions on the Highmore experiment farm in the black rust year, 1919. Note the plump kernels of the Acme and the shrunken condition of the other varieties.

DROUTH RESISTANCE OF ACME

The ability of a variety to withstand severe drouth is of great importance in South Dakota. There is scarcely a year in which moisture conditions are favorable throughout the growing season. In the dry years between 1909 and 1913 losses from drouth of from 50 percent to 100 percent were common in many localities of the state. It is apparent that the reduction of these losses by the growing of more drouth resistant varieties is very desirable.

Experiments so far conducted with Acme wheat in the drier portions of South Dakota and in other states show that it usually outyields other varieties in the northern Great Plains. The fact that that region is seldom visited by stem rust indicates that the high yielding ability of Acme is due to other factors besides rust resistance, and must be attributed to a peculiar ability to withstand drouth. From the evidence at hand, it seems reasonable to conclude that Acme is drouth resistant.

It is noteworthy that the most promising results with Acme wheat in South Dakota to date have been obtained on the high dry divides and old glacial moraines at altitudes around 2,000 feet above sea level. This fact leads to the belief that the range of this variety should be extended westward onto the high dry uplands of the Great Plains rather than onto the low valley lands of the more humid regions farther east.

EARLINESS OF ACME

Late maturing varieties of grain are very likely to be severely injured by drouth and hot winds, rust or hail. Early maturing varieties have better chances of escaping these dangers, and consequently, usually yield considerably more than their late maturing rivals.

Acme usually ripens about 2 days earlier than Kubanka and from 3 to 5 days earlier than Arnautka. It is not quite as early as Marquis as an average.

WHAT FARMERS THINK OF ACME WHEAT

Acme wheat was first introduced onto farms in South Dakota in the spring of 1916 when small lots were sent to J. E. McFadden of Webster, and Herman Banse of Wolsey. The reports received that year from these cooperators were favorable in that both showed the Acme wheat to have been free from stem rust while other varieties in the vicinity were badly rusted.

In 1917, a large number of cooperative tests were arranged.

The larger field tests were located in the following counties: Hyde, Clark, Day, Hamlin, Beadle and Brookings. Increased yields over the standard variety, either Marquis or Kubanka, were reported in every instance from 60 reports received, and not a single case was reported where there was material damage by rust.

Further trials on farms were arranged for 1918 in Brown, Marshall, Spink, Moody, Faulk, Haakon, Potter, Minnehaha, Douglas, McPherson and Jackson counties and the tests were continued in Hyde, Clark, Day, Beadle and Brookings counties. These tests consisted usually of from 4 to 5 acres planted beside Kubanka, or Marquis, the present leading varieties of the state. The year 1918 was especially favorable for wheat production in South Dakota. An abundance of moisture was available throughout the growing season and damage by rust was slight in most localities. In that year, the Acme outyielded the Marquis and Kubanka in nearly every case, where it was grown under similar conditions. The results of these tests are presented in the following tables.

Nearly all of the farmers who grew Acme wheat in 1918 commented on its remarkable rust resistance. Ralph Thurston, of Sisseton, Roberts county, says in his report, "The rust resistance of the Acme was remarkably good. It showed slight signs of rust on the first joint, but it seemed to sort of heal over and not affect the wheat, while the Marquis straw was entirely black and rotten. These two wheats grew side by side, under the same conditions."

A few unfavorable reports were received from the 1918 cooperators. These were all from the southeastern section of the state or the extreme eastern section where the wheat was grown on poorly drained soil or soil that was extremely rich in organic matter, which caused severe lodging. Lyman Merry of Dell Rapids, Minnehaha county, reported a yield of 30.7 bushels per acre, but says that it had a tendency to lodge and was also affected with scab.

G. L. Winright of Salem, McCook county, reported, "scab on Acme wheat was bad."

Albert Hanson of Elk Point, Union county, reported that his Acme wheat lodged badly, and that there were "a lot of heads that seemed to die before they got ripe," evidently due to scab or anthracnose.

George Dixon of Watertown, Codington county, says in his report that his Acme wheat, which was grown on rich land following potatoes, "practically all lodged after two unusually heavy wind storms."

These unfavorable reports were from low land or exceptionally rich land in the eastern and southeastern sections of the state.

In 1919, cooperative tests of Acme wheat were continued in a few cases, but as a rule the farmers who had sufficient seed of the new wheat to sow their entire acreage, discarded all other varieties so that comparable yields with other varieties could not be obtained. The principal thing of note in all cooperative tests of Acme wheat in 1919 was its rust resistance. Ben Sloat of Gettysburg, Potter county, grew 60 acres that year which in spite of the rust epidemic made 23 bushels per acre and weighed 63 pounds per bushel. In his report he says that it was entirely free from rust, while the Kubanka, S. D. 75 rusted considerably under similar conditions. This result was typical of several trials that year.

TABLE 5.

ACME WHEAT COMPARED WITH KUBANKA IN COOPERATIVE TESTS ON FARMS IN SOUTH DAKOTA IN 1917

Cooperator	P. O.	Co.	ACME		KUBANKA		Increased Yield
			Bushels Per Acre	Rust Resistance	Bushels Per Acre	Rust Resistance	
J. E. McFadden ..	Webster	Day	20.0	100	15.0	80	5.0
Bolland Bros.	Pierpont	Day	29.1	99	17.0	85	12.1
Average			24.5	99.5	16.0	82.5	8.5

TABLE 6.

ACME WHEAT COMPARED WITH MARQUIS IN COOPERATIVE TESTS ON FARMS IN SOUTH DAKOTA IN 1917

Cooperator	P. O.	Co.	ACME		MARQUIS		Increased Yield
			Bushels Per Acre	Rust Resistance	Bushels Per Acre	Rust Resistance	
Clarence Smith ...	Henry .	Clark	20.6	100	12.0	25.0	8.6
Herman Banse ...	Wolsey .	Beadle ...	18.3	—	15.4	—	2.9
J. E. McFadden ..	Webster	Day	20.0	100	14.0	80.0	6.0
Average of all reports			19.6	100	13.8	52.5	5.8

TABLE 7.

ACME WHEAT COMPARED WITH ORDINARY DURUMS IN COOPERATIVE TESTS ON FARMS IN SOUTH DAKOTA IN 1918

Cooperator	P. O.	Co.	ACME				DURUMS				Increased Yield
			Bu. Per Acre	Test Wt.	Lodging	Rust Resistance	Bu. Per Acre	Test Wt.	Lodging Resistance	Rust Resistance	
C. S. Blackman ..	Clark	Clark	24.0		98	100	18.5		95	95	5.5
J. E. Retz	Onaka	Faulk	30.3		100	100	13.5		100	100	16.8
Maurice Smith ...	Henry	Clark	16.8	60	100	100	11.5				5.3
Gale F. Peppers ..	Groton ...	Brown	24.7	60	90	100	20.0				4.7
Erle Neyhart	Gorman ..	Potter	40.0	62	100	100	40.0		100	100	0.0
J. E. McFadden ..	Webster ..	Day	28.0	64	100	100	28.0		95	98	0.0
David Gilkerson ..	Armour ..	Douglas ...	20.0		100	100	17.0	56	90	95	3.0
Average of all reports			26.3	61.5	98.3	100	21.1	56	96	97.6	

TABLE 8.

ACME WHEAT COMPARED WITH MARQUIS IN COOPERATIVE TESTS ON FARMS IN SOUTH DAKOTA IN 1918

Cooperator	P. O.	Co.	ACME				MARQUIS				Increased Yield
			Bu. Per Acre	Test Wt.	Lodging Resistance	Rust Resistance	Bu. Per Acre	Test Wt.	Lodging Resistance	Rust Resistance	
G. L. Winright ...	Salem	McCook ...	30.0	59	90	100	23.0	60	100	96	7.0
James Gilkerson ..	Armour ..	Douglas ...	20.0	58	95	100	16.0		100	80	4.0
David Gilkerson ..	Armour ..	Douglas ...	20.0		100	100	17.0	60	100	80	3.0
Lyman Merry	Dell Rapids	Minnehaha.	30.8	55	10	95	27.0	55			3.0
John Trenner	Cash	Perkins ...	14.0	60			10.0				4.0
J. E. McFadden ..	Webster ..	Day	28.0	64	100	100	16.0		100	90	12.0
M. N. Bolles	Brookings	Brookings .	14.8		100	100	10.4		100	badly rust'd	4.4
Ralph Thurston ..	Sisseton ..	Roberts ...	24.0		100	90	15.0	60	100	50	9.0
Geo. Dixon	Watertown	Codington .	20.0	52	30	Some rust	15.0	53	90	10	5.0
Average of all reports			22.4	58	78.1	97.9	16.6	57.6	98.6	67.7	5.7

TABLE 9.

ACME WHEAT COMPARED WITH MARQUIS IN COOPERATIVE TESTS ON FARMS IN SOUTH DAKOTA IN 1919

		ACME		MARQUIS		
Cooperator	P. O.	Bushels Per Acre	Rust Resistance	Bushels Per Acre	Rust Resistance	Increased Yield
Bolland Bros.	Pierpont	16.0	95	11.0	50	5.0
John Trenner	Cash	7.0	100	1.5	100	5.5
R. H. Thurston	Sisseton	12.0	100	5.3	0	6.7
C. S. Blackman	Clark	17.0	100	15.0	0	2.0
Geo. E. Stearns	Canton	8.0	99	0.0	15	8.0
Average of all reports		12.0	99	6.6	33.0	5.4

A rather extensive test of Acme wheat was conducted in 1919 on farms in Clark county under the supervision of County Agent A. J. Dexter. It was planned to grow the Acme wheat in direct comparison with other standard leading varieties on at least two farms in each township in Clark county. The Acme wheat was to be sown on the same day as the other varieties, on land similarly prepared, and at the same rate. Forty-seven farmers in the county agreed to cooperate in the demonstration and to sow the wheat according to the directions of the Farm Bureau. Accordingly, the seed was purchased from F. B. Smith, Henry, South Dakota, and distributed to the cooperators in 3 bushel lots. We quote from Mr. Dexter's report as follows:

Acme wheat S. D. 284 had been recommended as a high yielding and rust resisting wheat.

Consequently, it was planned early in the year to work up a series of demonstrations whereby at least two farmers in each township would raise the wheat in direct comparison with other varieties. Finally 47 farmers signed an agreement that on receipt of 3 bushels of Acme wheat at $3 per bushel, they would sow it according to directions of the Farm Bureau. The seed wheat was secured and distributed to the cooperating members. The seed itself was quite inferior in quality and not over 50 percent germinated. The Acme seed was sown on the same day, on land similarly prepared, and at the same rate as the seed of the varieties it was being compared with. The list of cooperators with their reports given, follows:

NAME	TOWNSHIP	ADDRESS	Variety	Rust Resistance	Yield Per A.
A. V. Thoreson	Day	Clark	Acme	95	10.5
			Marquis	0	6.5
L. J. Odland	Garfield	Clark	Acme	95	14
			Kubanka	85	14
			Marquis	0	7
A. H. Wicks	Woodland	Clark	Acme	98	11
			Marquis	0	9
H. H. Busmann	Washington	Bryant	Acme	90	12
			Marquis	0	10
C. S. Blackman	Day	Clark	Acme	98	17
			Marquis	0	15
F. C. Lindblom	Lake	Willow Lake	Acme	100	18
			Marquis	0	11
A. H. Blewitt	Raymond	Raymond	Acme	100	14
			Marquis	0	11
Claus Anderson	Warren	Crandall	Acme	80	13
			Durum	60	7
Leo J. Huber	Warren	Conde	Acme	100	8
			Marquis	0	4
Leon LeClaire	Richland	Willow Lake	Acme	99	13.3
			Kubanka	25	8.3
J. P. Ohlsen	Rosedale	Willow Lake	Acme	100	10.5
			Kubanka	80	13.5
Geo. Hempt	Fordham	Raymond	Acme	99	14
			Marquis	0	8.5

NAME	TOWNSHIP	ADDRESS	Variety	Rust Resistance	Yield Per A.
J. U. Reppe	Spr. Valley	Lily	Acme	100	23.3
			Marquis	50	18.0
P. M. Finstad	Cottonwood	Bradley	Acme	90	12
			Kubanka	80	16
W. P. Ohlsen	Hague	Willow Lake	Acme	100	9
C. R. Fox	Foxton	Naples	Acme	100	9.1
			Marquis	0	9.6
T. L. Fjelland	Garfield	Clark	Acme	100	15
			Kubanka		21
			Marquis		16
F. Bickel	Eden	Elrod	Acme	97	6.5
			Marquis	80	7.5
I. L. Jones	Ash	Raymond	Acme		18
			Marquis		12
J. J. Wolfe	Lincoln	Clark	Acme	100	16
			Kubanka	90	16
Geo. Moffit	Lincoln	Clark	Acme	100	7
			Kubanka	100	7
Geo. Kane	Thorp	Bradley	Acme	97	14
			Durum	50	12.3

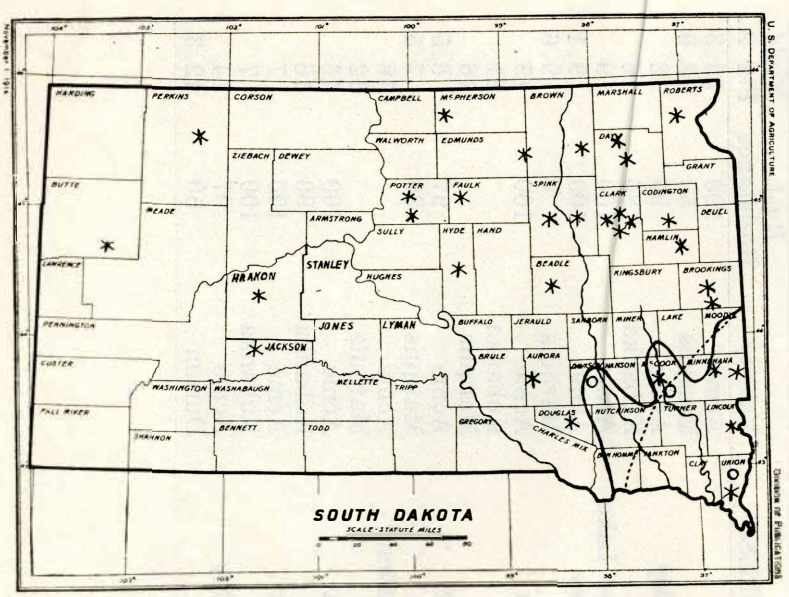

Fig. 4

.....Edge of 25 inch rainfall belt.

————Low land. South of this line is not adapted to growing Acme wheat.

* Localities where Acme wheat has given good results.

° Localities where Acme wheat has given unfavorable results due to wheat scab or to severe lodging.

SUMMARY RESULTS ALREADY OBTAINED

Variety	No. results	Yield	Rust Resistance
Acme	22	13½	97
Kubanka	6	12	76
Ordinary durum	3	10	55
Marquis	14	10	10

Indications point out the great superiority of the Acme as a rust resistant wheat over other varieties. The disappointing feature of the demonstration was the poor seed to start with, but after all arrangements had been completed with the 47 cooperators, it was thought better to go on with the seed, though inferior, than to throw out the whole demonstration.

WHERE ACME WHEAT SHOULD AND SHOULD NOT BE GROWN

Acme wheat is primarily a dry-land variety and is not adapted to that portion of the state lying within the 25 inch rainfall belt nor to low poorly drained soils or exceptionally rich soils in the eastern part of the state. Neither does it appear to be well adapted to irrigation, but results on this point are scanty, being confined to small plot experiments conducted on the Newell experiment farm.

WHEN TO SOW ACME WHEAT

A date-of-seeding experiment with Acme wheat has been in progress at the Highmore experiment farm since 1916. The results to date are presented in Table X. They clearly favor seeding as early in the spring as soil conditions are favorable. It is noteworthy that there is an average decrease in yield of nearly 5 bushels per acre for each 15 day period from March 15th to May 15th.

TABLE 10.

DATE OF SEEDING EXPERIMENT WITH ACME WHEAT, HIGHMORE, S. D.

Date of Seeding	1916	1917	1918	1919	Average all Years	1916-1918
			March 23			
March 14th to 16th	32.5		20.8		26.7	26.7
April 1st to 12th..	28.3	23.5	10.8	21.5	21.0	19.6
April 15th to 22nd	25.0		8.3	21.7	18.4	16.7
May 1st to 7th....	18.3	15.0	10.8	15.8	15.0	14.6
May 15th		5.8	10.0	7.1	7.6	

AMOUNT OF SEED TO SOW

A rate-of-seeding experiment with Acme wheat has been in progress at the Highmore experiment farm since 1916. The results to date appear to indicate that 5 pecks per acre is the most economical rate of seeding. The results are given in Table 11.

TABLE 11.

RATE OF SEEDING WITH ACME WHEAT, HIGHMORE, S. D.

Rate of Seeding	1916	1917	1918	*1919	Average 1916-1918	1917-1918
4 pecks	13.3	8.3	13.3	—	11.6	10.8
5 pecks	13.3	10.7	16.7	—	13.6	13.7
6 pecks	15.0	11.8	15.0	—	13.9	13.4
7 pecks		11.0	16.7	—		13.9
8 pecks		11.0	10.8	—		10.9

*Drowned out in spring.

MILLING QUALITY

Acme wheat is classed as amber durum or durum according to quality. Durum wheat is used primarily for the manufacture of macaroni, spaghetti, puffed wheat, etc. It is, therefore, not primarily a wheat for bread making purposes, but our investigations carried on with the cooperation of the United States Department of Agriculture, have given consideration to the loaf volume and bread making quality of the several varieties studied. The results have shown Acme to be similar to Kubanka in milling quality. Its yield of flour has been uniformly good and its loaf volume has been slightly lower than that of Kubanka, but not low enough to interfere with its value for the manufacture of durum wheat products. It has a more uniform grain than the older varieties and that in itself is welcomed by durum wheat millers. Milling and baking results follow for convenient reference.

MILLING AND BAKING DATA OBTAINED FROM SIX VARIETIES OF WHEAT GROWN AT BROOKINGS AND HIGHMORE, SOUTH DAKOTA, IN 1916

Variety or Station	Quantity Milled	Milling Results				Baking Results					
							Loaf				
										Color	
		Flour	Bran	Shorts	Loss	Absorption of water	Volume	Weight	Texture	Score	Shade
Brookings, S. Dak.	gms.	%	%	%	%	%	c. c.	gr.	%	%	
Kubanka	1000	66.8	8.2	24.1	.9	59.1	2120	470	83	83	V. creamy
Arnautka	1000	62.0	10.3	26.7	1.0	58.8	2080	487	80	83	V. creamy
Acme	1000	65.1	10.2	25.7	1.0	62.1	1910	497	89	83	Creamy gray
Marquis	1000	67.1	14.6	16.4	1.9	62.1	2320	498	80	78	Dark gray
Preston	1000	61.8	16.9	18.0	3.3	57.9	2080	486	81	81	Cr. dark
Kharkov	1000	70.4	13.7	13.8	2.1	58.5	1980	463	80	81	Cr. dark
Highmore, S. Dak.											
Kubanka	1000	66.2	9.7	22.5	1.6	61.2	2050	478	87	86	Creamy
Arnautka	1000	53.3	8.3	35.5	2.9	60.3	2300	500	88	88	Very creamy
Acme	1100	67.3	7.5	22.4	2.8	67.7	1870	506	86	84	Creamy gray
Marquis	1000	56.4	18.4	23.0	2.2	58.2	2480	487	88	87	Creamy dark
Preston	1000	57.0	23.5	17.0	2.5	60.6	2150	497	81	75	V. dr. creamy
Kharkov	1000	69.8	13.4	15.0	1.8	60.3	2060	490	75	79	V. dr. creamy

MILLING AND BAKING DATA ON WHEAT IN UNIFORM VARIETAL EXPERIMENTS

GRADE, BUSHEL WEIGHT, SCREENINGS, MOISTURE CONTENT, AND PROTEIN CONTENT OF SIX VARIETIES OF WHEAT GROWN AT BROOKINGS AND HIGHMORE, SOUTH DAKOTA, IN 1916

(Data obtained by the Office of Cereal Investigations in cooperation with the U. S. Bureau of Markets and the North Dakota Agricultural Experiment Station.)

Variety or Station	C. I. No.	Lab. No.	Grade	Bushel Weight		Screenings	Moisture Content			Crude Protein (Nx 5.7)	
							Wheat				
				Before Cleaning	After Cleaning		Before Tempering	After Tempering	Flour	Wheat	Flour
Brookings, S. Dak.				lbs.	lbs.	%	%	%	%	%	%
Kubanka	1440	3408	3 Dur.	55.	58.	6.6	11.5	14.7	11.3	17.3	17.0
Arnautka	4064	3410	4 Dur.	44.5	54.	3.6	12.0	15.6	11.2	15.9	15.9
Acme	5284	3420	2 Dur.	57.5	60.	2.8	10.3	14.2	11.2	19.0	18.2
Marquis	3641	3414	Sample Gr.	47.	51.	3.6	11.8	15.2	11.9	17.2	16.8
Preston	3081	3415	Sample Gr.	45.5	50.5	3.9	12.0	15.1	11.4	13.7	13.5
Kharkov	1442	3418	3 H. R. W.	55.5	60.5	1.2	12.0	15.0	12.2	15.4	15.3
Highmore, S. Dak											
Kubanka	1440	3474	3 Dur.	54.5	58.0	2.2	11.2	14.9	10.9	18.0	18.0
Arnautka	4064	3476	4 Dur.	42.0	49.0	7.5	11.6	15.0	11.7	17.3	17.4
Acme	5284	3484	3 Dur.	56.5	59.0	2.3	11.8	14.9	10.8	18.8	18.3
Marquis	3641	3479	Sample Gr.	42.0	45.5	3.8	11.0	15.0	11.6	16.7	15.6
Preston	3081	3480	Sample Gr.	45.0	49.0	3.5	11.1	15.0	11.3	16.4	15.8
Kharkov	1442	3482	4 H. R. W.	52.0	57.0	2.8	11.9	14.9	12.1	15.8	15.8

MILLING AND BAKING DATA, HIGHMORE WHEAT VARIETIES 1917

TESTS CONDUCTED BY NORTH DAKOTA AGRICULTURAL COLLEGE, COOPERATING WITH UNITED STATES DEPARTMENT OF AGRICULTURE.

Variety	Weight per Bushel	Yield of Flour	Milling Gain or Loss	Water Absorption	Loaf Volume	Color of Bread	Texture of Bread	Crude Protein
	lbs.	%	%	%	c. c.	Score	Score	%
Acme	62.5	74.6	0	63.5	1680	86	88	15.3
Kubanka	61.5	70.3	+1.2	59.4	1920	93	93	14.8
Power Fife	59.0	71.7	+1.4	59.1	1950	93	84	16.5
Haynes Bluestem	58.0	74.3	+1.4	58.8	1960	92	86	14.2
Preston	61.0	72.0	+0.9	56.8	2060	95	88	14.9
Marquis	59.0	72.2	+1.7	61.8	2470	96	94	16.4
Arnautka	59.0	74.1	+0.3	65.6	2180	91	94	16.3

MILLING AND BAKING DATA ON HIGHMORE WHEAT—1919 CROP

TESTS CONDUCTED BY NORTH DAKOTA AGRICULTURAL COLLEGE.

Variety	C. I. No.	Lab. No.	Grade	Bushel Weight		Screenings	Moisture Content WHEAT		Quantity Milled
				Before Cleaning	After Cleaning		Before Tempering	After Tempering	
				lbs.	lbs.	%			Gms.
Acme	5284	5138	1 Dur.	63	63	0	10.6	15.4	1400
Preston	3081	5137	3 DNS	55.5	58	0	10.6	15.1	1400
Marquis	3641	5136	5 DNS	52.5	56	0	10.4	14.0	1400
Kharkov	1442	5135	2 R. W.	60	63	0	10.4	15	1500
Prelude	4323	5139	1 DNS	59	61	0	10	15	1400
Pioneer	4324	5140	1 DNS	50	60.5	0	10	15	1500

MILLING AND BAKING DATA ON HIGHMORE WHEAT—1919 CROP

TESTS CONDUCTED BY NORTH DAKOTA AGRICULTURAL COLLEGE.

Variety	Milling Results				Baking Results					
					Loaf					
	Flour	Bran	Shorts	Loss	Absorption of Water	Volume	Weight	Texture	Color Score	Shade
	%	%	%	%	%	c. c.	gr.	%	%	
Acme	71.2	8.4	20.93	.57	60.29	1875	470	98	96	
Preston	67.5	15.2	17.93	.78	54.41	2284	452	96	96	
Marquis	67.6	15.7	16.71	.14	56.47	2216	462	95	95	Creamy
Kharkov	74.4	13.8	12.40	.60	54.7	1858	456	90.5	94	Creamy
Prelude	76.0	10.0	14.29	.35	52.94	2308	447	95	90	" gray
Pioneer	74.7	10.2	15.53	.53	54.7	2473	446	95	94	Creamy

MILLING AND BAKING DATA ON WHEAT VARIETAL EXPERIMENT

GRADE, BUSHEL WEIGHT, SCREENINGS, AND MOISTURE, PROTEIN AND ASH CONTENT OF ELEVEN VARIETIES OF WHEAT GROWN AT THE SOUTH DAKOTA EXPERIMENT STATION, BROOKINGS, SOUTH DAKOTA, IN 1918

Variety	C. I. No.	Lab. No.	Grade	Bushel Weight		Screenings	Moisture Content		Flour	Crude Protein (N x 5.7)		Ash
				Before Cleaning	Cleaning After		Wheat					
							Before Tempering	After Tempering		Wheat	Flour	Flour
				lbs.	lbs.	%	%	%	%	%	%	%
Kubanka	1440	4783	2 Am. Du.	59.7	59.0	3.1	11.9	15.0	12.5	15.2	14.5	.67
Arnautka	4064	4785	4 Am. Du.	56.0	56.1	3.0	11.0	15.0	12.8	16.0	15.3	.83
Haynes Bluestem	2874	5029	Smp. GDNS	47.0	50.5	6.2	8.8	15.0	12.7	15.3	14.5	.52
Powers	3697	4778	Smp. G. N. S.	49.6	51.3	2.5	11.3	15.0	12.8	13.9	13.1	.53
Marquis	3641	4781	1 D. N. S.	58.8	58.9	1.3	11.9	15.0	12.4	15.2	13.7	.46
Preston	3081	4780	Smp. GDNS.	51.8	53.1	1.9	11.3	15.0	12.3	14.1	12.5	.48
Pioneer	4324	4782	3 D. N. S.	55.8	56.5	1.5	11.7	15.0	12.4	16.0	14.2	.43
Prelude	4323	4784	5 D. N. S.	60.3	60.3	2.3	11.9	15.0	13.3	16.8	15.2	.41
Turkey	3689	4786	1 H. W.	61.0	62.0	1.3	12.8	14.0	12.4	14.6	13.3	.51
Acme	5284	4779	Smp. G. A. D.	60.5	60.0	2.7	11.7	15.0	12.6	15.8	15.2	.77
S. D. No. 121	1444	5050	2 R. Du.	60.0	59.3	8.9	8.9		11.9	13.3	14.9	.59

MILLING AND BAKING DATA ON WHEAT VARIETAL EXPERIMENT

MILLING AND BAKING DATA OBTAINED FROM ELEVEN VARIETIES OF WHEAT GROWN AT THE SOUTH DAKOTA EXPERIMENT STATION, BROOKINGS, SOUTH DAKOTA, 1918

Variety	Quantity Milled	Milling Results				Baking Results					
							Loaf				
										Color	
		Flour	Shorts	Bran	Loss	Absorption of Water	Volume	Weight	Texture	Score	Shade
	gm.	%	%	%	%	%	c. c.	gm.	%	%	
Kubanka	1300	74.2	20.7	8.6	3.5*	60.0	2250	502	93.5	93.0	Cr.
Arnautka	1300	71.6	19.0	9.8	0.4*	58.8	2480	485	96.5	93.0	Cr.
Haynes Bluestem	900	68.5	12.5	21.8	2.8*	59.4	2390	489	88.0	87.0	Cr.
Powers	1250	68.4	13.2	19.0	0.6*	56.8	1870	491	85.5	74.0	R. gr.
Marquis	1300	74.0	9.2	17.2	0.4*	57.4	2530	493	94.0	94.5	Sli. cr. gr.
Preston	1250	63.8	11.8	22.8	1.6*	57.6	2380	497	93.0	89.5	Cr. gr.
Pioneer	1350	69.6	10.9	18.8	0.7	57.4	2430	497	93.5	91.0	Cr. gr.
Prelude	1300	73.9	7.7	16.4	2.0	60.6	2670	493	90.5	89.0	Cr.
Turkey	1300	75.7	11.9	9.5	2.9	61.5	2560	501	90.5	89.0	Cr.
Acme	1200	73.2	16.8	10.5	0.5*	58.8	2340	489	94.0	92.5	Cr.
S. D. No. 121	1200	74.4	15.5	11.8	1.7*	64.1	2040	503	91.0	86.5	V. cr.

* Gain.

MILLING AND BAKING DATA ON WHEAT VARIETAL EXPERIMENT

GRADE, BUSHEL WEIGHT, SCREENINGS, AND MOISTURE, PROTEIN AND ASH CONTENT OF TEN VARIETIES OF WHEAT GROWN AT HIGHMORE SUBSTATION, HIGHMORE, SOUTH DAKOTA, 1918.

Variety	C. I. No.	ab. No.	Grade	Bushel Weight		Screenings	Moisture Content		Flour	Crude Protein (Nx 5.7)		Ash
							Wheat					
				Before Cleaning	After Cleaning		Before Tempering	After Tempering		Wheat	Flour	Flour
				lbs.	lbs.	%	%	%	%	%	%	%
Arnautka	4064	4734	2 A. Du.	59.6	53.8	3.3	9.9	15.0	12.5	16.2	15.6	.81
Marquis	3641	4742	1 N. S.	60.5	61.2	1.0	12.8	15.0	13.9	15.0	14.4	.53
Power	3697	4736	1 D. N. S.	58.8	59.6	1.3	10.4	15.0	13.6	17.3	16.2	.45
Haynes Bluestem	2874	4741	3 D. N. S.	56.4	57.2	1.9	10.6	15.0	13.6	16.2	15.3	.47
Preston	3081	4740	1 D. N. S.	61.5	62.0	1.6	10.8	15.0	12.4	17.3	16.4	.54
Pioneer	4324	4738	5 D. N. S.	62.5	62.5	1.8	10.6	15.0	13.5	18.0	16.0	.46
Prelude	4323	4739	5 D. N. S.	61.5	61.3	2.2	10.7	15.0	13.4	19.0	17.6	.47
Kharkov	1442	4733	1 H. Wn.	61.4	62.1	1.1	12.1	15.0	13.5	11.7	10.9	.46
Turkey	3689	4732	1 D. H. Wn.	60.9	61.8		11.5	15.0	13.1	15.4	14.4	.45
Acme	5284	4737	3 A. Du.	61.2	61.2	1.1	11.8	15.0	13.0	16.0	15.0	.82

MILLING AND BAKING DATA ON WHEAT VARIETAL EXPERIMENT

MILLING AND BAKING DATA OBTAINED FROM TEN VARIETIES OF WHEAT GROWN AT HIGHMORE SUBSTATION, HIGHMORE, SOUTH DAKOTA, IN 1918

Variety	Quantity Milled	Milling Results				Baking Results					
							Loaf			Color	
		Flour	Shorts	Bran	Loss	of Water Absorption	Volume	Weight	Texture	Score	Shade
	gm.	%	%	%	%	%	c. c.	gm.	%	%	
Arnautka	1400	72.8	19.2	9.8	1.8*	60.0	2150	500	97	94.5	Cr.
Marquis	1400	73.1	11.5	15.3	0.1	58.5	2470	502	90	94	Sli. cr. gr.
Power	1300	71.2	14.7	16.8	2.7*	57.9	2170	504	92	92.5	Cr.
Haynes Bluestem	1400	73.0	10.7	17.7	1.4*	60.6	2480	497	91.5	92	Cr.
Preston	1400	72.4	13.3	14.8	0.5*	59.4	2260	497	91	90.5	Cr.
Pioneer	1400	76.1	14.5	11.5	2.1*	58.5	2200	491	91.5	90	Cr. gr.
Prelude	1400	73.7	15.0	11.3	.0	59.7	2450	494	89	90.5	Cr. gr.
Kharkov	1500	73.0	10.9	16.9	0.8*	59.4	2110	508	94	96	Cr. gr.
Turkey	1500	72.1	11.2	16.5	0.2	56.2	2260	488	89.5	90	Cr. gr.
Acme	1400	70.0	20.7	9.5	0.2*	60.9	1980	507	94.5	94	Cr. gr.

* Gain.

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