

# Cooperative Extension Service

NORTH DAKOTA STATE UNIVERSITY  
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## Soybean Production

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### ROTATION

In recent years soybeans have become an important cash crop in southeastern North Dakota.

The Crop Reporting Service showed only 6,000 acres harvested in 1946. The acreage increased steadily, reaching a peak of 290,000 acres harvested in 1967. Although the acreage has tended downward with 173,000 acres harvested in 1978, 220,000 acres are predicted for planting in 1979. While production practices are improving, acreage tends to fluctuate in response to the anticipated yield-price return.

Soybeans are a long season crop. They are grown mainly in southeastern North Dakota, which is also the commercial grain corn area. Their need for favorable temperatures, a long growing season, and generally satisfactory moisture during pod filling somewhat limits their westward and northern expansion in the state. Although very early maturing varieties that can be grown farther north and west are available, they have limited yield capacity.

Soybeans fit well into a small grain rotation to replace summerfallow or other row crops. Soybeans mellow the soil, and plowing soybean ground in preparation for next year's crop is not necessary except where the straw is very heavy or the weed situation is bad. Because they are a late season crop, less soil moisture reserve is left for next year's crop than with fallow or early harvested small grain.

Well-nodulated soybeans produce most of their own nitrogen requirements. However, inoculation for nodulation should be used if well-nodulated soybeans have not been grown in the field within the past five years. Fertilization after soybeans should be about the same as after corn or small grains. See Circular S-F 9 (Fertilizing Soybeans) for more details. Soybeans should not follow sunflowers unless a suitable herbicide is available to control volunteer sunflowers.

### SOIL PREFERENCE

### SOYBEAN VARIETY SELECTION

CASE 5  
544.3  
NG  
A8x  
#A-250  
Soybeans do best when grown under the same soil conditions as corn. A mellow, fertile, medium-textured loam soil usually is best. Heavier soils should have good drainage. Sandy loam soils warm up faster, allowing soybeans to emerge sooner and develop in a cool or short growing season. Soils high in pH (pH 7.5) and alkaline soil types may lead to yellowing due to "iron chlorosis" and other nutrient problems. Some varieties of soybeans are more tolerant to "high" pH soils.

Choose a soybean variety that will mature under average local growing conditions and produce a satisfactory yield of high quality beans. In general, the farther north or west in the soybean area of North Dakota, the earlier the variety needed.

A soil relatively free of weeds is very desirable to avoid serious weed competition. Effective weed control, especially in narrow row spacings, is important for profitable soybean production. (See weed control section.)

Suggested soybean varieties are listed in Table 1 for North Dakota. Generalized areas of adaptation are indicated by zones. Early or late planting can move the variety adaptation areas, so consider your location and your own experience when choosing from the varieties listed. Experiment Station yields, variety characteristics and maturity classification may aid in variety selection. For yield trial information on varieties see Extension Circular A-654.



Table 1. Variety and agronomic information on soybeans suitable for North Dakota production.

Variety <sup>a</sup>	Relative Maturity	Height	Resistance to Lodging	Seed Size	Hilum Color	Zone <sup>b</sup>
Ada	v.early	short	good	large	yellow	3
Norman	v.early	short	good	large	yellow	3
McCall	early	short	good	large	yellow	2,3
Altona	early	short	good	v.large	black	2,3
Clay	med.early	short	good	med.large	yellow	2,3
Evans	medium	medium	good	large	yellow	2
Merit	medium	medium	good	small	buff	2
Swift	medium	medium	fair	large	black	1,2
Hodgson 78	med.late	medium	good	large	buff	1
Anoka	med.late	med.tall	fair	v.large	black	1

<sup>a</sup>Listed in order of maturity, earliest at top.

<sup>b</sup>See map Fig. 1 for soybean maturity zones.

### SEED QUALITY

The selection and use of high quality seed is one of the basic keys to satisfactory and competitive soybean yields. Hot, dry conditions during development and maturation may reduce seed size and increase seed injury.

Mechanical injury may be the greatest single cause of poor germination and seedling vigor in soybeans, occurring at almost any point during harvesting, handling or seed processing. Least mechanical injury occurs at 12-14% moisture. Severe bruising with seed coat breakage may occur at higher moisture content. Harvesting at a lower moisture content (8-10%) following intermittent wet and dry periods can increase the amount of cracking. Frequent combine adjustments can compensate for changes in seed moisture during the day.

The influence of soybean seed size on germination potential, early seedling vigor and crop yield is not always predictable. Planting seed of fairly uniform size from which excessive amounts of very small and extremely large seed have been removed may lessen problems in precision planting.

Select soybean seed which is free of disease, seed coat cracking, splits and green immature seed. Attempt to use seed produced the previous cropping year. Seed two years old or older usually has lower germination and less seedling vigor. Research has shown that when seed deterioration occurs seedling vigor declines first, ability to establish a stand in the field next, and germination capacity declines last. Therefore, if germination percentage is low in soybeans, the seed lot should be discarded because of possible lower seedling vigor and yield potential.

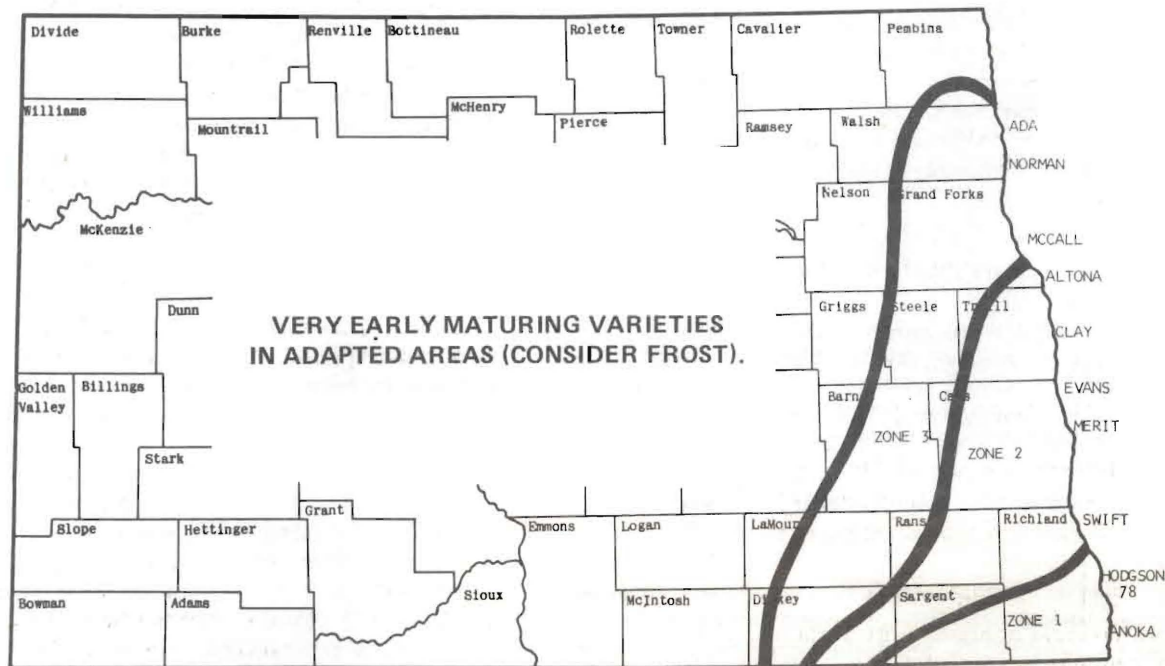


Fig. 1: General Maturity Zones for Soybean Varieties



## SEED TREATMENT

Treating soybean seed generally does not increase yield when high quality seed is planted. Seed treatment benefits most when the seed used is low in germination (below 80%) due to age, frost, weather, kernel damage (broken seed coats), or when germination and emergence are slow due to cold, wet soil. Commonly used seed treatments are Arasan, Captan and Terra-Coat. Apply them at the manufacturer's recommended rate. These treatments generally do not hinder nodulation, but should be applied before inoculation if used.

## INOCULATION

Inoculate soybean seed with "soybean rhizobia bacteria" before planting. This provides the necessary bacteria that let the soybean plants function as a legume, utilizing and storing nitrogen from the air. This inoculant is different from that required for alfalfa, sweet clover, and other legumes.

Inoculate soybeans close to planting time and after fungicide treatment if the seed is treated. Applying inoculum is cheap insurance of good nodulation which benefits the soybean crop and may be a small benefit to crops that follow.

## SEEDBED PREPARATION

Soybeans respond to good seedbed preparation. Shallow spring tillage to kill weeds before planting is effective on fall plowed fields. On soils where spring plowing is practical, plowing is usually done just before planting. Prepare a firm, moist seedbed, as free from weed seed as possible. The sooner you plant soybeans after the last cultivation, the better their chance to compete with weeds. The incorporation of preplant herbicides usually aids in improving soil tilth and seedbed preparation. Fields with excessive trash on the surface may hinder the precision of soybean planting.

## FERTILIZING

Soybeans do best in fertile soil and make good use of carry-over fertilizer. They are erratic in their response to direct application of commercial fertilizer. If a soil test of the field or response in other crops indicates distinctly low phosphate availability, a row application by planter attachment of 10 to 30 pounds of phosphate per acre may be recommended. Five to 10 pounds of nitrogen per acre is also recommended on non-fallow. If applied as a starter, the recommended placement of fertilizer is in a band 2 inches to the side and 2 inches below the seed. The use of "pop-up" (a small amount of fertilizer placed in direct contact with the seed) should not be used on soybeans, as severe fertilizer salt injury can result. Broadcast application is probably the most practical and safe.

Fertilizer results have varied considerably, so experience on your farm is your best guide. Leave an unfertilized check strip for comparison. The use of foliar fertilization is not a substitute for a good soil fertility program of soil applied fertilizers. Consult Extension Circular S-F 9 for additional information.

## PLANTING

Soybeans are susceptible to frost in spring and fall and to prolonged exposure to near freezing conditions. Plant soybeans after the soil has warmed and air temperatures are favorable. Plant as soon as possible five days before the average

last killing frost date. This will allow less than a 50% chance of frost killing the soybeans. Delayed seeding until the average frost date allows time to kill early weeds before planting soybeans. Extreme early planting in cool, wet soil may result in low germination and emergence.

Planting dates between May 10 and 25 appear to be most favorable for higher yields yet reduce the risk of frost injury. On fields where weeds are not a serious problem, plant as early after the average frost date permits so the beans can take full advantage of the entire growing season and produce top yields. Four years' data from "date-of-planting" studies made at the Fargo Experiment Station show that plantings made in later May had lower seed yield, poorer seed quality, lower oil content, shorter plant height, and pods set closer to the ground. Late planting may be justified only where weed control is of primary importance.

Planting in rows is the most common method and permits cultivation for weed control which is important in getting good yields. A corn planter with the proper plates, air planter, grain drill or sugarbeet planter may be used. Plant about 1 1/2 to 2 inches deep to place the seed in moist soil. Planting too deep (greater than 2 inches) or in a soil which crusts may cause poor emergence.

The most common row spacing is 30 inches. NDSU Experiment Station results with current varieties at Fargo, Casselton and Oakes show that row spacings narrower than 30 inches have given the same or higher yields than wider row spacings (Figure 2). A 2.7 bu/A increase was reported at Fargo when row spacing was reduced from 30 inches to either 6 or 12 inches. At Casselton, soybean yields increased approximately 5 bu/A when row spacings were reduced from 36 inches to 6 or 12 inches. Research reported on irrigated soybeans at Oakes, ND indicated that yields from narrow spaced rows were significantly higher than wider spaced rows. When early planted, soybeans in 12-inch row spacings yielded 25% and 40% more than 24 and 30-inch row spacings, respectively. The yield response due to narrower spacing was considerably less when planted late.

However, close drilled or solid seeded soybeans will produce satisfactory yields only if the land is relatively free of weeds and of good soil fertility. Some weed control early in the season can be obtained with a harrow or rotary hoe, but control often is not satisfactory if the field is very weedy. Herbicide combinations can also be very useful in weed control of solid-seeded soybeans.

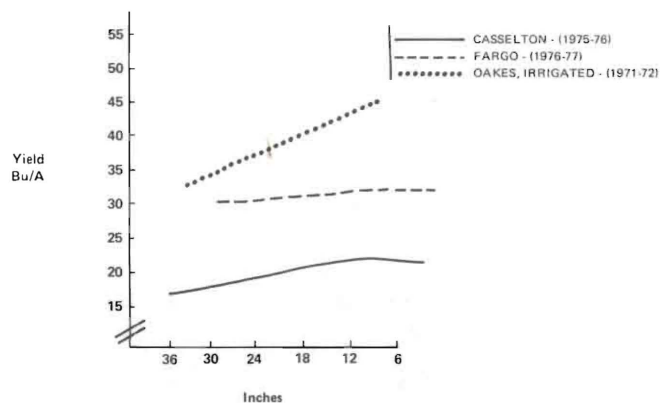


Fig. 2. The effect of row spacing on soybean yields at Casselton, Fargo and Oakes, North Dakota.



## RATE OF PLANTING

Planting rates of soybeans will vary depending on row spacings desired. Plant populations of approximately 150,000 plants per acre are most desirable. About 3,000 medium-sized soybeans weigh one pound. Soybeans weigh 60 pounds per bushel. Seeding rates for various row spacings are shown in Table 2. In all cases, adjust the planting rate for seed size and germination percentage.

Table 2. Planting Suggestions

Row spacing	lbs/A	Seeds/ft. Row
40"	45-50	11
36"	50-55	10
30"	55-60	9
24"	65-70	7
6 or 12"	85-100	4

## WEED CONTROL

Start weed control early, as soybeans are poor competitors with weeds when cool temperatures slow germination and growth. Prepare the seedbed immediately prior to planting the crop to kill germinating weeds. Use a rotary hoe, harrow or weeder after planting and before the soybeans emerge. Do not cultivate this way when soybeans are just emerging as the tender hypocotyl arch will be injured. For best results use these methods when the ground is not trashy, cloddy or wet and when the weed seedlings are just emerging and not more than 1/4 inch tall.

Preemergence or preplant incorporated herbicides offer the best opportunity for selective weed control in soybeans. Trifluralin (Treflan), profluralin (Tolban), fluchloralin (Basalin), dinitramine (Cobex) and pendimethalin (Prowl) are dinitroaniline herbicides applied preplant incorporated for the control of annual grasses and broadleaf weeds. These herbicides will not control wild mustard, common cocklebur and volunteer sunflower. Proper timing and incorporation depth for each herbicide is essential.

Herbicides such as alachlor (Lasso), chloramben (Amiben), linuron (Lorox), metribuzin (Sencor, Lexone) and metolachlor (Dual) applied to the soil surface at planting time or immediately following planting have given good to excellent broadleaf and grassy weed control. A number of these pre-emergence herbicides are enhanced by 1/4-1/2 inch of rainfall following application. Metribuzin and chloramben control many broadleaf weeds including wild mustard and certain grass weeds. Watch rates of metribuzin on sandy soils and do not use on soil above pH 7.4 as soybean injury may occur. Injury can be reduced by using herbicide combinations with lower rates of metribuzin.

Postemergence applications of bentazon (Basagran), dinoseb (Premerge, Dow General) and dinoseb + naptalam (Dyanap) can be used in soybeans for broadleaf weed control. Dinoseb should be applied at the cracking to crook stage to avoid injury. Emerging weeds will be killed and may provide some residual control of wild mustard. Bentazon has given consistent wild mustard control and control of other broadleaf

weeds. Fair control of redroot pigweed and lambsquarters can be expected when weeds are very small (less than 1 1/2 inches).

Herbicides such as diallate (Avadex) and barban (Carbyne) can be used to control wild oats in soybeans.

Soybeans are susceptible to injury from 2,4-D, MCPA or dicamba (Banvel) and drift into soybean fields should be avoided. (Refer to Extension Circular W-253 for further information on herbicide rates, mixtures and use.)

## HARVESTING

Straight combining is the most satisfactory and commonly used method of harvest. Swathing of soybeans can result in excessive field losses due to shattering. Use of floating headers, love bars and all row crop headers are necessary to reduce harvest losses. Keep your combine in good repair. A cutterbar in poor condition will increase gathering losses. Be sure 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. Use a reel speed about 25% faster than ground speed. Operate the cutterbar as close to the ground as possible at all times. Keep forward speeds at or below 3 miles per hour.

If stubble is high and ragged, or if separating losses are high, slow down. About four beans or one to two pods per square foot represents a loss of 1 bushel an acre.

Harvest soybeans when the plants are mature and the beans are dry, containing not more than 14% moisture. When beans are extremely dry, (8-10% moisture) harvesting will cause more shattering and seed injury. Under these conditions, combine during morning or evening hours or adjust the combine accordingly. Adjust cylinder-concave clearance according to the operators manual, usually 3/16 to 5/16 inch at the back and wider in front. When beans are tough, cylinder speed may have to be increased to 700-750 rpm. Decrease cylinder speed as beans dry to reduce breakage; 450-500 rpm is satisfactory for dry soybeans.

## STORING

Soybeans may be stored safely for short periods during the fall or winter with a moisture content as high as 14%. For safe storage during the spring or summer, soybeans should not contain more than 12% moisture. Sound beans, free of foreign material and split beans, store better and stay in condition longer. The maximum drying temperature for soybeans is about 140° F. When soybeans are to be used for seed, the temperature should not exceed 110° F. In drying soybeans, a grower is seldom confronted in removing more than 2 or 3 points of moisture.

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