

Bulletin No. 166

May, 1939



# University of Arizona

COLLEGE OF AGRICULTURE

AGRICULTURAL EXPERIMENT STATION

## SMALL GRAIN VARIETIES FOR NORTHERN ARIZONA

By

A. T. BARTEL AND IAN A. BRIGGS

PUBLISHED BY  
**University of Arizona**  
TUCSON, ARIZONA

# ORGANIZATION

ALFRED ATKINSON, Sc.D.....President of the University

## EXPERIMENT STATION STAFF

RALPH S. HAWKINS, Ph.D.....Acting Dean and Acting Director

### AGRICULTURAL CHEMISTRY AND SOILS DEPARTMENT

WILLIAM T. McGEORGE, M.S.....Agricultural Chemist  
 JAMES F. BREAZEALE, B.S.....Biochemist  
 THEOPHIL F. BUEHRER, Ph.D.....Physical Chemist  
 HOWARD V. SMITH, M.S.....Associate Agricultural Chemist  
 WILLIAM P. MARTIN, Ph.D.....Assistant Soil Microbiologist  
 RAYMOND H. KELLNER, B.S.....Assistant Agricultural Chemist  
 GEORGE E. DRAPER, M.S.....Assistant Agricultural Chemist (Phoenix)

### AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY DEPARTMENT

GEORGE W. BARR, Ed.D.....Agricultural Economist  
 ELZER D. TETREAU, Ph.D.....Rural Sociologist

### AGRICULTURAL ENGINEERING DEPARTMENT (Irrigation)

GEORGE E. P. SMITH, C.E., D.Eng.....Agricultural Engineer  
 HAROLD C. SCHWALEN, B.S. in M.E., M.S. in C.E.....Associate Agricultural Engineer  
 J. C. HILLER, B.S. in M.E.....Assistant Agricultural Engineer

### AGRONOMY DEPARTMENT

IAN A. BRIGGS, M.S.....Acting Agronomist  
 LLOYD V. SHERWOOD, Ph.D.....Assistant Agronomist  
 CHARLES HOMER DAVIS, M.S.....Assistant Agronomist  
 †ARTHUR T. BARTEL, M.S.....Assistant Agronomist

### ANIMAL HUSBANDRY DEPARTMENT

ERNEST B. STANLEY, M.S.....Animal Husbandman  
 ARTHUR H. WALKER, Ph.D.....Assistant Animal Husbandman  
 FRED GREMMEL, M.S.....Assistant Animal Husbandman

### VETERINARY SCIENCE DEPARTMENT

WILLIAM J. PISTOR, B.S., D.V.M.....Veterinarian  
 EDMUNDO FELIX, B.S.....Laboratory Technician

### BOTANY AND RANGE ECOLOGY DEPARTMENT

D. M. CROOKS, Ph.D.....Botanist  
 JOHN J. THORNBER, M.A.....Botanist  
 R. C. CHANDLER, Ph.D.....Assistant Botanist  
 LYMAN BENSON, M.S.....Assistant Botanist  
 ROBERT A. DARROW, Ph.D.....Assistant Range Ecologist  
 JOSEPH F. ARNOLD, M.S.....Research Assistant in Range Ecology

### DAIRY HUSBANDRY DEPARTMENT

\*WALTER S. CUNNINGHAM, M.S.....Dairy Husbandman  
 RICHARD N. DAVIS, M.S.....Associate Dairy Husbandman

### ENTOMOLOGY AND ECONOMIC ZOOLOGY DEPARTMENT

CHARLES T. VORHIES, Ph.D.....Economic Zoologist  
 \*ELMER D. BALL, Ph.D.....Entomologist  
 LAWRENCE P. WEHRLE, Ph.D.....Assistant Entomologist  
 E. R. TINKHAM, M.S.....Assistant Entomologist

### HORTICULTURE DEPARTMENT

†ALTON H. FINCH, Ph.D.....Horticulturist  
 W. A. FRAZIER, Ph.D.....Associate Horticulturist (Phoenix)  
 WILLIAM E. MARTIN, Ph.D.....Assistant Horticulturist  
 ROBERT H. HILGEMAN, B.S.A.....Assistant Horticulturist (Tempe)  
 \*C. W. VAN HORN, B.S.....Assistant Horticulturist (Yuma)  
 JUSTIN G. SMITH, B.S.....Assistant Horticulturist (Tempe)  
 †KARL HARRIS, M.S.....Assistant Irrigation Engineer (Phoenix)

### HUMAN NUTRITION DEPARTMENT

MARGARET CAMMACK SMITH, Ph.D.....Nutrition Chemist  
 LOUISE OTIS, Ph.D.....Associate Nutrition Chemist

### PLANT BREEDING DEPARTMENT

WALKER E. BRYAN, M.S.....Plant Breeder  
 ELIAS H. PRESSLEY, M.S.....Associate Plant Breeder

### PLANT PATHOLOGY DEPARTMENT

JAMES G. BROWN, Ph.D.....Plant Pathologist  
 RUBERT B. STREETS, Ph.D.....Associate Plant Pathologist  
 \*KARL D. BUTLER, M.S.....Assistant Plant Pathologist  
 MANFRED GOTTLIEB, B.S.....Assistant Plant Pathologist (Phoenix)

### POULTRY HUSBANDRY DEPARTMENT

HARRY EMBLETON, B.S.....Poultry Husbandman  
 HUBERT B. HINDS, M.S.....Associate Poultry Husbandman

\*On leave.

†In co-operation with United States Department of Agriculture, Bureau of Plant Industry.

‡In co-operation with United States Department of Agriculture, Bureau of Agricultural Engineering.

## TABLE OF CONTENTS

	PAGE
INTRODUCTION.....	18
FACTORS AFFECTING THE RESULTS.....	18
Climatic Conditions.....	18
METHODS AND FIELD PLOT RESULTS.....	20
Eagar 1927 to 1931.....	20
NURSERY METHODS.....	20
NURSERY RESULTS.....	24
Springerville-Nutriosos Tests.....	24
Flagstaff Tests.....	27
DESCRIPTION AND DISCUSSION OF VARIETIES.....	31
Wheat Varieties.....	31
Barley Varieties.....	33
Oat Varieties.....	33
GENERAL DISCUSSION.....	34
SUMMARY.....	35
ACKNOWLEDGMENT.....	36

## ILLUSTRATIONS

PLATE I.—BARLEY NURSERY AT NUTRIOSOS, ARIZONA, 1935.....	22
PLATE II.—WHEAT NURSERY AT FLAGSTAFF, ARIZONA, 1933.....	24
PLATE III.—MARQUIS WHEAT.....	31
PLATE IV.—RELIANCE WHEAT.....	31
PLATE V.—KUBANKA WHEAT.....	32
PLATE VI.—TREBI BARLEY.....	32
PLATE VII.—HANNCHEN BARLEY.....	33
PLATE VIII.—UNION BEARDLESS BARLEY.....	34
PLATE IX.—MARKTON OATS.....	35

# SMALL GRAIN VARIETIES FOR NORTHERN ARIZONA\*

By A. T. BARTEL AND IAN A. BRIGGS†

## INTRODUCTION

The small grains—that is, wheat, oats, and barley—are grown in northern Arizona mainly for feed. Practically all of this feed is consumed locally. Most of the small grains are grown between elevations of 5,000 and approximately 8,500 feet above sea level. Since there is such a variation in the elevation of the agricultural lands, one can also reasonably expect large variations in farming practices. Both irrigation and dry farming methods are followed in the production of small grains in this region. As a rule, where available, irrigation water is applied even though fair yields may be obtained without. The low cost of the irrigation water usually makes such practices profitable.

The tests to be discussed were conducted in two different periods. The first was carried on with wheat varieties planted at Eagar (located 2 miles south of Springerville) from 1927 to 1931. The varieties were sown with a drill in field plots. The second set of experiments was conducted with wheat, barley, and oat varieties at Eagar and Nutrioso from 1931 to 1935 and at Flagstaff from 1932 to 1937. These plantings were made by hand in nursery rows.

The agronomic results of these two sets of experiments will be discussed separately.

## FACTORS AFFECTING THE RESULTS

### CLIMATIC CONDITIONS

The elevations at Springerville and Flagstaff are about the same, being 6,852 and 6,907 feet, respectively, above sea level. The elevation at Nutrioso is somewhat higher than at Springerville and is approximately 7,800 feet. The climatic data for Springerville and Flagstaff are shown in Table 1. The mean monthly temperatures at Springerville are slightly higher than at Flagstaff. The last killing frost in the spring comes on an average 13 days later at Flagstaff than at Springerville which accounts for most of the 16 days' difference in the frost-free period between the two locations.

The seasonal precipitation at Springerville is somewhat lower than at Flagstaff, especially during the months of April and May. The low rainfall during May and June at Flagstaff often causes

\*Co-operative investigations of the Division of Cereal Crops and Diseases, Bureau of Plant Industry, U.S. Department of Agriculture, and the Arizona Agricultural Experiment Station.

†Assistant Agronomist, Division of Cereal Crops and Diseases, Bureau of Plant Industry, U.S. Department of Agriculture, and Acting Agronomist, Arizona Agricultural Experiment Station, respectively.

TABLE 1.—SEASONAL WEATHER DATA FROM APRIL TO SEPTEMBER AT FLAGSTAFF AND SPRINGVILLE,  
ARIZONA.

	April	May	June	July	August	September
<b>Flagstaff</b>						
Precipitation (43 yr. av.)	1.25	1.04	0.43	3.19	2.84	1.41
Mean temperature (43 yr. av.)	43.1	50.6	59.5	65.5	63.8	57.0
Last killing frost in spring		June 3				
First killing frost in fall		Sept. 30				
Frost-free days (38 yr. av.)		119				
<b>Springville</b>						
Precipitation (25 yr. av.)	0.45	0.45	0.62	3.23	3.17	1.58
Mean temperature (25 yr. av.)	46.6	53.9	63.1	66.2	64.0	58.9
Last killing frost in spring		May 21				
First killing frost in fall		Oct. 3				
Frost-free days (23 yr. av.)		135				

some drought injury before the rains come in July. It may also account for the low plant height obtained from the varieties when planted around Flagstaff. Any shortage of available soil moisture during June has a very detrimental effect on plant growth and yield in small grains. It is during this month that the small grain plants in northern Arizona go through the jointing stage and make the most rapid growth. Water is also needed at this time for the development of the flowers in the head. It has been found by many investigators that a shortage of moisture during the jointing stage in small grains results in a lower yield than if it occurs at any other time in the life of the plants. This fact undoubtedly accounts for most of the lower yields obtained at Flagstaff than at Springerville and Nutrioso, because at the latter two locations an irrigation is applied during June and the varieties are therefore not subjected to dry conditions.

No climatic data are available for Nutrioso, but since it has an elevation of almost 900 feet above Springerville one can reasonably expect slightly higher seasonal precipitations and lower temperatures.

## METHODS AND FIELD PLOT RESULTS

### EAGAR, 1927 TO 1931

The first experimental work with small grain varieties in northern Arizona was conducted with wheat from 1927 to 1931 at Eagar. Eight replications of each variety were planted in plots of single drill widths and ranging from 400 to 600 feet in length. The plantings were made each year on land that had been irrigated prior to planting. The seed was treated with copper carbonate for control of stinking smut or bunt. The agronomic data are shown in Table 2.

Black stem rust was the principal factor responsible for the low average yields; it affected all the varieties each year. The early maturing varieties, such as Federation and Marquis, gave comparatively high yields in those seasons when the rust infection was delayed. Regenerated Defiance, a late variety, produced the highest average yields. In 1927 and 1931 rust was so severe that much of the grain produced was unfit for milling purposes. The quality of the early maturing varieties, with the exception of Federation, was not reduced as much by rust as the later maturing varieties, as indicated by the test weight per bushel for 1927. In 1927 Marquis showed between 15 and 20 per cent of shattering due to hail.

### NURSERY METHODS

The trials with small grain varieties were started at Eagar during the summer of 1931. That fall the oat varieties were eaten off by stray livestock and no yields were obtained. The varietal nursery was again planted at Eagar in 1932 but early in the summer grasshoppers ate the plants to such an extent that many of the varieties never matured. Therefore, no yields were obtained

TABLE 2.—AGRONOMIC DATA ON WHEAT VARIETIES GROWN IN FIELD PLOTS AT EAGAR, ARIZONA, 1927 TO 1931.

Variety	C. I. No.	Stem rust %	Test wgt. (lb. per bu.)	Average yield (bu. per acre)					Av. yield % Marquis	
				1927	1928	1929	1930	1931		Av.
Regenerated Defiance.....	3703 <sup>a</sup>	25 <sup>b</sup>	53 <sup>c</sup>	16.5	15.4	21.6	19.6	22.7	19.2	111.6
Federation.....	4734	50	54	16.6	13.3	26.2	14.4	17.8	17.7	102.9
Pacific Bluestem.....	4067	28	53	14.5	17.1	18.8	20.2	15.7	17.3	100.6
Marquis.....	4158	28	59	12.5	15.4	22.3	18.5	17.3	17.2	100.0
Dicklow.....	3663	53	50	15.0	18.5	14.8	19.7	17.4	17.1	99.4
Baart.....	1697	43	59	15.9	14.8	18.2	16.5	17.3	16.5	95.9
Hard Baart.....	8274	33	60	16.9	14.5	15.0	15.2	16.5	15.6	90.7

<sup>a</sup> Accession number of the Division of Cereal Crops and Diseases, formerly Cereal Investigations.

<sup>b</sup> For 1931.

<sup>c</sup> For 1927.

in 1932. In 1933, 1934, and 1935, the tests were carried on near Nutrioso, Arizona. During 1935 this nursery was grown on a very fertile piece of ground near a barn, and lodging occurred in all the varieties. This lodging was especially severe in the wheat, which caused the yields of the different varieties to vary widely from those previously obtained. For this reason the 1935 wheat yields were not included in the average.

Tests of similar nature were started in the vicinity of Flagstaff, Arizona, in the summer of 1932 and continued through 1937. From one to two complete varietal nurseries were grown during each of the 6 years in the different representative locations around Flagstaff. Yields of the varieties were obtained each year except in 1933 when, due to poor stands, the grain yields were not believed to be of sufficient accuracy to be recorded.

All the variety tests with wheat, oats, and barley were conducted in nursery rows approximately 1 rod in length and 1 foot apart. There were from three to five replications of each variety in all nurseries every year. Typical nurseries are shown in Plates I and II. The varieties were planted at both Flagstaff and Springerville between May 15 and June 1.



Plate I.—Barley nursery at Nutrioso, Arizona, 1935. Left to right, three rows per variety—Hannchen, Union Beardless, and Trebi.

TABLE 3.—AGRONOMIC DATA ON WHEAT VARIETIES GROWN AT SPRINGVILLE AND NUTRISO, ARIZONA,  
FROM 1931 TO 1935.

Variety	C. I. No.	Date mature (Sept.)	Plant height (in.)	Av. stem rust (%)	Average yield (bu. per acre)					Av. yield Hope in com- parable years	Av. yield Hope in com- parable years
					1931	1933	1934	1935*	Av.		
Hope .....	8178	14	40	Tr.	35.4	34.8	31.9	40.0	34.0	.....	100.0
Komar .....	8004	13	39	1.0	.....	.....	30.6	57.1	30.6	31.9	95.9
Reliance .....	7370	13	40	11.5	27.2	36.3	28.0	52.1	30.5	34.0	89.7
Baart .....	1697	13	38	18.9	16.5	33.3	31.4	38.3	27.1	34.0	79.7
Marquis .....	4158	14	41	24.5	14.9	32.3	26.3	42.9	24.5	34.0	72.1
Pacific Bluestem	4067	20	47	31.0	20.1	29.5	21.5	52.1	23.7	34.0	69.7
Reg. Defiance.....	3703	21	46	29.3	17.9	23.7	29.5	43.7	23.7	34.0	69.7
Ceres .....	6900	14	40	7.9	12.5	.....	29.6	64.3	21.1	33.7	62.6

\* 1935 yields not included in average.



Plate II.—Wheat nursery at Flagstaff, Arizona, 1933. Left to right, three rows per variety—Hope, Ceres (the center row has been harvested for yield), and Pacific Bluestem.

## NURSERY RESULTS

### SPRINGERVILLE-NUTRISO TESTS

A total of forty-eight varieties of wheat was planted at Eagar in 1931. The percentage of stem rust which developed during the summer was about average for that region. Almost without exception the highest yielding varieties were those most resistant to stem rust. This emphasized the importance of including a large percentage of rust-resistant varieties in the future yield trials. In Table 3 are tabulated the results obtained for the period 1931-35 with a number of varieties in comparison with Marquis and Regenerated Defiance, the commonly grown varieties in this section.

The Hope variety ranked highest with an average yield of 34.0 bushels per acre, which was 27.9 per cent higher than Marquis and 30.3 per cent higher than Regenerated Defiance. There was only 1 year (1934) in which Komar was tested, and its yield was but slightly below Hope.

With the exception of Ceres a very close inverse relationship existed between the yield of grain and the percentage of stem rust in the various varieties. Hope and Komar are highly resistant to this disease, while Ceres and Reliance are moderately resistant.

Markton was easily the highest yielding variety of oats as shown in Table 4. This variety was highest in yield each year the test

TABLE 4.—AGRONOMIC DATA ON OAT VARIETIES GROWN AT SPRINGERVILLE AND NUTRIOSO, ARIZONA,  
FROM 1931 TO 1935.

Variety	C. I. No.	Date headed (Sept.)	Plant height (in.)	Average yield (bu. per acre)					Av. yield Mark-ton in com-parable years	Av. yield % Mark-ton in com-parable years
				1931*	1933	1934	1935	Av.		
Markton .....	2053	17	47	.....	95.0	94.7	91.9	93.9	.....	100.0
Swedish Select.....	134	19	47	.....	83.4	.....	75.4	79.4	93.5	84.9
Colorado 37.....	1640	18	47	.....	90.0	79.5	56.4	75.3	93.9	80.2
Idamine .....	1834	17	48	.....	89.2	70.7	63.6	74.5	93.9	79.3
Victory .....	1279	20	49	.....	83.0	70.9	68.1	74.0	93.9	78.8
Bliss Side.....	.....	23	51	.....	.....	.....	62.1	62.1	91.9	67.6

\* Eaten off by livestock and not harvested.

TABLE 5.—AGRONOMIC DATA ON BARLEY VARIETIES GROWN AT SPRINGERVILLE AND NUTRISO, ARIZONA, FROM 1931 TO 1935.

Variety	C. I. No.	Date mature (Sept.)	Plant height (in.)	Average yield (bu. per acre)					Av. yield Trebi in com-parable years	Av. yield Trebi in com-parable years
				1931	1933	1934	1935	Av.		
Trebi .....	936	9	29	46.2	60.5	90.0	79.8	69.1	100.0	
Hannchen .....	531	13	31	54.4	52.1	72.1	59.3	59.5	86.1	
Club Mariout.....	261	.....	28	.....	.....	.....	65.1	65.1	81.6	
Union Beardless.....	5976	13	34	.....	55.1	75.9	44.6	58.5	76.8	

was conducted. Its average yield was 15.1 per cent higher than Swedish Select and 19.8 per cent higher than Colorado 37. Victory, Idamine, and Swedish Select were the commonly grown varieties in the area.

Owing to the tendency of red oat varieties to vegetate and mature late under high elevations, they should not be grown in this section. A few varieties were planted in 1933 which did not begin heading until the third week in September when the other varieties were mature.

A total of twenty-five varieties of barley was first grown near Eagar during the summer of 1931. Most of them were discontinued because they were not adapted to this locality. The 4-year average yield of Trebi was 13.9 per cent higher than that of Hannchen. Union Beardless was the lowest yielding variety in the test as shown in Table 5.

#### FLAGSTAFF TESTS

The agronomic data of twelve of the higher yielding varieties of wheat which were grown during 1932-37 in the vicinity of Flagstaff are shown in Table 6. The Reliance variety yielded highest for the 5-year period. Its average yield was 9.9 per cent higher than Marquis and 13.5 per cent above Regenerated Defiance, the two commonly grown varieties. The Hope variety was second high in yield. Baart was the lowest yielding variety in the test.

During the summers of 1936 and 1937 an additional number of varieties were grown for the first time. Many of these varieties were not resistant to stem rust. A few of the more promising are included in Table 6 for a comparison with the varieties which have grown for longer periods of time. During this 2-year period Irwin Dicklow and Kubanka (brush tip type) yielded 27.1 and 12.2 per cent, respectively, above Reliance. Kubanka (brush tip type) was very erratic during the 2 years, being the highest yielding variety in 1936 and the lowest in 1937.

The inverse relationship between yield and percentage of stem rust in the varieties as a whole was not quite so striking as it was at Springerville. This indicates that the rust problem at Flagstaff was not so great as it was in the Springerville-Nutriosio area. This fact is observed by comparing the percentages of stem rust in Tables 3 and 6.

The results obtained during 1932-37 with a number of oat varieties are shown in Table 7. As in the experiments at Springerville-Nutriosio, Markton was the highest yielding variety for the 5-year period. Its average yield was 7.6 per cent above Colorado 37. Two red oat varieties, Kanota and Texas Red, had the lowest average yield of any in the test. Bliss Side (a strain of White Tartar), which is being grown to some extent around Flagstaff, was 15.1 per cent below Markton in grain yield. During 1936 and 1937 a few smut-resistant hybrids having Markton as one parent were grown. One of these, Markton  $\times$  Idamine (C. I. 2574), was the only one which yielded above Markton.

TABLE 6.—AGRONOMIC DATA ON WHEAT VARIETIES GROWN AT FLAGSTAFF, ARIZONA, FROM 1932 TO 1937.

Variety	C. I. No.	Date mature (Sept.)	Plant height (in.)	Stem rust (%)	Test weight (lb. per bu.)	Average yield (bu. per acre)					Av. yield in comparison-able years	Av. yield in comparison-able years
						1932	1934	1935	1936	1937		
Reliance	7370	14	30	4.0	59.5	21.3	18.0	10.1	18.1	17.1	17.1	100.0
Hope	8178	13	30	0.0	57.0	23.2	15.8	9.9	14.3	15.7	15.8	92.4
Pacific Bluestem	4067	15	36	12.1	58.5	20.1	.....	9.7	15.2	17.0	15.5	16.9
Komar	8004	12	30	1.0	59.3	.....	19.5	10.0	13.6	15.2	14.6	16.1
Marquis	4158	13	30	8.5	59.0	20.8	16.4	9.6	14.8	15.2	15.4	17.1
Ceres	6900	10	29	3.0	59.5	.....	15.7	10.3	15.5	16.5	14.5	16.1
Reg. Defiance	3703	17	34	10.0	58.8	17.0	15.7	8.7	14.3	18.2	14.8	17.1
Baart	1697	15	29	9.7	60.0	20.6	.....	7.4	8.1	12.9	12.3	16.9
Irwin Dicklow	8855	14	31	21.5	57.3	.....	.....	.....	24.7	21.3	23.0	18.1
Kubanka (brush tip type)	.....	14	40	0.0	61.5	.....	.....	.....	28.6	12.0	20.3	18.1
Federation	4734	12	25	17.5	57.5	.....	.....	.....	18.6	19.6	19.1	18.1
Thatcher	.....	14	27	Tr.	57.8	.....	.....	.....	13.1	14.7	13.9	18.1

TABLE 7.—AGRONOMIC DATA ON OAT VARIETIES GROWN AT FLAGSTAFF, ARIZONA, FROM 1932 TO 1937.

Variety	C. I. No.	Date mature (Sept.)	Plant height (in.)	Average yield (bu. per acre)					Av. yield Mark- ton in com- para- ble years	Av. yield Mark- ton in com- para- ble years	
				1932	1934	1935	1936	1937			Av.
				Markton .....	2053	18	31	45.2	23.3	29.3	47.3
Colorado 37.....	1640	16	31	46.3	24.4	23.3	39.9	37.1	34.2	37.0	92.4
Idamine .....	1834	15	30	47.4	24.4	22.3	32.6	30.8	31.5	37.0	85.1
Bliss Side.....	.....	29	38	.....	.....	27.6	37.3	.....	32.5	38.3	84.9
Texas Red.....	.....	15	30	41.3	.....	.....	34.3	32.4	36.0	44.1	81.6
Kanota .....	839	16	30	37.7	.....	.....	26.8	32.6	32.4	44.1	73.5
Markton × Idamine.....	2574	21	35	.....	.....	.....	56.3	37.7	47.0	43.6	107.8
Markton × Victory .....	2952	17	32	.....	.....	.....	42.9	38.8	40.9	43.6	93.8
Markton × Swedish Select	2975	20	36	.....	.....	.....	38.1	37.7	37.9	43.6	86.9

TABLE 8.—AGRONOMIC DATA ON BARLEY VARIETIES GROWN AT FLAGSTAFF, ARIZONA, FROM 1932 TO 1937.

Variety	C. I. No.	Date mature (Sept.)	Plant height (in.)	Average yield (bu. per acre)						Av. yield less in com- Union Beard- parable years	Av. yield less in com- Union Beard- parable years
				1932	1934	1935	1936	1937	Av.		
Union Beardless..	5976	15	23	41.1	18.8	30.4	44.4	26.6	32.3	100.0	
Hannchen .....	531	17	24	39.1	17.0	19.9	43.0	26.1	29.0	89.8	
Trebi .....	936	16	20	37.3	16.4	25.0	41.4	23.9	28.8	89.2	
Sacramento .....	4108	21	19	.....	.....	.....	32.0	24.3	28.2	79.4	
Colsess .....	2792	18	22	.....	.....	.....	37.1	17.0	27.1	76.3	
Club Mariout.....	261	15	17	.....	13.8	18.9	20.5	.....	17.7	56.7	

The Union Beardless variety of barley yielded highest each year of the 5 years (Table 8). Its average yield was 10.2 per cent above Hannchen. There were but very slight differences between the yields of Hannchen and Trebi. Hannchen was the tallest variety grown in the test.

## DESCRIPTION AND DISCUSSION OF VARIETIES

### WHEAT VARIETIES

The Marquis variety is a hard, red spring wheat (Pl. III). It is practically beardless or awnless, having only a few apical awns at the top of the spike or head. Its outer glumes are white to yellowish. Marquis has no resistance to stem rust and but slight resistance to stinking smut or bunt.

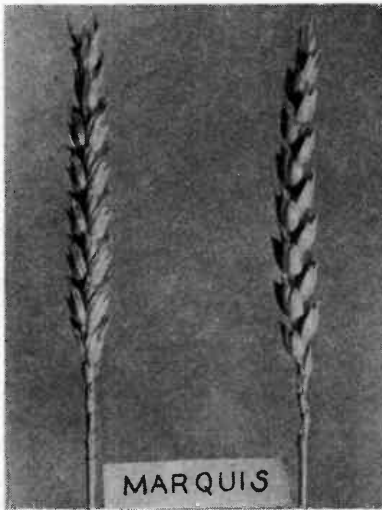


Plate III.—Marquis Wheat.



Plate IV.—Reliance Wheat.

The Regenerated Defiance variety has white semihard to hard kernels. The outer glumes are white. Its head is similar to Marquis and has only a few apical awns. Regenerated Defiance has but very slight resistance to stem rust and no resistance to bunt. The variety is somewhat later and taller than Marquis.

Reliance is another hard, red spring variety (Pl. IV). It has a fully awned spike or head. The outer glumes are white in color. Under the conditions at both Flagstaff and Nutrioso this variety has shown moderate resistance to stem rust. It is also moderately resistant to bunt.

The Hope variety is also a hard red spring wheat. It has a fully awned spike or head much like Reliance. It can be readily identified from Reliance by (1) small hairs or pubescence on its leaves



Plate V.—Kubanka Wheat.

and (2) purple colored stem. Hope has two desirable characteristics which make it suitable for a section like Springerville and Nutrioso: (1) it is highly resistant to stem rust, as indicated by having no rust at Flagstaff and only a trace at Springerville and Nutrioso, and (2) Hope is also resistant to stinking smut of wheat or bunt. The Hope variety originated from a cross of Vernal emmer  $\times$  Marquis. It has one of the characteristics of emmer in that the kernels are held more tightly than those of any other wheat variety tested. This feature causes Hope to be resistant to shattering and also to hail injury. Hails frequently occur in

the Springerville and Nutrioso area. In threshing Hope, it may be necessary to increase the cylinder speed in order to prevent white caps from appearing in the threshed grain. The Hope variety is susceptible to drought and heat injury. It should not be grown in locations where there is a shortage of soil moisture, especially during the jointing stage. Because of this feature the growing of Hope should be limited to the Springerville and Nutrioso areas or others of similar growing conditions.

The Kubanka (brush tip type) variety (Pl. V) is being grown to some extent in the vicinity of Flagstaff. It is a fully awned durum wheat having very hard white kernels. It has yellow colored outer glumes and is highly resistant to stem rust.

Irwin Dicklow is a beardless variety having only short apical

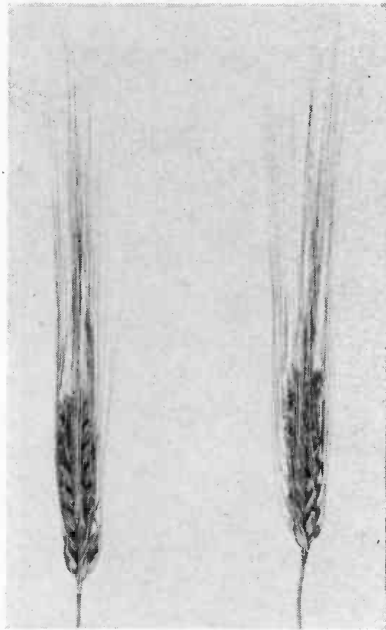


Plate VI.—Trebi barley. (Courtesy of the Division of Cereal Crops and Diseases, Bureau of Plant Industry, U.S. Dept. of Agric., Washington, D.C.)



Plate VII.—Hannchen barley.  
(Courtesy of the Division of Cere-  
al Crops and Diseases, Bureau of  
Plant Industry, U.S. Dept. of  
Agric. Washington, D.C.)

awns. It has soft white kernels, white outer glumes, and no resistance to stem rust or bunt.

Ceres and Komar are both fully awned, hard, red spring varieties very similar to Reliance in general appearance.

#### BARLEY VARIETIES

The Trebi variety is a fully bearded, six-rowed barley (Pl. VI). Its awns or beards are barbed or rough. The variety has considerable resistance to lodging and is adapted to a wide range of conditions.

Hannchen is also a fully bearded variety (Pl. VII), but it has a two-rowed spike or head rather than six-rowed as in Trebi. Many of these beards fall off before maturity. This barley grows taller than any of the other varieties tested.

The Union Beardless is a six-rowed variety and, as the name indicates, has no awns or beards and is known as a hooded type (Pl. VIII). It is very susceptible to covered smut, and care should be taken to treat the seed thoroughly before planting.

#### OAT VARIETIES

The Markton oat variety (Pl. IX) has a very widely adapted range. It is highly resistant to the oat smuts. It has a stiff straw and seldom lodges. Markton has a more open head or panicle than any of the other varieties tested. It has a light yellow colored kernel which has short awns or beards.

The Swedish Select oat is a midseason, white-seeded, bearded variety which yielded fairly



Plate VIII.—Union Beardless Barley.

well at Nutrioso. It was discontinued at Flagstaff after 2 years of low yields. It has an open type panicle.

The Colorado 37 is a midseason white oat bred in Colorado. It has an open type panicle, stiff straw, low percentage of hull, and beardless kernels. The variety seems to be well adapted to higher elevations.

Idamine is also a white-kernelled oat with an open head or panicle. It has very few awns or beards.

#### GENERAL DISCUSSION

Inasmuch as the wheat varieties in the field plots and in the nursery were planted on adjacent fields in 1931, it is of interest to compare the yields and percentage of stem rust under the

two treatments. All of the varieties in the wheat plots were included in the nursery in 1931. With the exception of Pacific Blue-stem, a fairly close relationship occurred between the rank of the varieties in the field plots and in the nursery. This agrees with what many other investigators have found—that nursery trials can to a large extent be substituted for field-plot trials. In general, the varieties in the field plots averaged slightly higher in yield and also had higher percentages of stem rust than in the nursery.

It has been mentioned that the wheat varieties in field plots at Eagar from 1927 to 1931 were planted on land which had been irrigated prior to planting. The prevalent method in the community is to plant dry and irrigate up. This results in a certain amount of soil crusting and makes at least one more irrigation necessary. No additional irrigation following that prior to planting was given the test plots during 3 of the 5 years. Although no attempt was made to determine the additional amount of water required for wheat production under the ordinary method as compared with that required on the test plots, the difference was considerable. These results created much interest among growers in the problem of water efficiency.

The control of bunt in the wheat varietal plots from 1927 to 1931 resulted in the widespread use of copper carbonate by farmers of Apache County. One commercial and several homemade treating machines were used with a marked reduction in the smutted grain.

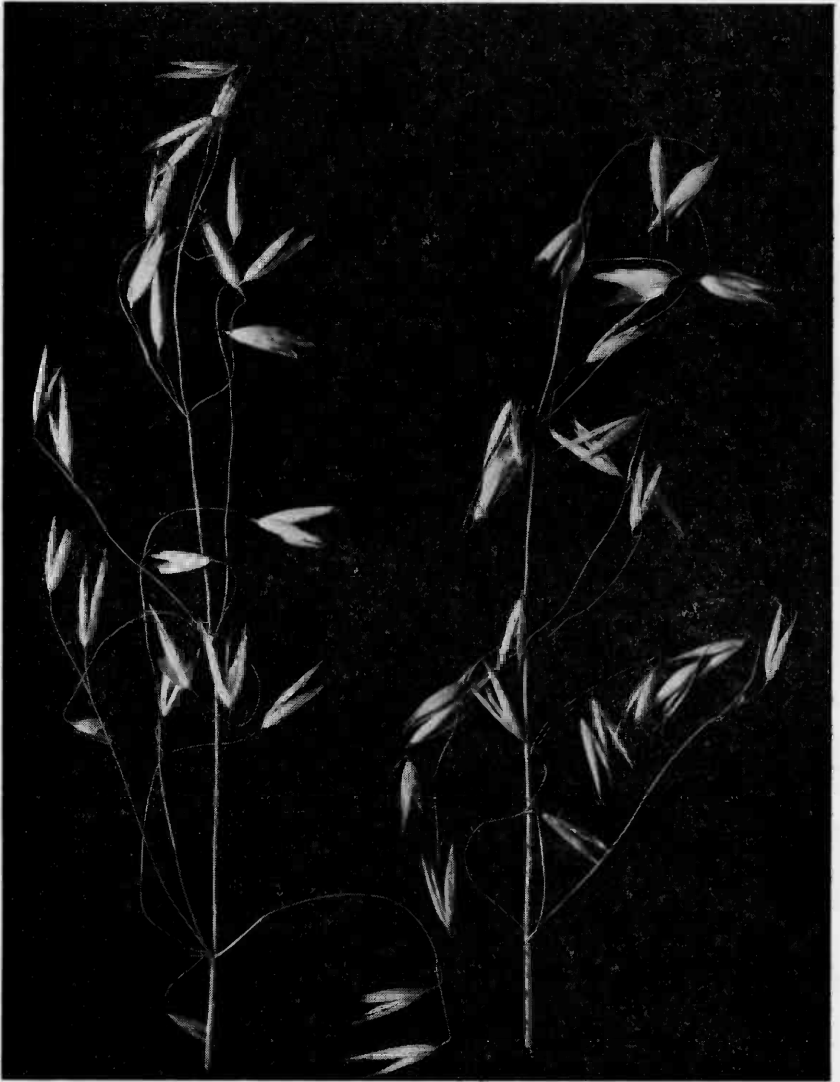


Plate IX.—Markton oats. (Courtesy of the Division of Cereal Crops and Diseases, Bureau of Plant Industry, U.S. Dept. of Agric., Washington, D.C.)

#### SUMMARY

Trials were made with wheat, oats, and barley varieties in the Springerville-Nutrioso area from 1931 to 1935 and in the vicinity of Flagstaff from 1932 to 1937. Both of these locations have elevations slightly over 6,900 feet, and the growing conditions differ mainly by the fact that at Flagstaff dry farming is practiced

while at Springerville and Nutrioso an irrigation is applied during the jointing stage in June.

Hope wheat, a variety highly resistant to stem rust, bunt, and shattering, was highest in yield at Springerville and Nutrioso. In the Flagstaff area Reliance was highest in yield for the 5-year period. Several varieties grown only for 2 years at Flagstaff produced higher yields than Reliance for the same length of time.

The highest yielding barley variety in the Springerville-Nutrioso district was Trebi, while around Flagstaff the Union Beardless variety was highest.

A smut resistant oat variety, Markton, was highest in grain yield at Springerville, Nutrioso, and Flagstaff. This variety is adapted to a wide range of conditions.

#### ACKNOWLEDGMENT

The splendid co-operation of C. G. Lueker, County Agricultural Agent, Coconino County, and H. T. Brawley, formerly County Agricultural Agent, Apache County, in locating farmers for the growing of the varieties, is greatly appreciated.