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Better Oats for South Dakota

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Better Quarts *for* South Dakota



AGRONOMY DEPARTMENT
AGRICULTURAL EXPERIMENT STATION
OF THE
SOUTH DAKOTA STATE COLLEGE OF
AGRICULTURE AND MECHANIC ARTS
BROOKINGS, S. D.

Guide to Growing Good Oats

1. Sow the variety best adapted to your locality. Richland has given the highest yields at Brookings, and Cole the highest yields at Highmore.
2. The midseason and late maturing varieties are not adapted to most of South Dakota.
3. Sow oats on a well prepared seedbed. Corn or any other cultivated crop leaves the soil free from weeds and in a good condition for oats.
4. A rotation containing corn, oats, and a legume gives excellent yields.
5. Sow the seed at the rate of eight pecks per acre in the eastern and central part of the state.
6. Seeding the oats the middle of April gives the best yields.
7. Stacking the oats before threshing gives a better quality grain than when left to weather and mold in the shocks.
8. Treat the seed with formaldehyde to prevent smut. Smuts in oats cause large losses each year.



Where Varieties Are Tested

A part of the State College Experiment Station devoted to the testing of varieties of small grains.

Better Oats for South Dakota

E. W. Hardies*

South Dakota ranks fifth in oats production in the United States. During the five years, 1920 to 1924 inclusive, about 76,000,000 bushels of oats were produced annually in this state. This is more than twice the average production of wheat in the state during the same period.

In the corn belt of the United States more oats are grown than any other small grain crop. This same situation exists in South Dakota; wherever corn is the most important crop large quantities of oats are also grown. It is a very satisfactory crop to grow between corn and sweet clover. The seedbed for oats is easily prepared when it follows corn and it also is a good nurse crop for sweet clover or alfalfa. The eastern counties produce the majority of the oats of this state.

Climate for Oats

The heaviest oats and the largest yields are produced in the northern states where the summers are cool. Oat kernels fill best during a cool growing season. It is in these northern latitudes that the late and medium late maturing varieties are best adapted. Farther south in the corn belt, the small early maturing varieties are better able to withstand the heat and drought, and are able to mature before the hot dry summer weather comes on. Each climate has varieties that yield best under its conditions.

Early Varieties Adapted to South Dakota

The summers of South Dakota are usually warm and dry. Such climatic conditions are very unfavorable for the late and midseason varieties. There is a great difference in the yielding ability of varieties in this state. The South Dakota Experiment Station has tested a large number of varieties and selections on the experiment farm at Brookings and Highmore.**

Table I gives the yields secured in the oat variety test at Brookings. The highest average yield during these eleven years was secured from Richland (Iowa 105). Richland is an early maturing yellowkerneled variety. Its yielding ability together with its earliness and short, rather stiff straw, makes this variety particularly adapted for growing on rich soils where other varieties are inclined to lodge. It is also resistant to black stem rust. Only in two out of eleven years at Brookings was Richland surpassed in yield.

*The author is indebted to A. N. Hume, head of the Agronomy Department, under whose directions the work at the various experiment stations is conducted, and to other department members who assisted in carrying out details.

**Numerous other varieties tested by the South Dakota Experiment Station and not mentioned in this bulletin have been reported in Bulletins 110 and 149.

Table I.—YIELD IN BUSHELS PER ACRE OF VARIETIES OF OATS IN THE TEST AT BROOKINGS.

Year	EARLY				MIDSEASON		HULLESS			
	Sixty Day S. D. 165	Sixty Day S. D. 168	Cole S. D. 316	Richland S. D. 1042	Lowar S. D. 1254	Gopjher S. D. 1279	Swed. Select S. D. 1112	Silvermine S. D. 443	White Russ. S. D. 640	Fowlds Hull- less S. D. 1261
1916	75.4	76.1	71.9	63.5	-----	-----	37.0	35.2	-----	-----
1917	60.2	85.9	82.5	85.9	-----	-----	51.6	55.0	-----	-----
1918	65.6	85.9	76.6	87.5	-----	-----	71.9	76.6	-----	-----
1919	48.4	43.7	43.7	50.0	-----	-----	31.2	18.7	-----	-----
1920	46.9	37.5	45.3	56.3	-----	-----	28.1	23.4	-----	-----
1922	42.2	45.3	45.3	50.0	57.8	-----	48.3	48.3	60.9	-----
1923	43.8	50.0	49.8	54.7	48.4	-----	39.1	39.0	23.4	28.4
1924	78.9	67.2	68.0	78.9	68.0	-----	57.8	59.4	40.1	56.2
1925	81.2	73.4	73.4	106.2	90.6	104.6	60.9	65.6	73.4	71.9
1926	51.6	51.6	59.4	71.9	42.2	56.2	37.5	43.0	63.4	14.1
1927	53.1	68.8	67.2	78.1	54.7	67.2	45.4	41.7	47.0	35.0
Av.	58.8	62.3	61.5	71.2	-----	-----	46.2	45.9	-----	-----
	Av. yield for 11 yrs. of four early varieties, 63.5 bushels						Av. yield for 11 yrs. of 2 midseason var. 46.1 bu.			

A further study of Table I shows that the early varieties are the best yielders at Brookings. The midseason varieties, Swedish Select, and Silvermine, yield considerably less than the lowest of the early maturing varieties. The average yield of the four early varieties is 63.5 bushels per acre, while that of the two midseason varieties is only 46.1

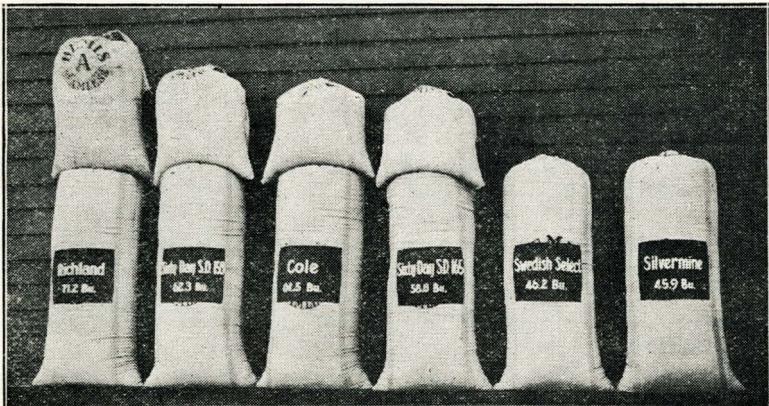


Fig. 1.—Comparative Yields Per Acre of Varieties at Brookings.

Richland, an early rust resistant variety, has given the highest yields at Brookings. The midseason varieties yield much less than the early varieties.

bushels, during the same eleven years. The late variety, White Russian, has only been included during the last six years. In 1922 it outyielded Richland by three bushels, but in the succeeding years the yield is much lower than that from the early varieties. White Russian is a very late rust resistant side-panicle oats and is best adapted to northern latitudes.

One variety of hullless oats is also listed in Table I. New and better varieties have been developed by the Agronomy Department since this variety was included in the tests. Fowlds Hullless was the first hullless oats to be developed here and is therefore included in the tests. The yields are given as a comparison between hullless and hulled oats. The hullless oats were figured at thirty-two pounds to the bushel, the same as for other oats. Hullless oats are low yielders when compared with the best hulled varieties.

Table II shows the yields of the most important oat varieties in the test at Highmore. At both Brookings and Highmore, many more varieties are tested but only the most important and highest yielding ones are given in Tables I and II.

Table II.—YIELDS IN BUSHELS PER ACRE OF VARIETIES OF OATS IN THE TEST AT HIGHMORE.

Year	EARLY					MIDSEASON		
	Sixty Day S.D. 165	Sixty Day S.D. 158	Cole S.D. 316	Richland S.D. 1042	Albion S.D. 1041	Iowar S.D. 1254	Swedish Select S.D. 112	Silver- mine S.D. 443
1917	31.2	46.5	52.3	32.8	27.8	-----	12.1	17.9
1918	48.5	35.1	47.7	43.7	41.5	-----	29.7	43.0
1919	42.2	35.5	57.0	38.7	43.3	-----	14.8	22.6
1920	43.8	43.8	48.4	31.2	25.9	-----	24.2	26.6
1921	16.4	18.8	17.2	14.1	18.8	-----	3.1	4.7
1922	-----	89.1	75.0	93.6	96.9	96.9	81.3	85.9
1923	62.5	56.3	62.5	57.8	59.4	64.1	65.6	64.1
1924	70.3	68.0	64.1	75.0	76.5	74.3	64.1	64.5
1925	54.3	61.7	57.1	63.3	59.4	50.0	39.8	42.2
1926	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1927	51.8	52.8	52.5	57.1	50.0	50.0	33.9	36.4
Av.	42.1	46.1	48.5	46.1	45.4	-----	33.5	37.1
Average yield for 11 yrs. of four early maturing varieties 46.5 bu.						Av. yield for 11 yrs. of two midseason varieties 35.3 bu.		

At Highmore and at Brookings, the highest yielding varieties belong to the early maturing group. Cole has given the largest yield during the eleven years reported in Table II. This is a selection from Sixty Day made by State College in 1907. It is a white oat and matures from two to five days earlier than Sixty Day.

At Highmore no significant difference exists between the yields of Sixty Day, S. D. 158, Richland, and Albion. The midseason varieties, Swedish Select and Silvermine, produce much lower yields than the early maturing ones.

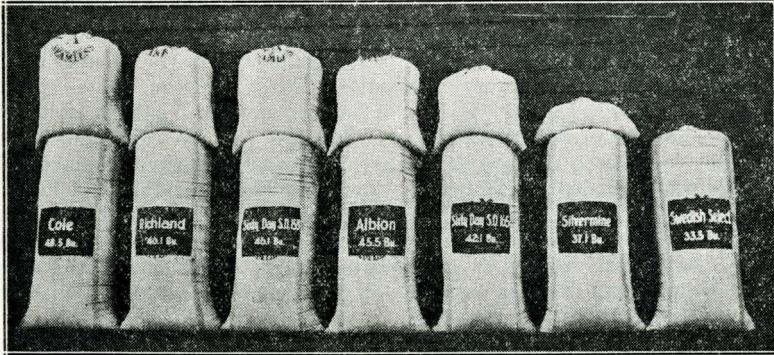


Fig. 2.—Comparative Yields Per Acre of Varieties at Highmore.

Cole, a variety developed by State College, is the highest yielding variety at Highmore. The midseason varieties yield much less than the early varieties.

Some Objections to Early Oats

Objections to the early oats are that the straw is short and on poor soil or dry years they are often difficult to harvest. When the farmers grow corn extensively there is often a conflict of farm work. The early oats is often mature and ready to cut at the time the corn is "laid by". Under such conditions, farmers are willing to plant a lower yielding mid-season variety which will enable them to finish the work in the corn fields before the oat crop is ready to harvest.

Early or Late Varieties

In Table III the yields of the varieties listed in Tables I and II are compared with their relative ranking. In computing the ranking, the yield of Swedish Select, a medium late variety, is used as 100 per cent, because of its wide distribution in South Dakota. It has already been observed that Richland has given the highest yields of all the varieties tried at Brookings. This early maturing, rust resistant variety yielded 54.1 per cent more than Swedish Select during the eleven years. At

Table III.—ELEVEN YEARS RESULTS OF THE YIELDS AND RELATIVE RANKING OF OAT VARIETIES TESTED AT BROOKINGS AND HIGHMORE.

Variety	BROOKINGS		HIGHMORE	
	Yield in Bushels per acre	Per cent yield of Swed. Select	Yield in Bushels per acre	Per cent yield of Swed. Select
Richland S. D. 1042.....	71.2	154.1	46.1	137.3
Sixty Day S. D. 158.....	62.3	134.8	46.1	137.3
Cole S. D. 316.....	61.5	133.1	48.5	144.8
Sixty Day S. D. 165.....	58.8	125.1	42.1	125.7
Swedish Select S. D. 112.....	46.2	100.0	33.5	100.0
Silvermine S. D. 443.....	45.9	99.4	37.1	110.8
Albion S. D. 1041.....			45.5	135.8

Highmore the best yielding variety is Cole. Here this variety yielded 44.8 per cent more than Swedish Select and 7.5 per cent more than Richland. This shows how important it is to seed the variety adapted to each locality. About half of the oat area in this state is seeded to varieties belonging to the midseason or late maturing groups. Seeding early varieties over the greater part of South Dakota would make a big increase in the oat production. Richland is the best variety that has been tried for the eastern part of South Dakota, and Cole for the area represented by Highmore. The comparison between the yields of the varieties is further shown in Figures 1 and 2.

Preparing the Seedbed

It is common practice in growing oats to seed it on a clean field after corn or some other cultivated crop. Where oats follows a cultivated crop, the seedbed is prepared by discing and harrowing the field before seeding. In sections of the state where small grains are grown extensively, oats are rotated with other small grains.

At the Highmore Experiment Station, oats are being seeded on corn ground by preparing the seedbed in different ways. This is in a three year rotation, consisting of (1) corn, (2) oats, and (3) winter wheat. Table IV gives the yields of oats secured by the different methods of seedbed preparation.

Table IV shows that the lowest yield, 39.2 bushels, was secured from the plats on which oats were drilled directly in the corn stubble without any previous preparation. The yield then increases consistently as more labor is expended in preparing the seedbed. Where the corn land was discd twice and harrowed twice the average yield for the same nine years is 48.5 bushels. This is an increase of 9.3 bushels per acre over the yield secured on corn land seeded to oats without any soil preparation.

Table IV.—YIELD OF OATS FROM DIFFERENT METHODS OF SEEDBED PREPARATION IN A (1) CORN, (2) OATS, (3) WINTER WHEAT ROTATION HIGHMORE.

Method of Preparing Seedbed	No. of years results	Yield in bushels per acre	Bushels increase
Oats drilled in corn stubble.....	9	39.2	
Corn stubble harrowed before seeding oats	9	42.7	3.5
Corn stubble discd once before seeding oats	9	45.2	6.0
Corn stubble discd once, harrowed once before seeding oats.....	9	46.0	6.8
Corn stubble discd twice, harrowed twice before seeding oats	9	48.5	9.3

Oats in a Rotation

In the preceding paragraphs it was pointed out that most of the oats grown in this state are grown in a rotation with corn. At the Brookings and Highmore Experiment Stations, experiments are being conducted with growing oats in different rotations. Table V shows the yields secured in the tests.

A study of Table V shows that at Brookings and Highmore the largest yields were produced when oats follows corn in a (1) corn, (2) oats, (3) sweet clover rotation. The only exception to this is at Highmore where oats are seeded on summer fallow. The increase due to summer fallowing is far from sufficient to warrant this practice. The lowest yields are from those plats where oats follows oats continuously. This practice not only brings low yields but it also brings a low quality product and therefore low prices. The grain from these plats is badly infested with wild oats and other weeds. Growing small grains continuously is a very good way of getting the land overrun with weeds.

Table V.—YIELD OF OATS IN DIFFERENT ROTATIONS.

Rotation	BROOKINGS		HIGHMORE	
	No. years results	Yield in bushels per acre	No. years results	Yield in bushels per acre
1. Continuous oats -----	13	42.7	11	40.4
2. Oats, sweet clover, corn	13	59.0	11	57.1
3. Oats, wheat, corn ----	--	---	11	42.2
4. Oats, corn -----	--	---	11	52.3
5. Oats, summer fallow ..	--	---	11	64.0
6. Oats, wheat, sweetclover	13	56.8	--	---
7. Oats, sweetclover, wheat	13	46.9	--	---

A comparison of rotations 1 and 4 at Highmore shows the value of a cultivated crop. The increase of oats is almost twelve bushels per acre. A corn crop leaves the land freer from weeds and in a good physical condition for the following crop. The introduction of sweet clover in the rotation, in No. 2, again increased the yield by nearly five bushels, over a (1) corn, (2) oats rotation. The immediate effect that sweet clover has on the following crop may be seen by studying rotations 6 and 7. Both of these rotations contain oats, wheat, and sweet clover. Where oats follows sweet clover the yield is 56.8 bushels, while where the oats follows wheat the yield is 46.9 bushels. The ideal rotation under the conditions would therefore consist of (1) corn, (2) small grain, and (3) a legume.

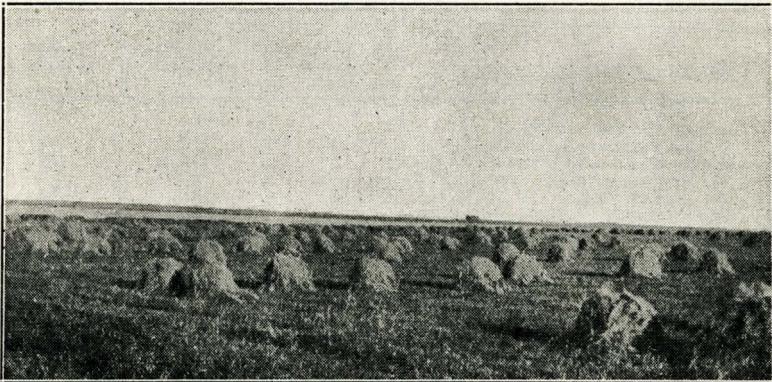


Fig.3.—A Field of Good Oats.

A good rotation containing a cultivated crop, small grains, and a legume produces good yields and controls the weeds.

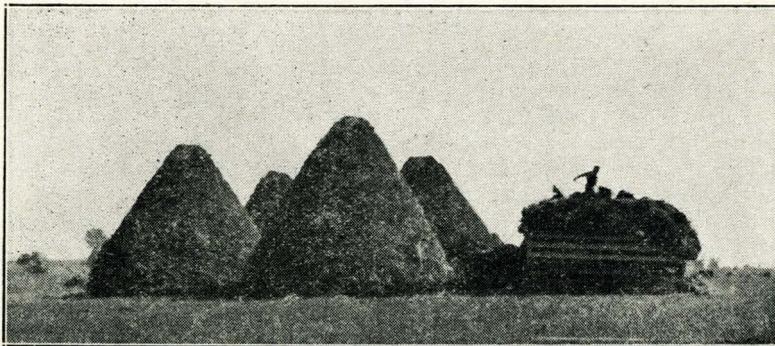


Fig. 4.—Preserving the Quality.

Stacking the grain before threshing keeps the kernels from getting moldy or weathered. Bright, clean oats brings the best price.

Time to Seed Oats

If we were to compare the time of seeding oats with wheat we would find that the oat crop is planted during a longer interval than wheat. Oat seeding is general in this state during the latter half of April and the first week in May. Experiments carried on with seeding oats at different dates show that the optimum date fluctuates from year to year. This data is given in Table VI. Owing to the fact that it was not always possible to make the plantings at the designated dates, the average yields would be misleading. A better method of comparison is to study the yields for each year separately and observe which date of seeding gave the highest yield for that year. By doing this we find that during three years the highest yields were secured from April 15 seeding. April 15 seeding therefore gave the highest yields more often than any other dates. One year the seeding made March 15 gave the best yields while during two years the May 1 seeding yielded best. The data is not very conclusive but it does show that when planting is delayed until after May 1 the yields are reduced.

Table VI.—YIELDS OF OATS IN BUSHELS PER ACRE WHEN SEEDED AT DIFFERENT DATES—HIGHMORE.

Year	DATE OF SEEDING						
	March 1	March 15	April 1	April 15	May 1	May 15	June 1
1917	---	---	---	46.4*	39.8	28.9	---
1918	23.4	43.4*	26.6	20.6	29.7	29.7	---
1919	---	---	45.3	49.4*	41.4	30.5	---
1920	---	---	45.3	---	50.0*	32.8	---
1921	16.4	18.8*	18.8*	14.1	12.5	---	---
1922	---	---	47.3	48.4	54.7*	50.0	31.3
1923	---	---	51.6	64.0*	59.3	53.1	31.2
1924	---	59.3	60.9*	50.0	54.6	44.0	---
No. of years giving highest yields	---	2	2	3	2	---	---

*—Largest yield for that year.

Rate of Seeding

In no other grain do we find such a large range in the amount of seed used per acre in common practice as we do in oats. The amount of seed used varies from six pecks to three and sometimes three and one-half bushels per acre. In the drier regions, lighter rates of seeding are made than where there is plenty of moisture. Rate of seeding tests have been conducted for a number of years.

Table VII gives the results of these tests at Brookings, Highmore, and Eureka. At Brookings and Highmore, the largest net returns per acre were secured by seeding eight pecks, at Eureka, the six and seven peck seeding gave the highest yield. The difference in yield secured from these two rates of seeding is insignificant and does not amount to more than the difference in the amount of seed sown. From Table VII one may conclude that the highest yields of oats in the Brookings and Highmore areas are secured by seeding eight pecks per acre. In the part of the state represented by Eureka seven pecks give better results than the heavier plantings.

Table VII.—YIELDS IN BUSHELS SECURED FROM DIFFERENT RATES OF SEEDING IN TESTS AT HIGHMORE, BROOKINGS, AND EUREKA.

Station	Variety	Number years results	Rate of Seeding in Pecks						
			4	5	6	7	8	9	10
Highmore	Cole S. D. 316	8	---	47.8	50.6	55.2	55.6	58.3	---
Brookings	Swedish Select S. D. 112	13	41.2	46.1	46.6	46.2	48.3	46.7	45.6
Eureka	Sixty Day S. D. 165	14	---	---	45.9	46.1	43.3	---	44.4

Treat the Seed for Smut

One of the serious and universally distributed diseases of oats is smut. This disease can be found in nearly every field in which the seed has not been treated. Two different kinds of smuts occur but fortunately both of them are controlled by the same method of seed treatment. Smuts of grain may be called a cumulative disease. When once smut appears in the grain field it gets worse from year to year. The spores causing this disease are carried on the seed. A few varieties of oats are very resistant or almost immune to this disease. All of the smut resistant varieties tested are low yielders and unadapted to South Dakota conditions. Hullless oats in general are very susceptible to smut.

Smut of oats can be successfully controlled by treating the seed with formaldehyde.

The formaldehyde treatment can be accomplished by several methods. The "dip method" consists in dipping the seed in a solution of one pint of commercial formaldehyde to forty gallons of water. It is then spread out and covered with canvas or blanket for two hours. In the "sprinkle method", one pint of formaldehyde is used to fifteen gallons of

water; the oats is shoveled in layers in a bin or wagon box over which the solution is sprinkled. The entire pile of oats is then shoveled over several times so that each kernel is moistened with the solution. The grain is covered for two hours. The third method is the concentrated formaldehyde method. Equal parts of formaldehyde and water are sprayed over the oats with an atomizer while the grain is constantly being shoveled over and over. Then it is covered for two hours. The objection to the formaldehyde treatments is that the dip and sprinkle methods leave the seed wet so that it is hard to keep it from heating, freezing, or sprouting. The concentrated method is disagreeable to use.

Hulless oats are easily injured by treating with formaldehyde. The safest way is to use copper carbonate dust at the rate of two or three ounces per bushel. Copper carbonate does not control smut on the common or hulled varieties.



Fig. 5.—Smutty Oat Heads.

Farmers lose money each year by growing oats that grade "smutty". Treat the seed with formaldehyde to prevent this loss.

Faults of Most Oats

Lodges on rich ground

Yields reduced by hot weather while filling

Is subject to rust and smut

Gives light weight kernels when climate and soil are unfavorable

Richland Oats

Has stiff straw, does not lodge

Matures early, kernels fill before summer heat

Is resistant to black stem rust

Proper developed kernels give the oats a good weight per bushel