Chapter 3

Variety Development, Testing and Selection

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Selecting soybean varieties for planting is perhaps the most important management decision a grower can make. With more than 100 soybean varieties available, selecting a few varieties to plant is challenging. A grower should consider many factors in making this extremely important decision.

The University of Arkansas provides a soybean variety testing program. The information obtained from this program is available to growers through an annual newsletter called *Soybean Update* and a computerized soybean variety selection program entitled *SOYVA*. Using this information will aid growers in selecting varieties adapted to each field.

Variety Development

The numerous varieties available to Arkansas growers come from publicly funded breeding programs in states throughout the South and from private companies. Arkansas growers are fortunate to have many private breeding programs represented in the state as well as two public breeding programs. These breeders strive for high-yielding lines and disease resistance with particular emphasis on resistance to stem canker, soybean cyst nematode and Phytophthora root rot. In addition, new breeding lines are also screened for tolerance to stress that is typical of Arkansas production environments.

Variety Testing

Each year the University of Arkansas Division of Agriculture conducts replicated variety field performance tests at locations representing the major production regions in the state. From each of these tests the following information is recorded:

- Yield
- Maturity date
- Lodging
- Shattering
- Plant height
- Ratings for naturally occurring diseases

Also, Division of Agriculture scientists conduct laboratory, greenhouse and field experiments to measure variety reaction to nematodes, diseases, excessive levels of soil chloride and tolerance to herbicides.

Variety performance tests, like all field experiments, are subject to uncontrollable variability. Variability may result from differences in soil texture, disease pressure or uneven soil moisture within the test area. For these reasons, variety tests are replicated three times. A test with three replications has each variety planted in three different plots within the test, and the information from the three plots is averaged.

Figure 3.1. Replicated University variety trials provide information on yield potential and enable screening for genetic differences in tolerances to diseases, herbicides and chloride.

Factors Affecting Variety Selection

There are many factors to consider when selecting soybean varieties for planting. These factors are discussed in the following section:

Maturity

Commercial production of soybeans in Arkansas uses maturity groups III through VII. For an efficient harvest, select varieties that mature over a suitable time period. Varieties with different maturity are more likely to spread out harvest than planting one variety at different times.

An earlier variety tends to be a better choice where a fall grain crop such as wheat will be planted or where fall land formation work will be conducted. However, many growers may not want a variety that matures before the completion of rice or corn harvest.

In dryland production, consider long-term weather patterns. Avoiding the brunt of late summer droughts in one of two ways is possible. First, an indeterminate maturity group (MG) III or IV variety can be planted early (April) to allow for pod fill before the drought. Second, a late-maturing variety (MG VI or VII) could use late summer rains to fill pods. The risk of poor growing conditions in any part of the season can be minimized by spreading out crop maturity with variety selection.

Table 3.1 shows the suggested percentage of acreage to plant within each maturity group for dryland and irrigated conditions. There is also benefit to planting varieties of differing maturity within a maturity group. For example, there is more maturity difference between varieties of a relative maturity of 5.1 and 5.9 than varieties with relative maturity ratings of 5.9 and 6.2.

Table 3.1. Recommended Planting Percentage of Specific Maturity Groups for Dryland and Irrigated Plantings in Different Regions of Arkansas

State Location	Suggested % of Acreage			
	Very Early[1] (III, IV)	Early (V)	Mid-Season (VI)	Late Mid-Season (VII)
Dryland Acres				
Northern 1/3	20	60	20	0
Central 1/3	20	50	30	0
Southern 1/3	20	30	30	20
Irrigated Acres				
Northern 1/3	35	50	15	0
Central 1/3	30	50	20	0
Southern 1/3	25	50	25	0

[1]Some MG III and IV varieties tend to shatter, so timely harvesting is very important. Seed from these varieties planted in Arkansas typically have low germination. The seed should not be kept for planting purposes unless tested for germination.

Lodging

Lodging can reduce yield and increase harvest loss. Excessive lodging before or during early soybean pod fill can reduce yields up to 30 percent. Lodging later in the season can reduce yields by reducing combining efficiency and slowing the speed of harvest. It tends to be more pronounced in rich, productive soils that produce a lot of plant growth. Lodging can be worse in dense populations. Plant varieties that tend to lodge at the lower end of the optimum seeding rate.

If lodging typically occurs in particular fields, select varieties that resist lodging and monitor plant populations closely.

Disease and Pest Resistance

The success or failure of a soybean variety in a field can be determined at times by a single disease organism. The positive identification of each disease is the key to disease management. The most feasible method of control is to select a variety with resistance to that disease. Variety selection must take into account the yield-limiting diseases known to be present in a field and those diseases that have a relatively high probability of occurring. (A more detailed discussion on this topic is covered in Chapter 11.)

Phytophthora Root Rot – This disease is predominantly found in clayey soils. It can cause stand loss and yield reduction. Varieties planted on clay (often referred to as gumbo) soils should contain resistance or field tolerance to Phytophthora root rot.

Root-Knot and Soybean Cyst Nematode – Some of the nematodes in Arkansas soils can reduce soybean yields drastically when left undetected. Yield losses are often mistakenly attributed to "inadequate fertility" or "weak ground." To determine the level and kinds of nematodes present, take a nematode sample in each field. Send the sample to the Nematode Diagnostic Laboratory by way of the local county Extension office for a general analysis.

Soybean cyst nematode control should represent a planned program of growing a non-host crop such as grain sorghum or corn followed by a resistant soybean variety and then by a susceptible soybean variety. If soybean cyst nematode is at a high level, a race determination test also needs to be conducted.

Root-knot nematode control can be assisted with resistant varieties and rotation with grain sorghum. Most corn varieties are excellent hosts of root-knot and should **not** be considered in a rotational plan as a non-host crop if root-knot is present in the field.

Frogeye Leaf Spot – This foliar disease reduces soybean yield of susceptible varieties in years where there is frequent rainfall and high humidity. This disease can be controlled with resistant varieties or by a properly timed foliar fungicide application.

Stem Canker – Once this disease has been identified in a field, consider it a serious threat to production each time soybeans are planted in that field. When weather conditions are favorable, this disease will be devastating to a susceptible variety. Select a variety resistant to stem canker for any field where stem canker has been identified.

Sudden Death Syndrome – Historically, this disease tends to affect high-producing, well-managed irrigated soybeans more frequently than dryland soybeans. In fields where this disease has been identified, select a resistant variety.

Aerial Web Blight – This disease is caused by the same organism that causes sheath blight in rice. It can reduce yields in soybeans. Data from Louisiana State University show that some soybean varieties have moderate resistance to this disease. Growers planting soybeans after rice with heavy sheath blight pressure should consider aerial web blight as a possible yield-limiting factor in their variety selection.

Herbicide Considerations

Soybean varieties respond differently in their ability to tolerate different herbicides. Some varieties express good tolerance to the herbicide metribuzin (Sencor®, Lexone® and Canopy®). Some varieties are severely injured when planted in soils where metribuzin has been applied. Additionally, some soybean varieties are severely affected by drift levels of propanil. Variety selection should take into account where propanil drift may occur after soybean emergence as well as where metribuzin may be used for weed control.

Some new soybean varieties have resistance to specific herbicides. Examples presently in place include Roundup® Ready and STS (sulfonylurea tolerant soybeans). The STS soybeans can more effectively tolerate Synchrony® and Pinnacle®, as well as Classic®, Lexone® and Sencor®.

Depending on weed spectrum, herbicide cost, etc., the availability of these new soybeans can greatly influence variety selection. Caution should be used that other important variety selection factors such as disease resistance, etc., are not overlooked when using a herbicide-resistant variety.

Chloride Sensitivity

Some soils in Arkansas have high levels of soil chloride. Soybean varieties have different responses to these chlorides. Some varieties are **includers** where roots take up the chlorides and distribute them throughout the plant. Other varieties are **excluders** where roots take up the chlorides but restrict them to the roots. Both includers and excluders are affected by high chloride levels, but damage to includers can be catastrophic. Therefore, where chlorides are a problem, select varieties that are chloride excluders.

Yield

One of the most important factors to consider in variety selection is yield potential. Varieties should be selected first on all other factors that affect production and then on yield. The best indicator of yield is to compare multi-year averages between varieties. Some varieties yield well on one particular soil type, location in the state or production system. Select varieties that perform well at locations similar to a particular farm or that perform well at all locations. Selecting varieties that will be high yielding in a particular field is difficult. University of Arkansas variety trials provide estimates of the relative yield potential of currently available varieties in different soil types and production systems.

It is important to consider the magnitude of yield difference when comparing varieties. Scientists use a least significant difference (LSD) value to determine if two varieties have different yield

potential. Small yield differences (less than the LSD value) are probably not meaningful, while large yield differences (greater than the LSD value) reflect difference in yield potential between two varieties.

One approach to take when evaluating new varieties is to plant a few selected new varieties each year on a rather limited basis. You can then evaluate these new varieties within their own unique production environment. Varieties will be produced with the grower's planting dates, row widths, irrigation and level of management. Then, varieties that perform well can be increased in acreage.

Soybean Update and SOYVA

The Cooperative Extension Service prints *Soybean Update* annually. This newsletter details the University of Arkansas' evaluation of soybean varieties in the Variety Testing Program. *Soybean Update* includes data, if known, on all the factors discussed in this section for variety selection. This publication can be used to select soybean varieties for specific field conditions that have high yield potential.

Essentially, all the data in *Soybean Update* is in a computerized program entitled *SOYVA*. This program asks specific questions concerning disease pressure, soil type, location in the state, irrigation or dryland, planting date and herbicide. The program then provides a list of recommended varieties and those not recommended. The two-year average yield of the recommended varieties can be compared for any location conducting variety testing trials.

To receive *Soybean Update* or a computer disk of the *SOYVA* program, contact your county Extension office. *SOYVA* and *Soybean Update* can also be downloaded from the Extension Agronomy Section website at http://www.uaex.uada.edu.

Conclusion

Soybean growers in Arkansas are fortunate to have numerous varieties adapted to their soybean growing conditions. Selecting the proper varieties is an important management decision. This decision-making process should represent a planned program to account for all factors associated with variety selection. Yield potential certainly is a major portion of this decision, but yield-limiting factors that threaten yield potential must be identified and considered during this production management process.

Soybean varieties are continually being improved. Use *Soybean Update* and *SOYVA* to choose varieties that allow for the highest possible chance of positive net returns. Using this information to test new varieties on farm each year is an excellent management tool available to soybean producers.