

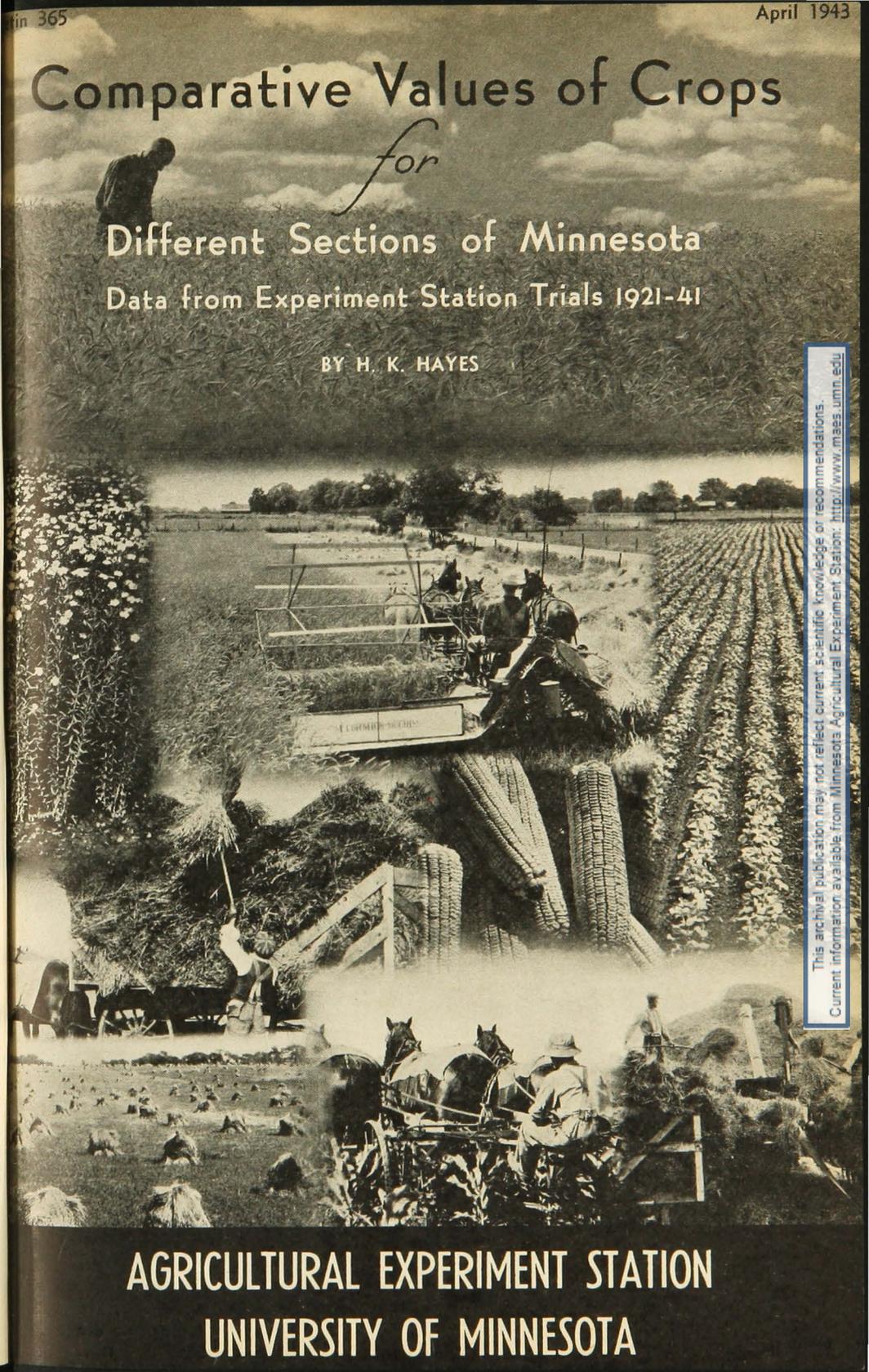
# Comparative Values of Crops

*for*

## Different Sections of Minnesota

### Data from Experiment Station Trials 1921-41

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**AGRICULTURAL EXPERIMENT STATION  
 UNIVERSITY OF MINNESOTA**

## *Summary . . .*

Varietal trials made at the Central and Branch Experiment Stations are conducted on fields that are under a system of crop rotation in common use by the more progressive farmers. Average yields of the various crops afford a reliable comparison of the productive capacity of adapted varieties of crops to those sections of Minnesota represented by the experiment stations. Comparisons of cash value per acre were based on yields given in the field trials and on average farm prices in Minnesota on December 1 from 1921 to 1935 and on November 15 from 1936 to 1941. The production of total digestible nutrients and protein was calculated in pounds per acre.

Average yields were given for two different periods—from 1921 to 1932, reported in a previous publication, and from 1933 to 1941.

Winter wheat is well adapted to the regions represented by the Central, Southeast, and North Central Experiment Stations. In these regions, winter wheat yielded more than spring wheat during both periods, averaging 3.6 bushels more from 1921 to 1932 and 3.4 bushels more from 1933 to 1941.

While durum wheat outyielded spring wheat by 3.8 bushels (averaged) at the Central, Southeast, West Central, and Northwest Experiment Stations from 1921 to 1932, both yielded about the same from 1933 to 1941. This resulted probably from the fact that during the latter period many varieties of spring wheat under trial were resistant to both leaf and stem rusts.

From 1933 to 1941 there was an opportunity to compare the yields of adapted varieties of corn with adapted Minhybrids.

On the average, the hybrids outyielded the varieties at the various stations as follows: Central 8.3 bushels per acre or 19.6 per cent, Southeast 9.9 bushels or 15.9 per cent, West Central 8.7 bushels or 20.7 per cent, Northwest 7.9 bushels or 26.3 per cent, and North Central 4 bushels or 12.8 per cent.

Average yields of barley and oats from 1921 to 1941, inclusive, at the various experiment stations show that these crops are relatively well adapted to all sections of Minnesota. The range in average yield of barley was from 28.9 bushels at Grand Rapids to

## . . . Summary

50.9 bushels at Waseca. For oats, the lowest average yield was 54 bushels at Duluth and the highest was 71.1 bushels at Waseca.

Among small grains and flax, the three more desirable crops from the standpoint of cash value are summarized by listing the cash value calculated for the three leading crops at each station: University Farm—winter wheat \$23.93, hard red spring wheat \$21.90, durum wheat \$21.54; Waseca—flax \$32.58, winter wheat \$26.57, durum wheat \$24.74; Morris—flax \$24.34, durum wheat \$22.25, hard red spring wheat \$20.98; Crookston—flax \$23.09, durum wheat \$21.63, hard red spring wheat \$19.87; Grand Rapids—winter wheat \$19.02, rye \$18.10, oats \$16.98; Duluth—flax \$21.30, hard red spring wheat \$17.20, oats \$16.20.

It should be emphasized that from 1933 to 1941 hard red spring wheat would lead durum wheat in cash value in all comparisons.

Soybeans were grown at five stations during the latter period from 1933 to 1941. They gave average yields in bushels per acre of 17.2 bushels at University Farm, 22.9 bushels at Waseca, 16.3 bushels at Morris, 15.6 bushels at Crookston, and 10.8 bushels at Grand Rapids. They are of considerable interest for feed because of their high yields of digestible protein. Calculated digestible protein in pounds produced per acre from 1921 to 1941 was 333 pounds at University Farm, 388 at Waseca, 337 at Morris, 266 at Crookston, and 203 at Grand Rapids.

On the basis of cash value per acre from 1921 to 1941, corn and soybeans compared as follows: University Farm—corn \$23.59, soybeans \$21.63; Waseca—corn \$34.29, soybeans \$25.22; Morris—corn \$24.70, soybeans \$21.89; Crookston—corn \$17.97, soybeans \$17.28; Grand Rapids—corn \$16.75, soybeans \$14.34.

At all five stations where it was grown, corn yielded more total digestible nutrients per acre than any other crop. At four stations where barley was its nearest competitor corn exceeded barley in digestible nutrients per acre as follows: 488 pounds at University Farm, 1,066 pounds at Waseca, 721 pounds at Morris, and 225 pounds at Crookston. At Grand Rapids corn exceeded rye, the nearest competitor, by 61 pounds in digestible nutrients per acre.



# Comparative Values of Crops for Different Sections of Minnesota

Data from Experiment Station Trials, 1921-1941<sup>1</sup>

H. K. Hayes

**V**ARIETAL TRIALS of farm crops are made at the Central and Branch Stations to determine which varieties are of greatest value for Minnesota farmers. The tests are made under systems of crop sequence that are recommended for the region, and on soils that as far as possible are representative of the region, in which the recommended varieties will be grown. The results of these trials should be indicative of the comparative yielding ability of different crops. Comparisons will be made on the basis of yield per acre, cash value, and digestible nutrients.

## Comparisons Made from Varietal Trials

Varieties included in the trials are believed to be of possible commercial importance and consist of new varieties bred at the Minnesota or other experiment stations and the standard recommended varieties that have been approved by the Agronomy Conference of the Minnesota Agricultural Experiment Station. As a rule, tests of different crops are not made on the same fields, because of lack of space; however, the most satisfactory fields available are used and over a period of years the yields obtained should be a

reliable index of comparative yields of different crops.

Varieties of small grains usually were grown in randomized blocks, with three replications at each station. During the period of this study the entire plot was harvested after the border rows were removed, or the yields were computed from a uniform number of square-yard samples harvested for the crop. The yield of each crop, for each of the years, is usually the average yield of all varieties of that crop grown in the varietal trials. When a variety was known to be a low yielder, but grown for other pur-

<sup>1</sup> Acknowledgment is made to project leaders at University Farm, including: F. R. Immer, A. C. Army, H. K. Wilson, E. R. Ausemus, A. H. Moseman, and E. H. Rinke; and agronomists and superintendents at the Branch Stations, including: R. S. Dunham, Crookston; R. O. Bridgford, Morris; R. E. Hodgson, Waseca; O. W. Swenson, formerly of Grand Rapids; and M. J. Thompson, Duluth, who kindly made available the data from varietal trials. Assistance in the preparation of these materials was furnished by the personnel of Work Projects Administration, Official Project No. 265-1-71-236, Subproject No. 487.

poses, its yield was not included in the average. Thus in flax several fiber varieties of low-yielding ability were not included in the averages.

The first report<sup>2</sup> of comparative trials was made in 1934, and included yields from 1921 to 1932, inclusive. The present report includes results of trials from 1921 to 1941, inclusive. A comparison is made of average yields during the first period from 1921 to 1932, inclusive, with those during a second period from 1933 to 1941, inclusive.

### Crops Grown at Various Stations

At University Farm, during the first period from 1921 to 1932, all crops were grown each year except soybeans, which were planted from 1921 to 1925 only. In the second period from 1933 to 1941 all crops were grown each year except soybeans which were not planted in 1933.

At Waseca, all crops were grown during the first period except as noted: rye was not grown in 1924 and 1930, flax was not sown from 1921 to 1927, soybeans were not grown from 1925 to 1932, and corn was not planted from 1921 to 1924. In the second period all crops were grown each year except flax, which was included only from 1938 to 1941, and soybeans, which were not grown in 1933.

At Morris, all crops were grown during the first period from 1921 to 1932, except flax was not sown from 1921 to 1923, and soybeans were not grown from 1926 to 1932. During the second period there was a crop failure in 1933 and 1934, and the averages include 1935 to 1941. All crops were

grown each year from 1935 to 1941 except rye, which was not sown in 1937.

At Crookston, all crops were grown in the first period except soybeans, which were planted from 1921 to 1924 only. In the second period oats and flax were not harvested in 1936, soybeans were not grown in 1933, and corn was grown only in 1938 to 1941.

At Grand Rapids, in the first period hard red spring wheat was not grown in 1929, winter wheat was not grown in 1928, rye was not grown from 1921 to 1923, and flax was grown only from 1925 to 1932. Corn was not included during the first period. In the second period soybeans were grown only from 1936 to 1941, while corn was not grown in 1938.

At Duluth, no corn, soybeans, or winter wheat were grown. Other crops were grown from 1921 to 1932 each year except flax, which was not sown from 1921 to 1925, inclusive. During the second period rye was not grown in 1936.

### Basis for Correcting Yields

Barley and oats were grown at all stations each year of the comparative trials, but in 1936 oats were not harvested at the Crookston Station. If a crop was grown for less than the full period, its yield is corrected on the basis of the average yield of barley and oats for the same period in relation to the average yield of barley and oats for the entire period. Thus at the Crookston Station soybeans were grown from 1921 to 1924, 1932 to 1935, and 1937 to 1941. The adjusted yield of soybeans at the Crookston Station was computed as follows: *Average*

<sup>2</sup> Hayes, H. K., and Borgeson, Carl, "Comparative Values of Farm Crops Grown at the Central and Branch Stations in Yield Trials," Minnesota Agricultural Experiment Station Bulletin 312, 1934.

yield of barley and oats, 1921-1924, 1932-1935, 1937-1941, inclusive: average yield of barley and oats, 1921-1941, inclusive = average yield of soybeans, 1921-1924, 1932-1935, 1937-1941, inclusive: X, where X = calculated yield of soybeans for 1921-1941, inclusive. Adjusted yields of other crops were computed in a similar manner.

**Basis for Computing Prices**

Average prices for the 21-year period were obtained from Minnesota Annual Crop Reports, 1921 to 1941, inclusive. December 1 Minnesota farm prices were used from 1921 through 1935, and November 15 farm prices were used from 1936 to 1941, inclusive. In the case of wheat, separate prices were given for spring wheat, including durum and hard red spring, and winter wheat from 1921 to 1927, and the prices for 1936 to 1941 included all wheat. During 1928 to 1935, prices were given separately for each of the three classes of wheat. The price of durum wheat was obtained by averaging the yearly price of all spring wheat from 1921 to 1927, the price of durum from 1928 to 1935, and the price of all wheat from 1936 to 1941. Prices for winter and spring wheat were obtained in a similar manner. It is probable that the average prices used for durum and for winter wheat are somewhat higher than they should be. Probably the discrepancies are greater for durum than for winter wheat.

The number of pounds of digestible protein and total digestible nutrients in 100 pounds of feed of the various crops compared in this bulletin is summarized here on the basis of results given by Morrison.<sup>3</sup>

**Digestible Nutrients in 100 Pounds**

	Protein	Total Nutrients
Wheat .....	11.6	84.0
Oats .....	9.4	71.5
Barley .....	9.3	78.7
Rye .....	10.3	80.1
Flax .....	21.4	108.7
Corn .....	7.3	82.5
Soybeans .....	32.8	86.2

It may be noted that wheat and rye are similar in their content of digestible nutrients, that barley and oats are lower in both digestible protein and total digestible nutrients than wheat and rye, that corn is lower in digestible protein than the small grains, and about equal to wheat in total digestible nutrients. Soybeans excel in total digestible protein and compare favorably with concentrated feeds such as gluten feed, linseed meal, or cottonseed meal. Flax is included for comparison even though it is not recommended as a farm feed.

The average yields per acre and the percentages of digestible nutrients for the various crops were used to calculate the number of pounds of digestible protein and total pounds of digestible nutrients produced per acre.

<sup>3</sup> Adapted from Morrison, F. B., "Feeds and Feeding," Twentieth Edition.



## Comparison of Crops

A comparison of average yields at the different stations for the various crops is given for two periods, from 1921 to 1932, inclusive, and from 1933 to 1941, in table 1. These comparisons give some idea of the adaptability of crops in different regions of Minnesota.

Oats, barley, and rye are well adapted to all regions of Minnesota. Hard red spring and durum wheat gave good yields at University Farm, Waseca, Morris, and Crookston. Spring wheat yielded considerably less than winter wheat at Grand Rapids, University Farm, and Waseca, and spring wheat does not seem to be well adapted at Grand Rapids.

Flax also gave low yields at Grand Rapids and comparatively lower yields at University Farm than the small

grains. Soybeans gave good yields at University Farm, Waseca, and Morris and comparatively good yields at Crookston from 1933 to 1941, inclusive. Yields at Waseca for 1933 to 1941 averaged 22.9 bushels per acre.

Corn yielded about the same at University Farm and Morris. During the period from 1933 to 1941 adapted Minhybrids averaged 50.7 bushels per acre. Yields of corn at Waseca were excellent, averaging 72 bushels per acre for hybrids during the period from 1933 to 1941. Yields of corn at Crookston and Grand Rapids were much lower than at the other stations where corn was grown.

During the period from 1933 to 1941, inclusive, there was an opportunity to compare corn hybrids with varieties of

**Table 1. Average weighted yield, in bushels per acre, of crops at the Central and Branch Stations from 1921 to 1941, for period I (1921-1932) and period II (1933-1941)**

Crop	Period	University	Waseca	Morris	Crookston	Grand	Duluth
		Farm				Rapids	
Bushels per Acre							
Oats	I	62.2	72.6	59.1	61.6	53.7	58.5
	II	52.4	69.1	57.0	53.8	60.4	48.1
Barley	I	40.5	52.1	34.3	33.9	28.8	34.3
	II	42.8	49.4	44.0	37.7	29.0	31.5
Hard red spring wheat	I	25.7	23.3	22.2	23.4	16.6	19.0
	II	21.3	25.6	23.7	19.2	17.4	18.4
Durum wheat	I	27.0	29.2	26.0	27.7	.....	.....
	II	20.5	25.9	23.3	19.7	.....	.....
Winter wheat	I	28.2	30.0	.....	.....	19.0	.....
	II	23.7	28.2	.....	.....	22.5	.....
Rye	I	28.4	34.2	28.5	.....	27.9	19.5
	II	37.4	39.4	28.5	.....	34.5	17.1
Flax	I	11.6	16.0	14.6	12.9	8.5	14.0
	II	11.3	20.3	12.4	13.0	9.9	10.2
Soybeans	I	16.5	13.3	18.3	9.8	.....	.....
	II	17.2	22.9	16.3	15.6	10.8	.....
Corn varieties	I	39.8	56.4	44.2	32.6	.....	.....
	II	42.4	62.1	42.0	30.0	31.2	.....
Corn hybrids	I	.....	.....	.....	.....	.....	.....
	II	50.7	72.0	50.7	37.9	35.2	.....

similar dates of maturity. At University Farm, the Central Station strain of Minnesota No. 13 was grown each year and Rustler was included from 1933 through 1937. Minhybrid 401 was grown all years, Minhybrid 301 in 1935 and from 1939 to 1941, Minhybrid 500 in 1938, 1940, and 1941, Minhybrid 602 in 1939 to 1941, and Minhybrids 502, 603, and 604 in 1941 only. The average yield of varieties was 42.4 bushels and of adapted hybrids 50.7 bushels. This is an average increase of hybrids over varieties of 8.3 bushels per acre, or 19.6 per cent.

At Waseca, the Murdock variety was grown all years from 1933 to 1941 except in 1933 and 1936. Silver King was grown from 1933 to 1936, and Golden King in 1933, 1934, and 1936. Minhybrids 301 and 403 were grown each year from 1933 to 1941, and Minhybrids 404 and 405 from 1938 to 1941. During the period from 1933 to 1941, varieties averaged 62.1 bushels and hybrids 72.0 bushels. This is an increase of 9.9 bushels per acre, or 15.9 per cent.

At Morris, the Morris strain of Minnesota No. 13 was the only variety tested during 1935 to 1941, inclusive. This is a high-yielding, early-maturing strain, especially adapted to this section, that was selected at the Morris Station. Minhybrid 401 was grown each year from 1935 to 1941, Minhybrid 601 in 1937 to 1938 and 1940 to 1941, Minhybrid 602 in 1939 to 1941, and Minhybrids 603 and 604 in 1941. The average yield of Morris Minnesota No. 13 was 42.0 bushels, and of the hybrids, 50.7 bushels. This is an increase of 8.7 bushels per acre, or 20.7 per cent, for the period from 1933 to 1941, inclusive.

Tests at the Crookston Station were made from 1938 to 1941. Haney's Minnesota No. 13 and the Crookston strain

of Northwestern Dent were the varieties grown. Minhybrid 402 was grown from 1938 to 1941, and Minhybrid 800 in 1940 and 1941. The varieties gave an average yield of 30 bushels, and the hybrids averaged 37.9 bushels. This is an increase of 7.9 bushels per acre, or 26.3 per cent, for the hybrids over the varieties.

At Grand Rapids, the same varieties of corn were grown as at Crookston. The two varieties and Minhybrid 402 were grown each year except in 1938, and Minhybrid 800 was grown in 1940 and 1941. The varieties averaged 31.2 bushels and the hybrids 35.2 bushels. This is an increase of 4 bushels per acre, or of 12.8 per cent.

The average yields in bushels per acre of the various crops, the average farm price per bushel, the calculated value per acre, the yield in pounds per acre, and the calculated digestible nutrients per acre are given separately for each of the Experiment Stations.

### *Central Experiment Station, St. Paul*

Table 2 is a summary of results at the Central Experiment Station. Yields of corn given in this and subsequent tables are an average for varieties from 1921 to 1932 and for hybrids from 1933 to 1941.

While durum wheat gave a higher average yield in bushels per acre than hard red spring from 1921 to 1932 by 4.3 bushels, the yield of durum from 1921 to 1941 averaged only 0.4 bushels more than the yield of hard red spring wheat. Winter wheat averaged 2.5 bushels more than spring wheat. Flax gave relatively low yields at University Farm, probably because it was

**Table 2. Averages for yield in bushels per acre, price per bushel, value per acre, yield in pounds per acre, and digestible nutrients per acre at the University Farm Station, 1921-1942**

Crop	Bushels per Acre	Price per Bushel	Value per Acre	Pounds per Acre	Digestible	Total
					Protein	Digestible
					pounds	pounds
Oats .....	58.0	\$0.30	\$17.40	1,856	174	1,327
Barley .....	41.5	0.48	19.92	1,992	185	1,568
Hard red spring wheat.....	23.8	0.92	21.90	1,428	166	1,200
Durum wheat .....	24.2	0.89	21.54	1,452	168	1,220
Winter wheat .....	26.3	0.91	23.93	1,578	183	1,326
Rye .....	32.3	0.58	18.73	1,809	186	1,449
Flax .....	11.5	1.79	20.59	644	138	700
Soybeans .....	16.9	1.28	21.63	1,014	333	874
Corn .....	44.5	0.53	23.59	2,492	182	2,056

more severely injured than other crops by drouth resulting from a gravel sub-soil at University Farm.

On the basis of calculated farm value, winter wheat led with a value of \$23.93 per acre, followed by corn with \$23.59, hard red spring wheat \$21.90, soybeans \$21.63, durum wheat \$21.54, barley \$19.92, rye \$18.73, and oats \$17.40.

The total yield of digestible nutrients was greatest for corn with 2,056 pounds per acre followed by barley at 1,568 pounds. Soybeans yielded 333 pounds of digestible protein per acre. While oats gave a low acre value, its yield of digestible nutrients was about the same as for winter wheat. Winter

wheat gave the highest farm value per acre of all crops and exceeded spring and durum wheat in pounds of digestible nutrients by approximately 100 pounds per acre.

### ***Southeast Experiment Station, Waseca***

Data for the Southeast Experiment Station at Waseca are summarized in table 3. The summaries include the same crops as were grown at University Farm. All crops tested gave excellent yields in these trials.

Corn, with an average yield of 64.7 bushels, led in average value per acre

**Table 3. Averages for yield in bushels per acre, price per bushel, value per acre, yield in pounds per acre, and digestible nutrients per acre at the Waseca Station, 1921-1942**

Crop	Bushels per Acre	Price per Bushel	Value per Acre	Pounds per Acre	Digestible	Total
					Protein	Digestible
					pounds	pounds
Oats .....	71.1	\$0.30	\$21.33	2,275	214	1,627
Barley .....	50.9	0.48	24.43	2,443	227	1,923
Hard red spring wheat.....	24.3	0.92	22.36	1,458	169	1,225
Durum wheat .....	27.8	0.89	24.74	1,668	193	1,401
Winter wheat .....	29.2	0.91	26.57	1,752	203	1,472
Rye .....	36.7	0.58	21.29	2,055	212	1,646
Flax .....	18.2	1.79	32.58	1,019	218	1,108
Soybeans .....	19.7	1.28	25.22	1,182	388	1,019
Corn .....	64.7	0.53	34.29	3,623	264	2,989

at \$34.29, followed by flax with \$32.58, winter wheat \$26.57, soybeans \$25.22, durum wheat \$24.74, barley \$24.43, hard red spring wheat \$22.36, oats \$21.33, and rye \$21.29. Where winter wheat can be grown successfully, it is an excellent cash crop for southern Minnesota. On soils adapted to it, flax appears to be of greater value as a cash crop than any of the small grains. Rye and oats, as at University Farm, gave the lowest calculated cash value per acre of the crops compared.

At Waseca, as at University Farm, corn excelled in total digestible nutrients and soybeans gave a high yield per acre of digestible protein. At both University Farm and Waseca, barley gave a higher yield of digestible nutrients than oats. At Waseca, oats gave a higher yield of digestible protein and total digestible nutrients than spring or winter wheat and was about equal to rye in digestible nutrients per acre.

**West Central Experiment Station, Morris**

The same crops were grown at Morris as at University Farm and Waseca, although winter wheat was included only during the first period. Previous

tests from 1921 to 1932 at Morris gave an average yield of winter wheat of 16.4 bushels compared with 22.2 bushels for hard red spring wheat. During the period from 1921 to 1932, inclusive, durum wheat yielded 3.8 bushels more, on the average, than hard red spring wheat, while hard red spring wheat yielded 0.4 bushels more than durum during the period from 1933 to 1941. Mindum durum was the only variety used to determine the value of durum wheat. With varieties of hard red spring wheat available that are resistant to both leaf and stem rust, there is probably no reason why hard red spring wheat should not yield as well as durum, on the average, in central and southern Minnesota, and in the Red River Valley region. Data summarizing results at the Morris Station are given in table 4.

Calculated values per acre give the following results: Corn \$24.70, flax \$24.34, durum wheat \$22.25, soybeans \$21.89, hard red spring wheat \$20.98, barley \$18.19, oats \$17.49, rye \$16.53.

Corn excelled in total digestible nutrients with an average of 2,153 pounds per acre and soybeans yielded 337 pounds of digestible protein, about the same as at University Farm. While

**Table 4. Averages for yield in bushels per acre, price per bushel, value per acre, yield in pounds per acre, and digestible nutrients per acre at the Morris Station, 1921-1942**

Crop	Bushels per Acre	Price per Bushel	Value per Acre	Pounds per Acre	Digestible Protein	Total Digestible Nutrients
					pounds	pounds
Oats .....	58.3	\$0.30	\$17.49	1,866	175	1,334
Barley .....	37.9	0.48	18.19	1,819	169	1,432
Hard red spring wheat .....	22.8	0.92	20.98	1,368	159	1,149
Durum wheat .....	25.0	0.89	22.25	1,500	174	1,260
Rye .....	28.5	0.58	16.53	1,596	164	1,278
Flax .....	13.6	1.79	24.34	762	163	828
Soybeans .....	17.1	1.28	21.89	1,026	337	884
Corn .....	46.6	0.53	24.70	2,610	191	2,153

barley yielded more pounds of grain per acre at University Farm and Waseca than were obtained for oats, the yield for oats and barley at Morris was 1,866 and 1,819 pounds, respectively. Barley, however, gave 98 pounds more digestible nutrients than oats but 6 pounds less digestible protein. Both barley and oats excelled the other small grains in yield per acre of total digestible nutrients.

### ***Northwest Experiment Station, Crookston***

Results of comparative trials at Crookston are given in table 5. Winter wheat and rye are not included in the summary. Rye was grown from 1921 to 1929 and at Crookston it gave a lower yield during this period than hard red spring wheat. Winter wheat is not adapted to the Red River Valley in Minnesota, because it is subject to severe winter injury.

The calculated values per acre are given in descending order. Flax led with a value of \$23.09, followed by durum wheat with \$21.63, hard red spring wheat \$19.87, corn \$17.97, oats \$17.55, soybeans \$17.28, and barley \$17.04. Considering the added cost of

growing corn and soybeans, it seems evident that they give a lower return per acre as a cash crop than the small grains. Oats gave a slightly higher cash value than barley. The cash value for the entire period from 1921 to 1941, inclusive, was greater for durum than for hard red spring wheat. However, from 1933 to 1941, the average acre yields of durum and hard red spring were 19.7 and 19.2 bushels, respectively, so that for this period hard red spring gave a higher return per acre than durum wheat.

Even with its low yield of 33.9 bushels per acre, corn led in total digestible nutrients with 1,566 pounds. Barley and oats excelled, also, with 1,341 and 1,338 pounds of digestible nutrients, respectively. The yield of soybeans of 13.5 bushels per acre gave a calculated yield of 266 pounds of digestible protein.

### ***North Central Station, Grand Rapids***

Results at the Grand Rapids station are given in table 6. Durum wheat is not included. During the first period Mindum durum yielded 16.1 bushels compared with 16.6 bushels for hard red spring.

**Table 5. Averages for yield in bushels per acre, price per bushel, value per acre, yield in pounds per acre, and digestible nutrients per acre at the Crookston Station, 1921-1942**

Crop	Bushels per Acre	Price per Bushel	Value per Acre	Pounds per Acre	Digestible	Total
					Protein	Digestible
					pounds	pounds
Oats .....	58.5	\$0.30	\$17.55	1,872	176	1,338
Barley .....	35.5	0.48	17.04	1,704	158	1,341
Hard red spring wheat .....	21.6	0.92	19.87	1,296	150	1,089
Durum wheat .....	24.3	0.89	21.63	1,458	169	1,225
Flax .....	12.9	1.79	23.09	722	155	785
Soybeans .....	13.5	1.28	17.28	810	266	698
Corn .....	33.9	0.53	17.97	1,898	139	1,566

**Table 6. Averages for yield in bushels per acre, price per bushel, value per acre, yield in pounds per acre, and digestible nutrients per acre at the Grand Rapids Station, 1921-1942**

Crop	Bushels per Acre	Price per Bushel	Value per Acre	Pounds per Acre	Digestible Protein	Total Digestible Nutrients
					pounds	pounds
Oats .....	56.6	\$0.30	\$16.98	1,811	170	1,295
Barley .....	28.9	0.48	13.87	1,387	129	1,092
Hard red spring wheat.....	17.0	0.92	15.64	1,020	118	857
Winter wheat .....	20.9	0.91	19.02	1,254	145	1,053
Rye .....	31.2	0.58	18.10	1,747	180	1,399
Flax .....	9.2	1.79	16.47	515	110	560
Soybeans .....	11.2	1.28	14.34	620	203	534
Corn .....	31.6	0.53	16.75	1,770	129	1,460

On the basis of value per acre, the crops may be listed as follows: winter wheat \$19.02, rye \$18.10, oats \$16.98, corn \$16.75, flax \$16.47, hard red spring wheat \$15.64, soybeans \$14.34, and barley \$13.87. When handled properly, winter wheat excels among the small grains for this region in Minnesota and apparently deserves to be more extensively grown where conditions are favorable for snow cover. Rye also is an excellent crop for this region. Rye led the small grains with 1,399 pounds of total digestible nutrients per acre, followed by oats with 1,295 pounds. Corn and soybeans did not give a very favorable showing at Grand Rapids, considering the added cost of growing, although corn gave the highest total yield of digestible nutri-

ents per acre with an average calculated yield of 1,460 pounds.

***Northeast Experiment Station, Duluth***

During the entire period at Duluth, only oats, barley, hard red spring wheat, rye, and flax were grown. Rye, durum, and winter wheat were tested during the first period from 1921 to 1932. Compared with hard red spring wheat they gave a lower cash value per acre and it did not seem worthwhile to include them in the trials for the period from 1933 to 1941. Results of the tests at the Duluth Station are given in table 7.

Cash values per acre were as follows: flax \$21.30, hard red spring

**Table 7. Averages for yield in bushels per acre, price per bushel, value per acre, yield in pounds per acre, and digestible nutrients per acre at the Duluth Station, 1921-1942**

Crop	Bushels per Acre	Price per Bushel	Value per Acre	Pounds per Acre	Digestible Protein	Total Digestible Nutrients
					pounds	pounds
Oats .....	54.0	\$0.30	\$16.20	1,728	162	1,236
Barley .....	33.1	0.48	15.89	1,589	148	1,251
Hard red spring wheat.....	18.7	0.92	17.20	1,122	130	942
Rye .....	18.5	0.58	10.73	1,036	107	830
Flax .....	11.9	1.79	21.30	666	143	724

wheat \$17.20, oats \$16.20, barley \$15.89, and rye \$10.73.

Barley and oats gave about the same yield per acre of total digestible nutrients and greatly excelled the other crops in this respect. Oats produced 14 pounds more of digestible protein per acre than barley.

### Comparison of Oats and Barley

Oats and barley are widely grown and it is interesting to compare their value. Barley excelled oats in pounds of grain per acre and total digestible nutrients at Waseca and University Farm. Oats yielded more pounds per acre at Morris than barley with less digestible nutrients per acre. Oats yielded higher at Crookston and Duluth in pounds of grain and gave about the same yield of digestible nutrients, while at the Grand Rapids Station barley yielded less than oats in pounds per acre and in pounds digestible nutrients.

Figures from government crop reports give oats a poorer rating in comparison with barley than do data obtained in experiment station trials. Table 8 gives the estimated average yields of oats and barley from 1921 to 1941 in the counties where the experiment stations are located, taken from

Minnesota Annual Crop Reports, in comparison with the results at the experiment stations. Taking barley yields as 100, calculated yields of oats were made from data at the experiment stations and from estimated county yields. The experiment station yield of oats in terms of barley as 100 were 93.1 at Waseca, 93.2 at University Farm, 102.6 at Morris, 108.7 at Duluth, 109.9 at Crookston, and 130.6 at Grand Rapids. The government crop report figures for Waseca County showed about the same relative yields of oats and barley as data from the experiment station, but in various counties where the experiment stations were located, differences ranging from 12 to nearly 50 per cent were found.

The differences between the results of experiment station comparisons and from estimated crop reports should be considered when comparing the relative values of oats and barley. In experiment station trials the fields are in regular rotation and neither crop is favored. It seems reasonable to conclude that farmers usually favor barley by giving it better land and more thorough seedbed preparation than for oats. The results at the experiment stations may be considered as a reliable comparison of the true value of the two crops.

**Table 8. Comparison of oat and barley yields at the experiment stations and the estimated yields of oats and barley in the counties in which the stations are located**

Location	Yield of Oats		Yield of Barley		Yield of Oats with Barley as 100		Difference
	Station	County	Station	County	Station	County	
	pounds	pounds	pounds	pounds	per cent	per cent	per cent
University Farm .....	1,856	984	1,992	1,239	93.2	79.4	13.8
Waseca .....	2,275	1,196	2,443	1,335	93.1	89.6	3.5
Morris .....	1,866	963	1,819	1,067	102.6	90.3	12.3
Crookston .....	1,872	902	1,704	1,134	109.9	79.5	30.4
Grand Rapids .....	1,811	1,042	1,387	1,275	130.6	81.7	48.9
Duluth .....	1,728	1,085	1,589	1,305	108.7	83.1	25.6