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Soybean variety selection

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One of the most perplexing production decisions a farmer faces is, "What variety should I plant?" You receive information on soybean varieties from mass media advertising, from friends or relatives, from seed dealers, from University and extension variety trials, and perhaps from your own strip trials. New varieties from both public and private organizations are abundant. Yields are increasing about one-third of a bushel per acre per year due to genetic improvement. While some new varieties show this response, other new varieties may not yield better than those you use now.

Given all this information and the new influx of varieties, how do you choose the best variety to grow? No one has yet developed a simple answer to this question, but it is the intent of this publication to present guidelines for choosing a variety for a given set of conditions.

Soybean varieties

Soybean varieties differ in growth type. **Determinate** varieties essentially complete their vegetative growth prior to flowering. The main stem ends in a large terminal pod cluster. These varieties are typically grown in southern Missouri (Group V and later-maturing varieties). **Indeterminate** varieties continue to increase in height for several weeks after they begin to flower. Height frequently doubles after the first flowers appear. These varieties are commonly grown in northern Missouri (Group IV and earlier-maturing varieties).

Soybeans flourish as they catch the sun's rays in fields throughout Missouri.

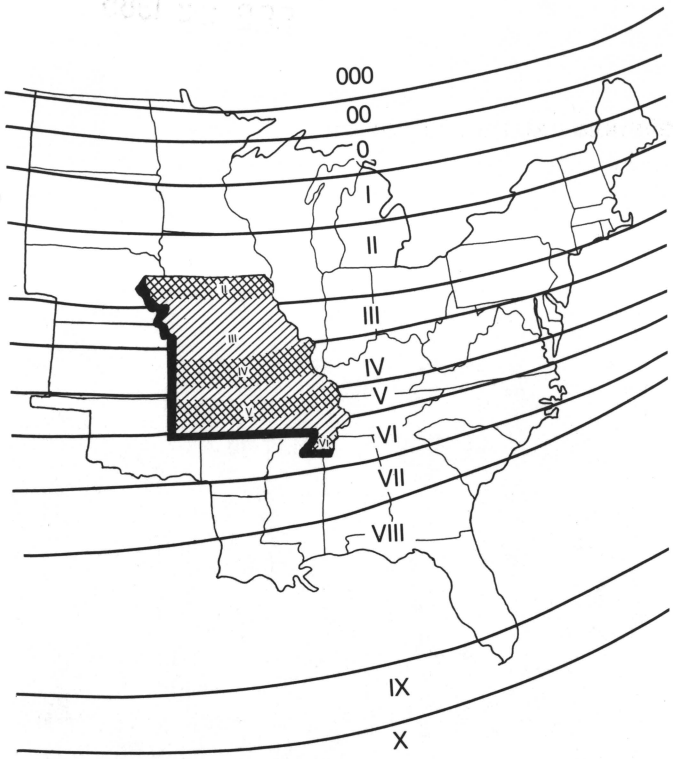


Figure 1. Soybean Maturity Zones

Two modifications are the determinate semi-dwarf and semi-determinate varieties. The determinate semi-dwarfs are true determinate varieties but are about half the height of normal varieties. Semi-determinate varieties are 6 to 10 inches shorter than common varieties and add only a small amount of vegetative growth after flowering and podding begin. Flowering periods of both types are slightly shorter than in commonly grown varieties. Determinate semi-dwarfs and semi-determinates are more lodging resistant than taller types and may yield more in high productivity environments (50+ bu/A). UMC Guide 4419 gives a more complete description of these varieties and recommended production practices for them.

Some varieties are pure line while others are a blend of two or more pure varieties. In general, blends perform no better than pure varieties. If a productive blend is used, seed should not be saved for a second year because the ratio of varieties in the blend is likely to change.

Evaluating varieties

Consider these five areas when evaluating varieties:

1. Yield,
2. Maturity,
3. Standibility,
4. Pest resistance,
5. Special considerations (crop use, shattering resistance, seed cost, and vigor).

Maturity

With the exception of yield, which reflects the total response of a variety to a set of growing conditions, maturity is the most important criterion in selecting a variety. If a variety is too early or too late at your location, it will be limited in potential performance.

Soybean varieties are classified into 13 maturity groups, from Group 000 grown in Canada to Group X grown in the tropics (see Figure 1). The earliest and latest varieties within a group may differ by as much as two weeks in maturity. Late Maturity Group II varieties (northern Missouri) to early Maturity Group VI varieties (Bootheel) are typically grown in Missouri.

Soybeans are photoperiod (number of hours of light) sensitive. When varieties are moved south of the area where they are typically grown, they mature faster than normal, resulting in seed fill occurring during the hot, dry period of July and August. When varieties are grown north of where they are adapted, maturity is delayed, resulting in seed fill during the cool, short days of fall. Frost before the crop reaches maturity is a distinct possibility.

Theories of risk, combined with known crop performance, suggest the latest variety used should be one that reaches physiological maturity just prior to the date when there is a 20 percent chance of a killing frost in the fall (see Figure 2). Yield performance will often tell us when a variety is too late or too early, since yields of these varieties will be lower than those of adapted varieties. Because of the potential for frost

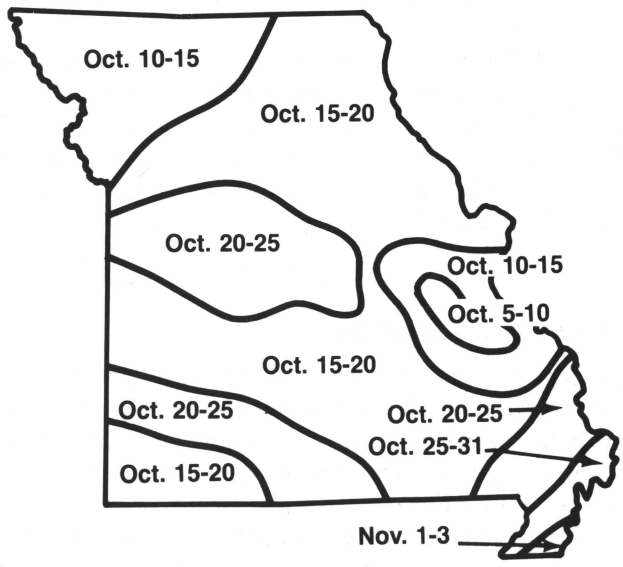


Figure 2. 20 percent probability of the first occurrence of a 28 degrees F in the fall.

and late harvest, circumstances will seldom dictate choosing a variety that will mature too late. However, the following situations may suggest the selection of shorter-season varieties: 1) If planting winter wheat is frequently delayed by harvest of full-season soybeans, you may wish to use early-maturing varieties for greater timeliness; 2) If planting is delayed until mid to late July, shorter-season varieties may be required; 3) If excessive lodging is a problem with full-season varieties, short-season varieties, which are normally more lodging resistant, may be used as a second choice to combat standibility problems on highly fertile and moist soils.

Temperatures also affect the maturity of varieties. For this reason, a farmer in southwest Missouri may need to use an earlier maturing variety than one at the same latitude in southeast Missouri because the elevation is higher, causing cooler temperatures.

Standibility

Both the genetic makeup of a variety and the environment in which it is grown can be responsible for standibility problems. Moist, fertile soils normally stimulate vegetative growth in soybeans and lead to tall lodging-prone plants. Certain varieties are inherently more susceptible to lodging than others. Consult University of Missouri yield trial results or other publications for information on the relative standibility of varieties. Use yield trials in which some lodging is present among most varieties, as opposed to trials in which there is no lodging. A scale of 1 to 5 is often used to denote lodging resistance, with 1 being the most resistant or upright and 5 indicating the soybeans are completely flat at harvest.

You can also use several management practices to reduce lodging. Reducing the seeding rate is a first step. Choosing slightly shorter-season varieties is sometimes helpful. Planting earlier or later than normal is often beneficial. Under high yielding environments (good moisture and fertility) where lodging is a problem even after all the above management practices have been initiated, using the new determinate semi-dwarf varieties may be indicated. These new varieties lodge very little in most situations. However, they require intensive management.

Pest resistance

Researchers are developing varieties resistant to diseases, nematodes, and nutrient problems, but few insect-resistant varieties have been developed. Resistance or tolerance has been bred into soybeans for phytophthora root rot, soybean cyst nematode, root knot nematode and some leaf diseases.

Phytophthora root rot is less serious in Missouri than in other states. But Missouri growers who have experienced plants dying throughout the season, especially on heavy, poorly drained soils, should have plant and soil samples analyzed at the Plant Diagnostic Clinic at the University of Missouri-Columbia. Many high yielding varieties with resistance or good field tolerance to the races of phytophthora found in Missouri are available from public and private sources.

Nematodes, particularly soybean cyst nematodes, have been a serious problem in southeastern Missouri, but are found in several other counties in the state. The University of Missouri's Delta Center Research Station near Portageville has provided leadership in developing varieties resistant to several races of the cyst nematode. Plant Diagnostic Laboratories at the Delta Center and at the University of Missouri-Columbia can determine whether a cyst nematode problem exists and what race is present. The laboratories will also give recommendations on variety selection, crop rotation, and other management practices to reduce the severity of this nematode problem. Consult UMC Guide 4450 for additional details.

County extension centers and reputable seed dealers generally have listings of disease-resistant varieties. First, determine, with their help, what the disease problem is. Then find varieties adaptable to your situation with resistance or tolerance to this disease. It is generally a good practice not to use disease resistant varieties unless a disease problem is actually present.

Special considerations

Other criteria, such as double cropping, crop use, varietal purity, shattering resistance, seed cost, and seed quality, are considerations in variety selection.

Few varieties perform differently when grown as a double crop instead of full season. Until better varieties are developed, good performing full-season varieties appear to be the best choice for double cropping.

Some yellow hila, large-seeded varieties are being grown for food purposes. Production for this market requires that only certain varieties be grown.

Shattering prior to harvest is sometimes a problem in a dry fall in western Missouri. Most new varieties have good shattering resistance.

Seed cost may influence choice of variety. If costs of two varieties differ, make sure there is enough potential yield difference to justify the extra expense. In most cases, a bushel or two of increased yield will cover any increase in seed cost. It is important, however, for you to shop around to find the best price on the highest quality seed of a given variety. Seed size also merits consideration. Small-seeded varieties do not require as many pounds of seed per acre, so they are worth more per bushel.

Yield

Although all the aforementioned criteria are important in variety selection, nothing is more satisfying (and most often more economical) than a high yield. Yield, after all, (and sometimes quality) is what production is all about. The University of Missouri tests more than 300 varieties at 11 different locations each year. Yield, lodging, maturity date, height, disease, nematode, and physical characteristics are published in a special report from the Agricultural Experiment Station and are available each January at county extension offices.

Because of soil and other variation among the plots, a value called an $LSD_{.05}$ is normally reported with the yields. The LSD (least significant difference) value is useful when comparing two varieties in the same trial. Even though two varieties have the same genetic potential for yield, they may have different yields due to slight differences in soil fertility, compaction, and other environmental factors. If the difference between two varieties is less than the LSD value, the difference between the varieties may be due to chance or minor environmental differences. However, if the difference between two varieties is greater than the LSD value, there is a 95 percent probability their performance abilities actually are different.

The methods used in rating the other characteristics of varieties in the trials are discussed in the performance report and should be read carefully before evaluating varieties.

With all this information, the question becomes, "How do I look through all the yield information available and make a wise decision?"

It is easy to look at the yield data, choose the highest-yielding variety, and stop looking. However, other characteristics should always be examined to determine whether that high-yielding variety has characteristics necessary to provide consistent and optimum yields. You may wish to choose a lower-yielding variety with other important characteristics. A variety may perform well in a disease-free environment. But if disease occurs often and the variety has no resistance, performance may be unsatisfactory. In such a case, a variety with resistance may be a better choice, even if it has a lower yield potential in a disease-free environment.

A variety has a genetic makeup that responds to different environments in unique ways. Disease resistance is just one reason for a potentially different response. In general, however, differences between varieties will vary with the yield potential of the environment. You may choose a variety that yields 60 bushels per acre in a high-yielding trial, but if, for example, you farm a droughty soil in southwestern Missouri, with no irrigation, this variety may not yield as much as one that yielded only 40 bushels in the same trial.

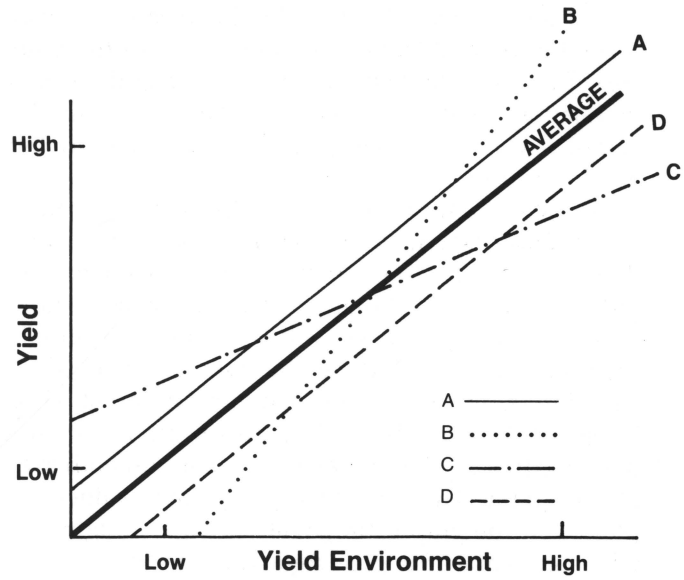


Figure 3. Variety type response to different yield environments. See text for descriptions of A, B, C, and D.

As varieties are planted in increasingly higher-yielding environments, they respond in four basic ways (see Figure 3). (Actually, there are many varied responses, but they all show some characteristics of one of the four types.) The following discussion pertains only to full-season soybeans with no serious pest problems. If the season is short or if pest problems exist, you must consider additional characteristics for the environments.

A variety we will call "A" always (or almost always) performs above average, no matter what the soil or weather conditions. Variety "B" is superior to "A" in a high-yielding environment, but is lower than average in a low-yielding environment. Variety "C" performs extremely well in low-yield situations but performs rather poorly in a high-yield situation. Finally, variety "D" always performs below average. This variety never stays on the market long unless it has a uniquely favorable characteristic that makes its production economically feasible.

Most Missouri farmers experience varying yields from year to year, and thus, a variety that performs like variety "A" would probably be the best choice. Farmers who have consistently high-yielding environments, possibly with irrigation, would probably favor varieties that perform like variety "B." Conversely, those growers on light-textured soils, with no irrigation, who frequently produce soybean yields less than 30 bushels per acre should be selecting varieties like "C." While this variety may not yield well in many trials, it would be a good performer in low-yield environments.

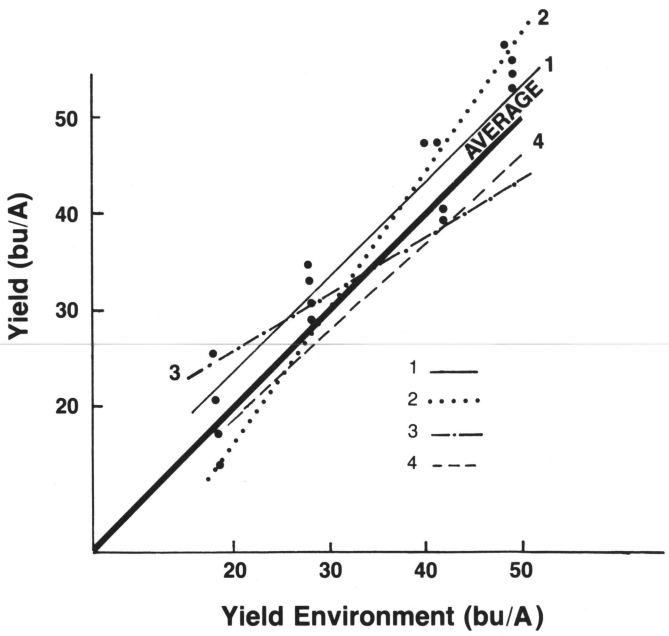
To evaluate varieties this way, accumulate as much performance information as possible.

Seek information on varieties adapted to your

local growing area. The data should be gathered over several years and from several locations within your area. By simply drawing a graph or listing the yields in relation to the average performance of all the varieties tested in a trial, you can readily identify the better performers.

To best illustrate this concept, we put together hypothetical information from two locations in two different years for four varieties within a large variety test (see Figure 4). While you should consider more years and locations, we will use this as a simple example. As indicated by the average yield of all varieties in the trials, we had four different yield levels: 20, 30, 40, 50 bu/A. To draw the graph with the data, we first mark these average values on both axes of the graph. Then, when these average values are plotted in the graph, they will fall on a straight line which goes at a 45 degree angle through the center of the graph. This line is labeled "average." We plot the yield data of each variety in each of the four environments. We then draw the best straight line through the four points for each variety to give a visual picture of the performance. In the example, variety 1 is like variety "A," variety 2 like "B," variety 3 like "C," and variety 4 like "D." The more data you can use and the wider range of environments variety trials are grown in, the better chance you have to determine just how a variety responds to certain environmental conditions.

The University of Missouri does not graphically display soybean varietal performance in its trial bulletins but does provide data from as many as 11 tests for many varieties. You can use this data to make calculations by hand or, if you have access to a computer, can use a regression analysis to make the calculations and graphs. Most University of Missouri extension offices in each county seat have a computer that can derive this information from an analysis of University trials.



Environment yield (location and year)

Variety	Location 1 Year 1	Location 2 Year 1	Location 1 Year 2	Location 2 Year 2
1	22	33	43	54
2	17	30	43	59
3	25	32	39	45
4	19	28	38	47
●	●	●	●	●
●	●	●	●	●
●	●	●	●	●
Average of all varieties	20	30	40	50

Figure 4. Table and graph of yields of four varieties tested in environments having different yield potentials.

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