

Planting Considerations

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Producing soybeans offers the farmer much flexibility in management and risk control options. For example, soybeans fit into a number of rotation systems with benefits to all involved crops. Also, soybeans can be planted from late spring, as a full-season crop, through mid-summer, or double-cropped after harvest of a winter annual crop such as wheat, rye, barley, oats, triticale, or canola. The following are suggestions for successfully planting soybeans to achieve stands for top yields.

ROTATION

Rotating soybeans with other crops like corn, cotton, or tobacco is an important practice for managing pests, using soil-applied nutrients efficiently, and sustaining soil productivity. Rotation can result in a reduction in production costs due to less chemical inputs for controlling pests like weeds, diseases, or nematodes.

When rotating with highly fertilized crops like cotton or tobacco, soybeans can effectively utilize residual nutrients left in the soil, thereby reducing fertilizer costs. In addition to these positive benefits, rotations usually improve yields due in part to the improvement of various soil biotic and physical characteristics. Recent research by Clemson Universities' Dr. Jim Frederick has shown rotating double-cropped soybeans with corn increased soybean yields 32%, compared to growing double-cropped soybeans continuously.

FIELD SELECTION

Soybeans can be produced successfully on a wide range of soils. However, soils that are inherently fertile, well-drained, and possess good water-holding capacity will produce the highest yields. Based on the current cost of producing soybeans (see chapter one Production and Management Risks), fields should be selected with soils that have a productive potential (under dryland conditions) of at least 40 bushels per acre. Information to assist with field selection is presented in the County Soil Survey, available from local USDA-NRCS offices. This publication contains aerial maps which show the soil types in each field in the county. Reference can then be made to detailed descriptions of the soils, including their productive potential for various adapted crops. In addition to soil survey maps, Clemson scientists are utilizing geo-referenced equipment (Veris 3100) that can map the spatial variability in soil type and depth of the subsoil within fields.

SEEDBED PREPARATION

Conventional seedbed preparation increases the costs of producing soybean and has several associated risks. While seedbed preparation using a disk harrow is practiced by many farmers, it is a practice that has many costs. Disking soil prior to planting stimulates weed emergence, compacts the soil at the 4- to 5-inch depth, causes rapid moisture loss from the soil surface, and increases wind and water erosion of the upper most layer of soil. Seedbeds are most often prepared using conventional tillage when (a) lime and/or fertilizer is to be incorporated into the plow layer, (b) residual herbicide(s) must be incorporated, (c) a dense layer of weedy and/or crop residue exists on the soil surface, and (d) to produce a well aerated seedbed for optimum seed germination and emergence.

Seedbed preparation for strip-tilled soybean involves a coultter and a narrow furrow opener (e.g., double disk). The coultter cuts through the surface residue (e.g., small grain residue if double-cropping) and the furrow opener prepares a narrow seedbed about an inch wide. Care must be taken to ensure the seed has good soil contact so that optimum germination/emergence can occur. Stand problems with conservation tillage can seriously cripple chances for good yields.

SOIL MOISTURE IS CRITICAL

Having enough soil moisture present at planting is extremely important for good soybean stands. The soybean seed must imbibe 50 percent of its weight in water before germination can begin. This is why soybean seed swell within an hour or so after planting if soil moisture is present. However, there can be enough moisture for "swelling" and not enough to complete the germination process, especially under extremely hot soil conditions. Seed in this situation are often attacked by bacteria or fungi, and rot in the soil.

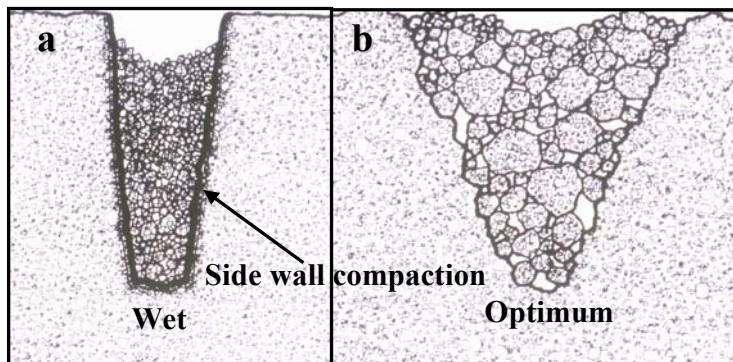
Seed planted in soils too hot or dry can present other problems. Farmers who "dust in" their soybean crop and wait on a rain often have to replant because the seed baked, much like being in an oven. If soil moisture is limited, or if soil temperatures 1 to 1½ inches deep are over 100 degrees, the farmer should not plant until soil conditions are more optimum - in other words, keep the seed in the bag!

DEEP TILLAGE

The sandy light-textured soils of South Carolina's Coastal Plain are low in fertility and water-holding capacity, and tend to form natural compacted zones or hardpans that are restrictive to root growth and development. Two types of hardpans are evident in most of these soils: a tillage pan 4- to 5-inches deep, caused by excessive tillage (mostly the disk); and a lighter-colored sandy layer about 7- to 15-inches deep and 1- to 4-inches thick (the E horizon). The E horizon is more compacted than either the topsoil or subsoil (B horizon) and is difficult, if not impossible, for roots to penetrate.

On Coastal Plain soils, deep tillage implements (in-row or broadcast subsoilers) are often needed to break compaction zones enabling roots to grow into the subsoil to access residual soil moisture and leached nutrients (including nitrogen, sulfur, and potassium). South Carolina research has shown that in-row subsoiling in wide rows (30 to 38 inches) ahead of planting can increase soybean yields in the Coastal Plain by 10 to 15 percent with even greater response during dry years. It is critical that these tillage practices are conducted during periods in which soils are not excessively moist. Deep tilling "wet" soils will fail to destroy the restrictive layer and will create compacted areas along the sidewalls of the tillage shanks (see Figure 1). **NOTE:** For more information on tillage, please see the *Doublecropping Wheat and Soybeans with Conservation Tillage* chapter.

Figure 1. Subsurface view of tillage under "wet" and optimum moisture conditions. Note the side wall compaction that occurs when soil are to wet.



HOW DEEP?

For achieving maximum economic returns from deep tillage, it is important to know the average depth to the subsoil and the depth and thickness of the restrictive layer. Research in the 1980s at Clemson's Edisto Research and Education Center on three different soils showed that row subsoiling should be done 1 to 2 inches into the subsoil so that roots can optimally access moisture and nutrients (see Table 1). **Note:** There is likely no benefit of tillage at depths greater than 2 inches below the upper surface of the subsoil.

Table 1. Soybean yield (bu/acre) as influenced by depth to subsoil and depth of in-row subsoiling at the Edisto REC in Blackville, SC, 1984.

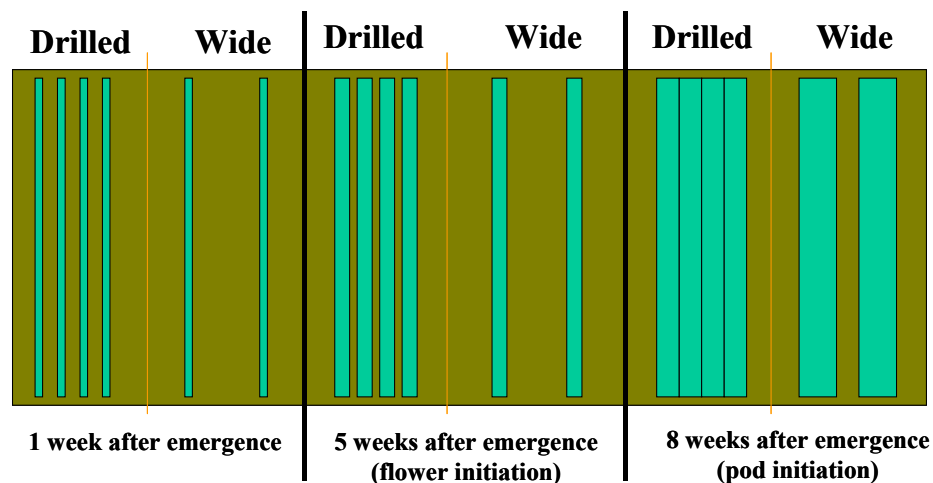
In-row subsoiling depth	Depth to subsoil		
	8 inches	12 inches	16 inches
No SS (disk only)	29	28	21
12 inches	33	39	33
14 inches	35	41	39
18 inches	36	42	42

Research by Tom Garner and Harold Musen.

PLANTING DATES, ROW WIDTH, & PLANT POPULATION

In South Carolina, Group V and VI offer top yield performance when full-season planting occurs from May 1 until June 10. Group V and VI varieties are recommended for later planting dates to allow adequate stem elongation prior to flowering. However, research has shown about a one-half bushel loss in yield potential for each day of planting delay after mid-June. For soybeans planted after June 10, seeding in row widths ≥ 30 inches is discouraged because the crop is not likely to lap the row middle and produce yields equivalent to drill-seeded soybean under a shortened growing season (see Figure 2). Regardless of row width, planting after July 1 will not allow adequate stem elongation prior to flowering and yields will be greatly suppressed.

Figure 2. Schematic diagram of canopy development of "late" planted drilled and wide-row soybeans. Because canopy development ceases near pod initiation, wide-row soybean fails to harvest sunlight from the row-middles, thus limiting yield.



When drill seeding soybeans, preference is given to fast-growing bushy varieties that will provide quick canopy, thereby shading out most weeds. **Drilled soybeans planted after June 10 in South Carolina have been shown by research to consistently provide a 10- to 15-percent greater yield than soybeans planted in wide rows.**

Farmers should use plants per row foot as a seeding rate guide rather than pounds per acre. Significant differences in seed size occur among varieties. Seeding rates based on pounds per acre can cause an inadequate or excessive population. In addition, it may lead to an added expense, especially when using Roundup Ready varieties in which a technology fee is accessed to each bag of seed purchased. For top yields, seeds should have a minimum germination of 80%. Seeding rates for various row spacings under optimum soil moisture are:

- 8 seed per row foot for 38-inch rows;
- 7 seed per row foot for 30-inch rows;
- 3 to 4 seed per row foot for 15- to 20-inch rows; and
- 2 to 2.5 seed per row foot for drilled rows less than 10 inches wide.

For maturity group V through VII, recent research at the Edisto REC has found that drill-seeded soybean yields were similar when seeded at 150,000 seed/acre (2 seed per row foot) compared with 250,000 seed/acre (3.3 seed per row) which has been commonly used by many growers. Assuming an average seed size of 3,000 seed per pound and a seed cost of \$28.00 per bag (50 pounds) for Roundup Ready soybean, the higher seeding rate costs an added \$18.67 per acre. The only time seeding rates should be increased is when planting with conservation tillage into dense residue that limits seed-soil contact, and seeding rates should only be increased 15% in this instance.

Soybean seed should be planted 1 to 1½ inches deep in soil moisture adequate for both germination and emergence. Follow this rule of thumb for determining if moisture is ideal for planting: a handful of a typical sandy loam soil with optimum moisture for planting should "ball up" and then fall apart as you form and then release a tight fist.