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G79-445 Soybean Variety Selection

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Soybean Variety Selection

This NebGuide has information on soybean characteristics that should be considered before selecting a variety to plant.

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Soybean characteristics that need to be considered in making the selection of a variety to plant include maturity, yield potential, plant type, height, seed size, emergence score, lodging, shattering, and disease and insect resistance. Many years are required to develop a new variety from the time an initial cross of soybeans is made until the time seed is available on a widespread basis. The advance of a potential variety through the early generations may be accomplished with only a few seeds of the selection being available through various levels of yield testing, followed by an increase of the seed to produce breeder seed, then to produce foundation, registered, and certified seed. All through these stages of development, the variety is evaluated for the many parameters of performance so that at time of release, the performance of the new variety is well documented.

Maturity

Ten maturity groups have been established for identifying the region of adaptation for soybean varieties in the United States. *Group II* and *III* varieties are best adapted to Nebraska conditions, as shown in *Figure 1*. The lines across the map are approximate limits of adaptation and are not meant to represent rigidly defined areas where a variety is or is not adapted. Cultivars from *Group II* or *III*, when planted in mid-May in Nebraska, will reach maturity by early September to early October, depending on the weather, location, and planting date.

Figure 1. Zones of best adaptation for cultivars of soybean Maturity Groups 00 through IX.
(Adapted from *Soybean Physiology, Agronomy and Utilization* by A.G. Norman. Academic Press. 1978.)

The onset of flowering in soybeans is photoperiod controlled. Soybeans are classified as "short-day plants," which means the plants will develop vegetatively until a critical daylength is reached that "triggers" the flowering response. In Nebraska, flowering usually begins in early July as the daylength decreases after the maximum daylength on June 21. For example, daylength in Lincoln is 15 hours on July 5, decreasing to 14 hours on August 11 (*Table I*). This period is the time of the most flowering activity for adapted soybean varieties in Nebraska.

Nearly all of the soybean varieties in maturity groups *II* and *III* are indeterminant types, with flowering activity spread over a 3 to 5 week period once the critical daylength has occurred. In indeterminant types, flowering begins at the lower nodes and progresses upward on the plant. The long flowering period allows these types to adjust to the effects of short-term stress or unfavorable environmental conditions.

Table I. Approximate Daylength at Lincoln, Nebraska--1978				
	Daylength		Sunrise	Sunset
Date	Hrs.	Min.	a.m.	p.m.
			(Standard Time)	
May 10	14	22	5:12	7:34
May 17	14	30	5:08	7:38
May 24	14	43	5:02	7:45
May 31	14	54	4:57	7:51
June 7	15	1	4:55	7:56
June 14	15	5	4:54	7:59
June 21	15	7	4:55	8:02
June 28	15	5	4:57	8:02
July 5	15	0	5:01	8:01
July 12	14	52	5:06	7:58
July 19	14	43	5:11	7:54
July 26	14	27	5:19	7:46
Aug. 2	14	14	5:25	7:39
Aug. 9	14	5	5:29	7:34
Aug. 16	13	48	5:36	7:24
Aug. 23	13	32	5:43	7:15

Determinant types of soybeans have a much shorter flowering period (2 to 4 weeks) and cease main-

stem growth once flowering has been "triggered," although vegetative branching may continue. Flowering in determinant soybeans is generally simultaneous at all nodes. Determinant varieties have about half the plant height and number of nodes compared to indeterminant types under Nebraska conditions. Determinant varieties may require higher seeding rates or narrow-row planting to provide more plant-to-plant competition and to produce greater height from the ground to the lowest pod. As new soybean cultivars are developed, especially the "dwarf" types, determinant types adapted to Nebraska conditions will become available. The variety "Elf" is one such type which is adapted, but relative advantages or disadvantages of the determinant types remain to be determined under Nebraska conditions.

The average date of maturity of most currently available soybean varieties is evaluated in the variety tests in Nebraska. Maturity is noted as when 95% of the pods have turned brown. This is not harvest maturity, but is the time when seeds are physiologically mature and additional dry matter will not be accumulated. Harvest maturity will be reached 10 to 20 days later, depending upon the weather.

Because soybean flowering is controlled by photoperiod, planting date affects the size of plant attained before flowering begins. Soybeans planted later have less time to develop vegetatively and thus will be shorter in size. Planting dates of May 10 to 20 provide long enough times of development for adequate vegetative growth with the indeterminant soybeans and provide good yield potential. Planting after June 1 generally results in lower yields due to reduction in the vegetative size of the plants. Pod formation and seed-filling periods are critical for the highest yield of soybeans. The photosynthetic rates of soybeans are highest at flowering and pod filling. Stress at these critical times, caused by drought, excess heat, mineral deficiency, etc., can cause the greatest yield reduction.

Yield Potential

Several high yield potential varieties in maturity groups *II* and *III* are available for Nebraska producers. Varieties developed by public institutions (Agricultural Experiment Stations and U. S. Department of Agriculture) are evaluated in the Nebraska variety performance trial program in outstate tests. The results of these trials are published each year in *EC 79-104 Performance of Soybean Varieties in Nebraska*, which is available from the Cooperative Extension Service. Both dryland and irrigation trials are conducted so that highly productive varieties can be identified. One should consult trial results that summarize several years of tests over a number of locations in order to select varieties which perform well in different environments.

Generally, the varieties that mature earlier have a higher yield potential than later varieties where irrigation is used. Irrigation tends to delay maturity, and the early varieties have responded better to irrigation.

In dryland production, the yield differences between early and late soybeans may not be as much, although full-season varieties will generally outperform early varieties in the long run.

Plant Type

Soybean varieties have different growth habits which can be exploited. The range is from highly branching types to thin-line types which produce a single, main stem. Ratings of some of the soybeans adapted to Nebraska conditions are shown in *Table II*.

The type of production system to be used (narrow-row vs. wide-row, irrigation vs. dryland) may make selection of a variety with a specific plant type beneficial. Row width and plant population may alter the

growth habit of soybeans enough to somewhat change the degree of branching. Branching may be beneficial if lodging is a problem or if hail is a risk.

Table II. Soybean plant type ratings and emergence scores.					
Cultivar	Type^a	Emergence Score^b	Cultivar	Type^a	Emergence Score^b
Hodgson	----	Poor	Wayne	3	Good
Hark	----	Good	Woodworth	2	Poor
Coles	----	Good	Cumberland	2	Good
Corsoy	2	Good	Oakland	3	Fair
Vickery	1	Good	Calland	3	Good
Harcor	----	Good	Elf	1	Good
Wells	1	Fair	Williams	2	Poor
Wells II	----	Poor	Union	----	Fair
Amsoy 71	1	Poor	Bonus	----	Poor
Nebsoy	----	Good	Cutler 71	----	Poor
Beeson	2	Poor	Kent	----	Good
Sloan	3	Poor			
^a Plant Type Descriptions: 1 = with some short, erect branches. 2 = Moderately branching, bush-type plants. 3 = Bushy type, with many long branches from lower portion of plant (Ohio State University data). ^b Rating of ability of soybean to emerge under unfavorable conditions.					

Plant Height

Taller varieties are generally more susceptible to lodging. Shorter varieties tend to outyield taller varieties when irrigation is used. New short varieties, which have excellent productivity, are becoming available and may prove useful for Nebraska conditions. Consult performance trial results to determine plant height characteristics of varieties.

Seed Size

Seed size is not directly correlated with yield potential as several smaller-seeded varieties have high yield records and vice versa. Seed size is markedly influenced by the environment during the seed enlargement period of growth. Seed size reduction caused by moisture or other stress at the seed-enlargement period can reduce yield substantially.

Larger-seeded varieties could encounter more difficulty in emergence than smaller seeded varieties, particularly in cool soil conditions. Research in Mississippi indicated small- and medium-sized seed gave more rapid emergence and greater early root development than large seed. However, over the range in seed sizes among varieties grown in Nebraska (from 12 to 20 g/100 seeds), this effect is not marked. Environment plays a large role in affecting seedling emergence. Heavy rainfall immediately after

planting can cause compaction and crusting on some soil types, making emergence difficult. The use of a rotary hoe will help break the crust and enable even the largest-seeded varieties to emerge.

Because of variance in seed size among varieties, seeding rates should be calculated on viable seed planted per ground area rather than on weight of seed.

Emergence Score

The emergence score of soybeans adapted to Nebraska conditions is shown in *Table II*. This score represents the ability of the seed to emerge under unfavorable conditions in a laboratory test. This test indicates that more than seed size is involved in emergence ability of soybeans. If soybeans are to be grown on soil with a crusting problem, or if planting depth must be deep (sandy soils), the emergence score may be a necessary criteria for variety selection.

Lodging Resistance

Lodging scores are reported in performance test results. These ratings give an indication of standability in various environments and locations. Lodging reduces yield and makes harvest more difficult, so good lodging resistance is important. Lodging of soybeans at the beginning of seed fill, when beans start to increase in size, is most detrimental to yield. Taller varieties are generally more susceptible to lodging. Determinant varieties are virtually resistant to lodging.

Shattering Resistance

The development of varieties that do not shatter has improved harvest characteristics of soybeans. Environmental conditions at time of maturity influence shattering. Shattering is considered as soybean varieties are evaluated in the testing programs in Nebraska. Early maturing varieties tend to be more prone to shattering than later-maturing varieties. Data from Kansas trials indicate shattering is markedly different from year to year.

Disease Resistance

Losses due to disease in soybeans are not a serious problem in Nebraska. Many diseases are seed-borne, so it is important to recognize certain of the seed diseases. Selection of seed for planting that is free of these diseases is important in reducing loss of production due to these diseases.

Seed diseases include purple seed stain, caused by the fungus *Cercospora kikuchii*. The infected seed has purple to brown discoloration and the seed coat may be roughened and cracked. This disease usually will not affect seed quality for processing, but use of seed for planting with purple stain is not recommended. Treatment of seed with a fungicide before planting may reduce early seed-borne infection.

Gray, moldy seed is caused by another fungus, *Diaporthe phaseolorum* var. *sojae*, which also causes stem blight. This fungus invades the plant and pod late in the season, especially under high humidity conditions. Seed infected with this fungus becomes gray to black in color, appearing moldy and shrunk. Prevention of this disease requires using clean seed for planting and using crop rotation. Use of a seed treatment fungicide may help reduce incidence of gray, moldy seed. Environmental conditions at the time of seed development affect the incidence of this disease, but no varietal differences in resistance are present.

These seed diseases are not serious in Nebraska due to our dry, low humidity conditions at harvest.

Phytophthora root rot, a soilborne disease that affects soybean growth in poorly drained, heavy soils, is another fungus disease. Several different races of the fungus *Phytophthora megasperma* var. *sojae* cause this disease. Seedlings "damp off" when this fungus infects the plant, while older plants turn yellow, their leaves wilt, and their roots rot until the plant dies. Use of resistant or tolerant soybean varieties is the best prevention of this disease. The soybeans used in Nebraska are rated for resistance to phytophthora in EC 79-104, *Performance of Soybean Varieties in Nebraska*. Although the disease has been identified in Nebraska, widespread losses have not been reported.

Bacterial pustule, a leaf disease, is caused by the bacteria *Xanthomonas phaseoli* var. *sojenis*. This is a seed-borne disease that can also remain on crop residue. Hard driving rains, which splash soil onto the foliage, and physical damage to the foliage allow this disease to develop. Resistant or tolerant varieties are available, so the use of one of these would be the best method of control of the disease.

Other diseases may occur, but are usually limited in scope in Nebraska. Use of resistant or tolerant varieties is the best method of disease control. Changes in production practices, such as crop rotation, may also aid in disease control.

Insect Resistance

Economic insect damage of soybeans in Nebraska is not extensive. Foliage feeding insects can be present and may cause no yield reduction, depending on time and extent of feeding. Soybeans can tolerate fairly high levels of defoliation (10-35%) during the vegetative development stages without reduction in yield. After blooming, loss of up to 20% foliage will not be detrimental.

Little or no soybean breeding and development work for insect resistance has been done for Nebraska-adapted soybeans because no serious insect problems are present. Thus, if insect problems appear, Extension entomologists should be consulted to identify the insect or insects and to recommend control measures.

Sources of Soybean Seed

There are many sources of soybean seed. The use of certified seed of known variety from reputable seedsmen will insure quality seed. The varieties developed by public institutions are available as certified seed. Commercial seed processors also have certified seed that is grown, processed, labeled, and marketed under strict standards.

In recent years, private companies have developed soybean varieties and offer these to producers. Some of the commercial numbers are pureline varieties; other are mechanical blends of different varieties. Performance trials of commercial soybeans from neighboring states give an indication of the productivity of commercial varieties or blends. Blends may be useful in special disease or stress problem areas, but the components of the blend should be fairly close in maturity so harvesting can be accomplished effectively. Performance results from company trials may also be useful for variety selection.

Conclusions

Use of adapted, high yield potential varieties with good agronomic characteristics can help increase soybean production. Soybean performance trial results, as well as small on-the-farm plantings, can aid in

identifying varieties with consistent performance. The use of clean, disease-free, highly viable seed of known variety is recommended.

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