Production Practices to Help Maximize Soybean Yields

Yield increases for soybeans have not kept pace with those of corn. Over the last 25 years, US average corn yields have increased by 1.5% per year while soybeans have only achieved a 1.1% per year gain. This may be in part to a lower level of management often applied to soybeans than to a corn crop. This article will examine agronomic practices to help increase soybean yields and profits, including variety selection, planting practices, soil fertility, crop rotation, weed control, use of inoculants and other practices.

Variety Selection for Top Yields

Right Product on the Right Acre: Matching soybean varieties to the specific requirements of individual fields is a core practice for maximizing soybean yields. Soil type, tillage system, drainage, geographic location, expected rainfall, potential diseases and other local factors must all be accounted for in choosing an appropriate variety. All varieties considered should have high yield potential, good standability and the ability to withstand environmental stresses. But in addition, resistance to specific races of SCN, resistance or field tolerance to Phytophthora root rot, other diseases, or iron deficiency chlorosis may be key to achieving high soybean yields in a particular field. Your local DuPont Pioneer sales rep can help you select the best soybean varieties for each field.

Newest Varieties: Soybean breeders at DuPont Pioneer make yield gains and agronomic improvements every year, using new genetic tools such as Accelerated Yield Technology (AYT) as well as marker-assisted selection. Sampling top new varieties each year and ramping these up to significant acreages can quickly have a significant impact on overall farm yields.

Planting Practices

Row Width: A review of soybean row spacing studies published within the past 10 years generally confirms previous results comparing 30-inch rows and drilled narrow rows. In five studies, drilled soybeans out-yielded 30-inch row soybeans by an average of 4.1 bu/acre. Six studies that compared 30-inch rows and 15-inch rows found similar results, with 15-inch rows holding a 3.6 bu/acre yield advantage. Yields were similar between 15-inch rows and drilled narrow-rows (Figure 1).

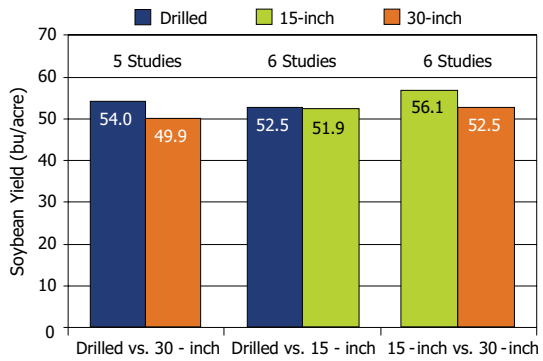

Figure 1. Average yield results from seven soybean row spacing studies published during the last ten years.

Planting Date: Soybean planting is trending earlier, particularly in operations with a planter dedicated to soybeans. DuPont Pioneer and university studies have shown that planting soybeans in the last half of April or first part of May often results in maximum grain yield potential. Early planting extends reproductive growth by initiating flowering earlier and prolonging the rate of reproductive development. This allows the crop to accumulate more nodes, increasing the potential for greater pod and seed number. In addition, recent studies indicate that full-season varieties respond better to early planting than short-season varieties. Today's fungicide + insecticide seed treatments have a proven role in early planting yield increases - helping protect seeds and seedlings from a myriad of stand-reducing soil borne diseases that otherwise could reduce stands and yields.

Seeding Rate: DuPont Pioneer research studies from 2006 to 2008 in 30-inch rows showed that optimum economic seeding rates for soybeans varied from 128,000 to 168,000 seeds/acre. Within this range, the appropriate rate depended on seed cost, grain price and whether a seed treatment was used. Fungicide/insecticide seed treatments were more effective than fungicide treatments alone in protecting stands and reducing seeding requirements. Growers should consider individual production practices and seedbed conditions when deciding on their seeding rate, including local soil type, residue levels, planting date, row width, etc. Though soybeans can adjust to lower stands, too much reliance on this ability can lead to poor stands and the need to replant in some situations.

Soil Fertility

K deficiency in soybeans.[1]

Phosphorus / Potassium: Some soybean producers depend on residual corn fertility to supply nutrients to their soybean crop. When soils are routinely maintained at high or very high levels of P and K, this may be a safe strategy, but when P and K are low, yield reductions are likely. A 60 bushels/acre soybean crop would remove about 48 lbs P2O5 and 84 lbs K2O from the soil in the grain. This is 33% less phosphorus but 55% more potassium than a 200 bu acre corn crop removes in the grain. Soil testing can determine if field levels are adequate to supply these or other required amounts.

Soil pH: Many chemical and biological processes in the soil are affected by pH, and maintaining pH in the proper range will maximize the efficiency of other crop inputs and decrease the risk of yield losses. Soybeans thrive in the pH range of 6.0 to 6.8 (in mineral soils). Liming acid soils or utilizing varieties with good iron deficiency chlorosis scores on high pH soils will help prevent yield reduction.

Nitrogen: Soybeans are high in protein and therefore in nitrogen, which removes about four lbs of N from the soil for each bushel of grain produced. This compares to less than a lb of N removed per bushel of corn grain produced. However, soybeans supply most of their own N needs by fixation of atmospheric N_2 into ammonium (NH_4+), a form that is readily available to the plant. Additional N is scavenged from the soil through organic

matter cycling and rainfall deposition to supply N needs not met by the nodulation process.

Research has shown that if ammonium or nitrate is available to be absorbed from the soil when nodules are present, N-fixation will decrease proportionally. For this reason, N fertilization in soybeans rarely results in agronomic or economic yield increases when nodulation is normal and is generally not recommended. However, research in some irrigated, high-yield environments has demonstrated that N applied during the pod or seed stages of soybean development may increase yield.

Foliar Fertilizer, Banding: In studies conducted in Iowa, foliar feeding increased yields only 15 to 20% of the time. However, it may be useful when soil nutrients are inadequately supplied, such as production on sandy soils or high-yielding irrigated fields. Studies in Iowa and Minnesota with banding fertilizer close to the row have not proven beneficial. Rather, stands were reduced and yields were not improved.

Crop Rotation

Crop rotation is important in all crops to break disease and insect cycles and increase yield. Diseases, such as soybean cyst nematode, white mold, brown stem rot and sudden death syndrome, survive in the soil or in crop residue and readily attack a successive soybean crop. Most soybean diseases survive more than one or two years in the soil, so rotation does not eliminate the problem. But time away from soybeans diminishes the amount of disease inoculum available to infect the next crop and thereby lessens its severity.

Rotation studies in Minnesota and Wisconsin showed that soybeans in a corn/soybean rotation yielded 8% more than continuous soybeans. These studies were conducted in good growing environments where moisture was not severely limiting. Soybeans following five years of continuous corn yielded 15 to 17% more than continuous soybeans.

Other Practices for Increasing Soybean Yields

Tillage has long been used to bury crop residue, prepare a seedbed and control weeds. Current planting equipment and herbicides now allow growers to achieve excellent soybean stand establishment and weed control with little or no tillage. No-till or reduced till practices can help minimize soil loss and increase organic matter levels that contribute to long-term productivity. Research studies have demonstrated that soybeans yields are similar across conventional till, minimum till and no-till. For this reason, growers can choose a tillage system that makes sense economically, environmentally and logistically and focus on optimizing other management practices within that tillage system.

Weed Control: If weeds compete with soybeans for moisture, light and nutrients during the critical development period from the second trifoliate stage to beginning flowering, yield may be reduced, even if weeds are ultimately controlled.

The development of more and more weed populations resistant to glyphosate makes the use of other herbicide modes of action an important component of a weed management system. Use of a pre-emergence herbicide followed by glyphosate is a system that allows for multiple active ingredients to be applied, while also controlling weeds earlier than glyphosate-only programs.

Soybean Inoculants: Newer inoculant products now offer several advantages over traditional (non-sterile, peat-based) products. New formulations deliver high populations of bacteria, on the order of 10 to 100 times more than traditional products. Use of sterile carriers prevents competition from other bacteria, and the ability to adhere to the seed has been improved. Also, newly available rhizobia strains have demonstrated improved nitrogen-fixing ability in some studies. "Extenders" prolong inoculant life when applied to seed long before planting or when a fungicide is also used.

In 2008, Pioneer studies in seven locations showed a 1.0 to 1.9 bu/acre advantage for inoculant products. In 41 DuPont Pioneer comparisons in the early 2000's, the average yield advantage for inoculants vs. un-inoculated seed was two bu/acre. University research has also demonstrated positive responses of about one to two bu/acre in general. These positive results should encourage growers to at least test new inoculant products. No-till soybeans planted in high crop residue with cooler, wetter soils may benefit most from new inoculant products.

Testing New Practices on Your Farm

Many growers may want to test various planting practices, seed treatments or inoculants, fertility options, or other factors prior to using them in full-scale production. Below are some tips for conducting your own treatment comparisons:

- Identify objectives: what do you want to measure and why?
- Design treatments to represent a single specific practice, and be careful to control other variables.
- Pick a uniform site to conduct the comparison, but do not always choose the most productive soil by default.
- Be sure the plot is large enough to identify small differences but not so large as to make weighing it difficult.
- Position comparisons in the field so all treatments have an equal chance. Replicate if possible.
- Measure yield, but also record other supporting observations.
- Do not depend solely on results from one location and one year. When possible, consider results over several years and locations.
- To compare two treatments across an entire field or field area, use the split-planter comparison tool of DuPont Pioneer. See your local Pioneer sales rep for details on this procedure.

[1] Photo of potassium deficiency in soybeans courtesy of Robert Mullen, Ohio State University.