

Seeding Rates for Winter Wheat in Nebraska

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A review of winter wheat trials in Nebraska shows how widely the number of seeds per pound can vary within and among varieties, leading specialists to recommend a change to planting by seeds per acre rather than seeds per pound.

Growers in Nebraska use seeding rates for winter wheat that vary from 30 to 180 pounds per acre. The lower rates are most common in drier areas. The higher rates are used for irrigated wheat, which often is seeded in narrower rows and later in the season since it often follows another crop rather than fallow. This later seeding date reduces tillering and requires higher seeding rates to compensate for the reduction. Also, higher yield potential requires higher seeding rates.

Winter Wheat Seed Size Varies

A change in winter wheat seeding rate recommendations should be made from using pounds per acre to seeds per acre. The number of winter wheat seeds in one pound can range from more than 20,000 to less than 10,000, depending on the variety and the year it was produced. *Table 1* shows the number of seeds per pound for the 2003 Nebraska Winter Wheat Variety Evaluation for eight trials. Winter wheat yields ranged from a low of 25 to a high of 109 bushels per acre. Seed size ranged from a low of 11,700 seeds per pound to a high of 19,100 seeds per pound.

The variety with the greatest variance in number of seeds per pound was Nuplains, a white wheat variety, which ranged from 13,300 to 19,100 seeds per pound. When weight is used for wheat seeding rates, a seed size difference of this magnitude can result in a 44 percent difference in the number of plants per acre.

The variety with the largest seed size was Heyne, a white wheat variety, produced in Cheyenne County. It had 11,700 seeds per pound. The variety with the smallest seed size was Nuplains which was produced in Furnas County and had 19,100 seeds per pound.

The Cheyenne County no-till plot had the largest average seed size for all the varieties at 12,900 seeds per pound while the smallest average seed size occurred at Red Willow

County with 15,900 seeds per pound. While not included in this trial, hybrid cultivars typically have larger seed that requires planting more pounds of seed.

All seed should be cleaned and the small and cracked seeds eliminated. Shriveled seed can reduce yields because germination is slower and emergence is reduced.

Selecting a Seeding Rate

Winter wheat is capable of compensating among yield components, which often results in similar grain yields being produced across a fairly wide range of seeding rates. However, using seeding rates that are too low can lead to excessive tillering. It also may delay maturity, increase weed competition and fail to make use of the plant's full yield potential. Using rates that are too high may increase costs, result in increased lodging and possibly reduce yields.

Too much competition, even among small grain plants, may lead to fewer kernels per head and lower kernel weight. The key is an optimum plant population with uniform distribution for efficient use of available resources.

A review of seeding rates vs. yield potential is helpful. On the average, there are 22 seeds per head and 5 heads per plant, or 110 seeds per plant. With an average seed size of 15,000 seeds per pound or 900,000 seeds per bushel, a pound of average-sized seed with 80 percent germination and emergence has a yield potential of approximately 1.5 bushel per acre. Seeding 40 pounds of seed with a weight of 15,000 seed per pound has a yield potential of 60 bushels per acre.

Large, dense seeds are considered to be of better quality than low test weight seeds. Large seed tends to tiller more than small seed; however, small dense kernels are better than large, light kernels. In the seed-cleaning process, a gravity table will remove the light seed. Another factor affecting seed quality is the protein content of the seed. The amount of protein, not the protein percentage, in the seed is very important to early seedling vigor. Large seed may have a lower protein percentage than small, shriveled seed, but because it is larger it may have more total protein per seed. Grain test weight often is used as a measure of seed quality, but test weight is a bulk density, or a weight per volume measurement, and small seed that packs well can have a high test weight. If producers use

Table I. Average number of seeds per pound for varieties planted in 2003 Nebraska winter wheat evaluation.

Winter Wheat Variety	Cheyenne Co. Fallow-WW	Cheyenne Co. No-till WW	Furnas Co. Continuous	Keith Co. Dryland WW	Lincoln Co. Dryland WW	Red Willow Co. Dryland WW	Saunders Co. Dryland WW	Scotts Bluff Co. Irrigated WW	Average Seed Weight	Range of Seed Weight
----- Number of thousands seed/lb -----										
Above	13.6	12.9	15.6	12.5	15.3	14.7	—	—	14.1	12.5-15.6
Akron	15.8	12.4	14.8	13.7	16.2	16.1	—	15.5	14.9	12.4-16.2
Alliance	16.2	13.8	16.1	13.6	15.3	16.6	13.8	14.5	15.0	13.8-16.6
Antelope	14.7	12.8	17.0	13.2	15.2	16.1	13.6	13.0	14.5	12.8-17.0
AP502CL	13.4	12.0	17.2	12.7	—	15.9	—	—	14.2	12.0-17.2
Arapahoe	16.5	12.6	16.1	14.8	15.4	17.3	14.6	—	15.3	12.6-17.3
Arrowsmith (W) ^a	16.0	13.4	15.6	13.6	13.1	14.7	13.9	12.2	14.1	12.2-16.0
Betty (W)	15.9	11.9	15.6	15.8	15.4	14.9	14.1	13.5	14.6	11.9-15.9
Couger	14.5	13.7	14.1	11.9	12.9	15.4	—	—	13.8	11.9-15.4
Culver	15.4	13.1	16.2	13.4	15.5	16.5	13.5	—	13.0	13.1-16.5
Halt	16.8	12.7	17.6	15.3	16.6	17.3	—	13.3	15.7	12.7-17.6
Harry	17.2	12.8	15.7	13.7	16.1	18.5	13.3	13.4	15.1	12.8-18.5
Heyne (W)	14.3	11.7	16.1	13.1	14.0	15.0	14.6	13.0	14.0	11.7-16.1
Jagalene	14.6	12.5	16.3	13.5	14.7	14.9	13.0	13.5	14.1	12.5-16.3
Jagger	13.8	12.9	15.3	14.1	14.6	15.2	13.0	12.4	13.9	12.4-15.3
Lakin (W)	15.1	13.4	14.7	13.1	16.1	15.5	12.9	14.1	14.4	12.9-15.5
Millennium	15.8	12.7	16.9	13.2	14.2	16.5	14.3	15.3	14.9	12.7-16.9
Niobrara	16.4	13.4	16.6	12.4	15.6	15.8	—	—	15.0	12.4-16.4
NuFrontier (W)	15.7	12.8	16.5	13.9	15.6	17.1	14.9	14.3	15.1	12.8-17.1
NuHorizon (W)	15.1	13.6	16.3	13.1	15.0	16.1	14.2	12.6	14.5	12.6-16.3
Nuplains (W)	16.4	14.1	19.1	13.3	15.4	18.0	15.5	15.1	15.9	13.3-19.1
Pronghorn	13.5	12.7	15.1	13.4	14.0	14.4	—	—	13.9	12.7-15.1
Thunderbolt	—	—	15.2	12.6	13.7	15.6	—	—	14.3	12.6-15.6
Trego (W)	14.7	12.5	13.7	12.1	14.3	15.3	12.4	13.7	13.6	12.1-15.3
Wahoo	16.0	12.4	15.3	13.2	14.1	15.6	13.8	14.1	14.3	12.4-16.0
Wesley	14.5	12.7	14.7	13.6	14.3	14.5	12.7	13.4	13.8	12.7-14.5
Average	15.3	12.9	15.9	13.4	14.9	15.9	13.8	13.7	—	—

^a(W) indicates a white wheat variety.

Table II. Range of optimum seeding rates by areas in Nebraska.

Panhandle	600,000 to 900,000 seeds/acre
Southwest	700,000 to 900,000 seeds/acre
Central	800,000 to 1,350,000 seeds/acre
Southeast	900,000 to 1,350,000 seeds/acre
Irrigated	1,000,000 to 2,500,000 seeds/acre

Table III. Yield potential in bushels/acre of a seeding rate of 18 seeds per foot of row with 80% germination and emergence and seeded on the recommended seeding date for the area.

Row spacing (inches)	Estimated yield potential (bu/acre)
6	153
8	115
10	92
12	77
14	66

Table IV. Seeding rate for winter wheat to achieve 18 seeds per foot of row.

Row spacing (inches)	Feet of row/acre	Wheat seeds/lb						
		12,000	13,000	14,000	15,000	16,000	17,000	18,000
----- lb/A of seed -----								
6	87,120	131	121	112	105	98	92	87
8	65,340	98	90	84	78	76	69	65
10	52,272	78	72	67	63	59	55	52
12	43,560	65	60	56	52	49	46	44
14	37,337	56	52	48	45	42	39	37

test weight as a seed quality measurement, they should use seed with test weight above 57 pounds per bushel. Actually, a high thousand kernel weight (TKW) is a better measurement of seed quality. A 30 gram (1.05 ounce) TKW, which translates to 15,200 seeds per pound, is an appropriate minimum TKW for a seedlot. A few varieties grown in Nebraska have small seed with a lower TKW, but their seed is still suitable for planting. With these varieties, producers should use the largest seed they can obtain.

Seed cleaning and sizing is essential to remove straw, chaff, dirt, stones, weed seeds, and broken, diseased or small shriveled kernels. Generally, seed cleaning will add 1 to 2 pounds to the seedlot's test weight by removing the small kernels. Taking a germination test is essential to determine the seed viability. After seed germinability has been determined, the seeding rate can be determined. Seed for planting should be above 85 percent germination.

How many winter wheat seeds should be planted per acre? There are several opinions on this. Floyd E. Bolton, crop scientist at Oregon State University, says 18 seeds per foot of row seems to be the point of diminishing yield increases, no matter what row spacing from 6 to 18 inches. This is for winter wheat seeded at an optimum planting date. Winter wheat seeded late because of weather or following harvest of another crop may

require the seeding rate to be increased by 30 to 60 percent. For dryland winter wheat in western Nebraska, row spacings of 10 to 14 inches are recommended. Weed competition can be reduced by using narrower row spacings. For irrigation, and especially with late seeding dates, row spacings of 6 to 8 inches are preferred. *Table II* lists optimum seeding rates by Nebraska areas. *Table III* shows the yield potential of winter wheat seeded on the recommended seeding date at 18 seeds per foot of row with 80 percent germination and emergence (stand establishment). *Table IV* provides the pounds of seed needed per acre for 6- to 14-inch row spacings and seed sizes of 12,000 to 18,000 seeds per pound, based on 18 seeds per foot of row.

Calibrating the Drill

With seeding rate determined, how can we be sure the drill plants the desired amount? First, use the operator's manual to set the drill. Then use one of the several items available to help calibrate the drill. For example, see NebGuide G1511, *Calibration of Sprayers (Also Seeders)*. Problem 10 from that NebGuide illustrates how to calibrate a seeder and is included on *page 4*.

Calibrating Seeders

How many pounds of seed should we collect if we want 18 seeds/ft of row with 10-inch row spacing. Seed size is 15,000 seeds/lb and we collect seed for 500 ft.

To determine lbs of seed needed/acre:

$$\frac{12 \text{ in/ft}}{10 \text{ in/row}} = 1.2 \text{ ft of row/ft} \quad 1.2 \times 43,560 \text{ ft}^2/\text{A} = 52,272 \text{ ft of row/acre}$$

$$52,272 \text{ ft of row/acre} \times 18 \text{ seeds/ft row} = 940,896 \text{ seeds/acre} \div 15,000 \text{ seeds/lb} = 62.7 \text{ lb/acre}$$

Determine area seeded with one opener on one acre:

10 in per row or

$$\frac{10 \text{ in}}{12 \text{ in/ft}} = 0.83 \text{ ft}$$

Test Box
500 ft long

Wt
for weight of
seed calibrated

$$415 \text{ sq ft} \\ (500 \text{ ft} \times 0.83 \text{ ft})$$

Acre Box

62.7 lb
seed/acre

$$43,560 \text{ sq ft acre}$$

$$\frac{Wt}{415} = \frac{62.7}{43,560}$$

$$43,560 \times Wt = 26,020.5 \quad (62.7 \times 415)$$

$$Wt = 0.6 \text{ lb/opener or } 9.6 \text{ ounces/opener} \quad (26,020.5 \div 43,560)$$

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