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Double-crop Soybean Production in Oklahoma

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Double-cropping soybeans and wheat is being practiced by a number of Oklahoma farmers as a means for improving cash flow, spreading risk, improving use of land and equipment, and achieving greater net returns on investment. Soil erosion, as a result of wind and water, can also be reduced as the ground is covered, essentially on a year-round basis.

Double-cropping soybeans and wheat is not hazard free. Moisture availability will be a critical factor in deciding whether to double crop. If adequate moisture for germination and emergence is present at wheat harvest, soybeans should be planted as soon as possible thereafter. If the top 2 inches of soil are dry and soybeans would not germinate and emerge without additional moisture, it would be better to wait for rainfall or, if available, use irrigation. In an extremely dry year, attempting to establish soybeans, following wheat harvest, may be difficult or even impossible. In those years, it might be more practical to avoid planting the soybean crop and plan for an earlier fall planted wheat crop. A rule of thumb for Oklahoma is, "If it's dry, don't try."

Research has shown that soybeans can be planted until about July 10 and still achieve acceptable yields. Lower yields would be expected from late plantings because of the shortened growing season. If soybeans have not been planted by July 10, growers may want to select an alternate crop and wait until another year to attempt to double-crop soybeans.

Residue Management

No-till practices are valuable in situations where moisture for germination is limited, as is normally the case after wheat harvest. Wheat straw can act as a mulch to conserve soil moisture, impede runoff, and prevent surface crusting. However, residues can make planting difficult. These problems can be overcome with proper equipment and straw management.

In a no-till system, small grain residue should not be bunched or windrowed unless it is to be baled and removed. Planters cannot penetrate windrowed straw and still place seed at the proper depth. The best chance for double-crop success following wheat will be obtained if the combine is equipped with a straw chopper and chaff spreader. The straw chopper should be capable of spreading the straw that comes through the rotor or off the straw walkers nearly the width of the header. Spreading this straw is critical for planting success. While not as important as spreading straw, it is a good management practice to spread the chaff and material coming off the cleaning shoe. This material will not be as difficult to plant through as straw, but it can create a cooler, wetter environment than adjacent areas not covered in chaff.

Figure 1. Standing residue from the use of stripper header.

Shade provided by standing stubble stimulates elongation of soybean stems and causes a higher first pod height. This makes soybean harvest easier and reduces harvest losses.

Variety Selection

Soybean varieties for double-cropping should be selected from those that are best suited to the typical growing conditions of a particular area. If planting is delayed past June 15, the use of a later maturing variety will offer the advantage of extending the growing season. Choosing a very early maturing variety for planting after wheat harvest usually results in short plants and low yields. Choosing a very late maturing variety will result in green plants and pods at frost.

Generally, varieties in maturity groups IV and V are best suited for double-cropping with wheat in Oklahoma. These varieties will grow taller and provide more total competition with weeds than will very early maturing varieties. When planted from June 15 to July I, Group IV varieties will mature in approximately 110 days and Group V varieties will mature in approximately 120 days.

Planting Equipment

No-till planting does not require specially equipped planters or drills, but they will perform better than most conventional seeders. For the best chance at success for double-cropping soybean, the planter or drill must do several things. It must cut through or move the small grain straw, place the seed into good contact with the soil, and cover the seed. Row crop planters can be equipped with coulters or row cleaners to cut or move residue or they can operate without no-till attachments. The key to success is proper adjustment and operation.

The straw should be dry and the soil should be relatively firm to enable the coulter and/or opener discs to cut through the straw, rather than press it into the seed trench produced by the openers. It's best if seeding takes place later in the day to avoid dew or moist residue. Think about trying to harvest wheat when the straw is 'too tough' to cut with a sickle. It will be more challenging to plant into similar straw. If the soil is dry or hard, the no-till planter or drill must have sufficient weight to achieve the proper penetration and depth control.

Seeding Rate

The recommended plant population for most of Oklahoma is to have about 100,000 plants per acre at harvest time. However, selecting a proper soybean seeding rate should take into account variety, row width, and production region. High soybean yields are possible with a wide range of plant populations because single plants of most varieties will utilize a 7- to 9-inch area in all directions around the main stem. A soybean plant has a tremendous ability to compensate for variations in population. Therefore, the penalty for over-planting or under-planting may be relatively small. Plants adjust to low populations by producing more branches per plant and by increasing the number of pods on both the main stem and branches. There is, however, little change in seed size and in seed number per pod. When grown under high populations, individual plants produce fewer pods, fewer branches, grow taller, and pod higher off the soil surface than when grown at low populations, which may make harvest easier. Yield potential is maintained with high populations since there are more plants per acre.

Seeding rate should be based on seeds per foot of row and not on pounds per acre. Table 1 provides the number of seeds per foot of row required to achieve a certain final plant population. Three levels of germination are used as examples. Most purchased seed is tagged at 80percent germination, which is the lowest germination acceptable by certification standards. The seed may actually have a higher germination resulting in a thicker stand.

Even though the germination of your planted variety may indicate 80 percent, it is very unlikely that the final plant stand will be 80 percent of planted seed. The seeding rates in Table 1 assume 90 percent emergence of the planted seed. To calculate the rate of seed per foot of row, use the following formula:

Desired Plant Stand (plants per foot of row) =

$$\frac{\text{Plants per foot of row}}{\text{\% seed germination}} \times \text{\% expected germination}$$

Some special circumstances may result in increasing the seeding rate. These are only suggestions and do not replace personnel experience. Increase the seeding rate for the following situations:

- 10 percent for rough seedbed
- 10 to 20 percent for no-till
- 15 percent for planting after July 1

Row width

Use of lower or higher plant population within certain row spacing should depend on the fertility level of the field, lodging resistance of the variety, and the architecture of the variety to be planted. Varieties susceptible to lodging or having a strong tendency to branch may perform better at lower populations. Also, the penalty for over-planting or under-planting non-branching varieties, may be more severe than those that tend to branch profusely at low populations. The branching variety will be able to compensate for a thin stand.

Table 1 indicates a general increase in plant population as you decrease row spacing. This can be done because

Table 1. Suggested plant populations and seeding rates for soybean planted in Oklahoma.

Row width (in)	*Feet of row per acre*	*Plants per foot of row*	*Plant Population per acre*	*Seed per foot of row**		
				*90%***	*80%*	*70%*
40	13,068	8.0	104,544	10.0	11.1	12.7
36	14,520	7.0	101,540	8.6	9.7	11.1
30	17,424	6.0	104,544	7.4	8.3	9.5
20	26,136	4.0	104,544	4.9	5.6	8.3
15	34,848	3.8	130,680	4.6	5.2	6.0
12	43,560	3.0	130,680	3.7	4.2	4.8
10	52,272	2.8	143,748	3.4	3.8	4.4
7	74,674	2.0	149,348	2.5	2.9	3.2
6	87,120	1.8	152,460	2.2	2.5	2.8

*Assuming 90% field emergence of the live seed.

**Germination percentage indicated on the bag.

Figure 2. Row spacing is one of many decisions that need to be made before planting.

plant-to-plant spacing is still similar even though you increase population. The plant still has that 7 to 9 inches of area to utilize.

Research in Oklahoma has not shown consistent yield response with row spacing less than 30 inches. In the cornbelt, a consistent response has been observed with narrow rows. In theory, the advantage of narrow rows over wide rows will be greater when early maturing varieties are planted very early or when the planting date for medium maturing varieties is delayed beyond June 15. In the case of double-cropping soybean, if planting is delayed after June 15, it would be recommended to reduce row width to less than 30 inches.

Planting Depth and Date

Soybean seed should be planted 1 to 1 ½ inches deep. This varies with the type of soil and existing moisture conditions. Soybean should be planted shallower in clay loams and other fine textured soils as compared to sandy soils. A 2 inches planting depth is the maximum on sandy soils. Planting should occur as soon as wheat harvest is complete. Planting can occur until July 10, but a slight to moderate reduction in yield can be expected by planting in early July. Planting date is important to maintain high yield potential.

Fertility

Fertilizing for the soybean crop at the same time you fertilize for your wheat crop is more practical than trying to make an additional application after wheat harvest. Time will be saved at a critical period. The higher fertility level may also benefit the wheat. If the soybean double-crop cannot be planted, the extra phosphorus and potassium applied will remain in the soil to benefit subsequent crops. In high yield conditions, 50+ per bushel, an application of 10 to 20 lbs nitrogen (N) applied post flowering, has been shown to increase yield. In high yielding conditions, the *Rhizobium* bacteria are unable to provide enough N to reach maximum yields. However, a response to the additional N is not certain. Special care should be taken if a late season N application is made using UAN (28,30-0-0). The fertilizer should be applied in the evening as temperatures are dropping so that leaf burn is avoided. Determine the soil fertility status with a reliable soil test and base expected crop yield on past experience. Soil pH should be 5.8 or greater. Yield loss can be expected if soil pH is below 5.8.

Inoculant is critical to the success of the soybean crop. Nitrogen is typically not a concern with soybean production, since they are legumes to manufacture an adequate amount of nitrogen for their own needs. The plant supplies the bacteria with an environment and nutrients in which to survive and multiply. In turn, the bacteria convert atmospheric nitrogen into a form that can be used by the plant through a process called nitrogen fixation. In order for nitrogen fixation to occur. *Rhizobium* bacteria must be present in the soil. Sometimes soils contain and adequate amount of *Rhizobium* bacteria, however, it is a risk not worth taking. In most cases, application of an inoculant calculates to less than 2 percent of your production costs, so it is a wise investment. With proper seed inoculation using soybean-specific inoculants, you increase your chances of having good nodulation.

Inoculants can be applied to the seed (liquid), in a hopper-box mixture (powder), or directly into the ground (granular), with an in-furrow application. Liquid inoculants are currently the most popular. Powder inoculants should not be used if other sources of inoculants are available. Powder inoculants may not perform as well when compared with liquid and granular types, especially if an additive is not used to adhere the inoculum to the seed. Producers should consider the following when making inoculant choices:

1. The cost of inoculant per number of *Rhizobium* bacteria.
2. Consider how it will be applied and whether any preparation of the product is needed.
3. Compatibility with seed, fertilizer, and other chemical treatments. As a general rule of thumb, insecticides are more toxic than fungicides, which are more toxic than herbicides.

Extreme importance should be used when handling and storing inoculants, as it is a live bacteria! Inoculants should be stored in a cool (less than 90° F), dry area, and never exposed to sunlight. As with any other product, always read and follow label directions. Four to six weeks after planting, plants may be dug up and evaluated for nodulation.

Weed Control for Stubble Planted Soybeans

Planting soybeans into wheat stubble (no-till) requires special considerations for weed control. Since weed control by cultivation may not be possible after the crop has emerged, weeds must be controlled by herbicide applications. Emerged weeds must be killed with a herbicide before the soybean crop is planted. Good spray coverage is very important since control depends on herbicide contact with the foliage. To penetrate effectively and provide required foliage coverage in wheat stubble, a minimum of 15 gallons of water per acre and 20 to 30 psi of pressure should be used. Where vegetation is extremely dense, up to 40 gallons of water per acre may be required. Glyphosate will provide adequate pre-plant weed control in most situations.

Summary of Double Crop Soybean Cropping Systems

- Plant no-till into wheat stubble.
- Leave a standing stubble of 8 inches or greater.
- Chop and spread straw, do not windrow.
- If moisture is adequate, plant immediately after wheat harvest.
- Pay attention to proper adjustment and operation of the drill or planter.
- Apply burn-down herbicide before planting to destroy emerged vegetation. Start with a clean field.
- Be prepared to use post-emergence herbicides as needed.

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