Seedbed Preparation

Soybean can be grown on a wide range of soil types under various cultural practices. Because of seed size and physiology, soybean seeds require about 50 percent of the seed weight in moisture to germinate. Also, soybean is seeded only 1 to 1.5 inches deep. These factors explain why preparation of a firm, uniform seedbed is important for optimum stand establishment. Shallow spring tillage to kill weeds before planting is effective on fall-tilled fields. Spring tillage usually is done just before planting. Several reduced-tillage programs can be followed. Many farmers are growing soybean under a no-till program. Special planters or drills may be required to handle surface residue in no-till and some reduced-tillage systems. Soybean, like other legume crops, has difficulty emerging through compacted layers and surface crusts.

Planting Date

Soybean is susceptible to frost and prolonged exposure to near-freezing conditions in the spring and fall. Plant soybean after the soil has warmed to 50 F and air temperatures are favorable. Soybean generally should not be planted earlier than five days before the average last killing frost. This provides less than a 50 percent chance of frost killing the soybean plant. Very early planting in cool, wet soil may result in low germination, increased incidence of seedling diseases and poor stands.

Planting dates during the first half of May are favorable for highest yields with a reduced risk of frost injury. Earlier seeding allows the use of full-season varieties, which typically yield more than shorter-season varieties.

Data from date-of-planting studies at the NDSU Fargo Experiment Station indicated that late plantings had lower seed yields, poorer seed quality, lower oil content, shorter plant height and pods set closer to the ground compared with optimum planting dates. Some early maturing varieties have had acceptable yields when weather factors such as hail, late spring frost, floods, etc., necessitate late planting or replanting.

Soybean stands with poor emergence often are replanted without considering the yield-compensating ability of the plants in the initial stand. The yield of an initial planting at less than full stand must be compared with the yield of the replanted crop to determine whether replanting is justified. Replanting costs include seed, tillage, replanting and labor. The yield of a replanted crop must be sufficiently greater than the yield of the initial planting to cover the expenses associated with replanting. Risk of fall freeze damage to the replanted crop must be considered when deciding the maturity of the variety selected for replanting.

Plan to plant seed 1 to 1¾ inches deep and place the seed in moist soil. Planting deeper than 2 inches or

in a soil that crusts may result in poor emergence and plant stand. Seeding in rows permits cultivation for weed control.

Planting Rate

Soybean yields have not varied significantly over a wide range of plant populations. A plant population of approximately 150,000 plants per acre is desirable regardless of row spacing. Seeds per pound in available varieties range from 2,200 to 3,400, with an average of 3,000 seeds per pound. High planting rates may cause yields to decrease in low rainfall environments because of drought stress, and in a good rainfall year, high plant populations may lodge more than low populations. Low plant populations reduce lodging but contribute to low pod set and excessive branching. Extremely low seed number per foot of row may result in erratic stands due to lack of seedling energy necessary to break the soil surface. This may be critical in solid-seeded stands where soils are prone to crusting.

Seeding rates should be increased (around 10 percent) to compensate for natural occurring factors that cause some live seeds not to develop into established plants. Slightly higher seeding rates also may be advantageous with late planting dates or in no-till, where soil temperatures are lower. If planting in narrow row spacings (less than 10 inches), we suggest soybean seeding rates be adjusted upward. We recommend seeding rates of 175,000 seeds per acre

in 12- to 15-inch row spacings and 200,000 seeds per acre when drill seeding. To ensure planting enough soybean seed, the planting rate should be based on a seed count. You will need to know the following to calculate the rate:

1. Desired population at harvest
2. Average stand loss for your farm
3. Germination value of your seed
4. Number of seeds per pound of seed

The following is an example for calculating planting rate:

1. Desired population at harvest is 150,000 plants per acre.
2. Normal stand loss is 10 percent.
3. Seed germination is 95 percent.
4. Soybean seed has a seed count of 3,000 seeds per pound or 180,000 seeds per bushel.

The seeding rate (SR), expressed as number of seeds per acre, can be calculated from the following equation: SR = D*[100/(M1)]*[100/(100-M2)], where D is the desired plant density per acre (150,000), M1 (germination percent = 95 percent) and M2 (average percent stand loss on the farm = 10 percent).

SR = 150,000*[100/(95)]*[100/(100-10)] = 175,450 seeds per acre

175,450 seeds ÷ 3,000 seeds per pound = 58.5 pounds/acre (lb/a) of soybean seed needs to be planted.

Row Spacing

Midwest research demonstrates that higher yields of soybean can be obtained in rows of less than 30-inch spacing if stands are well-established and weeds are controlled adequately. NDSU research indicates that 12- to 18-inch row soybean outyields wider-spaced soybean by an average of 5 percent. The advantages for narrow-row soybean are increased yield, reduced soil erosion, increased harvesting efficiency, early crop canopy closure to help control weeds, and the convenience of using existing small-grain equipment for some planting and harvesting operations. The primary disadvantages of narrow row production (solid seeding) are increased potential disease problems and seedling emergence problems if the soil crusts easily.

Planting Guide

To determine the number of seeds per acre planted, add seed to your planter or drill and operate it on a firm soil surface so seed is visible on the surface. Operate it for a short distance close to your normal operating speed. Then go back and count the number of seeds dropped in 1 linear foot of planter row. Make several counts and determine an average. Refer to one of the following charts to see that you are planting the number of seeds that you calculated in the earlier section.

Soybean seeds per linear foot of row (seed count of 2,500 seeds per pound).

Approx. pounds seed per acre	Seeds per acre	Seeds per foot of row with row spacing (inch) of:			
		6	12	22	30
40	100,000	1.2	2.3	4.2	5.7
50	125,000	1.4	2.7	5.3	7.2
60	150,000	1.7	3.4	6.3	8.6
70	175,000	2.0	4.0	7.4	10.0
80	200,000	2.3	4.6	8.4	11.5

Soybean seeds per linear foot of row (seed count of 3,000 seeds per pound).

Approx. pounds seed per acre	Seeds per acre	Seeds per foot of row with row spacing (inch) of:			
		6	12	22	30
40	120,000	1.4	2.8	5.0	6.9
50	150,000	1.7	3.5	6.3	8.7
60	180,000	2.1	4.2	7.5	10.4
70	210,000	2.5	4.9	8.8	12.1
80	240,000	2.8	5.6	10.0	13.8

Air Seeder Calibration

Calibrating an air seeder usually is done by following the directions listed in the operators manual. It usually will tell you to hand turn the seed metering system a number of turns for a predetermined area. This often is listed for one-tenth or one-fourth of an acre. Then the metered seed needs to be weighed on a scale. Sometimes these scales are provided with the air seeder. The weights need to be

multiplied by 10 for one-tenth of an acre or multiplied by 4 for one-fourth of an acre, and then adjustments can be made based on the previous calculated amounts.

Another method for calibrating an air seeder requires collecting seed from the seed openers. Probably the easiest method is to place a tarp under the openers, collect seed over an area or distance (one-tenth of an acre) and weigh the pounds of seed collected.

First, determine the pounds of seed to plant as calculated in the planting rate section of this publication.

Then, (1) determine the circumference (feet) of the seed meter drive wheel on your seeder using the following formula:

$$c_{(ft)} = \frac{\text{diameter in inches x } 3.14}{\text{12 inches per foot}}$$

(2) Determine the drive wheel revolutions required to equal one-tenth of an acre. Use the following chart to calculate this number, which is based on the width of your air seeder.

Travel distance to equal 1/10 acre.

Drill width	Distance
(feet)	(feet)
16	272
20	218
24	181
28	156
32	136
36	121
40	109
44	99
48	91

(3) Next, calculate the metering wheel revolutions to cover this distance:

$$\text{Metering wheel revolutions} = \frac{\text{distance to cover 1/10 acre (feet)}}{\text{Circumference of drive wheel (feet)}}$$

(4) Place seed in the air seeder bin and start the air delivery system. Manually turn the metering wheel the number of revolutions that were calculated to cover one-tenth of an acre.

(5) Weigh the seed collected on the tarp and multiply times 10. This number should equal the pounds of seed you want to plant.

Drill calibration is becoming extremely important so you can be sure you are planting the correct amount

of seed. If the amount of seed determined with either method is not equal to the amount of seed you desire, make an adjustment to the feed rate and recheck your seeder.

This method also works for determining the pounds of fertilizer to be applied.

Hula Hoop method for determining population of drilled soybean[1].

	Inside diameter of Hula Hoop (inches)				
No. of Plants	**30**	**32**	**34**	**36**	**38**
	Population x 1,000				
10	89	78	69	62	55
12	107	94	83	74	66
14	124	109	97	86	77
16	142	125	110	99	89
18	160	140	124	111	100
20	178	156	138	123	111
22	196	172	152	136	122
24	213	187	166	148	133
26	231	203	179	160	144
28	249	218	193	173	155
30	266	234	207	185	166
32	284	250	221	197	177
34	302	265	235	209	188
36	—	281	249	222	199
38	—	297	362	234	210
40	—	—	277	247	221
42	—	—	290	259	232
44	—	—	304	271	243
46	—	—	—	284	255

[1] Example: If you count 24 plants inside a 32-inch Hula Hoop, your plant population is 187,000 per acre. Make at least 10 random counts in representative areas per field.