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# Spring Wheat Varieties for South Dakota

K.H. Klages

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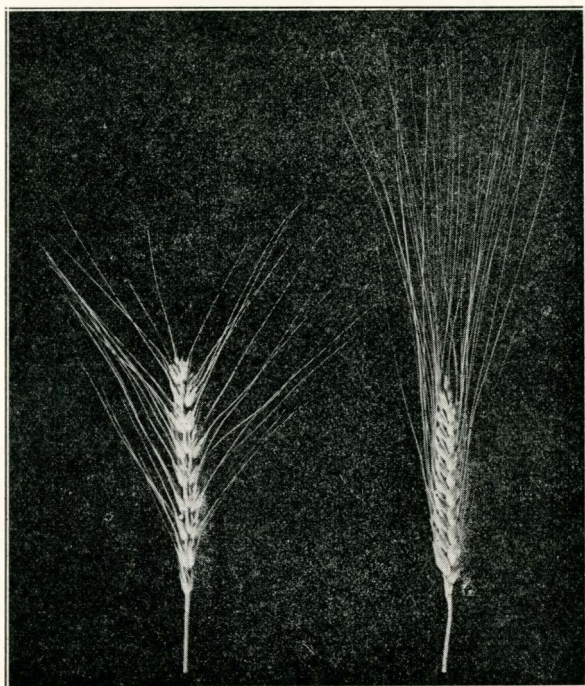
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# Spring Wheat Varieties for South Dakota

K. H. Klages



CERES

MINDUM

Recommended varieties of hard red spring and durum wheat

Agronomy Department  
Agricultural Experiment Station  
of the  
South Dakota State College of  
Agriculture and Mechanic Arts  
Brookings

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# Spring Wheat Varieties for South Dakota

K. H. Klages

## The Place of Wheat in South Dakota Agriculture

Wheat, next to corn, is South Dakota's greatest grain crop. This, as may be seen from Table 1, is true from the standpoint of acreage devoted to its production as well as from the relative value of the crop.

The trend of wheat production in South Dakota is shown graphically in Fig. 1. Wheat production as measured by the number of acres devoted to the crop increased rapidly from 1891 until the peak was reached ten years later. The record acreage in 1901 was 4,005,000 acres. From 1902 to 1907 there was a sharp decline in the wheat acreage of the state. By 1907 the acreage had declined to 2,900,000 acres. This period of decline was followed by a six year period of expansion. The second peak was reached in 1913 with 3,775,000 acres. This was decidedly below the high point of 1901. From 1913 to 1926 the decline in the wheat acreage of the state was broken into only by the great production of 1919, 3,896,000 acres, in response to the demand created for wheat by the world war. In 1926, the lowest point of the cycle, only 1,917,000 acres of wheat were harvested. The low acreage of 1926 was followed by decided increases in 1927 and in the last three years.

Fig. 2 gives the average yield of wheat per acre for the State of South Dakota for the period of 1891 to 1929. It is apparent that they fluctuate widely from season to season. The average yield per acre for the period was 11.3 bushels. The straight line trend as indicated by the horizontal position and the formula of the line of least squares,  $y=11.308+.005x$ , shows that the average yields exhibit but a very slight upward trend. The annual increment amounted to only .005 bushels per acre. In other words the secular yields remained practically unchanged. During the period here indicated certain factors such as decrease in the native fertility of the soil and increased damage from weeds worked definitely towards decreasing yields. On the other hand, such factors as the use of improved varieties and better cultural practices worked towards increasing yields.

It is interesting to note, even with a general decline in the wheat acreage of the state from 1913 to 1926 that the farm value of this crop in 1926, when the lowest acreage on record for the period under consideration was grown, exceeded the combined values of the oats, barley, and rye crops by a substantial amount. Table 1 shows that the average farm value of wheat for the ten year period of 1920 to 1929 was about equal to the combined values of the oats, flax and rye crops. This clearly brings out the point that wheat has been and still is the most important small grain crop produced in South Dakota. Since climatic and soil conditions in parts of South Dakota are especially favorable for the production of this crop, it is evident that wheat will continue to be one of the most important field crops of the state.



TABLE 1.—Comparative importance of South Dakota grain crops as measured by the average acreages, production, and farm values of the various crops for the ten year period, 1920 to 1929

| Crop   | Acreage<br>1000<br>acres | Production<br>1000<br>bushels | Av. yield<br>per-acre<br>in bushels | Value<br>1000<br>dollars |
|--------|--------------------------|-------------------------------|-------------------------------------|--------------------------|
| Corn   | 4,361                    | 109,552                       | 25.5                                | 59,118                   |
| Wheat  | 2,817                    | 31,055                        | 10.8                                | 31,819                   |
| Oats   | 2,428                    | 71,125                        | 28.9                                | 23,107                   |
| Barley | 1,130                    | 24,776                        | 22.2                                | 11,949                   |
| Flax   | 425                      | 3,229                         | 7.8                                 | 6,711                    |
| Rye    | 223                      | 3,046                         | 12.7                                | 2,177                    |

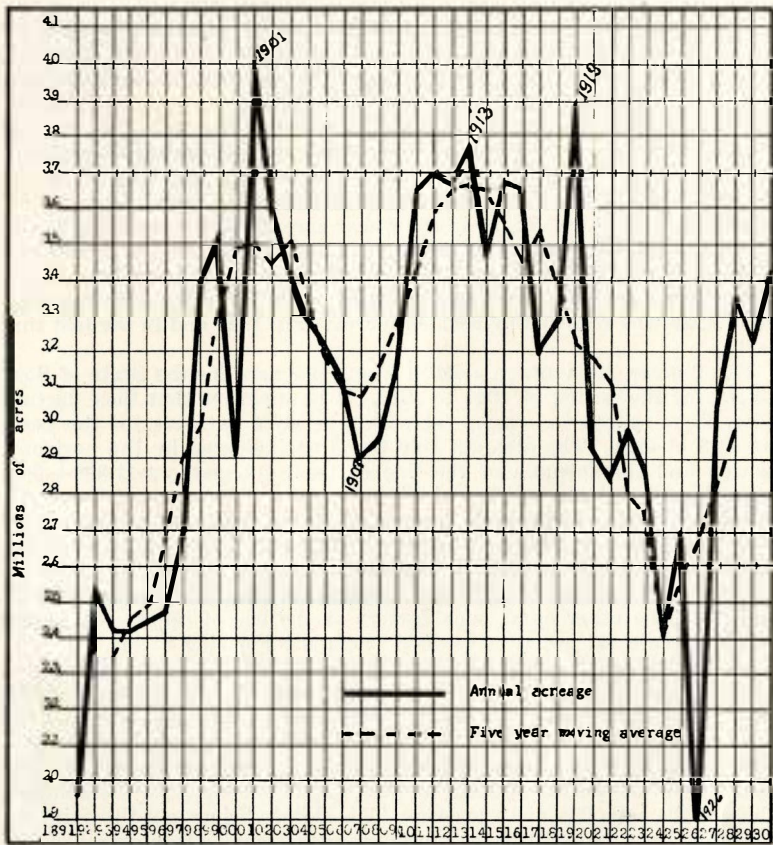


Fig. 1.—Trends in wheat production in South Dakota as shown by the acreage of the crop harvested from 1891 to 1930

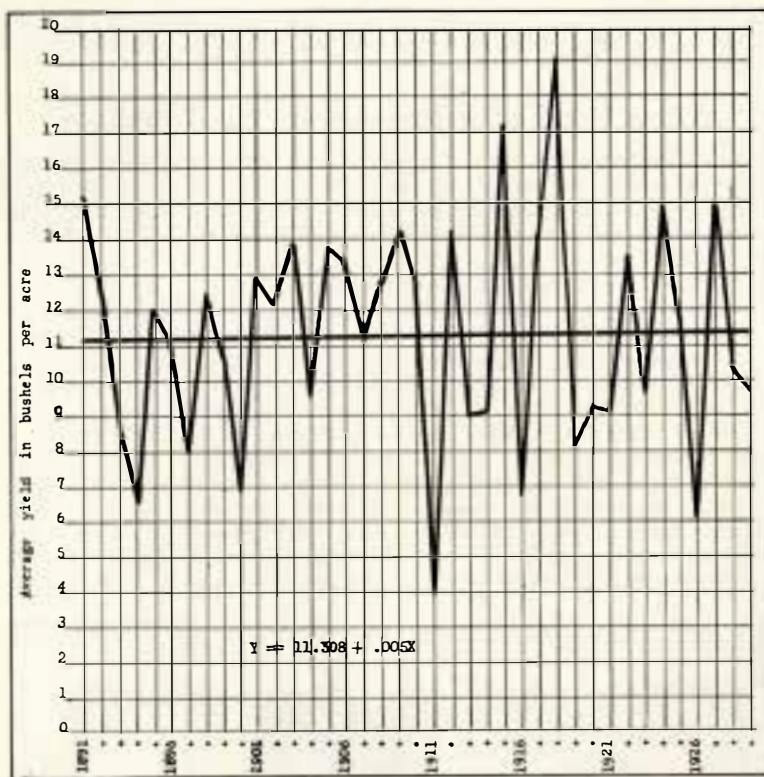


Fig. 2.—Average annual per acre yields of wheat and trends of yields for the state of South Dakota

## Distribution of Wheat Production in South Dakota

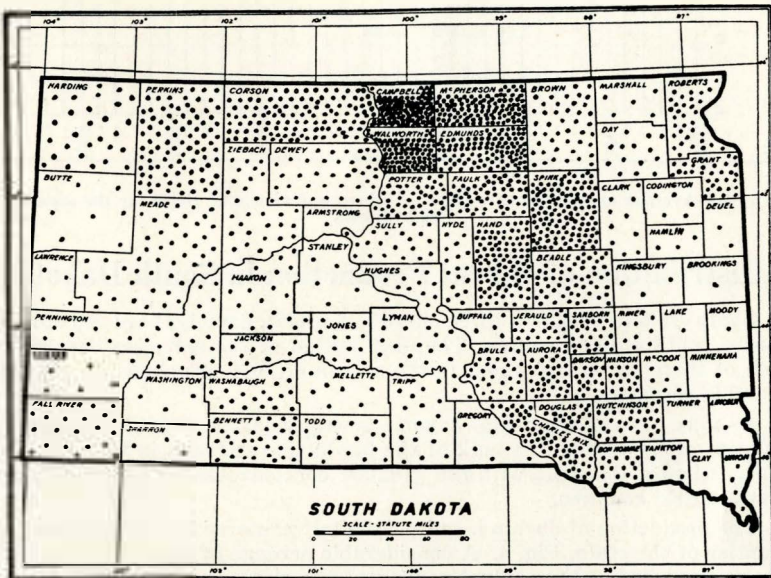
South Dakota produces three classes of wheat, namely, hard red spring, durum, and hard red winter. The distribution of the acreages devoted to each of these classes of wheat in the season of 1930 are shown in Figs. 3, 4, and 5, respectively.

As may be seen from Fig. 3, some spring wheat is produced in all the counties of the state. The bulk of the production is found in the east central portion of the state with the greatest concentration of acreage in the north central counties.

The production of durum is quite definitely centered in the northeastern counties of the state, Fig. 4. A considerable acreage of this class of wheat is also produced in the central portion of the state. In this latter section the hard red spring wheats are, however, of much greater relative importance.

District No. 1. Durum wheat producing area.

- Table 2 gives a tabulation of the distribution of the three classes of





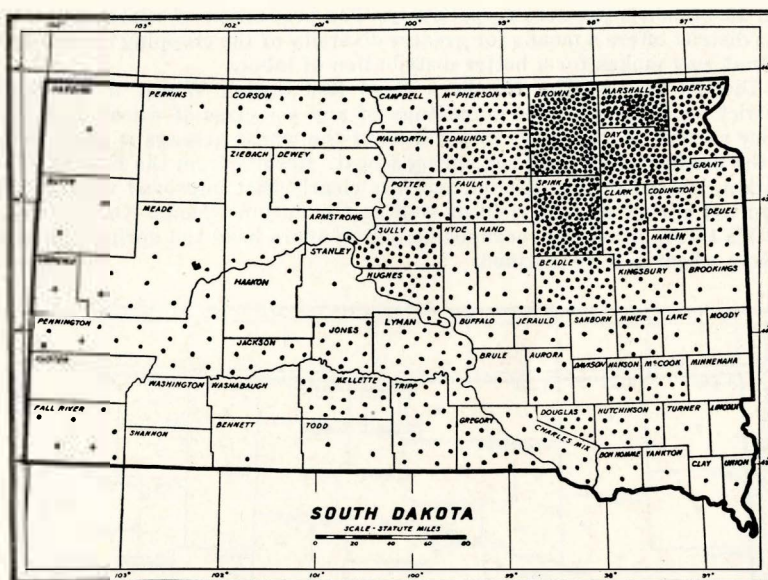


Fig. 4.—Distribution of durum wheat acreage in South Dakota, season of 1930. Each dot represents 1000 acres

for the respective areas. This will be treated later, after the experimental performances of the various classes of wheat have been cited and discussed.

**District No. 1—The Durum Wheat Area.**—This section produces about 55 per cent of the durum wheat of the state. The great predominance of durum wheat in this section is clearly shown in Table 2; 73.5 per cent of the entire wheat acreage in 1930 was devoted to the production of durum wheat. Studies to be reported on the relative yields of varieties of durum and hard red spring wheats will bring out the fact that improved varieties of this latter class will yield as well as varieties of durum. In view of the present price relationship between these two classes of wheat it would appear that growers may well shift from durum to hard red spring wheat.

**District No. 2.—The East-central Area.**—This section produces very little wheat. The acreage devoted to hard red spring and durum wheats is about equally divided. A small amount of winter wheat is being grown. Since the east-central portion of the state is devoted primarily to the production of feed crops, such crops as corn, barley, and oats are being grown to the exclusion of wheat. The production of spring wheat on a large scale cannot be recommended for this district. More attention can, however, rightly be given to increased production of winter wheat. Winter wheat grown under proper conditions may be expected to become an established and useful crop. The average yields of hard red winter, durum, and hard red spring wheats grown on variety test plats at Brookings for a period of 25 years from 1905 to 1929, as reported by Klages<sup>9</sup>, were 25.2, 17.0,

\* Reference by number is to "Literature Cited," p. 44.

and 15.6 bushels per acre respectively. The production of winter wheat in this district offers a means for greater diversity of the cropping system and in that way makes for a better distribution of labor.

**District No. 3.—The Northern Hard Red Spring Wheat Area.**—This district produces a higher percentage of any one class of wheat than any other section of the state; 78 per cent of the wheat acreage is given over to the production of hard red spring wheat. Results from the Eureka sub-station, located in this district, indicate clearly that improved varieties of hard red spring wheats yield as well as the durum wheats. On the basis of this information the recommendation of more hard red spring and less durum wheat is fully justified.

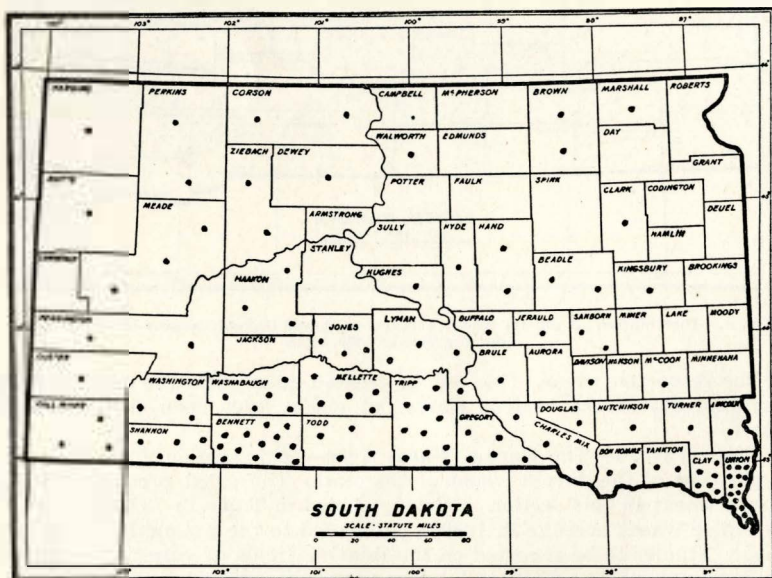
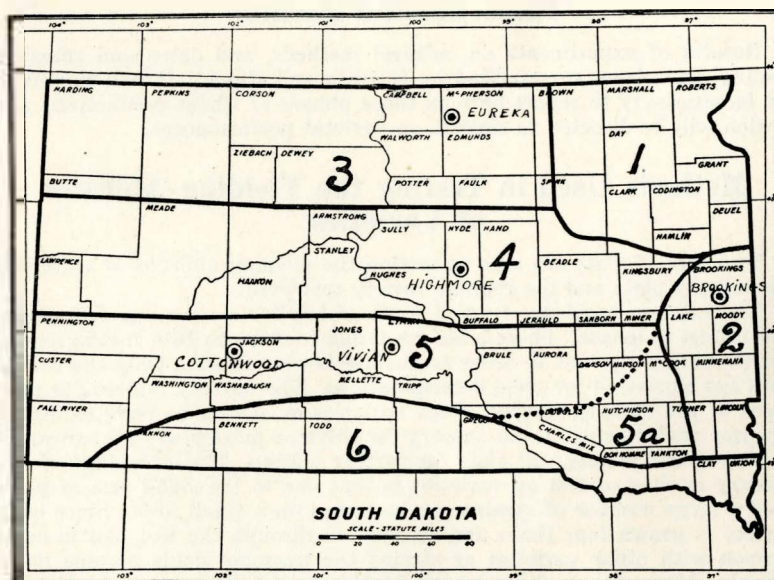


Fig. 5.—Distribution of hard red winter wheat acreage in South Dakota, season of 1930. Each dot represents 1000 acres

**District No. 4.—The Central Hard Red Spring Wheat Area.**—Conditions in this area are quite similar to those in the northern hard red spring wheat district. The fact that a higher percentage of the wheat acreage is devoted to durum wheat is to be noted. District 3 has only 21 per cent of its wheat acreage devoted to durum as compared to 36 per cent for district 4. Comparative yields of durum and hard red spring wheats at the Highmore substation, located in this district, indicate that much of the acreage now devoted to the production of the lower priced durum wheats may well be given over to the growing of hard red spring wheats. With the use of the proper variety this can be done without appreciable, if any, sacrifice of yield.

As may be observed from Table 2, a small amount of winter wheat is being grown in this district. Returns from this crop are too uncertain, how-

| District                    | CLASSES OF WHEAT GROWN   |   |                          |   |                          |   |
|-----------------------------|--------------------------|---|--------------------------|---|--------------------------|---|
|                             | Hard red spring          |   | Durum                    |   | Winter                   |   |
|                             | Acreage<br>1000<br>acres | Perc'tage<br>of total<br>wheat<br>acreage | Acreage<br>1000<br>acres | Perc'tage<br>of total<br>wheat<br>acreage | Acreage<br>1000<br>acres | Perc'tage<br>of total<br>wheat<br>acreage |
| 1. Durum wheat area         | 272                      | 26.1                                      | 766                      | 73.5                                      | 4                        | 0.4                                       |
| 2. East central             | 6                        | 43.0                                      | 6                        | 43.0                                      | 2                        | 14.0                                      |
| 3. Northern hard red spring | 841                      | 78.0                                      | 227                      | 21.1                                      | 10                       | 0.9                                       |
| 4. Central hard red spring  | 285                      | 61.2                                      | 168                      | 36.1                                      | 13                       | 2.7                                       |
| 5. Southern hard red spring | 443                      | 68.8                                      | 163                      | 25.3                                      | 38                       | 5.9                                       |
| 6. Winter wheat area        | 170                      | 59.4                                      | 53                       | 18.5                                      | 63                       | 22.1                                      |



**District No. 5—The Southern Hard Red Spring Wheat Area.**—Conditions here are quite similar to those in the central area. It is to be observed that a smaller percentage of durum wheat is being grown here than in the former district. Even less durum and more hard red spring wheat could well be grown. As is to be expected more winter wheat is being grown here as compared to the districts to the north. Winter wheat production is feasible especially in the southeastern portion of this district, designated as



5a in Fig. 6. Due to more severe winter conditions the production of winter wheat in the central and western portions of this district, except where it can be grown in protected places, is quite hazardous.

**District No. 6—The Hard Red Winter Wheat Area.**—While this section is designated as a winter wheat area it will be seen from Table 2 that the production of hard red spring wheat is of far greater importance than that of winter wheat. It is in this district that the greatest acreage of winter wheat is to be found; it is also here that the higher percentage of land in wheat is devoted to the growing of winter wheat. The durum wheats occupy a relatively unimportant place. Winter wheat has been an important crop in the eastern counties of this district for some time. It is however a comparatively new crop in the central and western portions of the district.

## Experimental Results

Results of experiments on cultural methods, and dates and rates of seeding, have been summarized by Hardies and Hume<sup>6</sup>. It will therefore not be necessary to report here on those phases of wheat production. Attention will be directed to reports on varietal performances.

### Methods Used in Testing the Yielding Abilities of Varieties

Two sets of plats are used in testing the yielding abilities of varieties, the nursery plats and the regular variety test plats.

The nursery consists of small plats of triplicate rows one foot apart and 18 feet in length. These plats are trimmed down to 16½ feet in length shortly before harvest in order to obviate border effects. Only the center rows are harvested for yield determinations. The nursery is used for purposes of preliminary testing. Such varieties or strains as have exhibited superior performance in the nursery for three or more years are advanced to the regular variety test plats for further testing. The advantage of the nursery method of testing varieties is that due to the small size of plats used a large number of strains can be tested on a small area. Since each variety is grown four times and distributed through the test plat in comparison with other varieties or strains the average yields become quite reliable. Nurseries were grown at Brookings and Highmore. At Eureka and Cottonwood the regular variety test plats only were grown. Fig. 7 shows the spring wheat nursery at Brookings during the early part of the season of 1931.

The regular variety test plats used up to 1930 were 1/50 of an acre in area. They were separated by cultivated alleys three feet wide. All plats were repeated three times. Since the cultivated alleys led to considerable border effects, a modification of Delwiche's<sup>8</sup> plan of laying out variety test plats was adapted. Delwiche's plan was modified so that only two rather than six drill rows were grown in the alleys between adjacent plats. The individual plats were separated from the two drill rows in the alley by a blank drill row on either side. The modified plan was found practical under South Dakota conditions in so far as it eliminated the need of cultivated alleys between plats, cut down border effects and reduced the possibilities of exaggerated yields. This method of laying out variety test

plats is discussed in detail by Klages<sup>10</sup>. With the abandonment of cultivated alleys the areas of the plats were cut down from 1/50 to 1/60 of an acre.

In most years the variety test plats followed corn. Due to the shortage of land available for variety test work this was, however, not always possible. Fig. 8 gives a general view of the cereal variety test plats at Brookings during the season of 1927.



Fig. 7.—Hard red spring wheat nursery during the early part of the season of 1931

### Results of Variety Tests of Common Spring Wheats at Brookings

Table 3 gives the annual acre yields of varieties of common spring wheat tested in the regular variety test plats at Brookings for a seven year period from 1925 to 1931, inclusive, together with the seven, six and three year average yields of the varieties compared for those respective periods. Varieties tested previous to 1925 are reported on in Bulletins 222 and 201 of this station by Hardies and Hume<sup>6</sup> and Hume and Evans<sup>7</sup>. Table 4 gives, for the convenience of the reader, a summary of the average yields for the given periods of comparison expressed on a percentage basis of the yields of Ceres. Fig. 9 gives a graphic summary of the relative performances of the varieties tested at Brookings. The varieties to be mentioned are described in a later part of this publication.

Ceres, as may be seen from Tables 3 and 4, was the outstanding variety for first two and longest periods of comparison. For the seven year period, 1925 to and including 1931, Ceres yielded around 16 per cent more than its nearest competitor, Kota, and 20 per cent more than Marquis. Quality and Prelude were decidedly low yielding varieties.



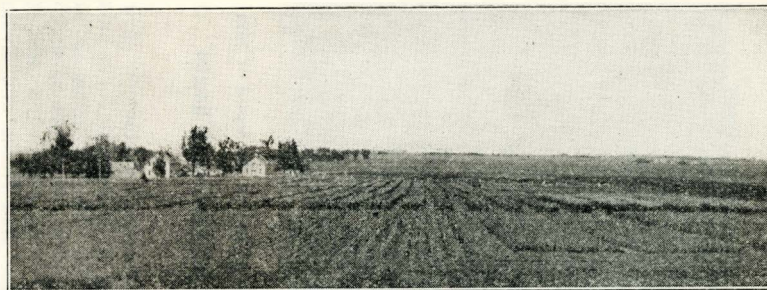


Fig. 8.—General view of the cereal variety test plats of Brookings, season of 1927

TABLE 3.—Annual and average yields of varieties of common spring wheat grown on the variety test plats at Brookings for one or more of seven years from 1925 to 1931, inclusive

| Variety               | C. I.<br>No. | S. Dak.<br>Acc. No. | 1925 | 1926 | Acre yields (bushels) |      |      |      |      | 1930 | 1931 | 7-yr.<br>average<br>1925-1931 | 6-yr.<br>average<br>1926-1931 | 3-yr.<br>average<br>1929-1931 |
|-----------------------|--------------|---------------------|------|------|-----------------------|------|------|------|------|------|------|-------------------------------|-------------------------------|-------------------------------|
| Ceres                 | 6900         | 1281                | 22.5 | 20.5 | 23.0                  | 17.5 | 28.0 | 21.2 | 12.0 |      |      | 20.7                          | 20.4                          | 20.4                          |
| Kota                  | 5878         | 1184                | 21.5 | 20.0 | 16.3                  | 14.6 | 23.3 | 15.5 | 10.8 |      |      | 17.4                          | 16.8                          | 16.5                          |
| Marquis               | 3641         | 515                 | 13.0 | 14.2 | 26.7                  | 13.8 | 20.3 | 16.3 | 11.5 |      |      | 16.5                          | 17.1                          | 16.0                          |
| Quality               | 6607         | 1261                | 19.6 | 9.2  | 15.0                  | 9.2  | 26.9 | 19.7 | 12.3 |      |      | 16.0                          | 15.4                          | 19.6                          |
| Prelude               | 4323         | 1264                | 12.2 | 5.9  | 18.7                  | 7.5  | 21.7 | 16.7 | 6.3  |      |      | 12.7                          | 12.8                          | 14.9                          |
| Reward                | 8182         | 1291                |      | 8.8  | 21.3                  | 12.5 | 27.0 | 21.3 | 10.0 |      |      |                               | 16.8                          | 19.4                          |
| Garnet                | 8181         | 1292                |      | 7.5  | 19.2                  | 13.3 | 26.7 | 18.7 | 10.3 |      |      |                               | 16.0                          | 18.6                          |
| N. Dak. 1656.84       | 8004         | 1296                |      |      | 29.2                  | 17.5 | 35.0 | 20.5 | 11.3 |      |      |                               |                               | 22.3                          |
| Marquillo             | 6887         | 1308                |      |      |                       | 15.4 | 26.9 | 17.3 | 7.2  |      |      |                               |                               | 17.1                          |
| Reliance              | 7370         | 1332                |      |      |                       |      | 27.9 | 19.3 | 12.3 |      |      |                               |                               | 19.8                          |
| Hope                  | 8178         | 1311                |      |      |                       |      | 28.6 | 15.8 | 7.0  |      |      |                               |                               | 17.1                          |
| Supreme               | 8026         | 1310                |      |      |                       |      | 15.6 | 15.8 | 10.3 |      |      |                               |                               | 13.9                          |
| Minn. 2303            | 10003        | 1409                |      |      |                       |      |      | 21.3 | 12.3 |      |      |                               |                               |                               |
| N. Dak. 1656.48       | -----        | 1356                |      |      |                       |      |      | 22.5 | 10.3 |      |      |                               |                               |                               |
| Minn. 2305            | 10005        | 1410                |      |      |                       |      |      | 20.0 | 12.7 |      |      |                               |                               |                               |
| Marquis x Emmer (H44) |              | 1329                |      |      |                       |      |      | 15.2 | 9.0  |      |      |                               |                               |                               |

The six year period of comparison, including some additional varieties, gives about the same results as the previous period. Ceres again occupies the high place. It is followed by Marquis, Reward, and Kota, which yielded about the same. Garnet yielded but slightly less than the above enumerated three varieties while Quality and Prelude come in as low producers.

In the final period of comparison N. Dak. 1656.84, a sister selection of Ceres, takes the lead. It is followed in turn by Ceres, Reliance, Quality and Reward. The three varieties here grouped with Ceres yielded from 3 to 5 per cent less than Ceres. Garnet yielded around 8 per cent less than Ceres. Hope, Marquillo, Kota, Marquis, Prelude and Supreme yielded decidedly less than Ceres. Reward gave a good account of itself in the six year period of comparison; it stands again among the higher yielders in the three year period. It is joined by Reliance and Quality. Comparative yields of Reliance are available for the final period only. The yields of Quality placed this variety among the low producers in the two former periods of comparison. This shifting in the relative position of Quality may in part be accounted for by the fact that climatic conditions during the last three year period were generally favorable to early maturing varieties.

The conclusions to be drawn from the variety test at Brookings are quite evident. Ceres and its sister selection, North Dakota 1656.84, are the outstanding varieties. In the three year period of comparison N. Dak. 1656.84 outyielded Ceres by 1.9 bushels per acre. Comparative yields of these two strains are available for a five year period. During that time N. Dak. 1656.84 yielded 22.7 as compared to 20.3 bushels per acre for Ceres. When the differences in the yield of these two strains are regarded in the light of their respective annual performances, as may be seen from Table 3, it will be found that their yields were identical for one of the five years and that the one outyielded the other each for two of the five years of comparison. The higher average values for N. Dak. 1656.84 were due to the exceptionally high yields of this variety in 1927 and 1929. In the other three years of comparison N. Dak. 1656.84 did not yield any more but rather less than Ceres. When the relative performances of these two strains are compared by "students" method the odds that they are significantly different in yielding ability are 7.14:1.

Fig. 10 shows a view of a field of Ceres in Day county in the season of 1931.

TABLE 4.—Average yields of varieties of common spring wheat at Brookings for the years indicated expressed on a percentage basis of the yields of Ceres for a period of 1925 to 1931, inclusive

| Variety         | S. Dak.<br>Acc. No. | 7-yrs.<br>1925-1931 | 6-yrs.<br>1926-1931 | 3-yrs.<br>1929-1931 |
|-----------------|---------------------|---------------------|---------------------|---------------------|
| Ceres           | 1281                | 100.0               | 100.0               | 100.0               |
| Kota            | 1184                | 84.1                | 82.4                | 80.9                |
| Marquis         | 515                 | 79.7                | 83.8                | 78.4                |
| Quality         | 1261                | 77.3                | 75.5                | 96.1                |
| Prelude         | 1264                | 61.4                | 62.7                | 73.0                |
| Reward          | 1291                |                     | 82.4                | 95.1                |
| Garnet          | 1292                |                     | 78.4                | 91.2                |
| N. Dak. 1656.84 | 1296                |                     |                     | 109.3               |
| Marquillo       | 1308                |                     |                     | 83.8                |
| Reliance        | 1332                |                     |                     | 97.1                |
| Hope            | 1311                |                     |                     | 83.8                |
| Supreme         | 1310                |                     |                     | 68.1                |

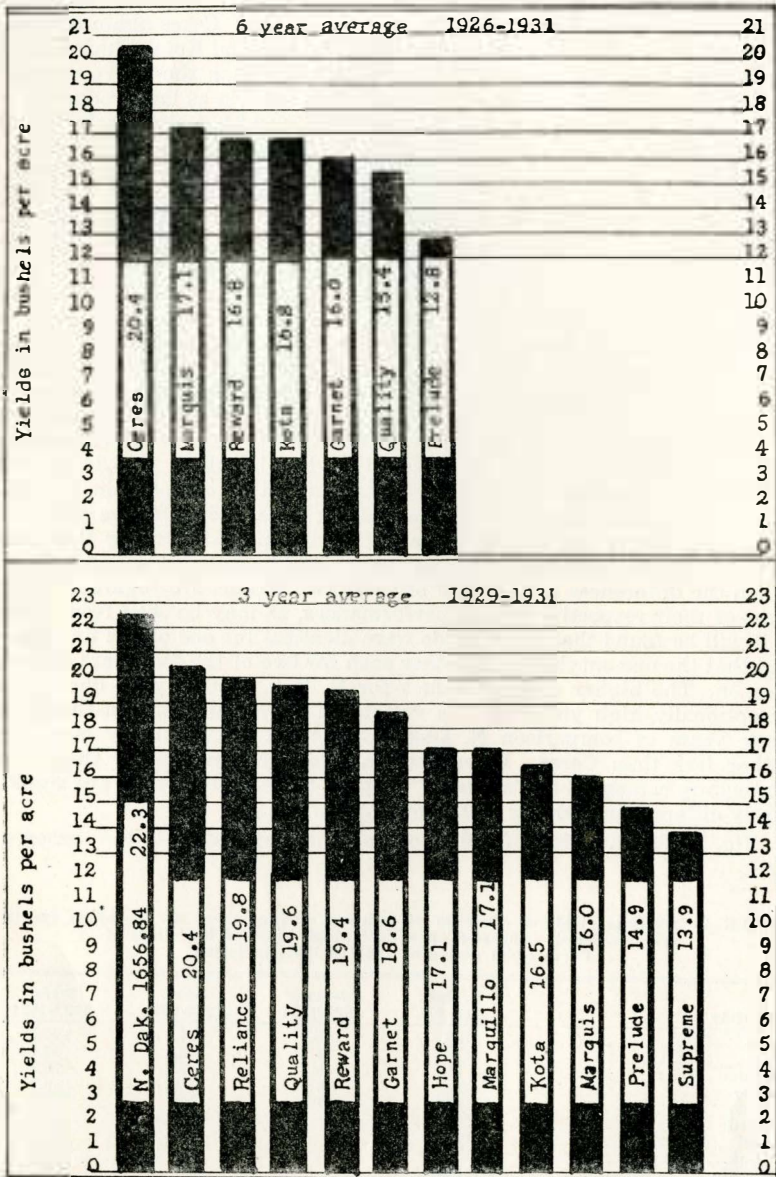


Fig. 9.—Average annual yields of varieties of common spring wheat grown on the test plats at Brookings for a 6 and a 3 year period of comparison



## Common Spring Wheat Nursery at Brookings

The spring wheat nursery contained 131 different strains and varieties in 1929, and 71 each in 1930 and 1931. It is not considered necessary to give here the yield data on all the various selections grown during the past three years. For that reason the yields of standard varieties only are reported in Table 5. Table 6 gives the agronomic data for these varieties. For the sake of comparison all varieties included in the general variety test were also grown in the nursery. Some of the varieties grown, such as Preston, Red Fife and Haynes Bluestem are of historic interest only.



Fig. 10.—A field of Ceres wheat in Day County, season of 1931

Ceres and Marvel are the outstanding varieties from the standpoint of yields. This is especially apparent from the last column giving the yields of the different varieties on a percentage basis of the yields of Ceres. The North Dakota selections 1656.85, 1656.84 and 1656.48 were grown for two years only. They gave a good account of themselves in that time, as did also other Marquis x Kota selections included in the test.

The varieties listed in Tables 5 and 6 will be discussed in detail in a later portion of this publication.

Too much emphasis should not be attached to a test extending over a period of only three years. It is interesting and of value, however, to compare the performances of varieties in the nursery with those previously reported on in the regular variety test.

Special attention is called to the rust data in Table 6. It will be observed that Ceres, while showing some stem rust, shows much less infection than other standard varieties. Supreme, Quality and Reward show very high percentages of rust.

TABLE 5.—Annual and average yields of standard varieties included in the common spring wheat nursery at Brookings, from 1929 to 1931, inclusive

| Rank | Variety         | S. Dak.<br>Acc. No. | Yields in bushels per acre |           |          | Average yield<br>1929-1931 | Yield on a<br>percentage<br>basis of<br>the yields<br>of Ceres |
|------|-----------------|---------------------|----------------------------|-----------|----------|----------------------------|--|
|      |                 |                     | 1929                       | 1930      | 1931     |                            |  |
| 1.   | Marvel          | 1331                | 22.0±1.32                  | 23.0±1.12 | 17.4±.82 | 20.8±.55                   | 100.5  |
| 2.   | Ceres           | 1281                | 23.2±1.40                  | 22.3±1.09 | 16.7±.79 | 20.7±.55                   | 100.0  |
| 3.   | Kearney         | 1334                | 21.9±1.32                  | 21.2±1.03 | 16.7±.79 | 19.9±.54                   | 96.1   |
| 4.   | Reliance        | 1332                | 17.1±1.03                  | 22.8±1.11 | 18.9±.89 | 19.6±.53                   | 94.7   |
| 5.   | Progress        | 1330                | 21.7±1.31                  | 20.8±1.01 | 15.7±.74 | 19.4±.54                   | 93.7   |
| 6.   | Reward          | 1291                | 18.3±1.10                  | 23.6±1.15 | 11.9±.56 | 17.9±.52                   | 86.5   |
| 7.   | Quality         | 1261                | 16.6±1.00                  | 16.8±.82  | 18.0±.85 | 17.1±.50                   | 82.6   |
| 8.   | Marquillo       | 1308                | 17.8±1.07                  | 21.9±1.07 | 11.5±.54 | 17.1±.51                   | 82.6   |
| 9.   | Preston         | 67                  | 17.4±1.05                  | 20.6±1.00 | 13.1±.62 | 17.0±.51                   | 82.1   |
| 10.  | Hope            | 1311                | 18.6±1.12                  | 19.2±.94  | 11.6±.55 | 16.5±.51                   | 79.7   |
| 11.  | Dico            | 1259                | 15.9±.96                   | 19.0±.93  | 14.2±.67 | 16.4±.50                   | 79.2   |
| 12.  | Power           | 1039                | 10.6±.64                   | 23.3±1.13 | 14.6±.69 | 16.2±.49                   | 78.3   |
| 13.  | Garnet          | 1292                | 14.5±.87                   | 20.2±.98  | 13.5±.64 | 16.1±.48                   | 77.8   |
| 14.  | Ruby            | 1262                | 12.4±.75                   | 18.6±.91  | 16.6±.79 | 15.9±.47                   | 76.8   |
| 15.  | Kota            | 1184                | 16.9±1.02                  | 16.2±.79  | 13.7±.65 | 15.6±.48                   | 75.4   |
| 16.  | Java            | 1335                | 13.4±.81                   | 20.2±.98  | 13.1±.62 | 15.6±.47                   | 75.4   |
| 17.  | Marquis         | 515                 | 15.2±.91                   | 17.9±.87  | 13.1±.62 | 15.4±.47                   | 74.4   |
| 18.  | Red Fife        | 1333                | 12.7±.76                   | 18.8±.92  | 13.4±.63 | 15.0±.45                   | 72.5   |
| 19.  | Haynes Bluestem | 169                 | 12.6±.76                   | 17.6±.86  | 12.4±.59 | 14.2±.43                   | 68.6   |
| 20.  | Supreme         | 1310                | 10.4±.63                   | 16.5±.80  | 15.4±.73 | 14.1±.42                   | 68.1   |
| 21.  | Prelude         | 1264                | 11.7±.70                   | 20.2±.98  | 9.4±.44  | 13.8±.42                   | 66.7   |
|      | N. Dak. 1656.85 | 1357                | -----                      | 27.6±1.34 | 18.2±.86 | 22.9±.80*                  |  |
|      | N. Dak. 1656.84 | 1296                | -----                      | 21.6±1.05 | 19.1±.90 | 20.4±.69*                  |  |
|      | N. Dak. 1656.48 | 1356                | -----                      | 23.3±1.13 | 16.8±.79 | 20.0±.69*                  |  |
|      | Marquis x Emmer | 1329                | -----                      | 22.7±1.11 | 12.8±.61 | 17.8±.63*                  |  |

\*Two year average, corresponding average yield for Ceres is 19.5±.67.

TABLE 6.—Summary of agronomic data for the standard varieties of common spring wheat grown in the nursery at Brookings, 1929 to 1931

| Variety                      | Stem rust<br>in per cent |      |      | Av. % of<br>stem rust<br>1929-31 | Days from<br>emergence to |               | Av. height<br>in<br>inches<br>1929-31 | Weight<br>per bushel |      |
|------------------------------|--------------------------|------|------|----------------------------------|---------------------------|---------------|---------------------------------------|----------------------|------|
|                              | 1929                     | 1930 | 1931 |                                  | Head-<br>ing              | Matur-<br>ity |                                       | 1930                 | 1931 |
| 1. Marvel                    | 25                       | 15   | 5    | 15.0                             | 65                        | 93            | 35                                    | 62                   | 61   |
| 2. Ceres                     | 16                       | 15   | T    | 10.3                             | 64                        | 93            | 33                                    | 59                   | 58   |
| 3. Kearney                   | 25                       | 12   | 5    | 14.0                             | 60                        | 91            | 33                                    | 58                   | 56   |
| 4. Reliance                  | 22                       | 21   | 5    | 16.6                             | 66                        | 94            | 32                                    | 57                   | 58   |
| 5. Progress                  | 20                       | 31   | 5    | 18.7                             | 65                        | 92            | 33                                    | 60                   | 60   |
| 6. Reward                    | 37                       | 37   | 10   | 28.0                             | 60                        | 90            | 30                                    | 63                   | 60   |
| 7. Quality                   | 40                       | 43   | 15   | 32.7                             | 59                        | 90            | 30                                    | 59                   | 60   |
| 8. Marquillo                 | 17                       | 3    | T    | 6.7                              | 64                        | 93            | 29                                    | 52                   | 55   |
| 9. Preston                   | 30                       | 28   | 15   | 24.3                             | 64                        | 94            | 35                                    | 59                   | 59   |
| 10. Hope                     | 0                        | 0    | 0    | 0.0                              | 66                        | 94            | 33                                    | 51                   | 57   |
| 11. Disco                    | 25                       | 39   | 5    | 23.0                             | 62                        | 90            | 31                                    | 59                   | 58   |
| 12. Power                    | 24                       | 21   | 15   | 20.0                             | 68                        | 97            | 34                                    | 59                   | 59   |
| 13. Garnet                   | 33                       | 30   | 10   | 24.3                             | 60                        | 88            | 30                                    | 56                   | 54   |
| 14. Ruby                     | 34                       | 30   | 5    | 23.0                             | 63                        | 90            | 32                                    | 57                   | 57   |
| 15. Kota                     | 22                       | 9    | 6    | 10.3                             | 67                        | 91            | 34                                    | 61                   | 60   |
| 16. Java                     | 31                       | 18   | 5    | 18.0                             | 62                        | 93            | 34                                    | 59                   | 56   |
| 17. Marquis                  | 35                       | 30   | 10   | 25.0                             | 65                        | 94            | 32                                    | 57                   | 58   |
| 18. Red Fife                 | 30                       | 32   | 20   | 27.3                             | 68                        | 95            | 31                                    | 56                   | 57   |
| 19. Haynes                   |                          |      |      |                                  |                           |               |                                       |                      |      |
| Bluestem                     | 30                       | 26   | 15   | 23.7                             | 68                        | 97            | 36                                    | 55                   | 57   |
| 20. Supreme                  | 40                       | 45   | 15   | 33.3                             | 64                        | 91            | 30                                    | 53                   | 57   |
| 21. Prelude                  | 31                       | 27   | 10   | 22.7                             | 57                        | 88            | 29                                    | 60                   | 57   |
| 22. N. Dak. 1656.85          | ---                      | 9    | T    | ---                              | ---                       | ---           | ---                                   | 61                   | 58   |
| 23. N. Dak. 1656.84          | ---                      | 12   | T    | ---                              | ---                       | ---           | ---                                   | 60                   | 57   |
| 24. N. Dak. 1656.48          | ---                      | 9    | T    | ---                              | ---                       | ---           | ---                                   | 60                   | 57   |
| 25. Marquis x Emmer<br>(H44) | ---                      | 0    | 0    | ---                              | ---                       | ---           | ---                                   | 52                   | 52   |



## Results of Variety Tests of Common Spring Wheats at Highmore

Table 7 gives the annual and average yields of common spring wheat varieties included in the variety test at Highmore for a seven year period from 1925 to and including 1931. Average yields are given for varieties grown for seven, six and four year periods. Table 8 gives the average yields of varieties included in the test for the given number of years on a percentage basis of the yields of Ceres. Fig. 11 gives a graphic summary for the varieties tested during the six and four year period.

Ceres is, as at Brookings, the outstanding variety for the two longer periods of comparison. For the seven year period it yielded 16.6 per cent more than Marquis and 22.8 per cent more than Kota. Reward is next to the highest yielding variety for the six year period, yet it produced 7.7 per cent less than Ceres.

In the final period of comparison the yields of Ceres are surpassed by a small margin by those of its sister selection, N. Dak. 1656.84, by Quality and by Reward. These varieties yielded only from 4.3 to 0.9 per cent more than Ceres. These differences are well within the limits of the probable error of the experiment. Seasonal conditions for the last four years of the test were favorable for early maturing varieties. This accounts for the relatively high yields of Quality and Reward, both of which are relatively early maturing varieties.

The results of the variety test at Highmore point decidedly to the value of Ceres and N. Dak. 1656.84 for the central part of the state. From the standpoint of quality, as may be observed from comparative milling and baking tests presented in a later part of this publication, Ceres rates significantly superior to N. Dak. 1656.84. Since the yields of these two varieties were practically the same it is recommended that the variety producing grain of the highest quality be grown.

TABLE 7.—Annual and average yields of varieties of common spring wheat grown on the variety test plats at the Highmore substation for one or more of seven years from 1925 to 1931, inclusive

| Variety         | C. I.<br>No. | S. Dak.<br>Acc.<br>No. | Acre yields (bushels) |      |      |      |      |      |      | 7-yr.<br>Av.<br>1925-<br>1931 | 6-yr.<br>1926-<br>1931 | 4-yr.<br>Av.<br>1928-<br>1931 |
|-----------------|--------------|------------------------|-----------------------|------|------|------|------|------|------|-------------------------------|------------------------|-------------------------------|
|                 |              |                        | 1925                  | 1926 | 1927 | 1928 | 1929 | 1930 | 1931 |                               |                        |                               |
| Ceres           | 6900         | 1281                   | 16.9                  | 4.9  | 34.1 | 1.7  | 16.8 | 25.3 | 2.1  | 14.5                          | 14.2                   | 11.5                          |
| Marquis         | 3641         | 515                    | 12.5                  | 4.3  | 31.4 | 2.2  | 15.2 | 16.8 | 2.2  | 12.1                          | 12.0                   | 9.1                           |
| Kota            | 5878         | 1184                   | 15.2                  | 4.0  | 22.8 | 4.9  | 12.6 | 17.1 | 1.5  | 11.2                          | 10.5                   | 9.0                           |
| Reward          | 8182         | 1291                   |                       | 2.5  | 29.5 | 0.8  | 17.4 | 24.0 | 4.1  |                               | 13.1                   | 11.6                          |
| Quality         | 6607         | 1261                   |                       | 1.7  | 27.2 | 0.2  | 18.9 | 24.4 | 3.6  |                               | 12.7                   | 11.8                          |
| Garnet          | 8181         | 1292                   |                       | 2.4  | 27.2 | 0.4  | 12.1 | 23.1 | 3.7  |                               | 11.5                   | 9.1                           |
| N. Dak. 1656.84 | 8004         | 1296                   |                       |      | 36.4 | 2.1  | 17.2 | 26.3 | 2.5  |                               |                        | 12.0                          |
| Supreme         | 8026         | 1310                   |                       |      |      | 1.7  | 17.2 | 18.0 | 2.6  |                               |                        | 9.9                           |
| Marquillo       | 6887         | 1308                   |                       |      |      | 0.8  | 16.7 | 18.7 | 2.2  |                               |                        | 9.6                           |
| Hope            | 8178         | 1311                   |                       |      |      | 4.2  | 12.7 | 15.1 | 1.4  |                               |                        | 8.4                           |
| Reliance        | 7370         | 1332                   |                       |      |      |      | 15.0 | 18.8 | 1.8  |                               |                        |                               |
| Minn. 2305      | 10005        | 1361                   |                       |      |      |      |      | 17.5 | 0.8  |                               |                        |                               |
| N. Dak. 1656.48 | 10014        | 1362                   |                       |      |      |      |      | 21.7 | 1.7  |                               |                        |                               |
| Prelude         | 4323         | 1264                   |                       |      |      |      |      | 24.3 | 2.6  |                               |                        |                               |

TABLE 8.—Average yields of varieties of common spring wheat at Highmore for the years indicated expressed on a percentage basis of the yields of Ceres for a period of 1925 to 1931, inclusive

| Variety         | S. Dak.<br>Acc. No. | 7-yrs.<br>1925-1931 | 6-yrs.<br>1926-1931 | 4-yrs.<br>1928-1931 |
|-----------------|---------------------|---------------------|---------------------|---------------------|
| Ceres           | 1281                | 100.0               | 100.0               | 100.0               |
| Marquis         | 515                 | 83.4                | 84.5                | 79.1                |
| Kota            | 1184                | 77.2                | 73.9                | 78.3                |
| Reward          | 1291                |                     | 92.3                | 100.9               |
| Quality         | 1261                |                     | 89.4                | 102.6               |
| Garnet          | 1292                |                     | 81.0                | 79.1                |
| N. Dak. 1656.84 | 1296                |                     |                     | 104.3               |
| Supreme         | 1310                |                     |                     | 86.1                |
| Marquillo       | 1308                |                     |                     | 83.5                |
| Hope            | 1311                |                     |                     | 73.0                |

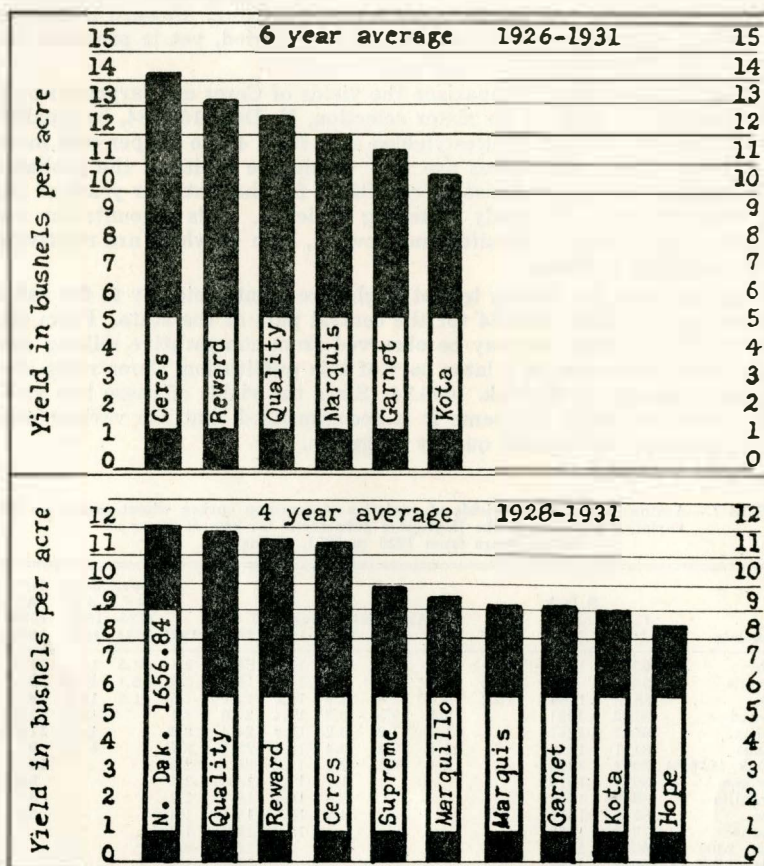


Fig. 11.—Average annual yields of varieties of common spring wheat grown on the variety test plats at the Highmore substation for a 6 and a 4 year period of comparison

### Common Spring Wheat Nursery at Highmore

The same strains included in the nursery at Brookings were also grown at Highmore. The yields of the standard varieties included in the nursery are given in Table 9 while the agronomic data for these varieties is given in Table 10.

Quality, Progress, Marvel, Reward, Ruby, Garnet and Disco outyielded Ceres in the three years of the test. The differences between the yields of these varieties and those of Ceres are not great enough, however, to be of significance statistically except in the case of the differences in the yields of Ceres and Quality. Quality, as may be seen from Table 10, matures somewhat earlier than Ceres. The three seasons of the test were favorable to comparatively high yields of early maturing varieties. As may be seen from Tables 7 and 8 and Fig. 11, Quality outyielded Ceres in the regular variety test for the shorter period of comparison, including the above mentioned years favorable to early maturing varieties. For the longer period of comparison, Ceres was the better yielding variety. This alone makes Ceres the more desirable and safer variety to recommend. When the quality of the grain of these two varieties is taken into consideration, it becomes evident that Ceres is by far the more desirable variety to grow. Quality is a white wheat and has for that reason no place in a section producing hard red spring wheat. The rust data secured at Highmore are, as may be seen from Table 10, very limited, yet it may be observed that Garnet, Supreme and Quality showed significant infections of stem rust

TABLE 9.—Annual and average yields of standard varieties included in the common spring nursery at Highmore from 1929 to 1931, inclusive

| Rank | Variety                  | S. Dak.<br>Acc. No. | Yields in bushels per acre |          |         | Yield on a<br>percentage<br>basis of<br>the yields<br>of Ceres |
|------|--------------------------|---------------------|----------------------------|----------|---------|--|
|      |                          |                     | 1929                       | 1930     | 1931    | 1929-1931  |
| 1.   | Quality                  | 1261                | 21.2±.83                   | 13.4±.54 | 2.3±.37 | 12.3±.35   |
| 2.   | Progress                 | 1330                | 21.0±.79                   | 13.6±.55 | .7±.11  | 11.8±.32   |
| 3.   | Marvel                   | 1331                | 18.8±.74                   | 13.0±.52 | 2.8±.46 | 11.5±.34   |
| 4.   | Reward                   | 1291                | 20.1±.79                   | 11.7±.47 | 1.8±.29 | 11.2±.32   |
| 5.   | Ruby                     | 1263                | 18.1±.71                   | 13.3±.53 | 2.1±.34 | 11.2±.32   |
| 6.   | Garnet                   | 1292                | 19.7±.77                   | 10.9±.44 | 2.8±.46 | 11.1±.33   |
| 7.   | Disco                    | 1259                | 18.1±.71                   | 13.2±.53 | 1.8±.29 | 11.0±.33   |
| 8.   | Ceres                    | 1281                | 19.3±.76                   | 10.3±.41 | 3.0±.49 | 10.8±.31   |
| 9.   | N. Dak. 1656.84          | 1296                | 18.3±.72                   | 9.7±.39  | 3.5±.57 | 10.5±.33   |
| 10.  | Supreme                  | 1310                | 18.4±.72                   | 11.0±.44 | 1.6±.26 | 10.3±.29   |
| 11.  | Preston                  | 67                  | 17.9±.70                   | 10.5±.42 | 1.9±.31 | 10.1±.29   |
| 12.  | Power                    | 1039                | 15.5±.61                   | 9.5±.38  | 4.1±.67 | 9.7±.33  |
| 13.  | Reliance                 | 1332                | 16.1±.63                   | 9.3±.37  | 2.2±.36 | 9.2±.27  |
| 14.  | Prelude                  | 1264                | 17.5±.69                   | 8.7±.35  | 1.5±.24 | 9.2±.27  |
| 15.  | Marquis                  | 515                 | 16.1±.63                   | 8.6±.35  | 1.7±.28 | 8.8±.26  |
| 16.  | Kota                     | 1184                | 15.9±.63                   | 8.9±.36  | 1.4±.23 | 8.7±.25  |
| 17.  | Marquillo                | 1308                | 14.7±.58                   | 7.7±.31  | 2.5±.41 | 8.3±.26  |
| 18.  | Haynes Bluestem          | 169                 | 13.7±.54                   | 8.8±.35  | 1.2±.20 | 7.9±.23  |
| 19.  | Hope                     | 1311                | 10.6±.42                   | 4.2±.17  | 1.9±.31 | 5.6±.18  |
| 20.  | N. Dak. 1656.85          | 1357                | -----                      | 14.9±.60 | 3.3±.54 | 9.1±.41*   |
| 21.  | N. Dak. 1656.48          | 1356                | -----                      | 12.7±.51 | 2.6±.42 | 7.6±.34*   |
| 22.  | Java                     | 1335                | -----                      | 11.4±.46 | 1.8±.29 | 6.6±.27*   |
| 23.  | Kearney                  | 1334                | -----                      | 11.0±.44 | 1.6±.26 | 6.3±.25*   |
| 24.  | Red File                 | 1333                | -----                      | 8.4±.34  | .9±.15  | 4.6±.19*   |
| 25.  | Marquis x Emmer<br>(H44) | 1329                | -----                      | 4.7±.19  | 2.2±.36 | 3.4±.21*   |

\* Two year average corresponding to two year average for Ceres is 6.7±.32.

even though the seasons encountered during the three years of the test were not favorable to rust epidemics.

Too much significance should not be attached to the yields reported in Table 9. The period of the test included one normal season, that of 1929. The season of 1930 was dry; as a result the yields were low. Due to extreme drought the 1931 crop was almost a complete failure.

TABLE 10.—Summary of agronomic data for the standard varieties of common spring wheat grown in the nursery at Highmore 1929-31

| Variety                       | Stem rust<br>in per cent |      |      | Av. % of<br>stem rust<br>1929-31 | Days from<br>emergence to<br>Head-<br>ing Matur-<br>ity |    | Average<br>height<br>in inches<br>1929-31 | Weight<br>per bu.<br>1930 |
|-------------------------------|--------------------------|------|------|----------------------------------|---|----|---|---------------------------|
|                               | 1929                     | 1930 | 1931 |                                  |   |    |   |                           |
| 1. Quality                    | 5                        | 8    | 0    | 4.3                              | 65  | 91 | 27  | 53                        |
| 2. Progress                   | 0                        | 8    | 0    | 2.7                              | 68  | 93 | 27  | 57                        |
| 3. Marpel                     | 0                        | 3    | 0    | 1.0                              | 70  | 95 | 27  | 57                        |
| 4. Reward                     | 2                        | 3    | 0    | 1.7                              | 64  | 91 | 27  | 55                        |
| 5. Ruby                       | T                        | 4    | 0    | 1.3                              | 67  | 92 | 27  | 53                        |
| 6. Garnet                     | 2                        | 24   | 0    | 8.7                              | 65  | 94 | 27  | 51                        |
| 7. Disco                      | 1                        | 5    | 0    | 2.0                              | 66  | 91 | 28  | 55                        |
| 8. Ceres                      | 0                        | 0    | 0    | 0.0                              | 69  | 93 | 27  | 53                        |
| 9. N. Dak. 1656.84            | 0                        | 1    | 0    | 0.3                              | 68  | 94 | 27  | 52                        |
| 10. Supreme                   | 2                        | 14   | 0    | 5.3                              | 68  | 93 | 27  | 50                        |
| 11. Preston                   | 0                        | 2    | 0    | 0.7                              | 67  | 98 | 28  | 51                        |
| 12. Power                     | 0                        | 4    | 0    | 1.3                              | 74  | 98 | 28  | 52                        |
| 13. Reliance                  | 0                        | 2    | 0    | 0.7                              | 70  | 95 | 27  | 51                        |
| 14. Prelude                   | 2                        | 0    | 0    | 0.7                              | 62  | 88 | 25  | 56                        |
| 15. Marquis                   | 0                        | 10   | 0    | 3.3                              | 71  | 94 | 27  | 49                        |
| 16. Kota                      | 0                        | 0    | 0    | 0.0                              | 72  | 95 | 28  | 54                        |
| 17. Marquillo                 | 0                        | 3    | 0    | 1.0                              | 67  | 94 | 26  | 49                        |
| 18. Haynes Bluestem           | 0                        | 2    | 0    | 0.7                              | 74  | 98 | 28  | 49                        |
| 19. Hope                      | 0                        | 0    | 0    | 0.0                              | 71  | 94 | 27  | 48                        |
| 20. *N. Dak. 1656.85          | -                        | 0    | 0    | 0.0                              | 63  | 90 | 23  | 54                        |
| 21. *N. Dak. 1656.48          | -                        | 0    | 0    | 0.0                              | 66  | 90 | 22  | 52                        |
| 22. *Java                     | -                        | 1    | 0    | 0.5                              | 63  | 88 | 22  | 52                        |
| 23. *Kearney                  | -                        | 5    | 0    | 2.5                              | 63  | 88 | 21  | 52                        |
| 24. *Red File                 | -                        | 5    | 0    | 2.5                              | 69  | 92 | 28  | 49                        |
| 25. *Marquis x Emmer<br>(H44) | -                        | -    | 0    | 0.0                              | 66  | 89 | 20  | 50                        |

\* Grown for two years only.

### Results of Variety Test of Hard Red Spring Wheats at Eureka

Table 11 gives the yields of varieties of hard red spring wheat tested at the Eureka substation. Fig. 12 gives a graphic summary of the relative performances of the different varieties. It will be observed that Ceres is again the highest yielding variety. The yields of Ceres are not, however, significantly higher than those of Reward. The differences in the yields of Ceres and Marquis are great enough to justify the use of the former variety.

A nine year test, extending from 1921 up to and including 1929, with the three varieties, Marquis, Kota and Preston, gave the average yields of the three respective varieties as 14.3, 13.6 and 13.3 bushels per acre.



TABLE 11.—Annual and average yields of varieties of hard red spring wheat grown on the variety test plats at the Eureka substation for one or more of five years from 1927 to 1931, inclusive

| Variety         | S. Dak.      |             | 1927 | 1928 | Acre yields (bushels) |      |      | 5-yr. av.<br>1927-31 | 3-yr. av.<br>1929-31 |
|-----------------|--------------|-------------|------|------|-----------------------|------|------|----------------------|----------------------|
|                 | C. I.<br>No. | Acc.<br>No. |      |      | 1929                  | 1930 | 1931 |                      |                      |
| Ceres           | 6900         | 1281        | 35.3 | Hail | 12.8                  | 17.5 | 17.1 | 16.5                 | 15.8                 |
| Reward          | 8182         | 1291        | 35.3 | Hail | 12.2                  | 16.9 | 17.3 | 16.3                 | 15.5                 |
| Marquis         | 3641         | 515         | 23.5 | Hail | 12.5                  | 16.7 | 14.4 | 13.4                 | 14.5                 |
| Reliance        | 7370         | 1332        |      |      | 16.1                  | 16.9 | 13.3 | —                    | 15.4                 |
| Marquillo       | 6887         | 1308        |      |      | 15.8                  | 14.7 | 14.4 | —                    | 15.0                 |
| Supreme         | 8026         | 1310        |      |      | 10.0                  | 18.1 | 16.0 | —                    | 14.7                 |
| Hope            | 8178         | 1311        |      |      | 13.6                  | 13.7 | 11.1 | —                    | 12.8                 |
| Minn. 2305      | 10005        | 1361        |      |      |                       | 18.0 | 16.8 |                      |                      |
| N. Dak. 1656.48 | 10014        | 1362        |      |      |                       | 18.0 | 15.3 |                      |                      |
| N. Dak. 1656.84 | 8004         | 1296        |      |      |                       | 16.9 | 14.2 |                      |                      |

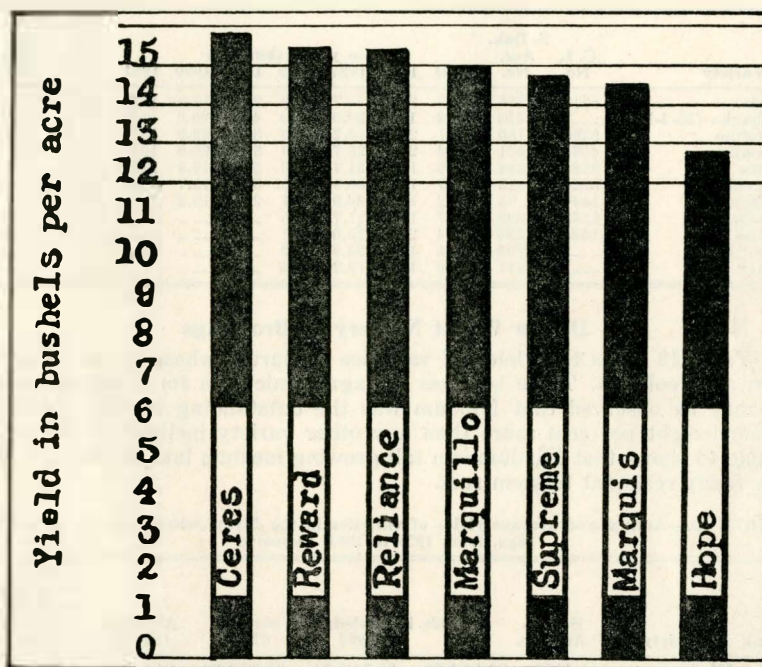


Fig. 12.—Average annual yields of varieties of hard red spring wheat grown on the variety test plats at the Eureka substation for the three year period of 1929 to 1931, inclusive

### Durum Wheat Variety Test at Brookings

Table 12 gives the annual and average yields of varieties of durum wheat tested at Brookings. The high yielding varieties for the seven year period of comparison are Nodak, Kubanka 75-3-15, Mindum and Arnautka. The differences in the yields of these varieties are not great enough to be significant. Nodak and Arnautka are the high yielding varieties for the



last period of comparison. The yields of Kubanka 75-3-15 and Mindum, while somewhat less than those of Nodak are still considerable higher than those of the other varieties tested.

The quality of Nodak is decidedly lower than that of Mindum and Arnautka. Because of that the last two varieties are preferred to Nodak. Not enough is as yet known of the quality of the Kubanka selection 75-3-15. Quality, especially color of the flour, is an important consideration in the durum wheats. Since Mindum is a good yielding variety and of recognized good quality it stands out as the best variety at this time. Arnautka is very similar to Mindum in yielding ability and also in quality.

TABLE 12.—Annual and average yields of varieties of durum wheat grown on the variety test plats at Brookings for one or more of seven years from 1925 to 1931, inclusive

| Variety           | C. I.<br>No. | S. Dak.<br>Acc.<br>No. | Acre yields (bushels) |      |      |      |      |      |      | 7-yr.<br>av.  | 4-yr.<br>av.  |
|-------------------|--------------|------------------------|-----------------------|------|------|------|------|------|------|---------------|---------------|
|                   |              |                        | 1925                  | 1926 | 1927 | 1928 | 1929 | 1930 | 1931 | 1925-<br>1931 | 1925-<br>1928 |
| Nodak             | 6519         | 1266                   | 37.6                  | 22.9 | 35.7 | 25.9 | 38.9 | 19.5 | 11.7 | 27.5          | 30.5          |
| Kubanka (75-3-15) | —            | 1413                   | 41.3                  | 18.3 | 30.0 | 20.9 | 41.7 | 20.0 | 13.3 | 26.5          | 27.6          |
| Mindum            | 5296         | 1160                   | 42.1                  | 25.0 | 19.2 | 24.2 | 36.1 | 22.0 | 14.7 | 26.2          | 27.6          |
| Arnautka          | 4064         | 1001                   | 43.4                  | 22.6 | 26.7 | 27.9 | 33.3 | 20.3 | 10.8 | 26.1          | 29.7          |
| Acme              | 5284         | 284                    | 37.6                  | 17.1 | 21.7 | 28.8 | 36.1 | 20.0 | 11.5 | 24.7          | 26.3          |
| Monad             | 3320         | 1113                   | 36.7                  | 17.5 | 30.9 | 22.5 | 31.1 | 19.7 | 13.3 | 24.5          | 26.9          |
| Kubanka           | 1440         | 75                     | 34.2                  | 17.9 | 20.9 | 21.7 | 27.5 | 19.3 | 11.8 | 21.9          | 23.7          |
| Pierson           | 4163         | 999                    | 41.7                  | 17.1 | 11.7 | 22.5 | —    | —    | —    | —             | 23.3          |
| Peliss            | 1584         | 1296                   | 23.4                  | 21.2 | 25.0 | 22.1 | —    | —    | —    | —             | 22.9          |
| Castillione       | —            | 1132                   | 31.1                  | 16.3 | 20.9 | 19.2 | —    | —    | —    | —             | 21.9          |
| Black Don         | —            | 1411                   | 25.0                  | 17.1 | 19.2 | 22.5 | —    | —    | —    | —             | 21.0          |

### Durum Wheat Nursery at Brookings

Table 13 gives the yields of varieties of durum wheat in the nursery test at Brookings. Table 14 gives the agronomic data for these varieties. It may be observed that Mindum was the outstanding variety, yielding around eight per cent more than any other variety included in the test. Table 14 shows that Mindum is a tall growing medium late maturing variety fairly resistant to stem rust.

TABLE 13.—Annual and average yields of varieties in the durum wheat nursery at Brookings, from 1929 to 1931, inclusive

| Rank | Variety              | S. Dak.<br>Acc. No. | Yields in bushels per acre |                       |                      | Av. yield<br>1929-31  | Yield on a<br>percentage<br>basis of<br>the yields<br>of Mindum |
|------|----------------------|---------------------|----------------------------|-----------------------|----------------------|-----------------------|---|
|      |                      |                     | 1929                       | 1930                  | 1931                 |                       |   |
| 1.   | Mindum               | 1160                | 28.1±1.69                  | 25.7±1.04             | 20.6±1.22            | 24.8±.78              | 100.0   |
| 2.   | Kahla                | 1174                | 24.3±1.46                  | 27.8±1.13             | 16.6±.99             | 22.9±.70              | 92.3  |
| 3.   | Nodak                | 1266                | 25.6±1.54                  | 23.8±.96              | 18.7±1.11            | 22.7±.71              | 91.5  |
| 4.   | Tunal Sel.           | 1415                | 30.3±1.82                  | 22.1±.89              | 15.1±.96             | 22.5±.74              | 90.7  |
| 5.   | Kubanka<br>(75-3-15) | 1413                | 22.3±1.34                  | 26.6±1.08             | 17.3±1.03            | 22.1±.67              | 89.1  |
| 6.   | Pierson              | 999                 | 22.8±1.37                  | 21.9±.89              | 21.3±1.27            | 22.0±.69              | 88.7  |
| 7.   | Arnautka             | 1001                | 21.6±1.30                  | 23.9±.97              | 18.7±1.11            | 21.4±.56              | 86.6  |
| 8.   | Hurst                | 1412                | 25.2±1.52                  | 20.1±.81              | 18.8±1.12            | 21.4±.68              | 86.6  |
| 9.   | Black Don            | 1411                | 22.7±1.37                  | 24.9±1.01             | 16.2±.96             | 21.3±.56              | 85.9  |
| 10.  | Acme                 | 284                 | 22.5±1.35                  | 23.0±.93              | 16.7±.99             | 20.7±.55              | 83.5  |
| 11.  | Algeria              | 340                 | 16.9±1.02                  | 27.8±1.13             | 16.8±1.00            | 20.5±.54              | 82.7  |
| 12.  | Monad                | 1113                | 19.5±1.17                  | 23.8±.96              | 17.8±1.06            | 20.4±.54              | 82.3  |
| 13.  | Castillione          | 1132                | 20.5±1.23                  | 24.9±1.01             | 13.6±.81             | 19.7±.53              | 79.4  |
| 14.  | Peliss               | 1256                | 15.9±.96                   | 24.7±1.00             | 17.8±1.06            | 19.5±.53              | 78.6  |
| 15.  | Kubanka<br>Pentad    | 75<br>1414          | 16.4±.99<br>—              | 24.2±.98<br>25.3±1.02 | 18.5±.89<br>15.7±.93 | 18.5±.52<br>20.5±.69* | 74.6<br>—   |

\* Two year average, corresponding averages for Mindum is 23.2±.80.

TABLE 14.—Summary of agronomic data for varieties in the durum wheat nursery at Brookings from 1929-1931

| Variety                 | Stem rust<br>in per cent |      |      | Av. % of<br>stem rust<br>1929-31 | Days from<br>emergence to<br>Head- Matur-<br>ing ity |    | Av. height<br>in<br>inches<br>1929-31 | Weight<br>per. bushel |      |
|-------------------------|--------------------------|------|------|----------------------------------|--|----|---------------------------------------|-----------------------|------|
|                         | 1929                     | 1930 | 1931 |                                  |  |    |                                       | 1930                  | 1931 |
| 1. Mindum               | 11                       | 3    | 0    | 4.7                              | 66   | 98 | 40                                    | 60                    | 57.5 |
| 2. Kahla                | 19                       | 14   | 0    | 11.0                             | 65   | 98 | 38                                    | 59                    | 58.5 |
| 3. Nodak                | 4                        | 2    | 0    | 2.0                              | 67   | 97 | 38                                    | 60                    | 55.5 |
| 4. Tunal Sel.           | 4                        | 1    | 0    | 3.0                              | 66   | 98 | 37                                    | 59                    | 54.0 |
| 5. Kubanka<br>(75-3-15) | 1                        | 4    | 0    | 1.7                              | 67   | 97 | 38                                    | 59                    | 55.5 |
| 6. Pierson              | 6                        | 12   | 0    | 6.0                              | 67   | 97 | 40                                    | 62                    | 60.0 |
| 7. Arnautka             | 1                        | 4    | 0    | 1.7                              | 67   | 99 | 40                                    | 60                    | 55.0 |
| 8. Hurst                | 7                        | 6    | 0    | 4.3                              | 68   | 99 | 39                                    | 60                    | 59.0 |
| 9. Black Don            | 18                       | 19   | 0    | 12.3                             | 65   | 96 | 38                                    | 62                    | 56.0 |
| 10. Acme                | 1                        | 3    | 0    | 1.3                              | 67   | 97 | 37                                    | 60                    | 56.0 |
| 11. Algeria             | 7                        | 7    | 0    | 2.3                              | 60   | 89 | 27                                    | 57                    | 56.0 |
| 12. Monad               | 4                        | 4    | 0    | 2.7                              | 67   | 97 | 38                                    | 60                    | 58.0 |
| 13. Castillione         | 21                       | 9    | 0    | 10.0                             | 65   | 96 | 37                                    | 60                    | 54.0 |
| 14. Feliss              | 16                       | 10   | 0    | 8.7                              | 65   | 97 | 37                                    | 59                    | 56.5 |
| 15. Kubanka             | 8                        | 5    | 0    | 4.3                              | 67   | 97 | 38                                    | 60                    | 56.0 |

### Durum Wheat Variety Test at Highmore

The results of the durum wheat variety test at the Highmore substation are given in Table 15. It will be observed that Acme is the highest yielding variety. The differences in the yields of Acme, Kubanka and Mindum are not great enough to be significant. Since Acme is a wheat of decidedly low quality it cannot be placed among the list of varieties to be recommended. This leaves then Kubanka and Mindum, both producers of good quality grain. Nodak, the variety producing the highest yields at Brookings, is better adapted to the eastern than to the central part of the state as is indicated by its relatively low yields at Highmore. But as previously stated, due to the lower quality of Nodak, Mindum is much to be preferred to it in the eastern part of the state.

TABLE 15.—Annual and average yields of varieties of durum wheat grown in the variety test plats at the Highmore substation in one or more of seven years from 1925 to 1931, inclusive

| Variety              | C. I.<br>No. | S. Dak.<br>Acc.<br>No. | Acre yields (bushels) |      |      |      |      |      |      | 7-yr.av-<br>erage<br>1925-31 | 6-yr.av-<br>erage<br>1926-31 | 8-yr.av-<br>erage<br>1918-25 |
|----------------------|--------------|------------------------|-----------------------|------|------|------|------|------|------|------------------------------|------------------------------|------------------------------|
|                      |              |                        | 1925                  | 1926 | 1927 | 1928 | 1929 | 1930 | 1931 |                              |                              |                              |
| Acme                 | 5284         | 284                    | 20.8                  | 7.1  | 31.2 | 9.7  | 12.7 | 20.0 | 1.0  | 14.6                         | 13.6                         | 19.3                         |
| Kubanka              | 1440         | 75                     | 17.9                  | 5.5  | 30.9 | 4.2  | 15.3 | 19.3 | 1.5  | 13.5                         | 12.8                         | 16.4                         |
| Mindum               | 5296         | 1160                   | 17.5                  | 5.5  | 30.9 | 5.7  | 13.7 | 19.1 | 1.5  | 13.4                         | 12.7                         | 18.4                         |
| Nodak                | 6519         | 1266                   | 16.9                  | 5.3  | 30.8 | 4.6  | 11.3 | 18.5 | 1.1  | 12.6                         | 11.9                         |                              |
| Arnautka             | 4064         | 1001                   |                       |      |      |      | 12.6 | 18.3 | 1.3  |                              |                              |                              |
| Kubanka<br>(75-3-15) | -----        | 1413                   |                       |      |      |      |      | 18.1 | 1.5  |                              |                              |                              |
| Monad                | 3320         | 1113                   |                       |      |      |      |      | 17.8 | 1.1  |                              |                              |                              |

### Durum Wheat Nursery at Highmore

Tables 16 and 17 give the annual and average yields and the agronomic data of the varieties of durum wheat included in the durum wheat nursery at the Highmore substation.

It will be observed that only four of the sixteen varieties tested surpassed Mindum in yield. The differences in the yields of any of these four varieties and those of Mindum are not in any case great enough to be of significance statistically.

What has been said regarding the seasonal conditions of the three years of the test under the discussion of the results of the common spring wheat nursery at Highmore applies here also. The fact that the three years in question were decidedly favorable to the early maturing varieties is brought out by the relative position of Algeria, the earliest maturing variety included in the test, as may be observed from Table 17.

Attention is called to the similarity in the annual performances of Mindum and Arnautka. These two varieties are very much alike.

TABLE 16.—Annual and average yields of varieties in the durum wheat nursery at Highmore from 1929 to 1931, inclusive

| Rank | Variety           | S. Dak.<br>Acc. No. | Yields in bushels per acre |          |         | Av. yield<br>1929-31 | Yield on a<br>percentage<br>basis of<br>the yields<br>of Mindum |
|------|-------------------|---------------------|----------------------------|----------|---------|----------------------|---|
|      |                   |                     | 1929                       | 1930     | 1931    |                      |   |
| 1.   | Tunal Sel.        | 1415                | 20.7±.81                   | 12.0±.63 | 4.9±.92 | 12.5±.46             | 107.8   |
| 2.   | Castillione       | 1132                | 19.5±.77                   | 13.2±.69 | 4.2±.79 | 12.3±.43             | 106.0   |
| 3.   | Algeria           | 340                 | 18.6±.73                   | 13.0±.68 | 4.3±.81 | 12.3±.43             | 106.0   |
| 4.   | Peliss            | 1256                | 18.7±.74                   | 12.2±.64 | 4.5±.85 | 11.8±.43             | 101.7   |
| 5.   | Mindum            | 1160                | 16.9±.66                   | 13.4±.70 | 4.6±.87 | 11.6±.43             | 100.0   |
| 6.   | Arnautka          | 1001                | 17.7±.70                   | 12.7±.66 | 3.9±.73 | 11.4±.40             | 98.3  |
| 7.   | Hurst             | 1412                | 17.1±.67                   | 11.5±.60 | 4.9±.92 | 11.2±.42             | 96.6  |
| 8.   | Acme              | 284                 | 18.8±.74                   | 12.3±.64 | 2.3±.43 | 11.1±.35             | 95.7  |
| 9.   | Kubanka (75-3-15) | 1413                | 15.7±.62                   | 12.8±.67 | 4.5±.85 | 11.0±.42             | 94.8  |
| 10.  | Kahla             | 1174                | 16.6±.65                   | 12.5±.65 | 3.7±.70 | 10.9±.38             | 94.0  |
| 11.  | Nodak             | 1266                | 16.6±.65                   | 11.9±.62 | 4.0±.75 | 10.8±.39             | 93.1  |
| 12.  | Pierson           | 999                 | 17.3±.68                   | 11.0±.57 | 4.1±.77 | 10.8±.39             | 93.1  |
| 13.  | Black Don         | 1411                | 16.3±.64                   | 11.9±.62 | 4.1±.77 | 10.8±.39             | 93.1  |
| 14.  | Monad             | 1113                | 16.6±.65                   | 11.6±.61 | 4.1±.77 | 10.8±.38             | 93.1  |
| 15.  | Kubanka           | 75                  | 17.3±.68                   | 11.1±.58 | 3.5±.66 | 10.6±.37             | 91.4  |
|      | Pentad            | 1414                |                            | 12.6±.66 | 4.5±.85 | 8.6±.54*             |   |

\* Two year average, corresponding average of Mindum is 9.0±.58.

TABLE 17.—Summary of agronomic data for varieties in the durum wheat nursery at Highmore from 1929-1931

| Variety              | Stem rust<br>in per cent |      |      | Av. % of<br>stem rust<br>1929-31 | Days from<br>emergence to |               | Average<br>height<br>in inches<br>1929-31 | Weight<br>per bu.<br>1930 |
|----------------------|--------------------------|------|------|----------------------------------|---------------------------|---------------|---|---------------------------|
|                      | 1929                     | 1930 | 1931 |                                  | Head-<br>ing              | Matur-<br>ity |   |                           |
| 1. Tunal Sel.        | 0                        | 5    | 0    | 1.7                              | 70                        | 100           | 35  | 59                        |
| 2. Castillione       | 0                        | 9    | 0    | 3.0                              | 69                        | 99            | 34  | 60                        |
| 4. Peliss            | 0                        | 10   | 0    | 2.3                              | 71                        | 99            | 35  | 59                        |
| 3. Algeria           | T                        | 7    | 0    | 2.3                              | 63                        | 91            | 30  | 57                        |
| 5. Mindum            | 0                        | 3    | 0    | 1.0                              | 71                        | 99            | 36  | 60                        |
| 6. Arnautka          | 0                        | 4    | 0    | 1.3                              | 71                        | 99            | 36  | 60                        |
| 7. Hurst             | 0                        | 6    | 0    | 2.0                              | 72                        | 99            | 35  | 60                        |
| 8. Acme              | 0                        | 3    | 0    | 1.0                              | 71                        | 99            | 34  | 60                        |
| 9. Kubanka (75-3-15) | 0                        | 4    | 0    | 1.3                              | 71                        | 99            | 35  | 59                        |
| 10. Kahla            | 0                        | 14   | 0    | 4.7                              | 69                        | 99            | 35  | 59                        |
| 11. Nodak            | 0                        | 2    | 0    | 0.7                              | 71                        | 99            | 35  | 60                        |
| 12. Pierson          | 0                        | 12   | 0    | 4.0                              | 71                        | 99            | 36  | 62                        |
| 13. Black Don        | 0                        | 19   | 0    | 6.3                              | 70                        | 99            | 35  | 62                        |
| 14. Monad            | 0                        | 4    | 0    | 1.3                              | 71                        | 99            | 35  | 60                        |
| 15. Kubanka          | 0                        | 5    | 0    | 1.7                              | 71                        | 99            | 35  | 60                        |

### Durum Wheat Variety Test at Eureka

Table 18 gives the results of the more recent test of durum wheat varieties at Eureka.

The yields of Kubanka and Acme were compared for a 13 year period from 1917 to and including 1929. During that period the former yielded 16.3 as compared to 18.3 bushels per acre for the latter. Since Acme has undesirable market characteristics it does not merit further testing even though it yielded somewhat more than Kubanka.

The results of the four year test, comprising only three crop yields, do not give much of an indication regarding the relative values of Mindum and Kubanka. The slightly higher average yields of Mindum was due mainly to its high yield in 1927. Since a good supply of pure seed of Mindum is available to the producer, whereas pure seed of Kubanka is scarce, it seems that Mindum is a good variety to grow. Mindum is quite acceptable to the market.

TABLE 18.—Annual and average yields of varieties of durum wheat grown on the variety test plats at the Eureka substation in one or more of five years from 1927 to 1931, inclusive

| Variety           | C. I.<br>No. | S. Dak.<br>Acc. No. | 1927 | Acre yields (bushels) |      |      |      | 5-yr. av.<br>1927-31 |
|-------------------|--------------|---------------------|------|-----------------------|------|------|------|----------------------|
|                   |              |                     |      | 1928                  | 1929 | 1930 | 1931 |                      |
| Nodak             | 6519         | 1266                | 43.6 | Hail                  | 20.8 | 16.4 | 14.6 | 19.1                 |
| Mindum            | 5296         | 1160                | 42.1 | Hail                  | 16.4 | 15.8 | 14.4 | 17.7                 |
| Kubanka           | 1440         | 75                  | 34.1 | Hail                  | 19.1 | 18.0 | 14.3 | 17.1                 |
| Kubanka (75-3-15) |              | 1413                |      |                       |      | 17.0 | 16.6 | ---                  |
| Acme              | 5284         | 284                 |      |                       |      | 18.4 | 16.2 | ---                  |

### Results of Cooperative Wheat Variety Tests

Through the courtesy of fifteen growers in the northeastern part of the state it was possible for the Experiment Station cooperating with the Extension agronomist and the respective county agents of the counties concerned to grow on their farms plats of wheat of the varieties indicated. Fig. 13 shows one of these cooperative wheat variety test plats on a farm near Holmquist in Day county.

The 1929 tests, Table 19, show the differences in the yielding abilities of Ceres and Marvel. Ceres outyielded Marvel, the differences in the yields of these varieties were but small. Quality was outyielded by both Ceres and Marvel by substantial amounts in the test where it was included.

Marquillo and Ceres, as may be seen from Table 20, emerged as high yielders in the 1930 common spring wheat tests. It will be recalled that Marquillo gave but moderate yields in tests previously reported. Due to the lower quality of the grain produced by Marquillo it should not be considered on an equal basis with Ceres even though it outyielded this variety on a few of the test plats. Ceres in 1930 as in the previous year outyielded Marvel in most instances.

Due to poor seasonal conditions the yields of the 1931 test plats, reported in Table 21, were low, yet even with low yields it is not difficult to see the superiority of Ceres. It was surpassed in yield in only two out of the nine tests. In most of the tests Ceres outyielded its nearest rival by very substantial amounts.



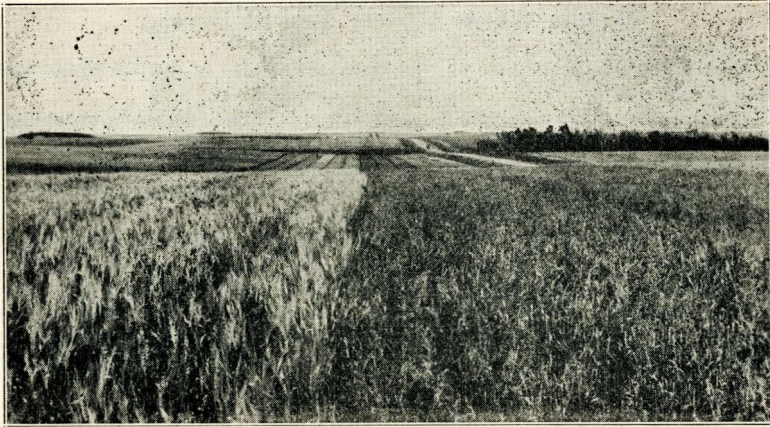


Fig. 13.—General view of the 1931 cooperative wheat variety test plats near Holmquist in Day County, season of 1931

TABLE 19.—Results of cooperative common spring wheat variety tests—1929

| Variety | Town near which test plots were located | County | Yield in bu. per acre | Yield in per cent of yield of Ceres |
|---------|---|--------|-----------------------|-------------------------------------|
| Ceres   | James                                   | Brown  | 37.2                  | 100.0                               |
| Marvel  | James                                   | Brown  | 34.4                  | 92.5                                |
| Quality | James                                   | Brown  | 33.2                  | 89.2                                |
| Ceres   | Bath                                    | Brown  | 18.3                  | 100.0                               |
| Marvel  | Bath                                    | Brown  | 17.9                  | 97.8                                |
| Ceres   | Barnard                                 | Brown  | 11.3                  | 100.0                               |
| Marvel  | Barnard                                 | Brown  | 10.8                  | 95.6                                |

TABLE 20.—Results of cooperative common spring wheat variety tests—1930

| Variety      | Town near which test plots were located | County   | Yield in bu. per acre | Yield in per cent of yield of Ceres |
|--------------|---|----------|-----------------------|-------------------------------------|
| 1. Marvel    | Aberdeen                                | Brown    | 31.9                  | 102.2                               |
| 2. Ceres     | Aberdeen                                | Brown    | 31.2                  | 100.0                               |
| 3. Marquillo | Aberdeen                                | Brown    | 26.8                  | 85.9                                |
| 4. Quality   | Aberdeen                                | Brown    | 23.4                  | 75.0                                |
| 5. Marquis   | Aberdeen                                | Brown    | 22.8                  | 73.1                                |
| 6. Hope      | Aberdeen                                | Brown    | 20.9                  | 67.0                                |
| 1. Marquillo | Bath                                    | Brown    | 17.6                  | 107.3                               |
| 2. Ceres     | Bath                                    | Brown    | 16.4                  | 100.0                               |
| 3. Marvel    | Bath                                    | Brown    | 15.0                  | 91.5                                |
| 4. Marquis   | Bath                                    | Brown    | 13.6                  | 82.9                                |
| 5. Hope      | Bath                                    | Brown    | 11.2                  | 68.3                                |
| 1. Ceres     | Britton                                 | Marshall | 28.2                  | 100.0                               |
| 2. Marquillo | Britton                                 | Marshall | 27.8                  | 98.6                                |
| 3. Hope      | Britton                                 | Marshall | 20.6                  | 73.0                                |
| 4. Marquis   | Britton                                 | Marshall | 18.2                  | 64.5                                |
| 1. Marquillo | Barnard                                 | Brown    | 20.2                  | 116.1                               |
| 2. Ceres     | Barnard                                 | Brown    | 17.4                  | 100.0                               |
| 3. Hope      | Barnard                                 | Brown    | 13.6                  | 78.2                                |
| 1. Marquillo | Warner                                  | Brown    | 28.8                  | 112.9                               |
| 2. Ceres     | Warner                                  | Brown    | 25.5                  | 100.0                               |
| 3. Marvel    | Warner                                  | Brown    | 24.2                  | 94.9                                |



The results of the cooperative durum wheat variety tests conducted in 1930 and 1931 are given in Table 22. The main outstanding feature of these tests is the superiority of Mindum over Red Durum. Red Durum is a very common type of durum now being grown in the northeastern section of the state. It is not only a low producer, as may be seen from Table 22, but produces grain of a lower market class. Mindum will, under favorable conditions, produce a wheat grading amber durum. In unfavorable seasons it may produce a grain classing as durum. Red durum will, however, produce wheat of the lowest class only regardless as to whether the seasons or growing conditions are favorable or unfavorable.

TABLE 21.—Results of cooperative common spring wheat variety tests—1931

| Variety               | Town near which test plots were located | County    | Yield in bu. per acre | Yield in per cent of yield of Ceres |
|-----------------------|---|-----------|-----------------------|-------------------------------------|
| 1. Marquis -----      | Holmquist                               | Day       | 8.1                   | 122.7                               |
| 2. Ceres -----        | Holmquist                               | Day       | 6.6                   | 100.0                               |
| 3. Progress -----     | Holmquist                               | Day       | 5.0                   | 75.8                                |
| 4. Marquillo -----    | Holmquist                               | Day       | 4.1                   | 62.1                                |
| 5. Hope -----         | Holmquist                               | Day       | 3.9                   | 59.1                                |
| 1. Ceres -----        | Andover                                 | Day       | 9.0                   | 100.0                               |
| 2. Marquis -----      | Andover                                 | Day       | 6.1                   | 67.8                                |
| 3. Marquillo -----    | Andover                                 | Day       | 6.0                   | 66.7                                |
| 4. Hope -----         | Andover                                 | Day       | 4.9                   | 54.4                                |
| 1. Ceres -----        | Britton                                 | Marshall  | 13.1                  | 100.0                               |
| 2. Marquis -----      | Britton                                 | Marshall  | 9.6                   | 73.3                                |
| 3. Marquillo -----    | Britton                                 | Marshall  | 6.3                   | 48.1                                |
| 4. Hope -----         | Britton                                 | Marshall  | 2.4                   | 18.3                                |
| 1. Ceres -----        | Waverly                                 | Codington | 15.9                  | 100.0                               |
| 2. Progress -----     | Waverly                                 | Codington | 15.8                  | 99.4                                |
| 3. Montana King ----- | Waverly                                 | Codington | 11.8                  | 74.2                                |
| 4. Marquillo -----    | Waverly                                 | Codington | 9.7                   | 61.0                                |
| 1. Progress -----     | Florence                                | Codington | 8.2                   | 106.5                               |
| 2. Ceres -----        | Florence                                | Codington | 7.7                   | 100.0                               |
| 3. Montana King ----- | Florence                                | Codington | 7.1                   | 92.2                                |
| 1. Ceres -----        | Watertown                               | Codington | 5.7                   | 100.0                               |
| 2. Montana King ----- | Watertown                               | Codington | 3.5                   | 61.4                                |
| 3. Progress -----     | Watertown                               | Codington | 2.3                   | 40.4                                |
| 1. Ceres -----        | Veblen                                  | Marshall  | 15.8                  | 100.0                               |
| 2. Marquillo -----    | Veblen                                  | Marshall  | 12.9                  | 81.6                                |
| 3. Hope -----         | Veblen                                  | Marshall  | 10.4                  | 65.8                                |
| 1. Ceres -----        | Bath                                    | Brown     | 6.9                   | 100.0                               |
| 2. Hope -----         | Bath                                    | Brown     | 2.6                   | 37.7                                |
| 1. Ceres -----        | Aberdeen                                | Brown     | 18.3                  | 100.0                               |
| 2. Marquis -----      | Aberdeen                                | Brown     | 17.1                  | 93.4                                |

## Comparative Yields of Hard Red Spring and Durum Wheat

Two factors come into consideration in evaluating the actual net returns that may be expected from a crop of either hard red spring or durum wheat; these are, of course, the relative yielding ability of the two types and the price per bushel that may be obtained. In the past few years durum wheats have been sold at a discount. The differences in the prices of common and durum wheat vary from season to season but the prices for the durum wheat are generally lower. Since higher prices per bushel may be expected from common spring wheat, a somewhat smaller yield per acre than of the durum wheats may be grown without influencing net returns.

TABLE 22.—Results of cooperative durum wheat variety tests in 1930 and 1931

| 1930 Results       |  |           |                             |  |
|--------------------|--|-----------|-----------------------------|--|
| Variety            | Town<br>near which<br>test plots<br>were located | County    | Yield in<br>bu. per<br>acre | Yield in<br>per cent<br>of yield<br>of Ceres |
| 1. Mindum -----    | Britton  | Marshall  | 32.8                        | 100.0  |
| 2. Red Durum ----- | Britton  | Marshall  | 25.7                        | 78.4   |
| 1. Mindum -----    | Barnard  | Brown     | 21.6                        | 100.0  |
| 2. Red Durum ----- | Barnard  | Brown     | 15.8                        | 73.1   |
| 1. Mindum -----    | Warner   | Brown     | 22.4                        | 100.0  |
| 2. Red Durum ----- | Warner   | Brown     | 15.8                        | 70.5   |
| 1. Pierson -----   | Aberdeen   | Brown     | 14.8                        | 108.8  |
| 2. Mindum -----    | Aberdeen   | Brown     | 13.6                        | 100.0  |
| 1. Red Durum ----- | Aberdeen   | Brown     | 28.8                        | 107.5  |
| 2. Mindum -----    | Aberdeen   | Brown     | 26.8                        | 100.0  |
| 1931 Results       |  |           |                             |  |
| 1. Mindum -----    | Holmquist  | Day       | 15.8                        | 100.0  |
| 2. Red Durum ----- | Holmquist  | Day       | 11.0                        | 69.6   |
| 3. Nodak -----     | Holmquist  | Day       | 8.7                         | 55.1   |
| 1. Mindum -----    | Andover  | Day       | 10.5                        | 100.0  |
| 2. Nodak -----     | Andover  | Day       | 8.9                         | 84.8   |
| 1. Mindum -----    | Britton  | Marshall  | 10.9                        | 100.0  |
| 2. Red Durum ----- | Britton  | Marshall  | 10.5                        | 96.3   |
| 1. Pierson -----   | Bath   | Brown     | 6.2                         | 159.0  |
| 2. Mindum -----    | Bath   | Brown     | 3.9                         | 100.0  |
| 1. Red Durum ----- | Florence   | Codington | 13.8                        | 117.9  |
| 2. Mindum -----    | Florence   | Codington | 11.7                        | 100.0  |
| 1. Mindum -----    | Watertown  | Codington | 7.2                         | 100.0  |
| 2. Red Durum ----- | Watertown  | Codington | 4.7                         | 65.3   |
| 1. Mindum -----    | Waverly  | Codington | 20.3                        | 100.0  |
| 2. Red Durum ----- | Waverly  | Codington | 12.5                        | 61.6   |

On the other hand, if the two types yield about the same, then the growing of the hard red spring wheat would be conducive to greater net returns.

Since the yield data available from the various stations over the state as well as those from the cooperative tests have shown rather conclusively that Ceres is the highest yielding variety of common spring wheat, and Mindum, if not the highest, is at least one of the highest yielding varieties of durum wheat, it is possible to compare the yielding abilities of these two types of wheat by a comparison of the relative yields of Ceres and Mindum. Table 23 gives the yields of these two varieties from comparative tests at Brookings, Highmore, Eureka and from the 1930 and 1931 cooperative tests. It will be observed that the yields of these two varieties of wheat, representing the highest yielding variety of each of the respective types, are very much alike. Only at Brookings, in the regular variety test as well as in the nursery are there any appreciable differences in the yields of Ceres and Mindum. This indicates that it would be profitable in many parts of the state to grow less of the durum and more hard red spring wheat of a variety such as Ceres. Fear of rust epidemics has been a great factor in upholding the durum wheat acreage of the state. Ceres is not as resistant to stem rust as are most varieties of durum wheat, yet it shows a fair degree of resistance and will, because of it, yield considerably more than a susceptible variety like Marquis in the event of a rust epidemic.

TABLE 23.—Comparative yields of Ceres and Mindum

|  | 7-yr. av. yield on the regular variety test plats at Brookings | 7-yr. av. yield on the regular variety test plats at Highmore | 5-yr. av. yield on the regular variety test plats at Eureka | 3-yr. av. yields in the nursery plats at Brookings | 3-yr. av. yields in the nursery plats at Highmore | Average yields of 1930 cooperative test plats | Average yields of 1931 cooperative test plats |
|--|--|---|---|--|---|---|---|
| Ceres  | 20.7   | 14.2  | 16.5  | 20.7   | 10.8  | 25.5  | 10.1  |
| Mindum                                       | 26.2   | 13.4  | 17.7  | 24.8   | 11.6  | 25.7  | 12.7  |
| Difference in the yields of Ceres and Mindum | -5.5   | +0.8  | -1.2  | -4.1   | -0.8  | -0.2  | -2.6  |

## Milling and Baking Qualities of Varieties of Hard Red Spring Wheat Tested

The yield of flour and the quality of such flour is an important consideration in the evaluation of the merits of any particular variety or strain of wheat. A good variety of wheat must have not only a good yielding ability but also the ability to produce a flour of high quality.

Milling data on wheat can be given quite definitely by means of stating the percentage yield of flour, shorts and bran and by means of notes on the color and texture of the flour, and its protein and ash content. The evaluation of the baking characteristics is more difficult. As stated by Coleman et al<sup>2</sup> "for the baker there is no set standard of quality, inasmuch as there is no universally standardized method of making bread. Nor are there any uniform standards for the finished product. Baking characteristics differ in degree of importance, as viewed by different people, depending upon the kind and quality of the product desired."

The perhaps most important baking characteristics are enumerated in Table 24 giving the milling and baking data of varieties of hard red spring wheats grown on the variety test plats at Brookings, Highmore, and Eureka, in 1929 and 1930.

The water-absorbing power of the flour is related more or less to the quantity and quality of the gluten. Other things being equal a flour with a high gluten content will absorb more water than one with a low gluten content. The volume of the loaf is given in cubic centimeters. The loaf volume, in tests where equal quantities of yeast, salt, and sugar are used, may be considered as an expression of the relative strength of the flour. The weight of the loaf is given in grams while the texture and color of the loaf are scored on a percentage basis. The ash content of a flour is, according to Bailey<sup>1</sup>, significant insofar as it is correlated with certain flour properties. As increase in the ash content may indicate a diminishing degree of refinement of the flour. It is also correlated with an increase in the acidity of the flour and a lowering of the color score.

Table 24 gives the milling and baking data for the varieties grown at the respective stations. Table 25 gives a summary of the average values

TABLE 24.—Milling and Baking Data of Varieties of Hard Red Spring Wheats Grown on the Variety Test Plats at Brookings, Highmore and Eureka in 1929 and 1930. (1)

| Variety                                   | Bushel weight pounds | Crude (2) protein % | Flour % | Milling results |        | Water absorption % | Volume c.c. | Baking results |           | Color % | Ash in flour % |
|---|----------------------|---------------------|---------|-----------------|--------|--------------------|-------------|----------------|-----------|---------|----------------|
|   |                      |                     |         | Shorts %        | Bran % |                    |             | Loaf           | Texture % |         |                |
| 1929—Hard Red Spring Wheats in Brookings. |                      |                     |         |                 |        |                    |             |                |           |         |                |
| Marquis                                   | 53.1                 | 13.8                | 65.7    | 13.6            | 21.1   | 60                 | 445         | 137            | 70        | 70      | .48            |
| Marquillo                                 | 55.1                 | 14.8                | 71.0    | 12.4            | 16.4   | 60                 | 398         | 138            | 60        | 56      | .52            |
| Ceres                                     | 58.0                 | 14.1                | 73.5    | 13.4            | 13.9   | 60                 | 463         | 138            | 78        | 72      | .50            |
| Reliance                                  | 54.3                 | 13.9                | 69.0    | 14.4            | 16.7   | 60                 | 410         | 137            | 60        | 74      | .43            |
| N. Dak. 1656.84                           | 59.0                 | 14.8                | 71.7    | 11.8            | 15.9   | 60                 | 413         | 139            | 66        | 78      | .45            |
| Supreme                                   | 47.2                 | 12.7                | 62.7    | 14.7            | 22.0   | 60                 | 463         | 136            | 70        | 58      | .51            |
| Hope                                      | 57.0                 | 14.7                | 73.2    | 10.7            | 15.4   | 60                 | 393         | 139            | 50        | 72      | .48            |
| Reward                                    | 60.0                 | 14.8                | 70.5    | 12.0            | 16.9   | 60                 | 493         | 136            | 88        | 82      | .44            |
| 1930—Hard Red Spring Wheats at Brookings. |                      |                     |         |                 |        |                    |             |                |           |         |                |
| Marquis                                   | 56.6                 | 15.0                | 68.8    | 13.8            | 16.9   | 60                 | 495         | 143            | 75        | 85      | .43            |
| Marquillo                                 | 55.4                 | 16.5                | 73.7    | 11.2            | 14.0   | 60                 | 490         | 142            | 70        | 70      | .46            |
| Ceres                                     | 58.7                 | 15.1                | 71.7    | 14.2            | 13.4   | 60                 | 515         | 139            | 80        | 95      | .46            |
| Reliance                                  | 58.1                 | 15.6                | 72.4    | 11.0            | 14.8   | 60                 | 558         | 140            | 85        | 95      | .39            |
| N. Dak. 1656.84                           | 57.6                 | 14.4                | 71.9    | 15.8            | 12.2   | 60                 | 499         | 139            | 70        | 70      | .46            |
| Supreme                                   | 53.4                 | 14.3                | 66.8    | 17.3            | 14.8   | 60                 | 505         | 145            | 85        | 90      | .46            |
| Hope                                      | 54.1                 | 16.3                | 69.5    | 12.6            | 16.6   | 60                 | 517         | 134            | 75        | 80      | .49            |
| Reward                                    | 59.4                 | 16.6                | 69.4    | 13.2            | 16.5   | 60                 | 550         | 144            | 85        | 85      | .47            |
| N. Dak 1656.48                            | 57.9                 | 14.1                | 71.0    | 11.8            | 16.6   | 60                 | 463         | 139            | 85        | 95      | .46            |
| Minn. 2305                                | 59.0                 | 16.1                | 73.6    | 12.8            | 13.9   | 60                 | 545         | 139            | 85        | 85      | .44            |
| Minn. 2303                                | 54.6                 | 16.6                | 68.9    | 11.1            | 19.2   | 60                 | 545         | 139            | 75        | 85      | .44            |
| 1929—Hard Red Spring Wheats at Highmore.  |                      |                     |         |                 |        |                    |             |                |           |         |                |
| Marquis                                   | 54.6                 | 18.7                | 70.6    | 16.4            | 13.7   | 58                 | 475         | 137            | 78        | 70      | .62            |
| Marquillo                                 | 50.7                 | 18.1                | 68.5    | 13.2            | 17.9   | 58                 | 393         | 142            | 50        | 56      | .60            |
| Kota                                      | 57.9                 | 18.6                | 72.6    | 13.1            | 13.4   | 58                 | 498         | 137            | 74        | 62      | .75            |
| Ceres                                     | 55.3                 | 17.2                | 68.3    | 14.3            | 18.1   | 58                 | 465         | 139            | 78        | 70      | .48            |
| Reliance                                  | 55.8                 | 17.9                | 71.4    | 13.2            | 14.7   | 58                 | 435         | 139            | 70        | 68      | .53            |
| Supreme                                   | 56.4                 | 16.9                | 69.9    | 11.1            | 18.1   | 58                 | 500         | 136            | 80        | 72      | .47            |
| Hope                                      | 50.1                 | 17.9                | 69.1    | 13.3            | 17.3   | 58                 | 415         | 138            | 60        | 66      | .55            |
| Reward                                    | 54.7                 | 18.8                | 66.9    | 12.1            | 21.4   | 58                 | 490         | 135            | 70        | 70      | .47            |
| Garnet                                    | 50.4                 | 18.7                | 66.1    | 16.3            | 18.4   | 60                 | 470         | 135            | 72        | 66      | .56            |
| Preston                                   | 55.1                 | 18.5                | 64.6    | 15.9            | 17.7   | 58                 | 390         | 141            | 50        | 50      | .60            |
| N. Dak. 1656.84                           | 53.5                 | 17.2                | 67.7    | 16.1            | 16.0   | 58                 | 458         | 138            | 74        | 72      | .53            |
| Quality (White)                           | 52.9                 | 17.0                | 71.4    | 13.2            | 15.7   | 59                 | 405         | 141            | 60        | 70      | .48            |
| 1930—Hard Red Spring Wheats at Highmore.  |                      |                     |         |                 |        |                    |             |                |           |         |                |
| Marquis                                   | 52.8                 | 17.8                | 67.8    | 17.1            | 15.3   | 60                 | 503         | 137            | 70        | 65      | .66            |
| Marquillo                                 | 52.6                 | 17.4                | 65.9    | 10.9            | 23.3   | 60                 | 480         | 140            | 65        | 65      | .58            |
| Ceres                                     | 57.6                 | 16.3                | 71.4    | 15.5            | 14.4   | 60                 | 493         | 140            | 75        | 75      | .61            |
| Reliance                                  | 54.4                 | 17.7                | 66.9    | 13.7            | 20.0   | 60                 | 445         | 142            | 70        | 80      | .56            |
| Supreme                                   | 54.1                 | 16.1                | 67.6    | 12.4            | 18.7   | 60                 | 540         | 141            | 80        | 85      | .52            |
| Hope                                      | 49.4                 | 16.6                | 69.4    | 15.5            | 13.8   | 62                 | 463         | 147            | 60        | 70      | .65            |
| Reward                                    | 59.1                 | 17.3                | 66.2    | 15.7            | 16.4   | 60                 | 453         | 139            | 85        | 90      | .58            |
| N. Dak. 1656.84                           | 57.4                 | 15.8                | 70.7    | 15.6            | 13.0   | 65                 | 483         | 149            | 60        | 65      | .60            |
| N. Dak. 1656.48                           | 54.7                 | 17.1                | 67.8    | 18.7            | 13.1   | 60                 | 478         | 140            | 75        | 80      | .64            |
| Minn. 2305                                | 58.3                 | 16.7                | 69.6    | 15.7            | 13.1   | 60                 | 448         | 140            | 70        | 70      | .55            |



**1929—Hard Red Spring Wheats at Eureka.**

|           |      |      |      |      |      |    |     |     |    |    |     |
|-----------|------|------|------|------|------|----|-----|-----|----|----|-----|
| Marquis   | 58.4 | 15.4 | 71.8 | 12.0 | 15.9 | 60 | 463 | 138 | 70 | 80 | .42 |
| Marquillo | 57.5 | 16.4 | 72.6 | 12.1 | 14.8 | 60 | 415 | 139 | 54 | 60 | .53 |
| Ceres     | 58.8 | 16.2 | 72.6 | 15.3 | 11.8 | 60 | 465 | 141 | 72 | 82 | .46 |
| Reliance  | 59.6 | 15.7 | 72.6 | 10.9 | 16.6 | 60 | 433 | 138 | 74 | 78 | .41 |
| Supreme   | 57.0 | 16.2 | 74.1 | 14.1 | 11.2 | 60 | 445 | 136 | 60 | 78 | .41 |
| Hope      | 56.7 | 15.0 | 72.6 | 12.3 | 14.3 | 58 | 525 | 136 | 90 | 78 | .48 |
| Reward    | 60.1 | 16.6 | 71.6 | 12.9 | 14.7 | 60 | 485 | 138 | 78 | 82 | .43 |

**1930—Hard Red Spring Wheats at Eureka.**

|                 |      |      |      |      |      |    |     |     |    |    |     |
|-----------------|------|------|------|------|------|----|-----|-----|----|----|-----|
| Marquis         | 55.4 | 17.4 | 66.7 | 16.4 | 15.6 | 60 | 495 | 141 | 75 | 85 | .50 |
| Marquillo       | 53.5 | 17.5 | 69.4 | 13.7 | 15.6 | 58 | 398 | 141 | 60 | 60 | .70 |
| Ceres           | 57.4 | 16.8 | 70.3 | 14.4 | 13.0 | 60 | 465 | 143 | 70 | 75 | .48 |
| Reliance        | 56.4 | 17.5 | 68.4 | 14.9 | 15.1 | 62 | 455 | 140 | 60 | 80 | .43 |
| Supreme         | 56.2 | 15.5 | 69.0 | 13.4 | 16.0 | 60 | 450 | 140 | 70 | 70 | .48 |
| Hope            | 50.3 | 18.0 | 68.6 | 11.6 | 18.1 | 58 | 460 | 143 | 65 | 65 | .43 |
| Reward          | 60.6 | 17.1 | 67.7 | 15.1 | 15.7 | 60 | 433 | 138 | 90 | 90 | .42 |
| N. Dak. 1656.84 | 56.7 | 16.5 | 70.5 | 15.1 | 13.9 | 60 | 458 | 142 | 70 | 80 | .52 |
| N. Dak. 1656.48 | 57.2 | 16.5 | 70.5 | 14.1 | 13.0 | 60 | 465 | 137 | 60 | 80 | .57 |
| Minn. 2305      | 57.6 | 17.4 | 68.7 | 16.4 | 13.7 | 58 | 460 | 137 | 60 | 80 | .58 |

(1) Data obtained by the Division of Cereal Crops and Diseases in cooperation with the Grain Division, Bureau of Plant Industry and Agricultural Economics of the United State Department of Agriculture.

(2) Crude protein equals nitrogen x 5.7 computed to a basis of 13.5 per cent moisture in the wheat.

TABLE 25—Summary of Milling and Baking Data of Varieties of Hard Red Spring Wheats Grown on the Variety Test Plats at Brookings, Highmore and Eureka in 1929 and 1930

| Variety            | Bushel weight<br>pounds | Crude (1)<br>protein<br>% | Flour<br>% | Milling results |           | Water<br>absorption<br>% | Volume<br>c.c. | Baking results          |              | Color<br>% | Ash in<br>flour<br>% |
|--------------------|-------------------------|---------------------------|------------|-----------------|-----------|--------------------------|----------------|-------------------------|--------------|------------|----------------------|
|                    |                         |                           |            | Shorts<br>%     | Bran<br>% |                          |                | Loaf<br>Weight<br>Grams | Texture<br>% |            |                      |
| Marquis            | 55.2                    | 16.4                      | 68.6       | 14.9            | 16.4      | 59.7                     | 479            | 138                     | 73           | 76         | .52                  |
| Marquillo          | 54.1                    | 16.8                      | 70.2       | 12.3            | 17.0      | 59.3                     | 429            | 140                     | 60           | 61         | .56                  |
| Ceres              | 57.6                    | 15.9                      | 71.3       | 14.5            | 14.1      | 59.7                     | 478            | 140                     | 76           | 78         | .50                  |
| Reliance           | 56.4                    | 16.4                      | 70.1       | 13.0            | 16.3      | 60.0                     | 456            | 139                     | 65           | 79         | .46                  |
| Supreme            | 54.1                    | 15.3                      | 68.4       | 13.8            | 16.8      | 59.7                     | 484            | 139                     | 74           | 76         | .48                  |
| Hope               | 52.9                    | 16.4                      | 70.4       | 12.7            | 15.9      | 59.3                     | 462            | 139                     | 67           | 72         | .51                  |
| Reward             | 59.0                    | 16.9                      | 68.7       | 13.5            | 16.9      | 59.7                     | 484            | 138                     | 83           | 83         | .47                  |
| N. Dak. 1656.84(2) | 56.8                    | 15.7                      | 70.5       | 14.9            | 14.2      | 60.5                     | 462            | 141                     | 68           | 73         | .51                  |

(1) Crude protein equals nitrogen x 5.7 computed to a basis of 13.5 per cent moisture in the wheat.

(2) Not grown at Eureka in 1929.

of the various milling and baking data. It will be observed from both of these tables that Reward shows a uniformly high score for color and texture of loaf. This variety is also generally high with regard to loaf volume. Marquis has been regarded more or less as a standard in a comparison of baking characteristics. It will be observed from the tabulated results given that Ceres measured up very favorably to the standard set by Marquis; some of the average values even surpass those of Marquis: N. Dak. 1656.84 does not measure up to either Ceres or Marquis. Marquillo shows in most instances a low score in texture and color of loaf, a low loaf volume and a relatively high percentage of ash. Reliance gave rather low values for loaf volume and texture of loaf. Supreme showed a good loaf volume and gave excellent scores for texture and color of loaf. Hope fell below Ceres and Marquis from the standpoints of loaf volume and scores on texture and color of loaf.

Data on the milling and baking characteristics of the varieties listed in Tables 24 and 25 are available through the courtesy of the Bureau of Plant Industry cooperating with the Bureau of Agricultural Economics of the United States Department of Agriculture.

## Descriptions of Varieties of Common Spring Wheat Tested

Varieties, the yields of which have been presented in tabular form, will here be discussed from the standpoints of appearance, origin, source of seed used in the experiments and adaptation to parts of South Dakota as indicated by their relative performances on the test plats. The yields of Ceres, since they were uniformly high at all stations, will be used as a standard in the evaluation of the varieties to be described. In cases where yields are available from both the regular variety and the nursery plats, for the sake of briefness, only those from the regular test plats will be mentioned. Free use has been made of the publications by Clark<sup>3</sup>, Clark, Martin and Ball<sup>4</sup> and by Wilson and Arny<sup>11</sup> for descriptions and histories of origins of varieties given here.

Ceres, S. Dak. Acc. No. 1281, C. I. No. 6900.—Ceres is a bearded variety with white glabrous\* glums, strong straw, is relatively non shattering and resistant to black stem rust but susceptible to both covered or stinking and loose smut.

Ceres was developed in 1918 by the North Dakota Agricultural Experiment station from a cross between Marquis and Kota. It has been grown commercially since 1926. Seed used in the tests was obtained from the North Dakota station in 1925.

Ceres is the highest yielding variety at the various stations over the state.

Ceres can be grown to advantage in all of the spring wheat producing sections of the state. It has great yielding capacity and produces a grain of good quality. In comparative milling and baking tests Ceres surpassed Marquis in test weight per bushel, flour yield, and in color and texture of crumb, while the volume of loaf produced was practically equal to that produced from Marquis.

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\* Glabrous means free from hairs, differing from pubescent or hairy, which causes the chaff or glumes to appear velvety.

**Disco, S. Dak. Acc. No. 1259.**—Like Ruby. See description of Ruby.

**Garnet, S. Dak. Acc. No. 1292, C. I. No. 8181.**—Garnet is awnless, with glabrous yellowish to white glumes. It matures from 5 to 7 days earlier than Marquis. The straw is mid-strong to weak. It is susceptible to stem rust but not infrequently escapes serious damage because of its earliness.

Garnet was produced from a hybrid between Preston and Riga made in 1905 by Charles E. Saunders, then Dominion Cerealists of Canada. Seed for the experiments was obtained from the North Dakota Agricultural Experiment station in 1926.

Garnet yielded over a six year period of comparison 21 and 19 per cent less than Ceres at Brookings and Highmore respectively. This variety due to low yields shown should not be grown in South Dakota.

**Haynes Bluestem, S. Dak. Acc. No. 169.**—A beardless, pubescent, tall growing, late maturing selection from bulk Bluestem, first distributed around 1892. It was formerly one of the most important varieties of hard red spring wheat but is now of no commercial importance mainly because of its lack of resistance to stem rust.

**Hope, S. Dak. Acc. No. 1311, C. I. No. 8178.**—Hope is a bearded wheat with glabrous, harsh glumes, is very resistant to shattering, has a strong straw of medium height, is immune to stem rust and resistant to leaf rust and covered and loose smut.

Hope is the result of a hybrid between Yaroslav emmer and Marquis made in 1915 by E. S. McFadden of Webster, S. Dak. Seed was obtained from Mr. McFadden in 1927.

Hope yielded 22 and 16 per cent less than Ceres in comparative tests at Highmore and Brookings, respectively.

Due to low yielding capacity Hope is not adapted for general field production except possibly in isolated sections in the very northeastern portion of the state where rust damage is most common. Hope is very susceptible to high summer temperatures.

**Java, S. Dak. Acc. No. 1335.**—Java is a bearded wheat with yellowish glabrous glumes, with a tall midstrong straw, is susceptible to stem rust but early enough to escape severe damage frequently. The kernels are red and semihard.

Java is probably one of the oldest varieties of spring wheat grown in the United States. Mention of it was made as early as 1837. It is said to have come from Switzerland. Other names used for this variety are Siberian, Black Tea, China Tea, Early Iowa and Swedish. Seed was obtained from the Nebraska Agricultural Experiment station in 1929.

This variety was grown in the nursery only. At Brookings it yielded 25 per cent less than Ceres. It was grown for only two years at Highmore and there yielded about the same as Ceres.

**Kearney, S. Dak. Acc. No. 1334.**—Kearney is a tall growing, awned, variety with white glabrous glumes. It ripens earlier than Java.

Kearney "originated," according to Kieselbach and Lyness, "in 1911 as an unidentified early maturing variety grown in Kearney county, Nebraska." Seed was obtained from the Nebraska Agricultural Experiment station in 1929.

Kearney has so far been grown in the nursery only. At Brookings as well as at Highmore it yielded somewhat less than Ceres. It is striking in appearance and merits further testing.

**Kota, S. Dak. Acc. No. 1184, C. I. 5878.**—Kota is a bearded wheat with white glabrous glumes, and a midstrong to weak straw. It is resistant to stem rust but susceptible to leaf rust and covered and loose smut.

It was distributed in 1919 from seed introduced by H. L. Bolley of the North Dakota Agricultural Experiment station from Russia in 1905.

Kota in tests extending over a period of seven years yielded 18 and 26 per cent less than Ceres at Brookings and Highmore respectively. Kota has already largely been and should be replaced by Ceres.

**Marquis, S. Dak. Acc. No. 515, C. I. No. 3641.**—Marquis is awnless, has white glabrous glumes, is of medium maturity, has a strong straw of medium height and is susceptible to stem rust.

Marquis resulted from a cross between a hard red wheat from Calcutta, India and Red Fife made by Charles E. Saunders. It was first grown as a pure line in 1904 and in commercial quantities in 1909. Seed was obtained by the station from Canada in 1913.

Before the development of Ceres, Marquis was the outstanding variety of spring wheat grown in the hard red spring wheat region of the United States. In comparative tests extending over a period of seven years Ceres outyielded Marquis by 20 and 17 per cent at Brookings and Highmore, respectively. At Eureka, Ceres outyielded Marquis by 3.1 bushels per acre or by 19 per cent over a period of five years. Marquis in the past few years has rapidly given way to Ceres. This substitution of varieties is fully justified by the uniformly higher yields of Ceres at no apparent sacrifice in quality. Since Ceres is far more resistant to stem rust than Marquis this substitution of varieties results in a reduction of the stem rust hazard and is for that reason desirable especially in the eastern portions of the state where damage from stem rust is most common.

**Marquillo, S. Dak. Acc. No. 1308, C. I. No. 6887.**—Marquillo closely resembles Marquis; it has a shorter stiffer straw and is resistant to stem rust.

Marquillo was developed at the Minnesota Agricultural Experiment station in cooperative experiments with the Office of Cereal Crops and Diseases, of the Bureau of Plant Industry. It resulted from a cross made in 1914 between Marquis and Iumillo, a rust resistant durum variety. It was distributed for commercial production by the Minnesota station in 1929. Seed was obtained from the Minnesota station in 1923.

Marquillo yielded 16 per cent less than Ceres in a three year test at Brookings, also the same percentage value less than Ceres at Highmore over a four year period. At Eureka it yielded but slightly less than Ceres.

As indicated by the differences in yields, Marquillo is not as well adapted to South Dakota conditions as Ceres. The quality of the flour produced from it is inferior to that from Ceres.

**Marquis x Emmer H44, S. Dak. Acc. No. 1329.**—This variety is of the same origin and quite similar to Hope in general appearance as well as in yielding ability. It is slightly taller and less uniform than Hope.

**Marvel, S. Dak. Acc. No. 1331.**—Marvel is similar in appearance to Preston. The spikes of Marvel are somewhat less dense than those of Preston; the beaks of Marvel have a tendency to be slightly longer.

Marvel is apparently a selection from Preston.

Marvel was grown in the nursery only. At Brookings its yields were



equal to those of Ceres while at Highmore they were somewhat higher than those of Ceres though not significantly so. Marvel yielded less than Ceres in cooperative experiments in the northeastern portion of the state.

Since the yields of Marvel did not differ materially from those of Ceres and since the quality of the flour produced is not so good as from Ceres, there is no justification for it being recommended at this time. Marvel is more susceptible to stem rust than Ceres.

**Minn. No. 2303, S. Dak. Acc. No. 1409, C. I. No. 10003.**—A beardless, stiff strawed wheat similar to Marquis in appearance, resistant to stem rust. It is the result of a double cross, Marquillo x (Marquis x Kanred). This variety was grown for only two years. It requires further testing.

**Minn. No. 2305, S. Dak. Acc. No. 1410, C. I. No. 10005.**—Of the same parentage as Minn. 2305 but a bearded selection. It has been tested for but two years; it requires further testing before it can be properly evaluated.

**N. Dak. 1656.84, S. Dak. Acc. No. 1296, C. I. No. 8004.**—Of the same appearance and parentage of Ceres. Seed was obtained from the North Dakota Agricultural Experiment station in 1927.

The yields of N. Dak. 1656.84 were somewhat higher than those of Ceres in the three years of comparison at Highmore. It yielded less than Ceres in the two year test at Eureka. The differences in the yields of this sister selection of Ceres and those of Ceres are not great and conclusive enough to be used as a basis of recommending it to be substituted for Ceres at this time. The results of milling tests reported showed that Ceres produced the better quality of flour.

**N. Dak. 1656.85, S. Dak. Acc. No. 1357.**—This selection is similar to Ceres in appearance and apparently in yielding ability; requires further testing.

**N. Dak. 1656.48, S. Dak. Acc. No. 1356.**—Similar in appearance and of the same parentage as Ceres. It has been grown for but two years in the nursery; requires further testing.

**Power, S. Dak. Acc. No. 1039.**—Very similar to Red Fife. It is somewhat more resistant to stem rust than Red Fife. It yielded slightly more than this variety but substantially less than Ceres. It was grown in the nursery only. Power is not of commercial importance.

**Prelude, S. Dak. Acc. No. 1264, C. I. No. 4323.**—This variety is also known as Wisconsin Wonder. Prelude is awned, has brown, slightly pubescent glumes, a short straw, matures very early, susceptible to stem rust.

Prelude is the result of a cross between Fraser and Gehun, a variety introduced from India, made in 1903 by Charles E. Sanders of Ottawa, Canada. It was first distributed in Canada in 1913. Seed was obtained from the North Dakota Agricultural Experiment station in 1916.

Prelude has given very low yields, 39 per cent less than Ceres at Brookings. It should not be grown; its yielding capacity is too low.

**Preston, S. Dak. Acc. No. 67.**—Preston is a bearded, white glumed wheat with a rather soft straw. It is very susceptible to rust. It resulted from a cross between Ladoga, a Siberian wheat and Red Fife, made in 1888 by William Saunders at the Central Experimental farm at Ottawa, Canada. Preston is no longer of commercial importance. It was grown in the nursery for historical interest. It yielded 18 and 6 per cent less than Ceres at Brookings and Highmore, respectively.

**Progress, S. Dak. Acc. No. 1330.**—A bearded wheat with white glabrous glumes and rather soft red kernels. It matures about the same time as Ceres.

Progress is the result of a selection made from Java in 1916 by the Wisconsin Agricultural Experiment station. Seed was obtained from that station in 1929.

Progress was grown in the nursery only. At Brookings it yielded 6 per cent less than Ceres, while at Highmore it yielded 9 per cent more than this variety.

Since the yields of Progress do not differ materially from those of Ceres and since this variety is less resistant to stem rust and produces grain of a lower quality than that from Ceres, there is no valid reason for growing it in place of the standard variety, Ceres.

**Quality, S. Dak. Acc. No. 1261, C. I. No. 6607.**—Quality is a beardless wheat with white glabrous glumes. It has a stiff straw of moderate height, is very susceptible to stem rust and early maturing. It has white kernels.

This variety was produced by Luther Burbank and distributed by him in 1918. Quality is also known under the names of Burbank and Burbank Quality, also, in sections of central South Dakota as Siberian wheat.

Quality yielded 25 and 11 per cent less than Ceres in six year tests at Brookings and Highmore, respectively.

The differences in the average yields of this variety and Ceres do not justify the growing of Quality. Due to its earliness Quality will in occasional seasons outyield Ceres. Since Quality is a white wheat it should not be grown in a hard red spring wheat producing area. This is true especially since it has no especially redeeming characteristics. The growing of two different classes of wheat in the same territory is certain sooner or later to lead to admixtures between the two types.

**Red Fife, S. Dak. Acc. No. 1333.**—Red Fife differs from Marquis in being somewhat taller and later and having longer, more open heads. Since it was formerly one of the most important varieties of spring wheat in the hard red spring wheat producing area it was included in the nursery for historic interest. It yielded 28 per cent less than Ceres at Brookings. It is not of commercial importance.

**Reliance, S. Dak. Acc. No. 1332, C. I. No. 7370.**—Reliance is a bearded wheat with glabrous white glumes. It is susceptible to stem rust.

Reliance resulted from a cross between Kanred and Marquis made in 1917 at the Sherman county Branch station, Moro, Oregon. It was developed by the Office of Cereal Crops and Diseases, Bureau of Plant Industry, in cooperation with the Oregon, Montana, North Dakota and Minnesota experiment stations. It was distributed for commercial growing in 1926. Seed was obtained from the Bureau of Plant Industry of the United States Department of Agriculture in 1929.

In three year tests Reliance yielded slightly less than Ceres at Brookings and 19 per cent less than this variety at Highmore. Since Ceres is more resistant to rust than Reliance it is the better variety for South Dakota conditions.

**Reward, S. Dak. Acc. No. 1291, C. I. No. 8182.**—Reward is awnless, has slightly pubescent white glumes, midstrong straw, is early maturing but susceptible to stem rust. It produces a high quality of flour.

Reward was produced from a cross of Marquis and Prelude made in 1911 at the Dominion Experimental farm, Ottawa. It was distributed for commercial growing in 1927.

In a test extending over a period of six years at Brookings, Reward yielded 18 per cent less than Ceres. At Highmore it yielded 8 per cent less than Ceres over a six year period; over a four year period it yielded as much as Ceres. It yielded about the same as Ceres at Eureka.

Reward is not so well adapted as Ceres in the eastern part of the state. It may be grown in the north central portion of South Dakota as an early maturing variety.

**Ruby, S. Dak. Acc. No. 1262.**—This variety is similar to Marquis in appearance. It has smaller heads, a purple straw and is earlier than Marquis. Ruby and Disco are from all indications identical.

Ruby resulted from a cross made in 1905 between Red Fife and a hybrid wheat known as Downy Riga by Charles E. Saunders. It was first distributed in Canada in 1917 and in the United States in 1921.

At Brookings Ruby, grown in the nursery, yielded less than Ceres. At Highmore both Ruby and Disco yielded about the same as Ceres. Since Ruby is susceptible to stem rust it is advisable that it be replaced by Ceres.

**Supreme, S. Dak. Acc. No. 1310, C. I. No. 8026.**—Supreme is entirely awnless, has white glabrous glumes, is of medium height and matures slightly earlier than Marquis. It is very susceptible to stem rust.

Supreme was developed as a selection from Red Bobs by Seager Wheeler at Rothern, Saskatchewan, Canada.

Supreme yielded 22 per cent less than Ceres in a three year test at Brookings and 14 per cent less than this variety in a four year test at Highmore. Due to its extreme susceptibility to stem rust it should not be grown in South Dakota.

## Description of Varieties of Durum Wheat Tested

**Acme, S. Dak. No. 284, C. I. No. 5284.**—Acme has yellow straw and rather small kernels. The kernels are pointed on the germ and blunt at the brush end. Millers object to the quality of Acme.

Acme originated from a pure-line selection of Kubanka made by M. S. Champlin at Highmore.

Acme at Brookings yielded on the variety test plats 6 per cent less than Mindum; in the nursery test the differences amounted to 16 per cent. At Highmore Acme yielded 9 per cent (1.2 bushels per acre) more than Mindum on the variety test plats while in the nursery plats Mindum yielded 4 per cent more than Acme.

Since Mindum yields as much or more than Acme and produces a grain of higher quality, it should be grown in preference to Acme.

**Algeria, S. Dak. No. 340.**—Algeria is a very early, short, weak strawed wheat with small heads and kernels. The glumes and awns are brown. The kernels are amber.

Developed from a selection out of a lot of wheat imported from Algeria in 1913.

Algeria was grown in the nursery only; at Brookings it yielded 17 per cent less than Mindum, at Highmore it yielded 6 per cent more than this variety. It is not recommended because of its low growth and weak straw.



**Arnautka, S. Dak. Acc. No. 1001, C. I. No. 4064.**—Arnautka has yellow glabrous glumes and yellow awns, large amber kernels and a tall midstrong straw. The heads are slightly nodding.

Arnautka is believed to have been introduced by Russian immigrants to North Dakota.

Arnautka and Mindum yielded alike at Brookings over a seven year period. The yields of these two varieties are also very much alike at Highmore. The nursery results at Brookings are more favorable to Mindum.

**Black Don, S. Dak. Acc. No. 1411.**—Black Don has blue black glumes and dark awns, and amber kernels. It is very susceptible to stem rust.

Black Don was introduced from Algeria in 1901.

Black Don is not desirable because of its low yield and susceptibility to stem rust.

**Castillione, S. Dak. Acc. No. 1132.**—A mixture of types with light and dark awns. The kernels are amber in color.

Castillione originated from a lot of seed from Italy.

Castillione was grown in the nursery only. At Brookings it yielded decidedly less than Mindum. At Highmore it yielded somewhat more than Mindum. It is not recommended because of its lack of resistance to rust.

**Hurst, S. Dak. Acc. No. 1412.**—This variety is similar in appearance to Kubanka. It was grown in the nursery only where it yielded less than Mindum.

**Kahla, S. Dak. Acc. No. 1174.**—Kahla is like Black Don in appearance, susceptibility to stem rust and yielding ability.

**Kabanka, S. Dak. Acc. No. 75, C. I. No. 1440.**—Kabanka has smooth, yellowish glumes, yellowish beards and large amber kernels. It is fairly resistant to stem rust. Kabanka produces a grain of high quality.

Kubanka was introduced from Russia in 1900 by M. A. Carleton, then cerealist of the United States Department of Agriculture.

Kubanka yielded less than Mindum in both the variety test plats and the nursery at Brookings. The yields of Kubanka and Mindum were identical at Highmore and Eureka.

Kubanka is a desirable durum wheat for the central part of the state. In the eastern portion of the state Mindum is the higher yielding variety. Seed of Kubanka available to producers is frequently badly mixed with seed of other durums and common wheats.

**Kubanka (75-3-15), S. Dak. No. 1413.**—Similar to Kubanka S. Dak. Acc. No. 75 from which it was selected by Matthew Fowlds of this station in 1915. It is more uniform, has stronger straw and somewhat smaller heads and kernels than the variety from which it was selected. The glumes of this selection are white in color whereas those of Kubanka are yellowish.

This variety has given good yields. It requires further testing with regard to yielding ability and quality of the grain produced.

**Mindum, S. Dak. Acc. No. 1160, C. I. No. 5296.**—Mindum is very similar in appearance to Arnautka. Because of poor expansion of its loaf, Mindum is inferior to both Kubanka and Arnautka for bread making. For macaroni manufacture, however, it has good color and apparently is equal to either of these varieties.



Mindum was selected from a mixture of durum found in a field of common wheat at the Minnesota Agricultural Experiment station in 1896. It was first distributed in 1917.

Mindum has produced outstanding yields, especially in the eastern portion of South Dakota. In the central part of the state it yielded no more than Kubanka or Arnautka. It is a desirable durum wheat for macaroni manufacture.

**Monad, S. Dak. Acc. No. 1113, C. I. No. 3320.**—Monad is very similar in appearance to Acme. The quality of the grain produced by it is low. It yielded considerably less than Mindum. It is not recommended. Monad is also known as D-1; it was introduced from Russia by the North Dakota Agricultural Experiment station in 1902.

**Nodak, S. Dak. Acc. No. 1266, C. I. No. 6519.**—Nodak is a selection from Kubanka made at the North Dakota Agricultural Experiment station. Nodak yielded about the same as Mindum. Milling and baking tests have given good results for Nodak as far as its adaptability for bread making is concerned. It is reported, however, not to produce as good a color of semolina and macaroni as either Kubanka or Mindum. For this reason it is less desirable than Mindum.

**Pentad, S. Dak. Acc. No. 1414.**—Pentad is also known as D-5, and Red Durum. The glumes and beards of Pentad are nearly white. The kernels are pointed at the germ and blunt at the Brush end and of a dull red color.

Pentad was grown in the nursery for only two years; it yielded less than Mindum in cooperative tests in the northeastern portion of the state.

Pentad, due to the color of the grain, is undesirable. Since it yields less than Mindum and produces a grain of lower quality, it should not be grown.

**Peliss, S. Dak. Acc. No. 1256.**—Peliss is also known as Black Bearded Durum. The heads are large, thick and compact, with long, stiff, black awns. The chaff is almost white. The kernels are amber in color, long and curved. Peliss is rather susceptible to stem rust.

Peliss was introduced in 1900 from Algeria by the United States Department of Agriculture.

At Brookings Peliss yielded 21 per cent less than Mindum. At Highmore its yields were about the same as those of Mindum.

Since Peliss is rather susceptible to rust and does not produce as much as Mindum it is not so desirable.

**Pierson, S. Dak. Acc. No. 999.**—Pierson is the same variety as Arnautka

**Tunal Selection, S. Dak. Acc. No. 1415.**—This is a selection from Tunal C. I. No. 3307. It has black glums and beards. The heads are large and broad. This variety is not recommended, mainly because of its weak straw.

## Summary of Varietal Recommendations for the Wheat Producing Districts of South Dakota

In an earlier part of this publication the state was divided into six wheat producing districts; these districts are shown in Fig. 6. Conditions pertaining to the production of wheat for each of the districts were briefly discussed.

It will be well at this time, since the various classes and different varieties of wheat likely to come up for consideration have been taken up

from the standpoints of their relative yielding capacities and agronomic characteristics, to summarize varietal recommendations for each of the wheat producing districts of the state. A summary of these recommendations will be found in Table 26.

Ceres is the outstanding variety of hard red spring wheat recommended.

The yield data presented show very definitely that Ceres meets the requirements for a high yielding hard red spring wheat of high quality for all the spring wheat producing areas of the state. Reward may be grown to advantage as an early maturing wheat in the western portions of Districts No. 3 and 4 where outbreaks of stem rust epidemics are not likely to occur. It will be seen from Table 26 that Marquis is not being recommended. The yields of this variety were so far behind those of Ceres as to justify the replacement of Marquis by Ceres.

Mindum is the outstanding variety of durum wheat as indicated from the yield data presented. Kubanka may be grown to advantage in districts No. 3 and 4. Arnautka is a good variety for all the durum wheat producing areas. An abundance of pure seed of Mindum is available in all parts of the state while the supply of unmixed seed of Arnautka and Kubanka is limited.

A shift from less durum to more hard red spring wheat is recommended for all the wheat producing sections of the state and especially for District No. 1, comprising the northeastern corner of the state. This is justified by the relative yields and the price relationships between these two classes of wheat.

TABLE 26.—Summary of recommendations for classes and varieties of wheat for the different wheat producing districts of South Dakota

| Wheat producing districts of South Dakota   | Relative importance of classes of wheat recommended  | Varieties of different classes of wheat recommended  |
|---|--|--|
| No. 1.—Durum wheat or northeastern district | 1. Hard red spring<br>2. Durum   | Ceres<br>Mindum, Arnautka  |
| No. 2.—East central                         | 1. Hard red winter<br>2. Hard red spring   | Turkey Red, Kharkof,<br>Minturki<br>Ceres  |
| No. 3.—Northern hard red spring area        | 1. Hard red spring<br><br>2. Durum (limited acreage)   | Ceres, Reward as an early maturing variety in central and western portion of district<br>Mindum, Kubanka, Arnautka |
| No. 4.—Central hard red spring area         | 1. Hard red spring<br>2. Durum (limited acreage)   | Ceres<br>Mindum, Arnautka, Kubanka   |
| No. 5.—Southern hard red spring area        | 1. Hard red spring<br>2. Hard red winter in southeastern portion of district and in protected places | Ceres<br>Turkey Red, Kharkof,<br>Minturki  |
| No. 6.—Winter wheat area                    | 1. Hard red winter<br>2. Hard red spring   | Turkey Red, Kharkof,<br>Minturki<br>Ceres  |

## Summary

Wheat next to corn is South Dakota's most important grain crop.

The acreage devoted to the production of wheat in South Dakota as well as the average yields per acre fluctuate widely from season to season. Nevertheless, since climatic and soil conditions are generally favorable to wheat production, it may be expected that wheat will continue to be one of the most important, if not the most valuable, small grain crop to be grown in the state.

The state of South Dakota is divided into six districts with regard to wheat production. Conditions pertaining to wheat production are discussed and recommendations relative to the types and varieties to be grown in each of these districts are given.

Ceres was the outstanding variety of hard red spring wheat grown on the variety test plats at Brookings, Highmore and Eureka. Ceres yielded 20.3 and 16.6 per cent more than Marquis at Brookings and Highmore, respectively, over a seven year period of comparison. At Eureka, Ceres yielded 18.8 per cent more than Marquis over a five year period of comparison.

Reward gave good, though not higher, yields than Ceres, at Highmore and Eureka. It may be grown to advantage as an early maturing variety in the north-central portions of the state.

Milling and baking tests, made by the Bureau of Plant Industry co-operating with the Bureau of Agricultural Economics of the United States Department of Agriculture, showed that the quality of Ceres was in every respect equal if not superior to that of Marquis. From the standpoint of quality Ceres rated significantly superior to its sister selection, N. Dak. 1656.84. Quality is an important consideration in the evaluation of a variety or strain of wheat.

Since the high yielding capacity of Ceres is well established by the tests reported, and since it produces a grain equal or superior in quality to that of Marquis, Ceres may well be recommended to replace Marquis in all parts of South Dakota. Furthermore, since Ceres shows a much greater degree of resistance to stem rust the growing of it rather than of Marquis serves to reduce materially the rust hazard in spring wheat production.

Outstanding varieties of durum wheat from the standpoint of yielding ability and quality, with special reference to their utilization in the manufacturing of macaroni, are Mindum, Arnautka, and Kubanka. Mindum is characterized by a wide range of adaptation as is evident by the uniformly high yield of this variety in the eastern as well as in the central parts of the state. Kubanka is more strictly adapted to the central and western portions of South Dakota. In the eastern part of the state the yields of Kubanka are surpassed by those of Mindum, Arnautka and Nodak. Nodak and Acme are high yielding varieties, though not better yielders than Mindum, but are not recommended because of the lower quality of grain produced.

Cooperative tests with varieties of durum wheat in the northeastern portion of the state point decidedly to the superiority of Mindum over Red Durum. Red Durum produces grain of markedly lower quality than Mindum and Arnautka.

Comparative yields of varieties of hard red spring and durum wheats in different parts of the state showed that the yields of the better varieties of these two classes of wheat were very much alike. In view of the price differential between these two classes of wheat, which is usually in favor of the hard red spring, it would be profitable for many producers to grow less of the durum and more hard red spring wheat of a variety such as Ceres. Fear of rust epidemics has been a great factor in upholding the durum wheat acreage of the state. Ceres is not so resistant to stem rust as are most varieties of durum wheat, yet it exhibits a fair degree of resistance to this disease and will because of this, yield substantially more than a susceptible variety like Marquis in the event of a rust epidemic.

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