Planting Corn in South Dakota

Lyle A. Derscheid

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PLANTING CORN
IN SOUTH DAKOTA

By LYLE A. DERSCHEID, Extension Agronomist. The data were collected by A. N. Hume, W. W. Worzella, L. O. Fine, D. B. Shank and F. E. Shubeck.

Corn is grown on approximately 4 million acres in South Dakota annually with a cash value of more than twice that of the next crop. Although it is a profitable crop, present farming conditions make it necessary for the producer to grow corn as efficiently as possible. He must ask himself these questions: What maturity corn should I plant? When should I plant? How much should I plant? What method of planting should I follow? What fertilizer treatment should I use? How should I control weeds and insects?

CORN IN THE ROTATION

Since corn is a relatively high value crop, you will want to raise it wherever it is adapted. Like other row crops it leaves much of the land bare and encourages soil erosion, but it allows for cultivation which aids in a weed control program.

In the eastern (especially southeastern) areas of the state you can raise corn continuously under certain conditions. When planted continuously, plant it on land that has a slope of 3% or less, so that erosion will be held to a minimum. Use an adequate amount of fertilizer to produce maximum yield and plant growth. Incorporate the residue from such a crop into the soil to minimize loss of soil organic matter. Apply manure, whenever possible, in order to maintain organic matter level. Do not remove the stalks from the field unless manure is used to supplement organic matter. It takes 3 to 4 tons of manure to replace the organic matter in the stalks and leaves of a 50-bushel corn crop. Use insecticides each year to control corn rootworms.

Corn is a good crop to raise in rotation with small grains in the eastern one-half of the state. Clean and timely cultivation prevents annual weeds from producing seed and is very helpful in reducing the weed problem during the entire rotation.

Corn is generally a high risk crop to plant after alfalfa or perennial grass. Although a rotation containing 2 years of an alfalfa-grass mixture followed by a row crop is a good rotation for controlling wild oats, the corn may not produce well. The alfalfa reduces soil moisture reserves and a long-season crop, such as corn, may not yield well unless an above normal amount of rain is received during the growing season or the previous fall. Rootworms may be a serious problem in corn following alfalfa.

DATE AND RATE OF PLANTING

Time and rate of planting depend on the maturity date of the hybrid, the level of soil fertility, length of growing season, amount of reserve soil moisture at planting time, and the average annual rainfall. If soil fertility is maintained at a level that will support a high population, moisture and length of growing season are generally the limiting factors. Consequently, rainfall and length of growing season are the bases for selecting corn of the right maturity and the correct date and rate of planting.

If you plant corn that requires the entire growing season in favorable years, you will get maximum yield in those years, but may get wet or soft corn during the less favorable years. The same is true if you use a high rate of seeding. Selecting an extra early variety in order to assure dry mature corn every year may result in lower total production over a period of years. Under South Dakota conditions, you should select a variety of a maturity that will produce dry mature corn in most years, if you can dry it or use silage or wet corn during poor corn years.

Do not plant too thickly. A thick stand of corn may produce more corn during wet years, but may not produce a satisfactory crop during dry years. A lower population will produce corn in dry years and will produce larger plants and a better crop during wet years.

If you have need for silage or are equipped to handle soft corn, you may want to plant a later hybrid or plant at a higher planting rate than is suggested for your area.

Figure 1. Crop adaptation areas of South Dakota.
South Dakota can be divided into four basic areas with regard to corn production.

**Southeastern Area**

This area includes nonirrigated cropland in crop adaptation area E (figure 1). Corn is grown on about 35% of the total acreage in this area as a feed or cash crop. Higher average yields are obtained in this area than in any other area of the state. Relatively high plant populations can be planted because average annual rainfall is 22 to 24 inches in most of the area and over 24 inches in part of it.

In a 1962 test with above normal rainfall on the Southeast Research Farm near Centerville, 6,000 plants per acre produced 65 bushels; 9,100 plants produced 88 bushels; 14,000 produced 108 bushels; 18,900 yielded 112 bushels; and 22,000 yielded 116 bushels. There was little increase in yield when populations were above 14,000 to 18,000 plants per acre. In 1963, less total rainfall associated with mid-season drought resulted in lower yields with 6,000 and 14,000 plants per acre and drastically reduced yields with 18,000 plants per acre.

Plant for a population of 12,000 to 16,000 plants per acre during mid-May using a hybrid that matures in 100 to 110 days, if you want dry corn every year. Follow the guide in table 1 to get the proper rate of planting.

**Eastern Area**

This area includes nonirrigated cropland of crop adaptation areas D1, D3, and D4 (figure 1). Corn is grown on about 25% of the total acreage in this area, as a feed or cash crop. One expects to get a good yield almost every year because average annual rainfall is 20 to 22 inches.

Research results obtained over a 10-year period at the main Experiment Station near Brookings, give a good indication of what can be expected from hybrids of different maturity, planted on different dates at several rates of planting.

Use of a hybrid of medium maturity with 10,000 to 12,000 plants per acre planted May 20 gave maximum yields of good quality corn. It is probable that corn planted on May 10 would have been equal. Planting on May 1 resulted in poor stands and lower yields; however, a later maturing corn produced as well when planted May 1 as when planted later. Planting on May 30 resulted in lower yields. A medium-late hybrid planted May 20 or May 30 produced wet or soft corn some of the years.

In a 1956 test on the Main Experiment Station, 10 hybrids with an average population of 15,000 plants per acre produced 86 bushels, and 17,800 plants produced 90 bushels.

Other experiments have been conducted in the northern part of the area. With above average rainfall, 12,000 plants per acre produced 99 bushels; 16,000 plants produced 127 bushels; and 20,000 produced 133 bushels. Under average or below average rainfall, 8,000 plants per acre produced 47 bushels; 12,000 plants produced 40 bushels; and 16,000 produced 29 bushels. Under high rainfall conditions there was no advantage in raising over 16,000 plants per acre and under drier conditions 8,000 plants produced maximum yields.

Plant for a population of 10,000 to 12,000 plants per acre during the middle of May, using a hybrid that matures in 95 to 105 days if you want to raise dry corn. Use later maturing hybrids in the southern part of the area and earlier hybrids in the northern part. Follow the planting guide in table 1 to secure the proper rate of planting.

**Central Area**

This area includes nonirrigated cropland in crop adaptation areas B2, C1, D2, C2, and C3 (figure 1). Research results obtained over a 10-year period at the Central Substation near Highmore indicate what can be expected from hybrids of different maturity planted on different dates at several rates of planting.

A rate of 7,000 to 8,000 plants per acre was superior in yield on all planting dates and resulted in good quality corn during 5 favorable years. Early

**Table 1. Planting Rate Needed to Give Various Populations of Corn Planted Several Different Ways with Several Row Widths**

<table>
<thead>
<tr>
<th>Planting method</th>
<th>Hill spacing</th>
<th>Final corn population plants per acre*</th>
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</thead>
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<tr>
<td></td>
<td></td>
<td>42&quot;</td>
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<tr>
<td>Hill</td>
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<tr>
<td></td>
<td>20&quot;</td>
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<tr>
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<td></td>
<td></td>
<td>3 per hill</td>
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<td></td>
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<td>Drilled or</td>
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<td>22,200</td>
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<tr>
<td></td>
<td>8&quot;</td>
<td>15,900</td>
<td>16,700</td>
<td>17,500</td>
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<tr>
<td></td>
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<tr>
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<td>11,100</td>
<td>11,700</td>
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<td>9,500</td>
<td>10,000</td>
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<table>
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<th>Kernels per hill</th>
<th>Hill spacing</th>
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<th>38x38</th>
<th>36x36</th>
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<td>3,300</td>
<td>3,700</td>
<td>4,100</td>
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<td>2</td>
<td>6,000</td>
<td>6,700</td>
<td>7,400</td>
<td>8,200</td>
</tr>
<tr>
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<td>3</td>
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<td>10,000</td>
<td>11,100</td>
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</tr>
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<td>15,100</td>
<td>16,700</td>
<td>18,400</td>
<td>20,600</td>
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</tbody>
</table>

*Corn populations have been adjusted to account for an average of 15% loss due to germination, cultivation, etc.
hybrids were definitely superior during dry years and with higher rates of planting. A medium-late hybrid with 6,000 plants per acre performed better when planted May 1 than when planted May 20 or 30. However, the May 1 planting still produced soft corn 5 out of the 10 years.

**North Central.** In crop adaptation areas B2, C1, and D2 (figure 1), 10 to 15% of the acreage is planted to corn. Average annual rainfall is 16 to 18 inches in area B2, 18 to 20 inches in C1, and 20 to 22 in D2. However, D2 has an elevation that is several hundred feet above that of adjacent areas. This higher elevation and cooler nights during the growing season do not favor maximum corn production.

Plant for a population of 6,000 to 10,000 plants per acre about May 20 using a hybrid that matures in 85 to 95 days if you want to raise good quality corn. Use the higher rates of planting and later maturing hybrids in the southeastern part of the area and lower rates with earlier hybrids in the northwestern parts.

**South Central.** In crop adaptation areas C2 and C3, the average annual precipitation is 18 to 20 inches. Approximately 20% of the acreage in C3 and 10% of the acreage in C2 is planted to corn.

Plant for a population of 8,000 to 10,000 plants per acre around May 10 using a hybrid that matures in 95 to 100 days if you want to raise good quality corn. Use the higher planting rates in the eastern part of the area and lower rates in the western part.

**Western Area**

This area includes nonirrigated cropland in crop adaptation areas B1, B3, and B4 (figure 1) west of the Missouri River. The annual rainfall is normally below 18 inches. Corn does not yield well and is used primarily as a summer fallow substitute. About 2% of the total acreage is devoted to corn.

Plant for a population of 4,000 to 6,000 plants per acre in crop adaptation area B1 and B3 and 6,000 to 8,000 plants in crop adaptation area B4. Use hybrids that mature in 85 to 90 days in crop adaptation area B1; 90 to 95 days in B3 and B4.

**Irrigated Areas**

Under irrigation, you can plant thicker than on dryland, but you will have to keep your soil fertility high in order to get maximum yields. You can generally grow a later maturing hybrid on irrigated cropland than on dryland. At Redfield the difference in maturity is about 5 days.

Several tests have been conducted at Redfield and Yankton to determine the proper rate of seeding. In one Redfield test, six hybrids with 14,570 plants per acre yielded 96 bushels, 19,360 plants produced 118 bushels, and 24,890 produced 111 bushels. At Yankton four hybrids with average population of 12,000 yielded 103 bushels, 16,000 plants produced 114 bushels, 20,000 yielded 111 bushels, and 32,000 produced 113 bushels.

In irrigated fields of the eastern and central areas, plant a hybrid that matures 5 days later than those planted on dryland. For the western area use a hybrid that matures about 10 to 15 days later than those planted on dryland. Plant for a population of 16,000 to 18,000 plants per acre. Use adequate amounts of fertilizer and irrigate properly.

**METHODS OF PLANTING**

For years the conventional method of planting corn has been to plow with a moldboard plow, disk, harrow, and plant. The weeds were controlled by cultivating three times. In years past the weeder was used to supplement the row-crop cultivator. During recent years, the rotary hoe and flextine harrow have been used to replace the first row-crop cultivation.

Listing corn has been a common practice in several areas of South Dakota for years. The weeds were controlled with a row-crop cultivator.

Several systems of minimum tillage have been developed for use by the corn producer. They involve fewer operations than the conventional method. Four of the systems are called (1) wheel track planting, (2) plow planting, (3) hard ground listing, and (4) strip processing.

**Wheel Track Planting**

Plowing with a moldboard plow is the only operation used for preparing the seed bed. All weeds and crop residue are turned under to keep trash from catching on the planter shoes. A regular corn planter is used to seed corn in tracks made by pack-
er wheels or the wheels on the tractor used to draw the planter.

There are several ways of making tracks in front of the planter shoes. One way is to extend the front wheels of the tractor to form tracks for the outside rows and set the rear wheels in to form tracks for the middle rows. A second system is to bolt another pair of wheels on the back wheels, using drums or pipes as spacers. All four rows are planted in tracks made by wheels on the rear axle. More extensive adjustments may be needed on some tractors.

Plant as soon after plowing as possible. Tractor wheels break clods, before they have a chance to harden, and produce a firm seed bed for the corn. The rows are packed and weeds are quick to grow in the rows. The area between the rows is rather loose and weeds do not germinate readily. Make provisions for controlling the early weed growth in the row with a herbicide or early tillage.

Few implements, however, are satisfactory for early tillage. Rotary hoes and either spiketooth and flextine harrows sink deeply into the loose soil, cover the corn, and stimulate weed germination between rows. Wheel track planted corn generally requires one less cultivation than conventionally planted corn. Otherwise, you can cultivate or use fertilizer, insecticides and herbicides the same as for conventional planting.

**Plow Planting**

Plowing and planting can be done in one operation by hitching a planter directly behind the plow. Attach a 1-row planter behind three 14-inch bottoms to get 42-inch spacing between rows or a 2-row planter behind five 16-inch bottoms to get 40-inch rows. You can mount packer wheels ahead of the planter and have a combination of wheel track and plow planting.

Weed problems and early tillage problems may be similar to those mentioned for wheel track planting. You may not be able to use a 4-row cultivator, otherwise, you can cultivate and use fertilizer, insecticides, and herbicides as for conventional planting.

**Hard Ground Listing**

Planting with a lister in unplowed ground prepares the seedbed and plants in one operation. It is a quick, easy way to plant corn. However, all weeds and weed seedlings must be controlled with tillage or spraying beforehand. You may have difficulty cultivating on rocky or soddy soil and you may have trouble controlling weeds or applying fertilizer.

**Cultivation problems.** If weeds are not controlled before planting, they will grow out the side of the furrow or on the ridges between furrows. A lister cultivator set to throw soil away from the row the first cultivation generally does not control weeds adequately. By the second cultivation, weeds may be too large to be controlled when the soil is thrown into the row. Lister cultivators do not give good control of perennial weeds or volunteer alfalfa or grass. Implements equipped with 12- to 14-inch sweeps that run down the center of each ridge aid in controlling perennials and large annuals.

In rocky soils, lister shovels may slide around the rocks, leaving crooked rows that are difficult to cultivate. Hard ground listing in land that has been in alfalfa or a perennial grass leaves clumps of sod that create a cultivation problem. Likewise, listing corn between last year's corn rows leaves stalks on the ridges that hamper cultivation operations. Plow alfalfa ground before listing and plow corn ground or chop stalks before listing corn to prevent these problems. Fewer problems are encountered when corn is listed in small grain stubble. For the beginner, soybean land is a good place to start.

**Fertilizer problems.** Broadcast applications of fertilizer are pushed to the tops of the ridges by the moldboard of the lister. Phosphorus moves as little as 2 inches during an entire growing season and may not reach the roots of corn planted 4 to 6 inches below the soil surface. In phosphorus deficient soils, some listed corn has suffered from lack of phosphorus until mid-July. On soils that receive an annual application of phosphorus or on soils that have an adequate supply of phosphorus to a depth of 6 inches, this problem is less acute. It is also less important with nitrogen because nitrogen is more soluble and moves farther in the soil.

However, the maximum response to starter fertilizer is obtained when the fertilizer is placed 2 inches below and 2 inches to one side of the seed. Until recently, implement manufacturers have not provided a satisfactory attachment for listers for this type of fertilizer placement.

**Strip Processing**

Strip processing refers to any method where only a narrow strip of soil is thoroughly worked before planting. It is a quick, easy method of planting corn, much like hard ground listing.

One implement that has been tested has a wide blade running shallow to kill weeds between the rows and a narrow blade running deep directly below the wide blade to loosen the soil. A section of rotary hoe was mounted behind the blades to till the soil in the row. It works well on disked cornstalks, but is not as well adapted to use in small grain stubble because trash tends to collect in front of the tillage units. In
Table 2. Effect of Planting Methods and Pre-emergence Weed Control on Yield of Corn in Brookings County

<table>
<thead>
<tr>
<th>Planting method</th>
<th>Spray treatment*</th>
<th>Bushels of corn per acre</th>
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</thead>
<tbody>
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<td></td>
<td>1959</td>
<td>1960</td>
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<tr>
<td>Conventional</td>
<td>No spray</td>
<td>24.0</td>
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<tr>
<td>Conventional</td>
<td>Band</td>
<td>32.3</td>
</tr>
<tr>
<td>Conventional</td>
<td>Over-all</td>
<td>---</td>
</tr>
<tr>
<td>Wheel track</td>
<td>No spray</td>
<td>29.1</td>
</tr>
<tr>
<td>Wheel track</td>
<td>Band</td>
<td>31.9</td>
</tr>
<tr>
<td>Wheel track</td>
<td>Over-all</td>
<td>---</td>
</tr>
<tr>
<td>Plow planting</td>
<td>No spray</td>
<td>---</td>
</tr>
<tr>
<td>Plow planting</td>
<td>Band</td>
<td>---</td>
</tr>
<tr>
<td>Plow planting</td>
<td>Over-all</td>
<td>---</td>
</tr>
<tr>
<td>Listing</td>
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</tr>
<tr>
<td>Listing</td>
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<tr>
<td>Listing</td>
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<td>---</td>
</tr>
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<td>Strip processing</td>
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<td>12.2</td>
</tr>
<tr>
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<td>Band</td>
<td>17.2</td>
</tr>
</tbody>
</table>

*2.4 lb./A. active ingredient per acre on area treated applied at planting time. Bands were 13 inches wide over the row. Simazine applied in 1959 and 1960 and atrazine in 1961.

hard, dry untilled soil it is difficult to hold the tillage sections at a uniform depth.

Since more problems arise at cultivation time, herbicides are more essential for weed control with this method than any other planting method. Proper placement of starter fertilizer is difficult to achieve with a planter attachment, especially in hard, dry soil.

Comparison of Methods

These methods of planting corn have been compared for yield and cost of seed bed preparation and planting.

Yield comparisons. The yields are given in table 2 for four experiments conducted in Brookings County over a 3-year period.

Corn plots following small grain in 1959 were deficient in moisture and phosphorus and infested with quackgrass. One hundred pounds of 20-20-0 fertilizer per acre were applied broadcast and left on the surface. Conventional and wheel track planting produced fair yields. Hard ground listing and the strip processing produced inferior yields due to poor fertilizer placement and lack of quackgrass control. In the other 1959 experiment, conventional, wheel track planting, and listing produced comparable yields, but strip processing was inferior, especially when weeds were not controlled with pre-emergence spraying.

In 1960 and 1961, plow planting and wheel track planting produced yields comparable to those obtained by the conventional method. Listing gave inferior yields in 1960, primarily because poor weed control was obtained. Disking before planting probably would have helped on this problem. Listing was also inferior in 1961 except when an overall pre-emergence spray was used for weed control.

Cost comparisons. Cost per acre was determined on a custom rate basis for 1962. The calculated costs for the five systems of planting corn are as follows: Conventional, $7.20 per acre; plow planting $4.50; wheel track, $4.50; hard ground listing, $3.00; and strip processing, $3.00. Disking before listing to control weeds that have emerged increases the cost of listing to $4.50 per acre. Band spraying pre-emergence to control weeds in strip processing raises the cost of this method to $5.85 per acre.

Custom rates were compiled from a South Dakota survey, local commercial operators, and from custom rates received from other states. The following values per acre were used in calculating costs: plowing $3.50 per acre, tandem disking $1.50, harrowing $0.60, planting $1.00, hard ground listing $3.00, strip processing $1.00, and plow planting $4.50 per acre.
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