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AG FACTS

Producing Soybeans in Narrow Rows

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The practice of growing soybeans in narrow rows can provide a tremendous benefit, both agronomically and economically, to soybean producers. This is well documented by research at Michigan State University and at other locations in the Midwest. Some advantages that can be attributed to narrow row production include:

- *Increased light interception*—Because plants are spaced more equidistant, sunlight is intercepted by the plant canopy before it reaches the soil surface, so more potential light energy may be used in photosynthesis.
- *Reduced within-row plant competition*—Because rows are closer together, plants can be spaced farther apart within the row, thus allowing for less competition for water and nutrients.
- *Earlier canopy closure*—Plants in narrow rows have a greater ability to shade late-emerging weeds and provide a measure of weed control not available in a wide row system.
- *Reduced soil erosion*—Because the plant canopy covers the soil surface earlier in the season, there is less chance for raindrops to dislodge soil particles.
- *Higher podding on the stem*—Because the lowest pods in narrow rows tend to be produced higher on the stem, harvestability is improved by reducing the number of pods left in the field.
- *Increased yields*—All of the above factors working together generally help narrow-row soybeans outyield wide-row soybeans by 10 to 20 percent.

This bulletin explains the advantages of producing soybeans in narrow rows, summarizes research conducted on narrow row soybean production at Michigan State University and elsewhere, and provides recommendations for growing soybeans in a narrow row system.

Why produce soybeans in narrow rows?

Conventional or wide row spacings are usually 30 inches or greater. In some cases, 28-inch row spacings are considered wide rows.

Narrow row spacings are usually any spacing less than 28 inches.

Solid seeded soybeans are those planted in row widths of less than 10 inches, and commonly in a 7-inch row spacing.

For this bulletin, any row spacing less than 28 inches will be considered a narrow row.

Yield Advantage

Research has been conducted in Michigan to determine the effect of row spacing on yield of soybean varieties from three maturity groups (0, I, and II). In one 3-year study conducted in Southern Michigan, the average increase for a 20-inch compared to a 30-inch row spacing was at least 15 percent (Table 1). The yield increase for a 10-inch compared to the 30-inch spacing was between 17 percent and 23 percent. All three maturity groups responded similarly to a closer row spacing.

In a more recent study conducted at two central Michigan locations (Saginaw and Huron counties) over a 2-year period, Hardin soybeans (group I) grown in 20-inch rows outyielded the beans in wide rows by 17 percent, and those grown in 10-inch rows outyielded beans in wide rows by 31 percent when averaged over locations (Table 2). The yield increase in Saginaw was much greater than in Huron County, but in no case did yield decrease in narrow rows.

Table 1.
Yields of three soybean varieties grown in Southern Michigan at three row spacings, and percent yield increase for narrow rows.

Variety	Maturity Group	Row Spacing	Yield	% Increase
		(inches)	(bu/acre)	
Evans	0	10	49.2	17
		20	48.2	15
		30	42.0	
Hodgson 78	I	10	54.9	23
		20	52.8	18
		30	44.8	
Corsoy	II	10	56.8	19
		20	55.0	15
		30	47.9	

SOURCE: Helsel, Johnston, and Hart, MSU.

Table 2.
Effect of row spacing on Hardin soybean yield at two central Michigan locations.

Row Spacing	Huron County	Saginaw County	Average
(inches)	----------bu/acre----------		
30	30	54	42
20	33	64	49
10	33	77	55

SOURCE: Hesterman and Isleib, MSU.

These studies show that the yield advantage for reducing the row width from 30 to 20 inches is greater than that for reducing the row width from 20 to 10 inches. From the data in Table 1, averaged over three cultivars, there was a 7 bushel per acre difference between 30 and 20 inch rows and only a 2 bushel difference between 20 and 10 inch rows.

Economic Advantage

Producing soybeans in narrow rows translates into greater revenue. Table 3 demonstrates the added revenue attributed to narrow rows at three different yield levels. Calculations were made assuming: 1) a 20 percent yield increase for 10-inch compared to 30-inch rows, and 2) soybeans priced at $4.50/bu. There are added expenses for producing soybeans in narrow rows. After a discussion of recommendations, these added expenses and the added net income from narrow rows will be summarized.

Recommendations for growing soybeans in narrow rows

Crop Rotation

Whether you produce soybeans in narrow or wide rows, it is strongly recommended that you follow a proper crop rotation. It is widely accepted that corn following soybeans in the rotation will out-perform corn following corn. It has also been shown that soybeans benefit from crop rotation. You can expect soybeans following corn to outyield soybeans following soybeans by 10 to 20 percent.

Variety Selection

Generally, shorter, less branching, and earlier maturing varieties respond best in narrow rows. Taller varieties tend to lodge more in narrow rows, and, because branching is reduced when soybeans are grown in narrow rows, varieties with less branching usually show a greater response. Information on height, lodging susceptibility, and relative maturity of different soybean varieties adapted to Michigan can be found in Extension bulletin E-1208, *Michigan Soybean Performance Report.*

In research trials conducted at University of Wisconsin, all varieties tested responded positively to narrow rows.

Fertilization

Fertilizer recommendations for narrow row soybeans should not differ greatly from those in wide row systems. Soil testing is still the key to profitable fertilizer use. Since soybeans fix nitrogen (N), N fertilizer is not needed. Phosphorus (P) and potassium (K) are the major nutrients needed. In addition, pay particular attention to soil pH. The optimum pH for soybeans is between 6.2 and 6.5.

Table 3.
Added revenue for narrow row soybeans at three yield levels.[1]

Yield in 30-Inch Row (bu/acre)	Yield in 10-Inch Row (bu/acre)	Added Revenue[2] (per acre)
30	36	$27.00
40	48	$36.00
50	60	$45.00

[1]At a yield level in 30-inch rows of 40 bushels per acre, you can expect, on average, to increase gross revenue by $36.00 per acre by growing soybeans in 10-inch rows. These calculations were made assuming soybeans grown in 10-inch rows will outyield soybeans grown in 30-inch rows by 20%.

[2]When soybeans are $4.50 per bushel.

Nitrogen fixation and plant growth is often reduced when pH is below 6.2. This often results in reduced yields.

Because yields are normally greater in narrow rows, fertilizer requirements may be slightly higher due to greater nutrient removal. Band placement of fertilizer, especially P and micronutrients, is most beneficial when soil test levels are low. Narrow row soybeans planted with a grain drill are often planted without fertilizer. Where soil test levels are low, higher rates of broadcast fertilizer may be needed to obtain the same yield as when fertilizer is banded. See Extension bulletin E-550, *Fertilizer Recommendations for Vegetables and Field Crops in Michigan* for P and K fertilizer recommendations.

Broadcast applications of micronutrients, particularly manganese (Mn), are ineffective in correcting deficiencies. Therefore, alternative methods, such as foliar applications, are needed to correct deficiencies. When micronutrient deficiencies are severe, planting narrow row soybeans without band placement is not recommended. Zinc (Zn) deficiency can usually be corrected by broadcasting 10 to 20 pounds of elemental Zn per acre. Manganese deficiency, however, cannot be corrected with broadcast applications.

Zinc and manganese deficiencies are rarely a problem on soils below pH 7.0. Soil tests for Zn and Mn are available and should be used to determine the need for them in a fertilizer program. More information on micronutrients is available in Extension bulletin E-486, *Secondary and Micronutrients for Vegetable and Field Crops.*

Seeding Rate

The ideal seeding rate varies with variety, date of planting, row spacing, and soil conditions at planting time. Many varieties branch and compensate for low plant densities and thus do not respond dramatically to changes in plant population. Some researchers believe that soybean yields are not reduced unless populations fall below 70,000 to 85,000 plants per acre. Higher seeding rates are recommended because of risks associated with obtaining uniform stands at low seeding rates and the problems associated with poor weed control.

The recommended seeding rate for most varieties planted in 15- to 30-inch row spacings is 125,000 to 150,000 viable seeds per acre. For rows 10 inches or less, the suggested seeding rate is 175,000. Certain determinate, semi-determinate, and semi-dwarf varieties may require higher plant densities to attain their full yield potential. Hobbit, for example, is a determinate variety that is recommended for narrow row production at populations of 200,000 plants per acre. When planting these varieties use a seeding rate of 200,000 viable seeds per acre or the rate recommended by the seller.

Adjust seeding rates up or down depending on environmental conditions. Increase seeding rates by 10 percent if planting very early (before May 1) or very late (after June 1). Planting too early often results in loss of stand. Planting very late usually results in short plants and less light interception. Also, increase seeding rates when planting a short season variety in an area where longer season varieties are normally planted, when planting into a poor seed bed, or where soil moisture conditions are not ideal. Some varieties branch profusely and these may perform just as well at lower plant populations. Varieties with limited branching may respond better to higher plant populations.

Base seeding rates on seeds per foot of row or seeds per acre rather than pounds or bushels per acre. Soybean varieties vary greatly in seed size, which will also vary from year to year, depending on growing conditions. In addition, the percent germination should also be considered in determining seeding rate. Percent germination is required by law to be reported on the seed tag, and information on seeds per pound should be available from the seed supplier. Use Table 4 to select the appropriate seeding rate.

Table 4.
Seeding rate based on seeds per foot of row*.

Row Spacing	Desired Viable Seeds Per Acre			
	125,000	150,000	175,000	200,000
(inches)	----------seeds per foot of row----------			
30	7.2	8.6	10.0	11.5
20	4.8	5.7	6.7	7.7
15	3.6	4.3	5.0	5.7
10	2.4	2.9	3.3	3.8
7	1.7	2.0	2.3	2.7

***To compensate for germination use the following formula:**

$$\frac{\text{Desired seeds/ft.}}{\text{\% germination}} = \text{Required seeds/ft.}$$

Example: 3.3 seeds/ft. desired at 90% germination

$$\frac{3.3}{.90} = 3.7 \text{ seeds/ft. required}$$

Planting Date

Early plantings yield better than late plantings due to greater interception of sunlight. Soybeans should be planted immediately following corn or any time after May 1 in Southern Michigan or after May 10 in central Michigan. As a general rule, soybean yields decline about one half bushel per day if planted after the middle of May. The advantage of planting early in narrow rows can be seen from Table 5. The data represent three years of research in Michigan with four soybean varieties. A greater increase from early planting was obtained in narrow compared to wide rows. While planting early into cool, wet soils may result in less emergence, yield losses seldom occur unless plant populations drop below 80,000 plants per acre.

Table 5.
Effect of planting date and row width on soybean yield.

Row Width	Date of Planting		
	Early May	Late May	Mid June
	bu/acre		
20 inches	55	51	40
30 inches	46	44	35
Difference	9	7	5

SOURCE: Helsel, Johnston, and Hart, MSU.

Planting Equipment

There are two widely-used methods for planting soybeans in narrow rows: unit planters and grain drills. Unit planters (corn planter units) can be used for planting narrow row soybeans either by adding units between the 30-inch spaced units, or by splitting the middle of 30-inch rows in a second operation. In either case, the result is a 15-inch row.

Grain drills have also been used for seeding soybeans in narrow rows. Unless each seed opener is fitted with depth bands or depth gauge wheels, depth of seed placement is usually not as exact or consistent with a grain drill as with a unit planter. The grain drill is best suited for row spacings of 7, 14, or 21 inches.

Researchers at Ohio State University studied the effect of planting equipment and row spacing on soybean yields. Their data (Table 6) showed increased yields as row spacing decreased for both types of planters. Yields were slightly better for the unit planter than the grain drill.

Table 6.
Interaction effects of planting tools and row width on soybean yields.

Row Width (inches)	Planting Tool		
	Unit Planter	Grain Drill	Difference
	bu/acre		
7	55.8	52.2	3.6
14	51.3	50.8	0.5
21	49.7	48.3	1.4
28	48.4	47.6	0.8
AVERAGE	51.3	49.7	1.6

SOURCE: Beuerlein and Ryder, Ohio State University.

Weed control—a major obstacle

One of the biggest obstacles to adoption of narrow row soybeans is the perception that effective weed control is not possible. Effective weed control *is* possible. However, management of the weed problems must be approached differently in certain situations. In general, more intensive weed management is needed.

Postemergence Herbicides

In narrow rows, neither cultivation nor postemergence herbicides are likely to be needed. However, when needed, more reliance is placed on herbicides compared to wide row systems, since cultivation may not be possible. Even if cultivation is possible, it will generally control only weeds between, not within, the row. In narrow rows, a greater proportion of the field will be "within" the rows. Also, since plant spacing within the row is greater, weed problems within rows are more likely to develop. In addition to reducing yield, weeds like black nightshade may also create problems in harvesting.

Cultivation

Soybeans in row spacings of 20 inches or greater can be cultivated relatively easily. In 15-inch rows, cultivation is possible but extreme care must be taken to avoid injuring the crop. In row spacings less than 15 inches, cultivation is very difficult. In spacings of 10 inches or less, cultivation is impossible so postemergence herbicides must be used to control emerged weeds.

Crop Canopy Closure

Table 7 shows typical numbers of days from planting to canopy closure with different row spacings. The narrower the row spacing, the earlier the canopy closure. Earlier canopy closure in narrow rows allows the soybeans to be more competitive with weeds. This helps to reduce the dependence on herbicide persistence for season-long control.

Table 7.
Days after planting before soybean canopy covers inter-row area.

Row Width (inches)	Number of Days
40	67
30	58
20	47
10	36

SOURCE: University of Nebraska.

Herbicide Rates

Since the crop canopy closes earlier in narrow rows, can soil-applied herbicide rates be reduced? Any time herbicide rates are reduced, the reliability of the treatment is diminished. Although less persistence of the herbicide may be needed, consistent, reliable weed control from soil-applied herbicides is critical in narrow rows. *Therefore, the same herbicide rates should be used in narrow rows as in wide (30-inch) rows.*

Wheel Traffic

If herbicide application in narrow row soybeans is needed and this application requires driving over soybeans, yield will probably not be affected. Such postemergence herbicide application is almost always done when soybeans are still small, usually in growth stages V1 to V3, when 2 to 4 trifoliolate leaves have expanded. Several studies in the Midwest have shown that any damage to soybeans at this stage will be compensated for by the adjacent rows and yield will not be reduced.

Keys to successful weed control in narrow row soybeans

- Select fields for narrow row production that do not have severe weed problems. Unmanageable weed problems will not go away in narrow rows. In fact, difficult weed problems will be harder to control with narrow rows.
- Select a herbicide program that fits the weed spectrum in the field and then apply uniformly and accurately at recommended rates. Do not reduce rates. For no-till soybeans, include a burndown herbicide to kill existing vegetation at planting time if needed. Specific herbicide recommendations for weed control in soybeans is available in Extension bulletin E-434, *Weed Control Guide for Field Crops.*
- Rotary hoe if no rain occurs for 7 days or more after a preemergence herbicide application. Rotary hoeing may also be important if crusting occurs. If crusting occurs, seedlings will have more difficulty emerging in narrow rows than in wide rows because the seeds in the row are spaced further apart.
- Use practices to give the crop the greatest possible competitive advantage over weeds.
- Scout fields on a regular basis (once per week is ideal) from planting until canopy closure. This will help to identify weed escapes early when control is still possible.
- Apply postemergence herbicides on a timely basis. Most postemergence herbicides are only effective when weeds are very small. As the soybeans get larger, it is more difficult to achieve adequate coverage of weeds with herbicides. In addition, the longer the weeds are allowed to grow, the greater effect they will have on crop yield.
- Take a clipboard on the combine when harvesting to record any weed problems in the field. This information will be very valuable in developing weed control programs for the following year.

Skip rows—another option

The principle of skip rows is to leave unplanted rows in an arrangement that allows driving through the field without driving on soybean plants. This can be done by modifying the planter to fit the desired pattern. The objective of this system is to gain the benefits of narrow rows without the necessity of driving on soybean plants to apply postemergence herbicides. A common pattern for skip rows is a 15-inch row spacing and 30-inch skips for tractor wheels.

When planting soybeans with skip rows, seed the narrow rows at the recommended rate for that row spacing. If possible, seed the rows next to the skip row at the rate recommended for the width of the skip.

Other problems

Several other problems may exist with narrow row production, and you should be aware of them.

- **Non-uniform seeding depth.** It may be difficult to control seeding depth with a grain drill unless it is equipped with depth gauge wheels.
- **Increased planting expenses.** Planting costs may be increased if you are using a unit planter because either additional planter units may be needed or additional labor and fuel may be required when splitting the middles of wide rows in a second pass. If you are using a drill which you already own for small grain seedings, no additional planting expenses are anticipated.
- **Greater lodging potential.** Soybeans grown in narrow rows usually grow taller and are thus more prone to lodging. If you have encountered lodging problems with a particular variety in the past, avoid that variety for narrow row production.
- **Reduced seedling emergence due to soil crusting.** If soil crusting becomes a problem prior to seedling emergence, soybeans seeded in narrow rows may have difficulty emerging. In narrow rows, fewer seeds are planted per foot within the row, so there is less opportunity for a group of seedlings to emerge at the same time in the same place. In wide rows at recommended populations, groups of seedlings can emerge and break through a crust. If severe crusting is encountered with narrow row soybeans, use of a rotary hoe is recommended to help seedling emergence.
- **White mold.** If *Sclerotinia* white mold has been a problem with either soybeans or dry beans in the past in a particular field, growing narrow row soybeans in that field may aggravate the problem. The potential for white mold is greater in a denser plant canopy because environmental conditions that favor the pathogen are more likely to occur.

Summary

In this bulletin, we have discussed some of the agronomic considerations and recommendations for narrow row soybean production and considered the challenges and opportunities offered by this practice. We have also discussed the increased income possible with the system. To conclude this topic, let's consider the added expenses of narrow row soybeans and look at the bottom line of net economic return or profitability.

Table 8 summarizes the economics of narrow row soybean production by listing the added income and the added expenses of switching one acre from 30-inch to 10-inch rows. Assuming a 35 bushel per acre yield in wide rows, a yield increase to 42 bushels per acre should be possible with 10-inch rows. This extra 7 bushels provides an additional $31.50 gross revenue (when soybeans are $4.50/bu). A savings of $4.00 per acre can also be found because no cultivation is necessary. Thus, the total added revenue is $35.50 per acre. Additional expenses for herbicide, fertilizer, planting and rotary hoeing total about $19.50 per acre, providing additional net income or profit of $16.00 per acre. This $16.00 per acre should be considered the *bottom line* advantage for narrow row soybean production in Michigan.

Table 8.
Economics of reducing soybean row width from 30 to 10 inches.

Item	$/acre	
Added Income		
20% yield increase (7 bu/acre × $4.50/bu)	31.50	
Reduced Cost		
Less 1 cultivation	4.00	
Total Added Revenue		35.50
Added Expense		
Herbicide[1]	8.00	
Fertilizer[2]	7.50	
Planter costs[3]	2.00	
Rotary hoeing[4]	2.00	
Total Added Expenses		19.50
Additional Net Income		16.00

[1]Based on estimate that one out of three years an extra postemergence herbicide application (costing $24/acre) will be necessary.

[2]Due to higher yield goals, estimate that an additional 25 pounds of P_2O_5 and K_2O will be required.

[3]Due to additional planter units purchased or increased labor and fuel costs.

[4]May or may not be needed depending on crusting and weed problems early in the season.

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