

T I P S F O R

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Profitable Soybean Production

Minnesota Extension Service
University of Minnesota

Soybeans are a major cash crop on Minnesota farms. Since they were first introduced to the state in the 1930s, soybeans have continually increased in importance to the agricultural economy. Many factors contribute to high yield soybean production in Minnesota and surrounding states but attention to the specific management practices discussed in this folder will result in production of these higher yields at lower cost per acre. Use of these practices will add little to production costs but each will contribute to increased total yield per acre, thereby reducing the cost per bushel. Some farmers are already doing a good job of selecting and using these cost effective inputs, but many others could benefit by implementing the practices discussed in this folder. All farmers should carefully evaluate the practices discussed in this publication and work to integrate them into their soybean management plan for the future. Your hard work will result in greater profitability from soybean production on your farm.

VARIETY SELECTION

Variety selection is one of the most important considerations in producing maximum economic yields of soybeans in Minnesota. Newer and improved varieties are constantly being developed by public and private breeders which are adapted to specific production areas. These varieties have improved performance in yield, disease resistance, standing ability, chlorosis tolerance, plant height and seed quality as well as oil and protein content in the seed. To assist growers in evaluating the maturity and yield performance of these newer releases, the Minnesota Agricultural Experiment Station publishes annually the results of extensive field and laboratory tests on the public varieties adapted to Minnesota as well as many of the privately developed varieties. This publication, AD-MR-1953, Varietal Trials of Farm Crops recommends the best performing public varieties for various locations in Minnesota. Growers should always compare performance of any non-recommended varieties with these proven performers, before purchasing and planting them. Growers with special problem areas or problem fields (high pH, poor drainage, prior disease problems) should review the additional data in AD-MR-1953 to select varieties which perform well under these adverse conditions. Data is also presented in Varietal Trials of Farm Crops each year on performance of public varieties in normal (30-inch) and narrow (10-inch) row spacings as well as early, normal and late planting dates.

SEED QUALITY

High quality seed is essential for maximum economic yield. Seed should be pure as to variety, high in germination, free of disease organisms and weed seed, free of mechanically damaged seed, and capable of vigorous early growth. Purchasing certified seed will generally assure such quality performance because it is produced by seedsmen who impose rigorous field and seed cleaning standards. All bag label information is important, read it carefully before you purchase and plant the seed.

A large portion of Minnesota soybean acreage is planted with homegrown (bin-run) seed. This practice can limit yields unless care is taken to properly produce, condition, and store home produced seed. Deterioration begins as soon as seed is mature on the plant but the process can be slowed by timely harvest, correct combine adjustment, as well as careful cleaning, handling, and storage procedures. When growers use their own seed they must plan ahead to maintain its quality and purity to prevent yield loss from bin-run seed use. As a part of the planning process, growers should avoid using seed from fields infested with downy mildew, pod and stem blight, anthracnose, soybean cyst nematode and white mold. Selecting and maintaining sound, clean, disease free seed lots and getting these lots germination tested before planting are desired assurances for quality performance.

SEED TREATMENTS

Treatment of soybean seed with insecticides or fungicides is not generally recommended. Since soybeans are being planted earlier to achieve higher yield, insecticide/fungicide applications may prove useful in preventing seed rotting or insect attacks in these cooler, damp soils.

Some companies are routinely treating their soybean seed with fungicides prior to bagging. If you plan to treat seed yourself always follow manufacturers directions as to rate and method of application.

Although seed treatment is generally not recommended it may be important in certain specific situations: 1) protecting seed from damping-off when planted early in cool, damp soils, 2) protection against phytophthora infections of tolerant varieties planted in heavy, wet soils. Rarely would a yield increase be expected from such seed treatments unless these fungal infections were very severe.

PLANTING DATE

Each year nearly half of Minnesota's soybean acreage is planted after May 22, which means that many farmers are guaranteeing that their yields and profits will be lower than the potential optimum since yields decrease as planting date is delayed.

Early May planting is best, even if slightly more time is required for seedling emergence from the cooler, wetter soils. Earlier seeding permits use of full-season varieties which typically yield more than shorter season varieties. Early planting also increases the likelihood that the planted variety will achieve its maximum yield potential. The following table shows expected yield reduction as planting is delayed in southern Minnesota. Similar reductions could be expected in central and northern Minnesota.

Date of Planting	Percent Yield Reduction
May 10	0
20	- 3
30	- 9
June 10	- 18
20	- 30
30	- 43

These data indicate small yield reductions with delayed planting until mid-May; however, large reductions in yield occur when planting is done after May 20. In addition to higher yield the earlier planted soybeans mature ahead of the killing frost and generally suffer less lodging problems. Harvesting can therefore be completed in better weather with lower harvest losses.

In summary, soybeans should be seeded as soon as the corn planting is completed with a target being all fields planted by May 20. Only top quality, disease free should be planted early.

SEEDING RATES

Many experiments have been conducted which show that soybean seeding rates can vary widely with little effect on final yield. The following table demonstrates the ability of soybeans to compensate for large differences in seeding rates in southern Minnesota. Similar results would be expected in central and northern Minnesota.

Seeds/Acre	Plants/Foot (30-inch row)	Percent Yield Reduction
157,000	9	0
118,000	7	- 2
78,000	5	- 10
39,000	2	- 25

Recommended seeding rates (plants/ft of row) are 12 seeds per foot in 40-inch rows; 9 seeds per foot in 30-inch rows; 6 seeds per foot in 20-inch rows; 5 seeds per foot in 15-inch rows; 3 seed per foot in 10-inch rows, and 2 seeds per foot in 6-inch rows. These recommended seeding rates will result in about 60 pounds of seed planted per acre (depending upon seed size which affects number of seeds per pound).

ROW SPACING

Minnesota soybean producers are planting soybeans in narrower rows as a result of research studies (1976-1985) demonstrating that higher yields result from these narrow spacings. Most recently, these data demonstrate that 10-inch rows out-yielded 30-inch rows by 3 to 5 bushels per acre (slightly over 8% yield increase). Earlier work in 1964-1965 demonstrated that 24-inch rows out-yielded 40-inch rows by nearly 6 bushels per acre.

The following table indicates the percent of soybean acres planted to various row widths in 1987 as compared to 1975.

Soybean Row Spacing in Minnesota*

Category	Percent of Acres	
	1975	1987
Wider than 34.6"	49	9
28.6"-34.5"	49	56
18.0"-28.5"	4	7
Narrower than 18"	—	}28
Broadcast	—	

*Minnesota Agricultural Statistics Service Data.

The advantages for narrow row soybean production are increased yield, reduced erosion, increased harvesting efficiency, and earlier canopy closure to control weeds.

Disadvantages of narrow row production are increased potential for weed or disease problems as well as increased cost of specialized planting equipment. The size of the farming operation and age of equipment will probably dictate the feasibility of maintaining separate equipment for corn and soybean planting and cultivation. Some growers might consider sharing narrow row equipment purchases or hiring a custom operator to plant soybeans in this higher yielding configuration.

CROP ROTATIONS

The results of a rotation study at the Lamberton and Waseca Experiment Stations in 1979-81 indicate a 4 to 5 bushel per acre yield advantage for a soybean/corn rotation as compared to continuous soybeans.

Crop rotation is also an important disease control strategy and may be more important in soybean production than for other crops because resistance is not available for certain soybean diseases.

Soybean diseases, such as Brown Stem Rot (BSR), Soybean Cyst Nematode (SCN), Pod and Stem Blight, Anthracnose, Downy Mildew and Septoria Brown Spot survive on soybean residue. Crop rotation and tillage that favors residue decomposition will help reduce these disease losses. Rotating soybeans with a non-host crop every second year is effective for most foliar and stem pathogens, while 2- or 3-year rotation is needed for root infecting organisms like the SCN or BSR.

SEED BED PREPARATION

Soybean producers have adjusted their seedbed preparation procedures in recent years to include various forms of reduced tillage. The purpose of these early tillage practices is to manage crop residue, aerate and dry the soil, control weeds, improve tilth, control soil erosion and water runoff and promote seed-soil contact. Each grower should select the combination of pre-plant tillage practices that will prepare an adequate seedbed for proper planting depth but leave as much residue in the non-seedbed area as possible. All primary and secondary tillage operations should be planned so as to minimize compaction and to prevent excessively cloddy seed beds.

Research on soybean production using various combinations of tillage practices indicate no significant loss in yield due to reduced tillage if good seed-soil contact and proper planting depth can be achieved.

WEED CONTROL

Control of weeds is one of the most critical components of a soybean production system because weeds compete with the

crop for light, water and nutrients. The amount of yield loss due to competition depends upon the degree of control, as well as the timeliness of control. Good weed control during the first 4 to 6 weeks of the growing season is essential for maximum yield. Minnesota farmers are generally aware of the importance of weed control and spend an average of \$27 per acre on herbicide treatments and/or cultivation on their soybean fields.

The first step in an economical weed control program is the identification of the problem weeds, both as young developing seedlings and as mature plants. Knowing the problem species and the extent of the infestation will allow you to plan the most economical control program for each field on your farm.

The second step is to evaluate the soil type and organic matter content of each field. This information is essential because application rates for soil-applied herbicides change with soil type (texture) and organic matter content and savings can occur by using only the rate required for each specific field situation instead of a common rate for all fields. Band applications, combined with cultivation, can also substantially reduce herbicide costs.

The third step is to inspect, adjust and calibrate all herbicide applicators to insure that the proper herbicide rate and/or distribution pattern is achieved. Substantial reductions in costs of herbicide can result from this simple procedure. Both overapplication and underapplication are economically important problems to correct. Early postemergence applications to small weeds or spot treatments to weed patches also allows you to use less herbicide.

The fourth step is to investigate possible herbicide cost savings by combining purchases with neighbors and/or buying in bulk after requesting bids from several dealers. Additional saving might be possible by using a different or lower cost formulation of the herbicide.

If you desire, more emphasis can be given to cultural practices such as crop rotations, narrow rows, increased crop seeding rates, or mechanical cultivation to control weeds rather than rely only on chemical control methods. Rotary hoes can be used early in the season to kill emerging weed seedlings in all row spacings. In wider row spacings (30 inches) some growers shallow cultivate once or twice before canopy closure to eliminate late emerging weeds. The decision on these later cultivations should be on the basis of number and type of weeds present, because no more cultivations should be done than are necessary to control the weed problem.

FERTILITY

Soybeans are rotated with corn on most farms in Minnesota, and in areas where corn yields are high, soybean yields are also high. In the past only small amounts of fertilizer have been applied to the soybean crop but the beans benefited from the high fertility levels maintained for the corn crop. These days there is no substitute for fertilizer applications based on the results of reliable soil tests. Soil tests help in two ways. First, if the nutrient status of a field is low, yields may be limited and the soil test data will indicate the quantity of each nutrient present and how much is needed to achieve the desired yield goal. On the other hand the soil test could show that the nutrient status of the field is in the medium and/or high range and that an additional fertility expense on that field *would not* be cost effective. Remember all fertilizer decisions should be based on an accurate soil test, done at a reliable soil testing laboratory.

Fertility recommendations from soil tests at the University of Minnesota Soil Testing Laboratory are based on realistic yield goals indicated by the farmer. There are no specific guidelines for selecting soybean yield goals but the following suggestions should assist you in picking a realistic goal for your field. Do not use the county or area average yield figures, nor should you go for the world record soybean yield. A high yield reported from your area would be a good goal or if you desire a more specific personal value, calculate your average soybean yield for the

past 4 to 5 good production years and increase this value by 15 to 20 percent. Remember that the most profit results from highest yields, but your goals should be realistic and achievable.

Now that you have tested your soil and received your report based on your yield goal you are ready to purchase and apply the recommended rates of all nutrients. A few simple points should be kept in mind to insure maximum return for your fertilizer dollar.

(1) Calculate the exact cost of all nutrients - Usually more than one product can be used to supply nutrients and the prices of these products are not the same. Take time to calculate the cost of the individual nutrients (being sure to include the cost of application). Contact your dealer or your county extension agent if you need help in such calculations. Keep in mind that research has clearly shown little difference in the efficiency or effectiveness of most of the fertilizer formulations sold today. The real control of fertilizer effectiveness is the soil chemistry and not the formulation chemistry. Also remember that it is expensive to build up P, K and Zn to high or very high levels. There is no evidence that high or very high soil test levels of these elements are needed to produce high yields.

(2) Foliar fertilization is expensive and generally ineffective. Some years ago interest in foliar fertilizer applications to soybeans intensified because research results from a study in Iowa showed increased yields using foliar sprays containing N, P, K and S. Because of the cost of these treatments and lack of a consistent response, foliar fertilizer sprays to supply N, P, K and S are not recommended.

(3) Don't purchase miracle products. Each year growers are exposed to various "new" products that claim produce miraculous results. Such products are often described as "so new that others have not yet learned of them" and the price is generally quite high. The salesperson is new in the area and disappears soon after the sales are completed. Be aware!! Don't purchase products which have not been evaluated in reputable research trials. If you are not sure of a product, check with local fertilizer dealers and your county agricultural agent, if it's good it won't be a secret to anyone. If the product is useful, there will be ample time to purchase and use it. If it turns out to be worthless you saved a lot of money.

GROWING SEASON TROUBLESHOOTING

During the course of the growing season many problems can arise in your fields. Drought, hail, frost, disease and insect infestations are a few of the natural disasters which can damage your crop. Decisions to replant, to spray with fungicides/insecticides or when, if and how to harvest should be carefully made. Factors such as calendar date, extent of damage, number of plants, number of insects, and cost of treatment will need to be determined before a sound economic decision can be made. Contact your county agricultural agent, local dealer or crop consultant for assistance in making these important decisions.

HARVESTING

Farmers can increase their return per acre by reducing harvest losses as well. Timely harvesting will prevent shatter losses as the soybeans dry to moisture contents less than 13 percent. Keeping your combine properly adjusted, the cutter bar close to the ground, as well as using slower ground and reel speeds will also reduce harvest loss. Taking time for these may not seem to save very much, but researchers have measured 3 to 5 bushels per acre yield losses for careless combining procedures.

At times it may be advantageous to harvest soybeans at moisture levels above those for safe storage to reduce harvest losses. The beans should then be air dried to 13 percent or less for storage of 6 months to a year and to 11 percent for longer storage periods.

SUMMARY

In the immediate future the successful farmer-businessmen will be those whose farm records and production cost data are carefully documented and analyzed. Those growers who get maximum yield for the costs incurred will return the greatest profit. The best crop producers will focus their attention on timeliness of planting, harvesting and chemical weed control as well as improving their variety selection, fertilizer use, chemical selection and purchasing skills. Keep in mind that market prices of grain do not affect a crop's response to management practices and have little to do with reducing unit costs, but keep in mind that most successful farmers have developed good marketing strategies to compliment their production strategies. Learn to be one of these successful farmers.

RELATED PUBLICATIONS

1. A Guide to Computer Programmed Soil Test Recommendations for Field Crops in Minnesota, 1985. G.W. Rehm, C.J. Rosen, J.F. Moncrief, W.E. Fenster and J. Grava. AG-BU-0519. Agricultural Extension Service, University of Minnesota.
2. Varietal Trials of Farm Crops, Current edition-Minnesota Report 24, AD-MR-1953. Agricultural Experiment Station, University of Minnesota.
3. Cultural and Chemical Weed Control in Field Crops, Current edition, AG-BU-3157. R.L. Becker, B.R. Durgan, J.L. Gunsolus. Minnesota Extension Service, University of Minnesota.
4. Tips for Reducing Weed Control Costs, 1986. B.R. Durgan. AG-FO-2898. Minnesota Extension Service, University of Minnesota.