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Planting Corn in South Dakota

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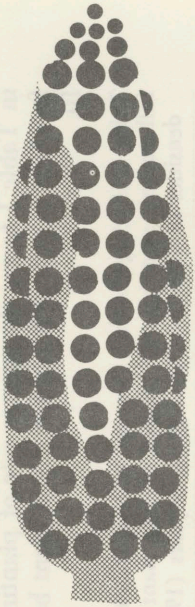

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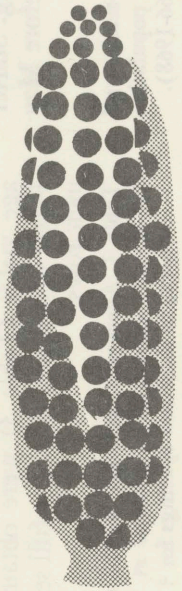
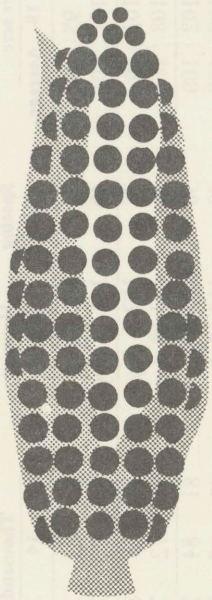
Planting Corn

in south dakota





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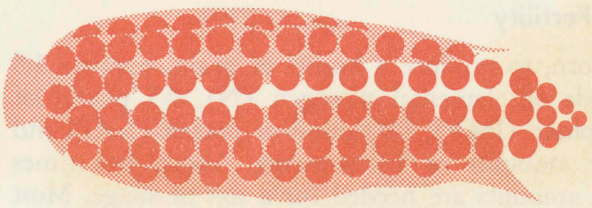

Planting Corn in south dakota

By **Lyle A. Derscheid**, Extension agronomist, from data collected by **A. N. Hume, W. W. Worzella, L. O. Fine, D. B. Shank, F. E. Shubeck,** and **Q. Kingsley**, Agricultural Experiment Station.

Corn is a profitable crop in several areas of South Dakota, but demands a high degree of production efficiency. As with other row crops it leaves much of the land bare and encourages soil erosion, but it allows for cultivation to aid in weed control.

In eastern South Dakota (especially the southeastern part) corn can be raised continuously under proper management.

Plant corn on land with a slope of 3% or less to minimize erosion, loss of nutrients and loss of water absorbing capacity from the soil. Use enough fertilizer to produce maximum yield and plant growth. Incorporate residue from a corn crop into the soil to lessen loss of soil organic matter. Apply manure, whenever possible, to maintain organic matter level. Do not remove stalks from the field unless manure is used to supplement organic matter. It takes 3-4 tons of manure to replace the organic matter in stalks and leaves of a 50-bushel corn crop. Use insecticides each year to control corn rootworms.

For most efficient production, corn growers must make decisions concerning row width, plant population, maturity of the hybrid, soil fertility, date of planting, method of planting, weed and insect control, soil and moisture conservation, and other management practices.

Where to Plant

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

Corn planted on summer fallow may suffer from lack of phosphorous unless larger-than-normal amounts of this fertilizer are applied.

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 good for controlling wild oats, the corn may not produce well. One reason is that alfalfa reduces soil moisture reserves so 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. Also, rootworms, wireworms or cutworms may be a serious problem in corn following alfalfa.

Maturity Date

Most corn companies now rate their corn hybrids according to the number of "growing degree days" (GDD) required for maturity. "Growing degree days" for corn for various areas of the state are shown in Figure 1. It is a helpful guide for selecting hybrids of the proper maturity. Growing degree days for your area is one factor to consider, but moisture and length of growing season also are important for selecting corn of the right maturity.

Several companies also give the Minnesota maturity rating. These ratings seldom fit South Dakota conditions. Most hybrids mature 5 or 6 days earlier in South Dakota than in Minnesota. A hybrid with a Minnesota 100-day maturity rating would be a 95-day corn in South Dakota.

Full season corn will produce maximum yield in favorable years, but may yield wet or soft corn during less favorable years. The same is true if a high rate of seeding is used. Planting an extra early variety 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 with a maturity that will produce dry mature corn in most years. However, you should be able to dry it or use silage or wet corn during poor corn years. If you cannot dry it or use the silage you should select an earlier maturing hybrid.

Plant Population

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.

Yields of bigger, later, full-season hybrids are not so sensitive to variations in populations as smaller, early-maturing hybrids. With more favorable growing conditions, the bigger hybrids have a greater capacity to increase ear size to make up for deficiencies in stands.

In years with above average rainfall higher populations are advantageous, but unless you are a good weather prophet it is best to plan on an average year. Excessive populations during a dry year may be disastrous. However, large quantities of subsoil moisture at planting time, may lessen the risk of using a higher planting rate.

Table 1. Planting rate needed to give various populations of corn planted several ways with several row widths.

Planting method	Hill spacing Inches and kernels/hill	Final corn population plants per acre* Row spacing in inches 40	38	36	30
Hill dropped	16—2 per hill	16,700	17,500	18,300	22,200
	20—2 per hill	13,300	14,000	14,700	17,700
	3 per hill	20,000	21,000	22,000	26,600
	24—2 per hill	11,100	11,700	12,200	14,750
	3 per hill	16,700	17,500	18,300	22,200
	28—2 per hill	9,500	10,000	10,500	12,600
	3 per hill	14,300	15,000	15,700	19,000
	4 per hill	19,000	20,000	20,900	25,300

	Kernel spacing (inches)	Row spacing in inches 40	38	36	30
Drilled or listed	6	22,200	23,400	24,400	29,500
	8	16,700	17,500	18,300	22,200
	10	13,300	14,000	14,700	17,700
	12	11,100	11,700	12,200	14,750
	14	9,500	10,000	10,500	12,600

	Kernels per hill	Hill spacing (in inches) 40x40	38x38	36x36	30x30
Checked	1	3,300	3,700	4,100	5,900
	2	6,700	7,400	8,200	11,800
	3	10,000	11,100	12,300	17,800
	4	13,300	14,800	16,500	23,700
	5	16,700	18,400	20,600	29,600

*Corn populations have been adjusted to account for an average of 15% loss due to germination, cultivation, etc.

Narrow Rows

Corn yields can be increased slightly in eastern and southeastern areas of the state by using a row spacing of less than 40 inches. In narrower rows, it is believed that corn plants make more efficient use of soil moisture, nutrients and sunlight. Research at the Cornbelt Research Center near Centerville indicates that some yield advantage may come from reducing row width from 40 to 30 inches but yields are not materially increased by reducing row width to 20 inches. With high populations (16,000 to 18,000), yield responses in favor of narrow rows are generally greater than with 10,000 plants per acre.

Mechanical weed control is more difficult in 20-inch rows and herbicides are not always 100% effective. A few weeds will lower yields more than enough to offset any yield advantage gained by the use of 20-inch spacings.

Soil Fertility

Corn, to produce a bushel of grain, requires 1.5 pounds of elemental nitrogen (N), 0.5 pound of phosphate (P_2O_5), 1.0 pound of potash (K_2O) and lesser amounts of 13 elements. About five times these amounts are needed for a ton of silage. Most South Dakota soils cannot provide enough available nitrogen or phosphorus and sometimes potassium or zinc to produce yields desired by most corn producers. Although some plant food will come from the soil, the remainder must be supplied from other sources, such as fertilizer, manure, or legumes. This is especially true under serious soil erosion conditions.

Soil testing, including the general soil test as well as tests for nitrates and zinc, is the most effective way to determine what additional plant food should be applied. In times of fertilizer shortage, it is important to put on the right amount—too much fertilizer is wasteful and not economically practical.

Legumes (through microorganisms) remove nitrogen from the air and store it in the soil. Legumes, if plowed under, increase organic matter, which improves soil structure and provides nitrogen, phosphorus and smaller amounts of other elements for plant growth. An alfalfa crop, for example, provides most of the plant food for one corn crop but leaves little residual plant food for a second and perhaps a third crop. Although one might not wish to use a legume as the source of plant food, the value of organic matter of a plowed-under legume should not be overlooked. It is the only practical way of maintaining or improving soil structure to provide better water absorption, greater moisture storage, and lower power requirements for plowing and other tillage operations. Alfalfa removes soil moisture to considerable depths in the subsoil, which in turn can adversely affect the succeeding crop, especially a long-season crop such as corn.

More complete information on the use of fertilizer is in a fact sheet "Fertilizing Corn and Sorghum."

Weed and Insect Control

Weeds can be controlled by mechanical cultivations and/or by herbicides. Herbicides are applied preplant, pre-emergence, or post-emergence. Methods are discussed in a Fact Sheet, "Weed Control in Corn." Some corn hybrids are tolerant to some herbicides while others are quite susceptible. This is especially true with 2,4-D.

Corn Rootworm, corn borer and other insects must be controlled to get maximum production. Some of these are discussed in Fact Sheets, "Corn Rootworm and Control" and "European Corn Borer Control."

Planting Date

Time of planting depends on the number of growing degree days required for the maturity 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.

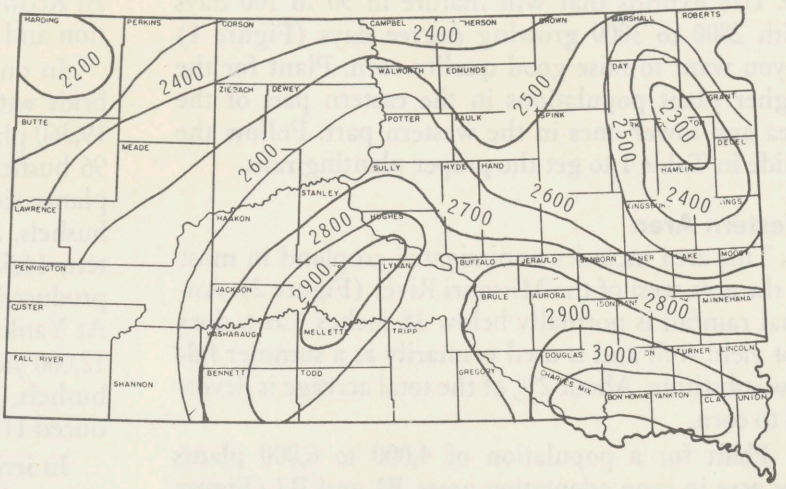

Figure 1. Adjusted growing degree days in South Dakota—base temperature of 50° F. for period May 3 to October 3.

AREA RECOMMENDATIONS

South Dakota is divided into six basic areas with regard to corn production (Figure 2).

Extreme Southeastern Area

This area includes nonirrigated cropland in six southeastern counties (Figure 2) and coincides with crop adaptation area E (Figure 3). Corn is grown as a feed or cash crop on about 35% of the total acreage in this area. This area produces average yields higher than in any other area of the state. Relatively high plant populations can be planted because average annual rainfall ranges from 22 to 25 inches. Although an average 5 inches of rain falls during late May and June, more significant is the nearly 3 inches that falls the last week of July and the first 3 weeks of August.

Plant for population of 14,000 to 18,000 plants per acre in 30-inch rows. Plant the bulk of your corn during the second week in May. Use hybrids that will mature in 100 to 110 days with 2700 to 3000 growing degree days (Figure 1). Follow the guide in Table 1 to get the proper rate of planting. Starter fertilizer is generally needed if you plant before May 10.

Research from 1966 to 1968 near Centerville (Table 2) indicates that the full-season hybrid produces an average of 8 bushels more corn per acre than the short-season hybrid. Yields from 20- and 30-inch row spacings were equal, and were 6 to 8 bushels higher than from 40-inch row spacings. Populations of 12,000 to 18,000 plants per acre produced about the same amount of corn which was somewhat higher than for 10,000 plants. Highest yielding combination for these 3 years was the full-season hybrid at 16,000 plants per acre in 30-inch rows.

Research during 1970 to 1973 at the same location near Centerville, indicates that highest yields were obtained with 12,000 plants per acre during a dry year of 1970, 14,000 plants in the average year of 1971, and 20,000 plants of a full-season hybrid in 30-inch rows during the wet year of 1972. Highest yields were obtained with 18,000 plants of a short-season hybrid in 35-inch rows during 1973, a year with above average spring moisture and low rainfall in August. For the 4-year period highest average yields (Table 3) were obtained with 12,000 to 14,000 plants per acre of a full-season hybrid in 30-inch rows.

Table 2. Average bushels per acre of two (short-season and full-season) corn hybrids planted at five plant population densities in three row spacings for 3 years (1966-1968).

Row Spacing (inches)	Hybrid Maturity Rating	Thousands of plants per acre					
		10	12	14	16	18	Average
40	105-day	87	92	96	96	95	92
40	118-day	98	102	105	99	101	101
30	105-day	93	100	101	101	102	100
30	118-day	105	110	107	113	108	108
20	105-day	93	102	98	105	102	100
20	118-day	106	107	107	106	109	107
Average	105-day	91	98	98	101	100	97
Average	118-day	103	106	106	106	106	105

Table 3. Average bushels per acre of two (short-season and full-season) corn hybrids planted at five plant population densities in three row spacings for 4 years (1970-1973).

Row Spacing (inches)	Hybrid Maturity Rating	Thousands of plants per acre					
		12	14	16	18	20	Average
40	102-5 day	82	83	78	82	76	80
40	113-18 day	83	84	77	77	74	79
35	102-5 day	83	85	81	85	77	82
35	113-18 day	86	72	76	75	81	78
30	102-5 day	81	84	79	80	77	80
30	113-18 day	88	87	78	77	83	83
Average	102-5 day	82	84	79	82	77	81
Average	113-18 day	86	87	77	76	76	80

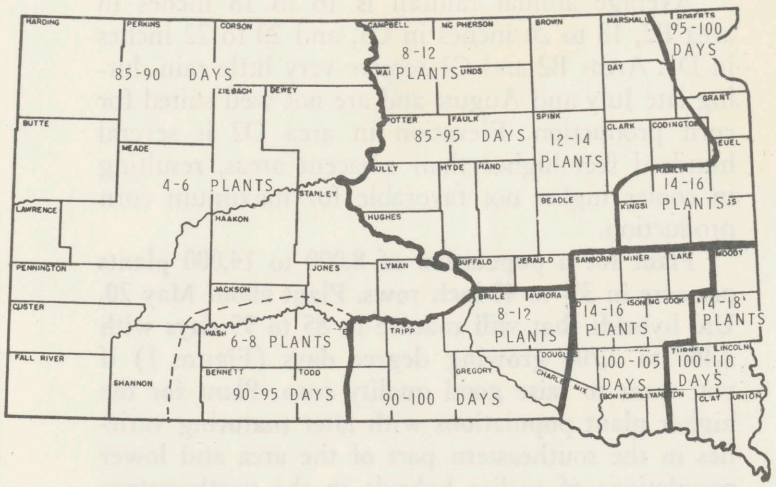

Figure 2. Plants per acre (in thousands) and maturity range (in days) for mature high quality corn.

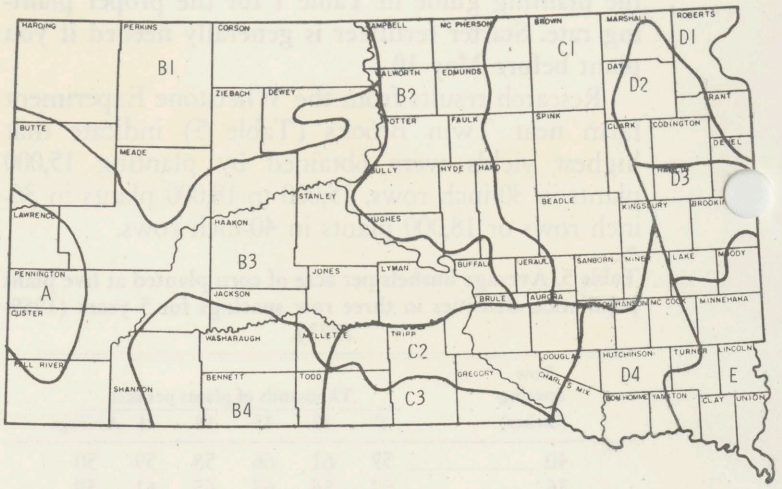

Figure 3. Crop adaptation areas of South Dakota.

Over the 8-year period 1966-1973, the most corn was produced (Table 4) with 14,000 plants per acre of a full-season hybrid in 30-inch rows.

Table 4. Total bushels per acre of two (short-season and full-season) corn hybrids at four plant population densities in two row spacings for 8 years (1966-1973).

Row Spacing (inches)	Hybrid Maturity rating	Thousands of plants per acre 12	14	16	18	Average
40	102-5 day	702	718	718	723	715
40	113-18 day	766	759	739	750	754
30	102-5 day	738	757	739	751	747
30	113-18 day	809	809	784	773	794
Average	102-5 day	720	738	729	737	731
Average	113-18 day	788	784	762	762	774

In other experiments at the same location, corn was planted on four dates each of 2 years—April 26, May 9, May 20, and June 3 in 1968 and May 12, May 19, May 26 and June 2 in 1969. In general the best yields were obtained by planting May 9 to 20. Greatest response to fertilizer (20 to 30 bu/A) was obtained from plantings made on April 26, however, yield was still about 5 bushels lower than from fertilized corn planted a couple of weeks later.

Southeastern Area

This area includes nonirrigated cropland in 11 southeastern counties (Figure 2) and coincides with crop adaptation area D4 (Figure 3). Corn is grown as a feed or cash crop on about 25% of the total acreage in this area. One expects to get a good yield almost every year because average annual rainfall is 20 to 22 inches. The area receives about 20% (4.5 inches) of the yearly total during June and about 12% (2.5 inches) between July 26 and August 22, a period critical for corn.

Plant for a population of 14,000 to 16,000 per acre in 30- to 35-inch rows. Plant during the middle of May. Use hybrids that will mature in 100 to 105 days with 2800 to 3000 growing degree days (Figure 1). Follow the guide in Table 1 to get the proper rate of planting. Starter fertilizer is generally needed if you plant before May 10.

Research results in Tables 2, 3, and 4 and summarized in the preceding section give an indication of what can be expected in this area from hybrids of different maturity, planted at different rates in different row spacings. However, note that the average annual rainfall was 24.9 inches during 1966-68 and 26.6 inches in 1970-73 when these results were obtained. Best plant population in these experiments may be a little higher than can be used with 20 to 22 inches of precipitation.

Northeastern Area

This area includes nonirrigated cropland in all or part of 7 northeastern counties (Figure 2) and includes the area in crop adaptation areas D1 and D3 (Figure 3). Corn is grown as a feed or cash crop on about 20% of the total acreage in this area. One expects to get a good yield almost every year because average annual rainfall is 20 to 22 inches. The area receives about 20% (4.5 inches) of the yearly total during June and about 12% (2.5 inches) between July 26 and August 22, a period critical for corn.

Plant for a population of 14,000 to 16,000 plants per acre in 35- to 40-inch rows. Plant during the middle of May. Use hybrids that will mature in 95 to 100 days with 2500 growing degree days in crop adaptation area D1 if you want good quality corn. Use hybrids that will mature in 100 to 105 days with 2500 to 2600 growing degree days in area D3. Follow

the planting guide in Table 1 for the proper planting rate. Starter fertilizer is generally needed if you plant before May 10.

Research results from the Whetstone Experiment farm near Twin Brooks (Table 5) indicate that highest yields were obtained by planting 15,000 plants in 30-inch rows, 15,000 to 18,000 plants in 36-inch rows or 18,000 plants in 40-inch rows.

Table 5. Average bushels per acre of corn planted at five plant population densities in three row spacings for 5 years (1969-1973).

Row Spacing (inches)	Thousands of plants per acre					
	9	12	15	18	21	Average
40	57	61	66	58	59	50
36	52	56	63	65	61	59
30	50	57	60	66	66	60
Average	52	58	63	63	62	

Other experiments in the northern part of the area gave these results: With above average rainfall, 12,000 plants per acre produced 99 bushels; 16,000 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 produced 40 bushels; and 16,000 produced 29 bushels. Under high rainfall conditions there was little advantage in raising over 16,000 plants per acre and under drier conditions 8,000 produced maximum yields.

Ten years of research near Brookings give an indication of what can be expected from hybrids of different maturity, planted on different dates at several rates of planting in southern counties of this area.

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 other research near Brookings, 10 hybrids with an average population of 15,000 plants per acre produced 86 bushels an acre, and 17,800 plants produced 90 bushels.

North Central Area

This area includes nonirrigated cropland in all or parts of 19 north central counties (Figure 2) and includes most of the area in crop adaptation areas B2, C1, and D2 (Figure 3). In these counties about 11% (14% in eastern half and 7% in western half) of the total 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 inches in D2. Areas B2 and C1 receive very little rain during late July and August and are not well suited for corn production. Elevation in area D2 is several hundred feet higher than adjacent areas, resulting in cooler nights not favorable for maximum corn production.

Plant for a population of 8,000 to 14,000 plants per acre in 35- to 40-inch rows. Plant about May 20. Use hybrids that will mature in 85 to 95 days with 2,400 to 2,700 growing degree days (Figure 1) if you want to raise good quality corn. Plant for the higher plant populations with later maturing varieties in the southeastern part of the area and lower populations of earlier hybrids in the northwestern part. Follow the guide in Table 1 to get the proper planting rate.

Research conducted with five corn hybrids at the North Sioux Valley Research Farm near Watertown during 1969 to 1972 indicates the results one should expect in eastern counties of the area. Yields from 16,000 plants per acre were 4 bushels per acre higher (57 bu in 40-inch rows and 63 in 30-inch rows) than from 12,000 plants (53 in 40-inch rows and 59 in 30-inch rows). Likewise, yield from each population density was 6 bushels per acre higher in 30-inch rows than in 40-inch rows. In 1972, a wet year, 12,000 plants produced 81, 77, and 71 bushels per acre in 30-, 35-, and 36-inch rows while 14,000 plants produced 88, 85 and 76 bushels and 16,000 plants produced 93, 87, and 82 bushels per acre from the three row spacings.

Research during 10 years near Highmore indicates what can be expected from hybrids of different maturity planted on different dates at several rates of planting in the western part of the area.

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 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 May 30. However, the May 1 planting still produced soft corn for 5 out of the 10 years.

South Central Area

This area includes the nonirrigated cropland in all or parts of 8 counties (Figure 2) and coincides with crop adaptation areas C2 and C3 (Figure 3). Average annual precipitation is 18 to 20 inches. Approximately 8% of the total acreage (10% east of the river and 6% west of it) is planted to corn.

Plant for a population of 8,000 to 12,000 plants per acre in 35- to 40-inch rows. Plant around May

10. Use hybrids that will mature in 90 to 100 days with 2800 to 3000 growing degree days (Figure 1) if you want to raise good quality corn. Plant for the higher plant populations in the eastern part of the area and lower ones in the western part. Follow the guide in Table 1 to get the proper planting rate.

Western Area

This area includes nonirrigated cropland in most of the area west of the Missouri River (Figure 2). 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 areas B1 and B3 (Figure 3). Use a hybrid that will mature in 85-90 days with 2200 to 2600 growing degree days (Figure 1). Plant for a population of 6,000 to 8,000 plants in crop adaptation area B4. Use hybrids that mature in 90 to 95 days with 2800 to 2900 growing degree days (Figure 1). Use the guide in Table 1 to get the proper planting rate.

Irrigated Areas

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

In one Redfield seeding rate experiment, six hybrids with 14,570 plants per acre yielded 96 bushels, 19,360 plants yielded 98 bushels, and 23,000 produced 96 bushels. In a second test, 12 hybrids with 10,000 plants yielded 85 bushels, 14,520 plants produced 91 bushels, and 19,360 produced 94 bushels. In a third test, 14,520 plants yielded 112 bushels, 19,360 plants produced 118 bushels, and 24,890 yielded 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.

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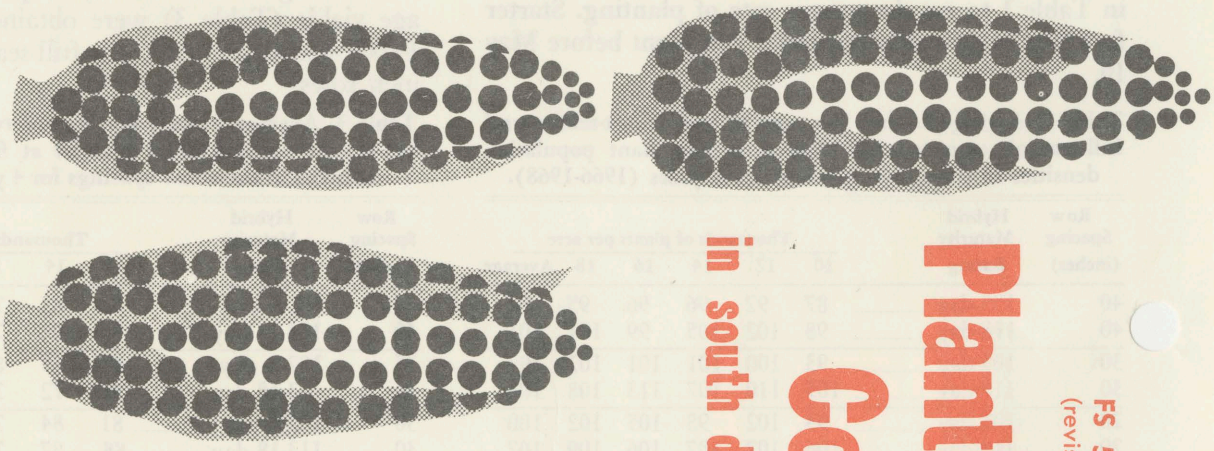

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