NO-TILL FARMER

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Growing High-Yield No-Till Soybeans

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By Ed Winkle

Yield Booster Tips

By Ed Winkle, HyMark Consulting

When farmers worry about rising input prices like fertilizer, talk starts up about replacing corn acres with more soybeans in an effort to trim overall expenses. But how do you capture more yield with your soybeans?

Yield Booster #1 Soil

Soybeans grow best under good soil conditions, such as a highly fertile, medium textured loam soil, even though profitable soybeans can be produced on a wide range of soil types.

Heavier, fine-textured soils require good drainage to produce top yields.Sandy loam soils warm up faster, allowing soybean plants to emerge sooner and develop rapidly.

Soybeans planted in soils with above 7.8 pH with high salinity or high-lime soils may cause leaf yellowing due to iron chlorosis or other nutrient concerns. Some varieties of soybeans are more tolerant to high-lime soils. A lack of lime is a major concern in many fields east of the Mississippi, while too much lime is often a problem in areas west of the river.

Yield Booster #2 Rotations

Soybeans fits well in many crop rotations. Since soybeans are legumes, they are usually rotated with grass crops. However, some no-tillers have had good success growing continuous soybeans.

The key is to properly factor soybeans into your crop rotation and not go after an

immediate attempt to make sky-high profits. While many Midwestern growers rely on a rotation of 1 year of corn and 1 year of soybeans, a better bet in many areas might be a 5-year rotation that consists of 2 years corn, 2 years soybeans and 1 year wheat.

Yields of no-till wheat following soybeans are often higher than when wheat is seeded after other crops. Studies from soil fertility and from several states indicate that corn will yield better following soybeans than after corn. As a legume, soybeans provide a break in the biological cycle of various cereal diseases, accounting for part of the difference in yields.

Soybeans should follow corn, wheat, barley or other grass crops in a rotation to minimize disease carryover and fully utilize the nutrients available within the soil profile.

Soybeans should not follow alfalfa, dry edible beans, canola or sunflower where white mold disease (Sclerotinia sclerotiorum) has been detected. White mold uses soybean as a host, which allows the

organism to carryover to other susceptible crops.

Yield Booster #3 Seed Selection

Variety selection should be based on maturity, yield, lodging and disease reaction. The comparative maturity and yield of soybean varieties can be obtained from yield trials compiled by universities, companies and crop consultants.

Characteristics that address your specific disease problems are extremely important in variety selection. Choosing high-performing varieties adapted for your management style and region will have a major impact on both yield and profitability.

Since soybeans respond to day length, the actual calendar date is highly influenced by latitude location. As a result, each variety has a narrower range of north to south adaptation, sometimes less than 100 miles. Yield and quality are affected dramatically when a season-ending freeze occurs before a variety reaches physiological maturity.

Dates of maturity as listed in yield performance tables indicate when the plants within a particular variety are observed and estimated to be physiologically mature. Harvest should commence 7 to 14 days after your soybeans are physiological mature.

Relative maturity ratings are provided for many varieties entered in trials at various locations. These ratings consist of a number for the maturity group designation, such as 000, 00, 0 or 1. This is followed by a decimal and another number, ranging from .0 to .9, which indicates maturity rankings within each maturity group.

Early no-till seeding and glyphosateresistant varieties have actually increased the length of maturity for many varieties.

Soybean lodging characteristics are an important consideration when growing conditions favor high yields. Lodging reduces yield and often creates serious harvesting problems. When higher yields are obtained with irrigation, lodging becomes a major consideration along with variety selection, water management and planting density.

Major soybean disease concerns in the Corn Belt include pythium, phytophthora, stem canker and brown stem rot. While crop rotation is important to prevent these diseases, plant breeders continue to develop resistant varieties and information on control strategies as disease pressure increases.

Yield Booster #4 Seed Quality

Seed producers should handle each seed like eggs from the day it is planted until the day the crop is

delivered to the grower. Seed damage not only reduces germination, but also opens it up to pythium, fusarium, phytopthora, rhizoctonia and other diseases.

Selection and use of high-quality seed, as well as matching the disease package genetics to your location, are basic keys to optimizing soybean yields. Any amount of stress development can reduce seed size, increase seed injury and lower germination.

Mechanical seed damage is the greatest single cause of poor soybean germination and low seedling vigor. Damage can occur at any point during harvesting, handling or seed processing. The smallest amount of mechanical damage occurs at 12% to 14% moisture.

Severe bruising and broken seed coats may occur. Harvesting at low moisture content (8% to 10%) following intermittent wet and dry periods will often increase seedcoat cracking.

The impact of soybean seed size on germination potential, early seedling vigor and crop yield is not always predictable. Seed of fairly uniform size with few very

small or extremely large seeds can reduce problems with precision planting.

Select soybean seed that is free of disease, seed-coat cracking and splits. Use seed produced only during the previous crop year, as 2-year-old seed usually has lower germination and reduced seedling vigor.

"Good soybean nodulation often will not occur in fields that are under extremely dry conditions…"

Seedling vigor declines when soybean seed deterioration occurs, the ability to establish a uniform stand declines and germination is reduced. When the soybean germination percentage is low, the seed lot should be discarded due to the potential for lower seedling vigor and reduced yield.

Yield Booster #5 Seed Treatment

Treating soybean seed under many conditions with a fungicide, or a fungicide plus an insecticide, often does not increase yields when high-quality seed is planted. However, seed treatment definitely is a benefit for conditions where seed is damaged by disease, frost, excessive seedcoat breakage, age or in fields where soybeans are planted 2 or more years in a row. Seed lots that do not meet certification standards should not be used.

Many seed companies routinely treat soybean seed with fungicides prior to bagging. Farmers planning to treat seed themselves should always follow the fungicide and insecticide label directions for the proper rates and methods of treatment. Some fungicides used with inoculums require that the soybeans be

planted within 24 hours.

Yield Booster #6 Inoculation

Soybeans that are properly nodulated have the ability to fix nitrogen from the atmosphere. Nodulation requires the inoc- lation of the seed prior to planting with certain species of rhizobium bacteria. The inoculation of seed for planting in fields having a prior soybean history is suggested with the new strains of bacteria.

The inoculation of wheat the year prior to planting soybeans in fields where they have never been grown can also help prepare fields for soybeans. This has been demonstrated with limited research.

Several types of inoculums are currently available for soybean seed treatment.Among the oldest and most common are peat-based materials. Peat is a good carrier for soybean inoculums, but does not adhere to the seed as well as some other materials.

For best results, peat-based materials should be applied as a slurry and mixed with the seed, particularly on ground where soybeans have not been previously grown.

If peat-based inoculums are used, the slurry should be made with carriers like sugar water or skim milk. The slurry inoculum carrier should be thoroughly mixed with the seed as close as possible to planting to greatly increase the number of rhizobiums that stick to each seed.

While clay-based materials can be applied dry and readily stick to the seed, they become sticky when wet and can plug your planter. Seedboxes should be emptied and cleaned each night if claybased inoculation products are used.

Granular inoculation materials can be applied separately from the seed through the granular insecticide hopper on your planter. While granular materials are more expensive, they're usually very effective and recommended for new soybean ground.

Another dry formulation is talc-graphite based. It can be useful in increasing seed placement accuracy and flowability, particularly when over-treating fungicideinsecticide treated seed that sometimes leaves a rough or chalky seed coat.

Liquid inoculants are a convenient formulation for growers handling bulk soybeans. A relatively simple pump and spray system can be used to apply inoculants as your no-till planter or drill is filled with seed via bulk conveyors.

Important factors that affect nodulation are the viability of the inoculums, amount of rhizobium on the seed and soil nitrate level. The viability of soybean inoculums depends on storage time and storage conditions.

Check the inoculum expiration date and refrigerate or store these products in a cool place. Since the inoculum can be easily killed by direct sunlight, avoid exposure of inoculated seed to sunlight or excessive heat.

Good nodulation usually will not occur in fields under extremely dry conditions or with high levels of residual soil nitrogen. While available soil nitrogen will normally be preferred for nodule formation, soybean seed planted in fields that are high in soil nitrate nitrogen should always be inoculated in order to provide a source of rhizobium for future crops.

Yield Booster #7 Seed Bed

Soybeans offer limited amounts of crop residue after harvest and often cause the soil to be sufficiently mellow so deep tillage is not necessary for seedbed preparation. However, reduced amounts of residues may predispose the soil to additional erosion.

Because of seed size and physiology, a soybean will need to have about 50% of its weight in the form of moisture to germinate. Soybeans should normally be seeded 1 to 1.5 inches deep.

These factors explain why the preparation of a firm, uniform seedbed is important for optimum stand establishment. Like other legumes, soybeans have difficulty emerging through compacted layers and surface crusts.

Yield Booster #8 Fertilizing

Soybeans yield best in highly fertile soils and make good use of carryover fertilizer. If a soil test or response in other crops indicates low phosphate availability, an at-planting band application of 10 to 30 pounds per acre of phosphate may be beneficial. However, most researchers suggest building phosphorous levels with the crop grown prior to soybeans.

Over time, sample the soils in bean fields so you can see the nutrient intake,

what nutrients are out of balance and what micronutrients are missing. You can take soil samples at flowering, after harvest or anytime. But the important thing is to get your soil sampling on a schedule and to select a testing laboratory with which you have confidence.

In addition, pull plant tissue samples every summer. The goal is to have every needed nutrient at a high level for producing top yields.

Fields with no prior soybean history may benefit from additional nitrogen if soil test results indicate there's less than 60 pounds per acre available in the top 24 inches. High nitrogen fertility circumvents the benefits of rhizobium bacteria, as the bacteria will not convert atmospheric nitrogen when soil nitrogen is

readily available to the plant.

Soybeans without nodules or with ineffective nodules definitely respond to nitrogen. Since legumes have the ability to fix nitrogen, inoculating soybean seed is important, especially with fields that have not recently been planted to soybeans. Crop response to phosphorus and potassium are not always noticeable during the year of application.

Approximately 60% of the phosphorus and 50% of the potassium taken up by soybean plants is removed at harvest. A bushel of soybeans contains about 0.75 pounds of phosphorus and over 1 pound of potassium.

Put at least some fertilizer down early. Most growers should apply potassium in the fall. You can anticipate that it will take more than 3 years to break down all of the applied potash.

Starter fertilizer should be placed in a band 2 inches to the side and 2 inches below the seed. Pop-up fertilizer should not be used, as salt injury can result from direct contact of the fertilizer with the seed. This may reduce your soybean plant stands.

"When soybean plants and pods are tough, your combine's cylinder speed may need to be increased…"

Look at the possibility of using calcium nitrate fertilizer and sulfur. Consider broadcasting or banding high-calcium pelletized lime. Don't be afraid to think outside the box when it comes to meeting the nutrient needs for top soybean yields.

Micronutrient deficiencies in soybeans can be a problem with high pH soils. Iron chlorosis generally occurs with high-lime soils and is the most commonly reported

trace element concern. The typical iron deficiency (chlorosis) symptom is yellow leaves with green veins.

Suggested foliar treatments to correct iron deficiency include:

- 20 pounds per acre of ferrous sulfate mixed with 100 gallons of water and applied at a rate of 10 to 20 gallons per acre.
- 0.10 to 0.15 per acre of iron as iron chelate that is applied in a water carrier at the second trifoliate leaf stage.

These treatments will usually eliminate iron deficiency symptoms, but may not result in a profitable yield increase. Selecting varieties tolerant of high-lime soils can counteract iron chlorosis.

Since the response to fertilizing soybeans has varied considerably, your own on-farm experience is the best guide. Remember, foliar fertilization is usually not a substitute for a good soil-fertility program of

soilapplied fertilizers and micronutrients.

Yield Booster #9 Seeding

As with most crops, soybeans are susceptible to frost and prolonged exposure to near freezing conditions in both spring and fall. No-till soybeans after the soil has reached 50 F and air temperatures are favorable.

Seeding generally should not take place more than 5 days prior to the average last killing spring frost. This provides less than a 50% chance of a spring frost killing your soybeans.

Your planting dates may well be a barrier to producing high bean yields. The key is to match maturity to sunlight and moisture, as soybeans are more sensitive to these factors than corn.

Seeding in cool, wet conditions with the right no-till rig is preferable to planting in hard ground. Emergence will be delayed with hard ground and the soybean roots don't have the chance to develop properly.

Early planting dates with a low risk of frost injury are favorable for higher yields, but you run the risk of low germination, increased incidence of seedling diseases and poor stands.

No-till your soybeans as early as the spring frost date allows in order to take full advantage of the entire growing season and produce maximum yields. Earlier seeding allows the use of full-season varieties, which typically yield more than shorter-season varieties.

Most research studies indicate late plantings result in lower yields, poorer seed quality, lower oil content, shorter plant height and pods set closer to the ground compared to optimum planting dates. However, some early-maturing varieties have produced acceptable yields when weather factors like hail, late spring frost and floods require very late planting or replanting.

No-tilling soybeans into corn stalks or a killed cover crop is the most common method used today. A pre-emergence burndown with a residual chemical usually results in improved weed control.

Seeding can be done with a row-crop planter, air planters, grain drills and air seeders. However, the seed-metering system of many no-till grain drills must be adjusted carefully to avoid seed damage. Plant 1 to 1.5 inches deep into moist soil. Planting deeper than 2 inches or in a soil that crusts may lead to poor emergence.

With some no-till drills, the seeding mechanics are antiquated, and some of the older drills do a better job than some of the newer models. While belt meters and seedbox treatments work well, the two normally don't get along together.

To reduce seed damage, replace the steel drill flutes with plastic. But this often requires a complete rebuilding of the seedboxes on an existing drill.

Yield Booster #10 Seeding Rates

An ending plant population of 120,000 to 125,000 plants per acre is desirable regardless of which row spacing is used. However, top yields have been harvested with anywhere from 80,000 to 120,000 plants per acre.

Medium-sized soybeans contain about 2,800 seeds per pound. A bushel of soybeans will produce about 150,000 plants per acre, assuming 90% germination. This seeding rate would leave you with plants that are spaced about 1.5 inches apart with a 30-inch row spacing.

Seeds per pound range from 2,200 to 3,600. Seeding rates should be based on the number of viable seeds planted per foot of row.

High seeding rates may result in reduced yields in low rainfall years due to drought stress. In good rainfall years, high populations may increase lodging. While low plant populations can reduce lodging, they contribute to low pod set and excessive branching.

Extremely low seed numbers per foot of row may result in erratic stands due to a lack of needed seedling energy to help the plant break the soil surface. This may be critical in solid-seeded stands with soils prone to crusting.

If planting in narrow rows or solidseeding, soybean seeding rates can be adjusted upward. Recommendations call for seeding rates of 175,000 seeds per acre in a 12- to 15-inch row spacing, and 200,000 seeds per acre when solid-seeding in a 6- to 8-inch row.

Ten years of row spacing data from Beck's Hybrids in Atlanta, Ind., indicate that wider row widths can yield as well as narrower row widths. This data documents an average yield of 60.5 bushels in 7.5-inch rows, 62.1 bushels in 15-inch rows and 60.4 bushels per acre in 30-inch rows.

Some 60% of soybeans are seeded in row spacings of 15 inches or less. Many farmers prefer seeding with no-till planters rather than no-till drills to allow for more accurate plant spacing, proper seeding depth control and reduced seed cost. Where dry conditions in August are a concern, narrow rows may increase the amount of moisture loss from transpiration.

The use of 30-inch rows, or possibly using skip-row technology, may be beneficial in drier regions. This may allow growers to increase the plant population within the row, thus lifting pod height on soybeans. This can help overcome the concern that reduced plant populations in drier regions may lower pod heights.

The advantages for narrow-row and solidseeded soybeans generally are increased yield, reduced erosion, increased harvesting efficiency, early crop canopy closure to help control weeds and the convenience of using existing small grain equipment for seeding and harvesting.

The primary disadvantages of solidseeded soybeans are increased potential for weed and disease

problems, seedling emergence problems with easily crusted soils and increased herbicide costs.

Close-drilled or solid-seeded soybeans will produce satisfactory yields only if the land is relatively free of weeds, has good fertility and adequate soil moisture during pod-filling.

Yield Booster #11 Rollers

The primary purpose of rolling soybean ground is to push rocks down into the soil surface and level the soil so a lower cutter bar height can be used at harvest. This will reduce harvest losses by cutting soybean stems below the pods instead of cutting above or through low pods.

Rolling a field before soybeans have emerged can lead to improved seed-to-soil contact and reduce the potential for plant injury. Disadvantages are increased potential for soil surface crusting and soil erosion.

However, rolling fields after the crop has emerged can lead to cracked or broken stems. Soybean plants will die if the stem is broken below the cotyledon leaves, due to the loss of all growing points. Injured plants may be more susceptible to lodging and disease.

Limited university research and farmer testimonials indicate rolling between the cotyledon and first trifoliate stages of soybean may limit the injury potential. Try to roll fields during the warmest part of the day on less-turgid plants to minimize injury potential. If you roll soybeans, increase seeding rates by 5%.

Yield Booster #12 Weed Control

No-till soybeans are a poor competitor with weeds since cool soil temperatures lead to slow germination and reduce early season growth. However, soybeans are good competitors in warmer soils due to rapid seed germination and seedling growth.

Control of early weeds is among the most critical components of a profitable soybean production system. Weed control during the first 2 to 4 weeks of the growing season is essential to maximize yield. It's much easier to accomplish this with no-till than with more intensive tillage systems.

Good cultural practices, such as thorough seedbed preparation, adequate soil fertility, choice of a well-adapted variety and the use of good-quality, high germination seed that is free of weed seeds, all lead to a healthy soybean crop that can compete effectively.

Many effective herbicides are available for weed control in soybeans and most are labeled for tankmixing with other herbicides for broad-spectrum weed control. An economical weed-control program involves several critical strategies:

- Identify weed species present as seedlings, older plants or potential weeds based on previous infestation problems.

- Evaluate soil type, texture and organicmatter content of each field in determining proper rates for soil-applied herbicides.
- Inspect, adjust and calibrate your sprayers or banding equipment to ensure accurate herbicide application and even distribution.
- Read and follow the product label carefully when using herbicides. Soybeans are especially susceptible to injury from 2,4-D, MCPA, dicamba, curtail and picloram (Tordon). Avoid nonlabeled herbicide drift into soybean fields.

Your last weed-control pass should be done at or just before your soybeans flower, which is too early for applying most fungicides. Most researchers believe the best time to apply fungicides is at the R2 stage of growth.

Shifts in weed species or increased weed populations have been known to occur with continued planting of the same crop. By planting 2 years of soybeans and applying the same herbicide or using the same cultural practices in both years, you help speed the weed-selection process.

Yield Booster #13 Diseases

While white mold has been observed in solid-seeded fields of soybean, the problem has seldom been reported in 30-inch or wider rows. When soybeans are planted on white mold-infected land, planting in 30-inch or wider rows is recommended.

Wider rows offer increased air movement and reduce the chance that the disease will reach an economically damaging level. The risk of yield loss from white mold is also greater with soybean varieties that are susceptible to lodging.

Major concerns with soybeans following soybeans are disease problems, weed species shifts and an increased potential for soil erosion. Cover crops are recommended for soybeans following soybeans. Annual ryegrass and cereal rye work well when managed properly.

Three of the most worrisome pest problems are white mold, brown stem rot and soybean cyst nematodes (SCN). These concerns are often greater with soybeans grown after soybeans.

White mold and SCN persist in the soil. Brown stem rot (fusarium) overwinters and can live as a saprophyte on soybean residue.

A few other organisms that survive the winter on residue include those causing bacterial blight, bacterial pustule, anthracnose, stem canker, pod and stem blight and brown spot.

Soybeans following soybeans promote the growth of these organisms as first-year soybeans allow reproduction and buildup of disease inoculums and nematode populations.

As a result, the second year of soybeans is planted into elevated disease or high nematode levels. However, if the secondyear growing season is dry, disease incidence could be reduced.

Yield Booster #14 Soybean Cyst Nematodes

Soybean cyst nematodes have been studied in North America since their introduction from Asian-sourced seed discovered in North Carolina in 1954. Much time and money has been allocated to research, resulting in better varieties, treatment recommendations and a keener understanding of the pest.

A split soil test is recommended for egg counts of the nematode, which feeds on host plants. The lab will recommend that you consider abandoning soybean planting (10,000 eggs per 100 cc of soil) or select resistant varieties for reduced populations. An Internet search will give detailed background on SCN, which is a major soybean pest that costs growers billions of dollars in yield losses.

Control of host weeds, such as henbit or purple dead nettle, is important. Research by Mike Brown at Southern Illinois University suggests that annual ryegrass cover crops can cause the eggs to hatch prematurely, greatly reducing nematode populations.

Yield Booster #15 Soybean Aphids

Soybean aphids are small (approximately 1/16 inch long) soft-bodied insects that may be winged or wingless. Nymphs can be much smaller than adults. The soybean aphid is light yellow in color with black cornicles called "tailpipes." Winged adults will have a black head and thorax.

Buckthorn (Rhamnus spp.) is the only known overwintering host. Aphid eggs are winter hardy and can survive extended periods of cold temperatures.

Soybean aphids hatch in the spring and are expected to produce two or three generations of wingless females before a winged generation leaves the overwintering host to feed on soybean plants.

Aphids suck sap from soybean plants. When aphid infestations are large, infested leaves tend to wilt or curl. Other symptoms of direct feeding damage may include plant stunting, reduced pod numbers, lower seed counts, puckering and a yellowing of leaves.

The aphids excrete honeydew, a sweet substance that accumulates on surfaces of lower leaves and promotes the growth of sooty mold.

As the soybean plant growing point slows, aphids reduce their reproductive rate, move down to the middle or lower part of the plant and feed on the undersides of leaves, stems and pods. Toward the end of the growing season, the colonies rapidly increase in number and migrate back to buckthorn.

Soybean aphids are capable of transmitting viruses during the feeding process. Several important viruses

include alfalfa mosaic, soybean mosaic and bean yellow mosaic.

Symptoms are frequently associated with specific fields. General symptoms of soybean viruses include plant stunting, leaf distortion, leaf mottling, reduced pod

numbers and seed discoloration. Infected seed is the most important means for introducing soybean mosaic virus into a field.

Check these guidelines for evaluating soybean aphid treatment:

• Begin scouting soybean fields at the V3 to V4 plant stage to determine if aphids are present. No treatment is recommended at this time and is actually discouraged so insecticides do not reduce the presence of predators and parasites.

• The critical time for making treatment decisions based on population levels appears to occur during the late vegetative to early reproductive (Vn to R2 growth stages). Data from many states indicate the best results from treatment occur from mid-July to early August.

Treatment to manage soybean aphids is recommended at early flowering (R1 to R2) when aphids are abundant on most plants (spray when aphids number 25 or more per sampled leaf).

University of Wisconsin research trials found a population of 200 aphids per plant during the susceptible growth stages (R2 to R4) resulted in a yield loss of about 6 bushels per acre.

Yield Booster #16 Scouting

Doing your own crop scouting or hiring a consultant to do this task is extremely valuable in making sure your soybean plan results in top yields. Besides taking steps to protect this year's crop, scouting is also valuable in planning next year's crop.

Yield Booster #17 Roots

Make sure that you dig up some bean plants during the season and analyze them. Study the roots, nodules and soil aggregation compared with other fields in the area. Don't be afraid to show these plants to others and get another opinion.

Another good idea is to occasionally dig a root pit and examine the soil profile to at least a depth of 2 feet.

Yield Booster #18 Harvesting

Soybeans are easy to thresh, but the challenge is to get all the soybeans into storage. Straight combining is the most satisfactory and commonly used method of harvest, as swathing can result in field losses of up to 25% due to shattering.

Floating headers, pickup reels, love bars and row-crop headers are helpful in reducing harvest losses.

Be sure all knife sections and ledger plates are sharp, and that wear plates, hold-down clips and guards are properly adjusted. Proper reel speed in relation to ground speed will reduce gathering losses. Ideal reel speed is 25% faster than your ground speed.

Keep the cutter bar as close to the ground as possible at all times and harvest at a speed that is below 3 mph. Slow down when the soybean stubble is high, ragged or if separating losses are high. Leaving four beans or up to two pods per square foot represents a yield loss of 1 bushel per acre.

Harvest when mature plants contain 14% moisture. Harvest may be started at 17% to 18% when air drying is available. However, harvest as much of the crop as possible above 12% moisture to avoid cracking and splitting.

When soybeans are extremely dry, (8% to 10% moisture), harvesting will cause more shattering and seed injury. Under extremely dry conditions, combine during morning or evening hours when the relative humidity is higher. Adjust the cylinder concave clearance according to the operator's manual.

When soybean plants and pods are tough, cylinder speed may need to be increased. Decrease cylinder speed as soybeans dry during the middle of the day to reduce breakage.

Herbicides can be applied as a desiccant to aid harvesting if green weed growth delays harvest. Do not apply a desiccant until soybean moisture is under 30% and 65% of the seed pods have reached a mature brown color.

Make sure all residues are spread evenly. The long-term impact of residue is permanent soil change that affects the amount of humus, microbes, soil temperature, moisture, oxygen, pests and weed-seed patterns.

Take extensive notes during harvest and pay close attention to yield-monitor changes in different areas of each field. Spend the winter months going over precision ag maps. Use this data to build a multiyear plan with the goal of raising soybean yields.

Yield Booster #19 Storage

Soybeans may be stored safely for short periods during cold weather with moisture content as high as 14%. For safe storage during spring or summer, soybeans should not contain more than 12% moisture.

An air screen cleaner to remove foreign material, weed seeds and fines should be used before applying air and heat to soybean. Beans free of foreign material and splits store better and remain in good condition longer.

The maximum drying temperature for soybeans is 140 F. When soybeans will be used for seed, temperature should not exceed 105 F. When drying soybeans, it's unlikely you will need to remove more than 2% or 3% moisture.

Why Soybean Variety Selection is So Critical

By James H. Herbek and Morris J. Bitzer, University of Kentucky agronomists

While selecting the right soybean variety is only of one many decisions a grower must make, it's among the most important. Soybean varieties differ greatly, not only in yield potential, but also in many other characteristics.

Using adapted varieties with the best combination of desirable characteristics for your particular situation will maximize returns.

Maturity

Unlike other crops, such as corn where time of maturity largely depends on temperature, soybean maturity is largely controlled by day length. A soybean plant is photoperiod sensitive, which means it makes the transition from the vegetative to the reproductive phase of growth in response to change in day length. However, the key to the start of flowering is actually the length of darkness.

Each soybean variety depends on a critical period of darkness to change from the vegetative to the reproductive stage. When this amount of night length is reached, the soybean will begin flowering regardless of how much vegetative growth it already has.

Since an early variety is sensitive to a shorter night, it requires fewer hours of darkness to initiate flowering than a later variety. A late variety requires longer hours of darkness to initiate flowering. Since this allows a longer period of vegetative growth, the plant matures later in the season.

For this reason, full-season soybean varieties should be favored over early varieties for late-season plantings. These varieties have more time for vegetative growth and grow taller, which results in the potential for better yields.

For comparisons of relative maturity, soybean varieties are divided into 10 maturity groups, which form narrow bands from north to south across the United States. These groups are ranked in succeeding order of maturity from the earliest (Group 00) to the latest maturity (Group VIII).

Earlier maturing varieties, which flower and mature under a relatively long day and shorter night length, are best adapted to the short-season conditions of the northern states.

Each succeeding group requires a slightly longer growing season, and is adapted to growing conditions further south, with Group VIII varieties requiring the longest growing season. As plant maturity groups move south, varieties within each group require slightly shorter days and longer nights to flower and mature.

Each variety is placed in the maturity group where it can utilize most of the growing season, yet mature safely before frost. However, the maturity zones for each group are relative as a variety can be grown outside its ideal zone and still provide suitable performance. Even so, the realistic limit on adaptability is only about 100 miles north or south.

When a variety is grown out of its area of adaptation, poor performance often results. When a variety adapted to a southern latitude (shorter days and longer nights) is grown further north, the longer day lengths and cooler night temperatures cause it to remain growing vegetatively longer, resulting in an excessively tall plant. Since the start of flowering may be delayed, the plants may not mature before frost.

A soybean variety adapted to northern latitude, when grown further south under shorter day lengths and warmer night conditions, will cease vegetative growth earlier than normal. This results in smaller plants and reduced yields.

Varieties in the various maturity group classifications are also related to plant growth type. Most soybean varieties grown in the north are indeterminate growth types. With indeterminate varieties, flowering occurs earlier in the season and occurs simultaneously with vegetative growth for several weeks, which means that the vegetative and reproductive growth periods overlap each other.

Review Soybean Fertilization Basics

By James H. Herbek and Morris J. Bitzer, University of Kentucky agronomists

The only effective way to provide the necessary guidelines for meeting the fertility needs of your soils for soybeans is to combine soil test results with the past fertilizer management and cropping history.

Plant analysis may also be used to verify a suspected nutrient problem or evaluate a crop's nutrient status. While plant analysis is not a substitute for soil testing, it's most effective when used with a regular soil testing program.

Lime

Lime neutralizes soil acidity by correcting the soil pH. Proper soil pH is important and will affect almost all of the critical fertility factors included in growing soybeans.

A soil pH that is too high can reduce manganese and zinc availability. When the soil pH is too low, you may see problems with molybdenum deficiency, decreased phosphate availability and toxic levels of aluminum or manganese.

The desired pH level for soybeans is 6.2 to 6.8, which allows for some safety and assures that maximum production can be achieved. Soybeans respond very well to liming of acid soils, as the most frequent problem with soybean production is low soil pH.

Since the soybean plant is a legume, it requires proper soil pH for good nodulation, nitrogen fixation and plant growth. As the soil pH drops below 6.0, soybean yields will likely decrease, largely due to molybdenum deficiency and reduced nodulation and lower nitrogen fixation, Aluminum or manganese toxicity can be expected to be a problem when the pH drops below 5.5.

Since the quality of lime varies, know the effectiveness of each material to neutralize soil acidity so proper rates can be applied based on soil test results. The neutralizing value of lime is determined by both purity and fineness and is an estimate of the percentage of lime that will be available to neutralize soil acidity over a 4-year period.

Since lime takes 6 to 12 months to materially increase soil pH, apply it at least 6 months before planting soybeans. Fall applications are practical since they allow enough time for the lime in the soil to react before the next growing season.

For maximum benefits, thoroughly mix lime with the soil, especially when the soil pH is very low and large amounts of lime are needed. Although lime can't be mixed into the soil in no-till fields, surface applications are effective. But it takes longer before the lime will influence soil acidity.

Nitrogen

Soybeans require large amounts of nitrogen — roughly 4 pounds for each bushel of yield. Since soybeans are a legume, they can provide needed nitrogen fixing bacteria, which form nodules on the roots and can fix atmospheric nitrogen for the plant or from the uptake of soil-mineralized nitrogen.

Some research has shown that a yield response to applications of nitrogen fertilizer is unlikely when soils are maintained at the proper pH and the soybeans are well nodulated. Consequently, nitrogen applications are often not recommended for well-nodulated soybeans. In fact, adding nitrogen can sometimes reduce or deter the fixation of nitrogen in the nodules.

An application of nitrogen may be of value where:

- Poor nodulation has occurred because of poor inoculation.
- Acid soils exist where molybdenum is not used
- Other harsh soil environments exist that result in nitrogen deficiencies

Slow and small growth, small and pale green leaves, yellow color, old leaves and

early defoliation characterize nitrogen deficiency. Nitrogen deficiencies due to poor

nodulation can normally be overcome with a nitrogen application before early pod set.

Phosphorus

Consistent yield responses to phosphorus fertilization of soybeans have been generally limited to soils testing low in available phosphorus, even though each bushel of yield removes about 0.9 pounds of phosphorus.

With medium testing soils, responses to direct phosphorus fertilization have been inconsistent and normally quite small. Little or no yield response to phosphorus fertilization can be expected on soils testing medium-high to high in phosphorus. In general, the highest soybean yields have been obtained on soils with a medium to high soil test for this nutrient.

Phosphorus is considered an immobile element because it can react with the soil in ways that minimizes movement with soil water. However, the loss of phosphorus due to topsoil erosion can be a concern.

Liquids, fluid suspensions and dry sources of phosphorus are considered equally effective when properly applied at recommended rates. Material preference is primarily related to ease of handling and cost.

Phosphorus deficiencies are often difficult to recognize. They generally appear as thin, dwarfed stems, lackluster leaves and early defoliation. Leaves tend to be more erect and form an acute angle with the stem.

A limited supply of phosphorus reduces the number and efficiency of nodule bacteria, but correcting a phosphorus deficiency in the same crop year is difficult.

Potassium

Soybeans remove higher amounts of potassium in the grain (about 1.4 pounds of phosphorus per bushel) than most other crops. Average yield responses are very similar to those obtained for phosphorus under many other soil test levels.

Soybeans are likely to respond to potassium fertilization on soils testing very low or low in available potassium. Medium-testing soils provide infrequent, small responses to potassium. Soybeans are not likely to respond to direct application of potassium fertilizer on medium high to high testing soils.

Potassium is also considered to be an immobile element because it can react with soil fractions and be retained by the soil's cation exchange capacity. As a result, potassium leaching is of little importance except with very sandy soils. Several sources of potassium can be used, all equally effective.

Potassium deficiencies appear as stunted growth with shortened internodes. Leaf edges are generally curled downward (cupped) and the leaf margins show yellowing and browning, especially on the lower leaves. Correction based on soil testing as a preventive measure is the best policy.

"Banded fertilizer applications should be placed 2 inches to the side and 2 inches below soybean seed..."

Applying Phosphorus, Potassium For direct application of phosphorus and potassium with soybeans, broadcasting is most convenient and practical, especially with large amounts.

Soybeans do well on residual fertility available from previous crops if enough fertilizer is applied to also meet soybean plant needs. This practice is often used when double-cropping soybeans after small grains. The required amounts of phosphorus and potassium for both crops can be applied when wheat or barley is seeded in the fall.

Banded or row applications are suggested where small amounts are being used, as they are more efficient on low-testing soils. Rates for broadcasting on low-testing soils can normally be reduced by one-third with banding.

Since soybeans are particularly susceptible to fertilizer (salt) injury, avoid direct fertilizer contact with the seed. Banded applications should be placed 2 inches to the side and 2 inches below the seed. Do not place fertilizer with the seed or stand reduction may occur, especially under dry conditions.

No-till limits application mainly to surface broadcasting. Research indicates that fertilization is not a major obstacle in no-tillage and that surface applications of phosphorus and potassium have not reduced yields.

When soil tests are medium or higher, yields are comparable to more intensive tillage systems where fertilizer has been mixed with the soil. However, soils with low fertility levels should be raised to medium or high soil-test levels before no-tilling soybeans.

Micronutrients

Soils usually supply adequate secondary and minor elements for optimum soybean growth. While molybdenum and manganese deficiencies have been observed in some areas, this is normally due to improper soil pH.

Molybdenum

Symptoms of molybdenum deficiency are stunted plants with pale green or yellow leaves, which are also signs of a nitrogen shortage. These symptoms are caused by a lack of nitrogen rather than a lack of molybdenum in the leaves. The nitrogen-fixing bacteria in the soybean nodules require molybdenum.

Without adequate molybdenum, soybeans fail to produce nodules properly and show nitrogen deficiency symptoms.

The availability of soil molybdenum to plants is closely related to soil pH. As soil acidity increases and results in a lower soil pH, the availability of soil molybdenum decreases and deficiencies appear.

Since molybdenum deficiencies should not occur if soils are properly limed to a pH of 6.2 or higher, the best recommendation is to have a good liming program. However, when lime hasn't been or can't be applied far enough ahead of planting to raise the soil pH above 6.2 at seeding time, applying molybdenum is recommended.

An application of 1 to 2 ounces of sodium molybdate (0.4 to 0.8 ounces of elemental molybdenum) per acre as a seed treatment is satisfactory for applying molybdenum when no seed inoculants are needed.

If seeds are inoculated at the same time, they must be planted immediately or the bacteria's viability will be sharply reduced. A safer method when the seed is inoculated is to broadcast molybdenum by dissolving sodium molybdate in water and spraying it on the soil before seeding beans.

However, molybdenum should not be used as a substitute for a good liming program since proper soil pH has many other beneficial effects in addition to molybdenum availability. When the soil pH level is too low (under 5.5), molybdenum may not be effective. In many soybean fields, molybdenum should be considered as an emergency treatment until the soil pH can be adjusted with liming.

Maganese

A manganese deficiency with soybeans is characterized by interveinal chlorosis on the newer leaves even though the veins remain green. The severity of the deficiency can be determined from the interveinal leaf color as it varies from pale yellow to almost white.

In Kentucky, manganese deficiency has been mainly confined to medium and fine-textured soils with a soil pH of 6.5 or

higher. While high pH and poor drainage are contributing factors, treatments to reduce soil pH are not practical.

Foliar applications of manganese on deficient soybeans after symptoms have been recognized provided satisfactory results and are superior to soil applications at planting time. Foliar manganese spray is recommended as chelated manganese or a solution of manganese sulfate.

Manage Soybeans To Maximize No-Till Profits

By Darrell Bruggink, Managing Editor

Soybeans should not be a forgotten crop, not with market prices normally shooting all over the place during the crop marketing year. By paying a little more attention to managing no-till soybeans, you can really reap the rewards of a good crop, suggests a veteran crop consultant that works with many Midwestern growers.

Having worked with no-tilled soybeans for three decades, Mike Dailey of Mount Vernon, Ohio, outlines a number of things you can do to make your soybean production more profitable.

"No-till beans are a system, and you can't leave out partial steps and expect those beans to be profitable," Dailey says.

Seed Selection

There are several considerations, including whether you plant genetically modified soybeans or conventional, or even a food-grade, lowlinolenic variety. If soybean cyst nematodes, Phytophthora or brown stem rot are problems, choose varieties that offer protection.

Also, match tall beans to upland areas of fields, yet select shorter beans in lowland areas to avoid lodging. Select varieties for moisture levels. Tiled fields allow earlier planting versus saturated fields.

Protect Seed

"Seed treatments are economically sound every time," Dailey says. "I can't think of a time when they aren't sound."

For example, Ohio State University (OSU) research shows that growers are sacrificing 5 to 8 bushels per acre if not using a seed-applied fungicide.

Even if you see no evidence of disease, OSU research shows yield increases of 1.6 bushels per acre. Even that can net a return of two to three times the investment.

Cruiser seed-applied insecticide is a good choice to control grubs when rotating out of sod, but use a seed treatment to ward off wireworms, sandhill cutworms and first generation bean leaf beetle.

Inoculants Pay

The bacteria of most inoculants today are three to four times more potent than older versions.

"Inoculants are a must-have," Dailey says. "We put inoculant on seed coming out of the gravity bed into

the no-till planter, so it's fresh and alive in the planter."

Make sure to get inoculant once it arrives at your dealership and keep it cool, Dailey adds. You can expect a yield increase of 2 to 7 bushels per acre.

Sample at 2 Inches

Regularly soil sample at 6 to 8 inches, but sample at 2 inches occasionally. You'll find more phosphate and potash at that 2-inch level, Dailey says, and you can save money on fertilizer.

"We are often overfertilizing due to that 8-inch sample," he says. "In no-till, it's cooler and damper at the surface under residue and there is more root proliferation there. That stuff is highly available because that's the active part of your soil."

The pH should be 6.4-plus. If soil pH levels are below 6.0, you need to add molybdenum to aid in Rhizobium root nodulation. At ph levels of 7.0 or greater, iron and manganese availability may be problematic.

Minimum phosphorus and potassium levels should be 50 to 75 in a wheat rotation, but ideally 75 to 90 in a long-term rotation.

Control Weeds Early

"Seed treatments are economically sound everytime…"

Pre-plant control is critical, Dailey says, and he's increased yields 4 to 7 bushels per acre when weeds are gone before planting. Removing weeds allows for easier planting into warmer and crumbly soils, and helps avoid open slots or smeared sidewalls, Dailey adds.

Post applications of glyphosate should be completed by V4 stage on old-style Roundup Ready soybeans to avoid yield losses. Newer varieties can be sprayed up to pod formation.

"If you have tough annuals like marestail or giant ragweed, hit them early and hard to avoid resistance," Dailey says.

Plant Narrow

Narrow rows of 7.5 to 15 inches produce the highest yields and best weed suppression, Dailey says.

He suggests planting beans in thirds: one third early to avoid slugs and white mold; one-third at the premium time for yields; and another third later to avoid wet soils.

For 7.5-inch rows, Dailey recommends a seed spacing of 2.5 to 2.9 seeds per foot, equaling a population of 180,000 to 195,000 seeds. For 15-inch rows, go with 4.3 to 4.7 seeds per foot, or 150,000 to 165,000.

"You can cut back on populations, but you better not have slugs, pythium or phytophthora," Dailey says.

"Otherwise, you'll drop below ideal harvest levels of 115,000 to 135,000 plants in 7.5-inch rows."

In-Crop Pests

First-generation bean leaf beetles can bring a virus to soybeans. Scout and spray field edges for grasshoppers and Japanese beetles. Brown stinkbugs probe pods late in the season and cause diseases and rots. Soybean aphids must be sprayed once they reach 250 per plant, if populations are increasing.

Spread bait pellets to controls slugs. For a $14-per-acre investment, you can protect $33 in lost yield.

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