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Row Spacing and Seeding Rate Recommendations for Corn in Nebraska

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This NebGuide provides information on narrow-row and twin-row corn and seeding rates for corn in the eastern two-thirds of Nebraska. Recommendations for western Nebraska are in *Recommended Seeding Rates and Hybrid Selection for Rainfed (Dryland) Corn in Nebraska*, NebGuide G2068.

Row spacing and seeding rate are important considerations when trying to optimize corn grain yield. Recently twin rows have emerged as an alternative to narrow rows. Twin-row production splits the plant population of a single row into two rows spaced 7 inches apart.

A 2011 USDA farmer survey found that average corn row spacing in Nebraska was 31.3 inches, with 30-inch spacing being most common. Only 1.7 percent of the corn was planted with row spacing of 20.5 inches or less. Twin-rows are used on a small percentage of corn production area in Nebraska.

A 2012 USDA farmer survey found that the average plant population at harvest was 29,000 plants per acre for irrigated corn and 21,850 plants per acre for rainfed corn in Nebraska. Between 2008 and 2012, the percentage of production area in Nebraska planted to a population of greater than 30,000 plants per acre doubled to 28 percent.

Selection of appropriate row spacing and seeding rate is influenced by the variable climatic conditions found in Nebraska. Mean annual precipitation ranges from 20 to 36 inches in the eastern two-thirds of the state and distribution varies seasonally. The length of the growing season as reflected by the number of growing degree days also differs across Nebraska. In general, the quantity of solar radiation from June through August is high.

Figure 1. Twin-row planting of corn.

With proper management of water, nutrients, and pests, interception of solar radiation becomes the most important factor for row spacing and seeding rate decisions. Narrowing the row spacing and increasing seeding rate may increase corn grain yield by increasing interception of solar radiation at some growth stages. Narrow rows improve plant distribution and increasing seeding rate increases leaf area index, leading to greater interception of photosynthetically active solar radiation during vegetative growth.

Modern corn hybrids tolerate crowding stress better than old hybrids. These genetic advances and technological improvements in planting equipment have spurred interest in narrow and twin-row planting as two means to increase corn grain yields.

Row Spacing

Several research studies on corn row spacing have found little yield difference between 30-inch rows and narrower rows. In nine Iowa trials, average yields were similar for 15-inch and 30-inch rows. A three-year irrigated study in east central Nebraska found no yield difference between 15-inch and 30-inch rows. In a rainfed study in northeast Nebraska, corn yield was four percent more for 20-inch rows compared to 30-inch rows, possibly due to the more northern location. Increased yield has been previously reported with 20-inch rows compared to 30-inch rows at higher latitudes. The greatest response for narrowing row spacing was found north of I-90 where the growing season is short and early maturity hybrids are planted.

There have been little and/or inconsistent yield increases in recent comparisons of twin-row and 30-inch row corn in Alabama, Indiana, Iowa, Missouri, Nebraska, and Ohio (*Table I*). This lack of response is logical when interception of solar radiation is considered. Research conducted in Nebraska in 2009 and 2010 found a 4.2 percent and 2.3 percent increase in solar radiation interception at the V9 growth stage and no increase at earlier or later growth stages. If near full interception of solar radiation occurs by flowering with 30-inch rows, little yield increase is expected from narrowing rows.

Table I. Comparison of corn yield responses with twin-row and 30-inch rows.

Location	*Site-Years*	*Row Configuration*		*Yield Difference*	
		Single	*Twin*		
		—— Bushels/Acre ——			— % —
Nebraska	3	220	223	3	1.3
Indiana	3	189	188	-1	-0.5
Ohio	1	180	182	2	1.1
Iowa	3	196	195	-1	-0.5
Missouri	4	107	99	-8	-7.5
Alabama	2	125	124	-1	-0.8
Mean				-1	-1.2

Narrowing row spacing may result in benefits other than yield increases. Narrow rows result in quicker canopy closure, resulting in better control of late spring and summer weeds, reduced herbicide application, and reduced soil erosion. Narrowing corn row spacing also allows the same planter to be used for both corn and soybean production.

Seeding Rate

Seeding rate of corn has continually increased during the past decade. Plant population recommendations are based on plants per acre at harvest. This is different from the seeding rate that is determined at planting. Often, the harvest plant population is 5 to 10 percent lower than the seeding rate due to incomplete germination and emergence and plant death during the growing season. Current Iowa and Illinois plant population recommendations are 36,000 plants per acre, which is equivalent to a seeding rate of 37,800 to 39,600 seeds per acre. This recommendation suggests that seeding rates for irrigated corn in Nebraska should be increased.

Two seeding rate research studies were conducted at the University of Nebraska–Lincoln Agricultural Research and Development Center near Mead under irrigated and rainfed conditions using hybrids varying in maturity, morphology characteristics, and pest resistance traits, none of which influenced the seeding rate response (*Table II*).

The first study involved irrigated corn production using three hybrids. Yield increase was greatest when the seeding rate was increased from 29,400 to 34,600 seeds per acre. Seeding rate increases above 34,600 seeds per acre did not result in yield increases.

Table II. Influence of seeding rate on corn grain yield in east central Nebraska.

Study 1 (2009 – 2011)		*Study 2 (2008 – 2010)*		
Seeding Rate	*Grain Yield*	*Seeding Rate*	*Grain Yield*	
			Irrigated	*Rainfed*
Seeds/Acre	Bu/Acre	Seeds/Acre	—— Bu/Acre ——	
		21,000	183	179
29,400	210	26,200	190	183
34,600	223	31,500	208	189
39,900	223	36,700	209	192
45,100	223	42,000	222	190
		47,200	222	190

In another study, four hybrids were planted into both irrigated and non-irrigated conditions. Yield increased as seeding rate increased from 21,000 to 42,000 seeds per acre in the irrigated environment and from 21,000 to 31,500 seeds per acre in the rainfed environment. Increases beyond those seeding rates did not result in yield differences for the two environments.

In eight on-farm research trials conducted from 2010 to 2012 for irrigated corn in eastern and south central Nebraska (*Table III*), yield at the optimum seeding rate ranged from 206 to 251 bushels per acre with an average of 224 bushels per acre. The optimum seeding rate ranged from 28,000 to 40,000 seeds per acre with an average economic optimum seeding rate of 34,000 seeds per acre.

In 11 on-farm research trials conducted in 2010 and 2012 for rainfed corn in eastern and south central Nebraska, yield at the optimal seeding rates ranged from 76 to 179 bushels per acre with an average of 119 bushels per acre. The optimum seeding rate ranged from 24,000 to 30,000 seeds per acre with an average economic optimum of 26,000 seeds per acre. Optimum seeding rate was related to yield, indicating economic optimum seeding rates of 24,000 seeds per acre when expected yields for the field were below 110 bushels per acre and more than 30,000 seeds per acre when expected yields were more than 160 bushels per acre.

Table III. Influence of seeding rate on irrigated corn grain yield in Nebraska on-farm research trials.

Seeding Rate	2010	2011	2012 Set A	2012 Set B
Seeds/Acre	Bushels/Acre			
28,000	209	206	213	
30,000				226
32,000	217	205	235	
34,000				228
36,000	222	202	239	
38,000				226
40,000	224	198	241	
42,000				226
Location (County)	2 — Seward and Clay	2 — Hamilton and Seward	3 — Dodge and Seward	3 — Hamilton and Seward

Considering results from the trials conducted in Nebraska in recent years, the most profitable seeding rate on average varies with yield level and price of seed relative to price of grain (*Table IV*). When seed cost is $225 per 80,000 seeds and expected grain value is $6 per bushel, the highest net returns are with 34,000, 30,000, and fewer than 24,000 seeds per acre where yield is above 200, between 120 and 200, and below 120 bushels per acre, respectively. Net returns are not affected much if the seeding rate is 2,000 seeds per acre more or less than the optimum as seen for high-yielding irrigated corn (*Figure 2*).

Stalk strength and lodging potential also need to be considered when making seeding rate decisions. Increasing the seeding rate of corn in eastern Nebraska resulted in increased lodging (*Table V*). Lodging is also hybrid dependent so it is important to check seed company ratings for root and stalk strength.

Table IV. Economic optimum seeding rate for $6 per bushel corn determined from Nebraska replicated trials.

Seed, $/Bag	Yield Level, Bushels/Acre >200	120-200	<120
	N=11	N=5	N=7
125	36	30	28
225	34	30	<24
325	33	26	<24
425	31	<24	<24

Optimum row spacing and seeding rate varies with many factors including climatic conditions, available growing degree days, soil type, water availability, and hybrid characteristics. The recommended seeding rate does not appear to vary with the cropping system, and variable rate seeding has shown little benefit except in fields with large differences in soil characteristics and/or with portions of the field being irrigated and rainfed.

Table V. Influence of seeding rate on lodging of corn plants in east central Nebraska.

Study 1 (2009 – 2011)		Study 2 (2008 – 2010)		
			Lodging	
Seeding Rate	Lodging	Seeding Rate	Irrigated	Rainfed
Seeds/Acre	%	Seeds/Acre	%	
		21,000	3	3
29,400	7	26,200	4	4
34,600	13	31,500	5	8
39,900	14	36,700	6	11
45,100	18	42,000	6	15
		47,200	7	17

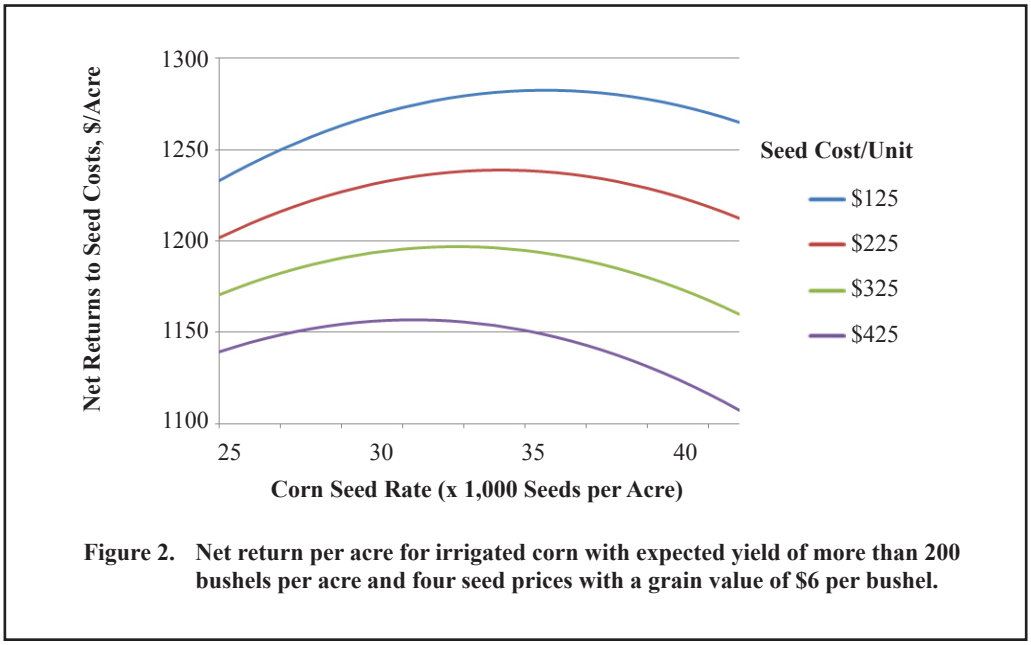

Figure 2. Net return per acre for irrigated corn with expected yield of more than 200 bushels per acre and four seed prices with a grain value of $6 per bushel.

Conclusion

Narrow-row and twin-row corn planting is not likely to drastically increase yield for much of Nebraska, although there is evidence of an advantage with narrow rows for rainfed corn in northeast Nebraska. Twin-row corn research in the Corn Belt has resulted in little and/or inconsistent yield increases. Seeding rate effects on yield have generally been consistent for all row spacings and corn hybrids evaluated.

Most Nebraska producers could increase corn yield by increasing seeding rate. Current Nebraska research suggests that yield increases may be possible by increasing plant population at harvest beyond the USDA reported averages in Nebraska of 29,000 plants per acre (30,450-31,900 seeds per acre) for irrigated production and 21,850 plants per acre (22,943-24,035 seeds per acre) for rainfed production. Research from the eastern Corn Belt recommends plant populations near 35,000 plants per acre for adequate water situations. This is equivalent to a seeding rate of 36,750-38,500 seeds per acre. In eastern and south central Nebraska, irrigated corn seeding rates of 34,000 seeds per acre and rainfed rates of less than 24,000 to 30,000 seeds per acre are near the economic optimum, the latter varying for expected yields of less than 110 bushels per acre to more than 200 bushels per acre.

Fields with a history of high yields offer greater yield potential with increased seeding rate. However, producers must be wary of negative effects that may result, including reduced stalk strength, increased lodging, and seed costs. The potential for increased lodging with a high seeding rate must be weighed against yield goals when determining seeding rate.

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Index: Crop Production/Field Crops
Corn
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