

WISCONSIN

BEST MANAGEMENT PRACTICES GUIDE



BEST MANAGEMENT PRACTICES

The mission of the Wisconsin Soybean Marketing Board (WSMB) is to maximize the profitability of Wisconsin's soybean producers by investing Wisconsin's soybean checkoff funds in targeted domestic and international research, promotion and communication initiatives. The volunteer farmer-leaders who serve on the WSMB board of directors invest your checkoff dollars in research to improve soybean production practices to make your farm more profitable and ensure the sustainability of Wisconsin soybean production.

This guide highlights three significant management practices that can help you be more successful in your soybean operation. The practices are proven to contribute to higher yields in both research environments and farmers' fields. Use these best management practices (BMPs) throughout the growing season to help you achieve success in 2016 and beyond.



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AGRONOMY 101

VARIETY SELECTION

Selecting varieties is one of the first decisions you make for each growing season. Common factors when rating varieties include yield potential, pest (disease, insect, nematode and herbicide) resistance traits, lodging, maturity date, and protein and oil content. Choosing the right varieties for your farm can make a big difference in your bottom line, so be sure to take the characteristics of each of your fields into consideration when selecting next year's varieties. Here are two other factors to consider:



- **Maturity group**

Growing conditions vary across Wisconsin, but you should be selecting a soybean variety that fits into maturity groups 0-III. The lower the maturity group number, the earlier the soybean plant will mature.

- **Seed treatments**

Seed treatments can be a worthwhile investment, providing protection against insects, diseases and soybean cyst nematode. University of Wisconsin

Soybean and Wheat Extension Specialist Shawn Conley, Ph.D., recommends applying fungicide and insecticide seed treatments for early-planted soybeans to manage pests that flourish in the cool, wet environment that is often present early to mid-spring.

PLANTING

After selecting your soybean varieties, the second step to a successful season is to get your soybeans in the ground. Follow Conley's suggestions below to ensure that you are planting at the right time, right rate and right spacing:

- **Planting date**

Although soybeans can be planted over a wide window of time and still be successful, you should aim to have yours planted by May 10th to avoid potential yield loss caused by a late planting date. Yield losses range from 0.2 to 0.5 bushels per acre a day when delayed past early May.

- **Planting population**

Get the most out of your acreage: aim to plant 140,000 to 160,000 soybean seeds per acre. If you are still planting soybeans after the third week in May, bump the planting population up to 180,000 to 200,000 (the later the planting date, the higher the population) to maximize yield potential.

- **Row spacing**

Maximize sunlight interception by planting your soybeans in rows spaced 20 inches wide or less. Narrower rows also offer assistance in fighting weeds, due to an earlier canopy closure that shades weed seedlings.

SCOUTING

Even the best soybean varieties planted under the right conditions cannot perform to their full ability without your watchful eye. Be sure to scout regularly during the growing season to spot potential issues with the growth of your crop or with various pests before either puts a dent in your bottom line. Check for successful emergence and consistent plant stands early in the season and be on the lookout for diseases, insects and weeds throughout.

PEST MANAGEMENT

Management of diseases, insects and weeds is critical to the ultimate success of your crop. Soybeans can be attacked during any stage, but are susceptible to yield-robbing pests and diseases from the seedling stage through pod fill (R6). The following best management practices will provide guidance and advice for scouting, prevention, and identifying common pests, economic thresholds and treatment options.

TABLE 1: MAJOR DISEASES THAT IMPACT SOYBEANS IN WISCONSIN AND THEIR CONTROL MEASURES

	TIMING	CONDITIONS	MANAGEMENT
Phytophthora root and stem rot	V0-V6 (seed to late vegetative phase)	<ul style="list-style-type: none"> • Cool, wet weather. • Poorly drained soils. 	<ul style="list-style-type: none"> • Avoid planting into cool, wet soils. • Improve field drainage. • Use fungicide seed treatments and resistant varieties.
Pythium root rot	V0-V2 (seed to early vegetative phase)	<ul style="list-style-type: none"> • Cool, wet weather. • Poorly drained soils. 	<ul style="list-style-type: none"> • Avoid planting into cool, wet soils. • Improve field drainage. • Use fungicide seed treatments.
Stem canker, stem blight, and seed decay	After flowering	<ul style="list-style-type: none"> • Warm temperatures and wet weather prior to flowering. • Dry weather after flowering can increase stem canker. • Cool weather and high humidity or rain during pod fill can increase stem blight and seed decay. 	<ul style="list-style-type: none"> • Manage field residue. • Use fungicide seed treatments. • Foliar fungicides may be needed at mid-flowering to beginning maturity.
Soybean cyst nematode (SCN)	All season	<ul style="list-style-type: none"> • More likely to occur in fields where soybeans were grown in the last 1 or 2 years. 	<ul style="list-style-type: none"> • Soil sample to determine if SCN is present. • Plant resistant varieties and reduce plant stress. • Use a regular crop rotation. • Rotate sources of SCN resistance to slow SCN population shifts.
Sudden death syndrome (SDS)	Flowering to maturity	<ul style="list-style-type: none"> • Moist soil at planting, followed by cool conditions at flowering. • Early planting. 	<ul style="list-style-type: none"> • Plant resistant varieties. • Use regular crop rotation. • Improve field drainage. • Use fungicide seed treatments.
White mold	After flowering	<ul style="list-style-type: none"> • Cool, wet weather during vegetative phase. • Wet or foggy weather at flowering. • Lack of air circulation under canopy. • High plant populations and narrow rows. 	<ul style="list-style-type: none"> • Plant resistant/tolerant varieties. • Reduce tillage. • Use regular crop rotation. • Apply foliar fungicides in high risk fields between R1 (first flower) and R3 (beginning pod) to avoid economic loss.

DISEASES AND NEMATODES

Diseases can and do cause economic loss for Wisconsin soybean farmers. Several major diseases, including white mold, may be controlled with fungicide applications in-season. Other diseases, such as Phytophthora root and stem rot, soybean cyst nematode and sudden death syndrome, may only be prevented at or before planting using resistant varieties, seed treatments or cultural practices like crop rotation. Nothing can be done once symptoms are present in the field.

To prevent disease from reducing your soybean yields, follow these best management practices:

- **Plant resistant varieties**

This is the first line of defense against diseases that rob soybean fields of yield. Selecting varieties that are resistant to diseases and nematodes reduces the need for fungicide application and reduces costs.

- **Use a seed treatment**

Not all seed treatments are equal. Be sure to use a seed treatment that controls the primary disease issue you are targeting. For example, some seed treatments are only effective against Phytophthora or Pythium and not effective against sudden death syndrome.

- **Scout**

Regularly scout your fields for disease. Scouting is the only way to clearly identify disease problems and select an appropriate treatment. Be sure that the disease is properly identified so that you can choose the best management strategy.

- **Rotate crops**

Rotation of crops is a simple and effective way to maintain the health of the soil and prevent the incidence of some diseases.

Need help identifying a disease issue in your field? Send samples to the University of Wisconsin-Madison Extension Plant Disease Diagnostics Clinic (PDDC). Visit labs.russell.wisc.edu/pddc/ for more information.

WONDERING IF SCN IS PRESENT ON YOUR FARM?

WSMB sponsors free SCN soil testing for Wisconsin soybean farmers. To order a kit, call 608-262-1390, email freescntest@mailplus.wisc.edu or visit the WSMB website at www.wisoybean.org.



INSECTS

When should you treat your fields for insects?

To avoid unnecessary costs, remember to treat for insects only once threshold levels have been met or exceeded, signaling that insect populations will cause economic loss.

How are insect thresholds determined?






Entomologists use field research to mathematically set economic thresholds based on numerous variables, including knowledge of the particular insect and damage potential as well as the potential value of the harvested crop and the cost of insect-control practices.

These thresholds pinpoint the density at which an insect population will cause large enough yield losses that it will negatively impact a farmer's bottom line. Thresholds provide a guide for farmers to know when to apply control measures.



Pictured Above: Soybean looper

TABLE 2: MAJOR INSECTS THAT IMPACT SOYBEANS IN WISCONSIN AND THEIR CONTROL MEASURES

	INSECT	INJURY	THRESHOLD
	<p>Bean leaf beetle</p>	<p>Larvae feed on roots, but most damage is caused by adults feeding on soybean leaves, causing holes in the leaves.</p>	<p>Overwintering generation:</p> <ul style="list-style-type: none"> • Treatment is rarely needed for seedling soybeans (VC-V2), however control should be considered if defoliation is greater than 35% and there is a field average of 7 beetles per row foot. <p>Summer generation:</p> <ul style="list-style-type: none"> • Before R1: 30% defoliation • R1 to R4: 20% defoliation • R4 to maturity: 5 to 10% of pods damaged
	<p>Leaf defoliators</p> <ul style="list-style-type: none"> • Japanese beetle (adult)- pictured • Green cloverworm • Grasshopper 	<p>Feeding injury consists of holes on soybean leaves or feeding on the leaf edge</p>	<ul style="list-style-type: none"> • Before R1: 30% defoliation • R1 to R4: 20% defoliation
	<p>Seedcorn maggot</p>	<p>Maggots attack germinating seed and cotyledon prior to emergence.</p>	<ul style="list-style-type: none"> • Use insecticide seed treatments. • No in-season rescue treatment available.
	<p>Soybean aphid</p>	<p>Aphids extract plant sap from soybean plants, causing leaves to yellow and drop from plant under high populations.</p>	<ul style="list-style-type: none"> • Before R6: aphid populations are increasing and there are 250 or more aphids per plant and 80% plants infested.
	<p>Spider mites</p>	<p>Mites pierce the leaf cell and suck plant sap.</p>	<ul style="list-style-type: none"> • Mites are present between R1 and R5. • 15% or more of the leaf area is discolored and stippled with yellowing leaves. • Live mites are present. • Hot, dry weather is expected to continue.

Photos: David Marburger, University of Wisconsin-Madison; John Obermeyer, Purdue; Shawn Conley, University of Wisconsin-Madison.

MEASURING INSECT DAMAGE

Physical damage from insects is often indicated by defoliation and/or pod damage. Refer to Figure 1 when determining leaf-defoliation levels while scouting.

Figure 1: Representations of various levels of soybean leaf defoliation

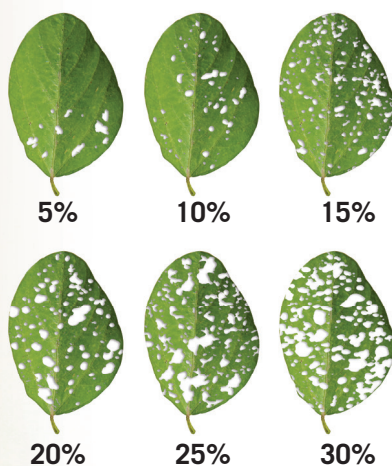


Figure 1

WEEDS

Herbicide-resistant weeds plague many farmers and have the potential to increase production costs and put a dent in soybean yields. While limited herbicide resistance has been documented in Wisconsin, it is never too early to reduce the chances of herbicide-resistant weeds showing up on your farm. Keep herbicide-resistant weeds at bay by following the best management practices outlined below.



USE DIFFERENT HERBICIDE MODES OF ACTION (MOAs)

Preventing and managing herbicide-resistant weeds begins with a strong, integrated weed-management program. Your program should include a minimum of two different herbicide MOAs that are effective for control of the weeds you are targeting. Always check the herbicide label for MOA group number and use different MOAs with overlapping weed spectrums in rotation, sequences or mixtures. Frequent use of herbicides with the same MOA is the most important factor in the development of herbicide-resistant weeds.

YEAR-ROUND MANAGEMENT

Successful weed management is a yearlong process. Weed control begins with burndown before planting and continues through the growing season and following harvest. Use the following best management practices when using herbicides throughout the year:

Before and during planting:

- **Prepare a weed-free seedbed**

The first step in an effective weed-management strategy is to plant into a clean field. Tillage can be a valuable control measure against weeds in fields that are reduced-till or conventional-till. Take advantage of herbicide burndown options in no-till fields.

- **Plant narrow rows**

The leaf canopy will close sooner in soybeans planted in narrow rows (20 inches or less) than wide rows (30 inches or more). The canopy shade will reduce weed competition and maximize the amount of sunlight the soybean plant can capture.

In-season weed control:

- **Scouting and documentation**

Scout your fields and document weed species present in individual fields each year. This allows you to make

decisions based on the MOAs previously used in that field and the level of weed control they exhibited. Know your weeds: Which are most problematic in your fields? When do they grow and pollinate?

- **Pre-emergence and postemergence herbicides**

The most critical time to control weeds is up to four weeks after emergence. When using a pre-emergence herbicide, fewer weeds emerge, which reduces the number of weeds that will need to be controlled by postemergence herbicides. In addition, pre-emergence herbicides provide insurance against the devastating effects of early-season weed competition with the crop. The reduction in weeds exposed to the postemergence herbicides also helps to proactively manage against herbicide resistance.

Scouting is the only reliable way to know if the pre-emergence herbicides you applied were effective. When weeds survive pre-emergence

applications, use timely applications of postemergence herbicides that have different MOAs than the pre-emergence herbicides you used.

- **Use the full herbicide rate**

Use the full labeled rate for all herbicides you apply. Spray weeds when they are actively growing and follow herbicide label recommendations to ensure that application is before weed size limits are exceeded.

After harvest:

- **Preparing for the next crop**

During harvest, make scouting reports on any weeds that were present during crop harvest as these will be weeds contributing to the soil seedbank and will require better management in the future.

Use fall weed-control measures, such as tillage or burndown and residual herbicides, to reduce weed-seed production and prepare your fields for

the next crop. Also, thoroughly clean harvest equipment from problematic fields as they can transfer weed seed among fields.

- **Crop rotation**

Diversifying crop rotation can facilitate use of different herbicide MOAs, tillage practices and competitive crop environments that reduce selection for problem weed species and herbicide resistance.









“In soybeans, there is hidden yield loss with weed competition that growers don’t necessarily know they have,” says Dr. Shawn Conley. “Control those weeds early with a pre-emergence herbicide and follow up to make sure they are effectively managed.”

For more information on weed management and herbicide resistance, visit www.TakeActionOnWeeds.com.



TABLE 3: MAJOR WEEDS THAT IMPACT SOYBEANS IN WISCONSIN AND THEIR CONTROL MEASURES

		GROWTH	THREATS	WEAKNESSES
	Crabgrass	<ul style="list-style-type: none"> • Germinates from mid-spring to late summer 	<ul style="list-style-type: none"> • Often the last grass species to emerge 	<ul style="list-style-type: none"> • Controlled by many soil-applied herbicides
	Common lambsquarters	<ul style="list-style-type: none"> • Germinates and emerges early in the spring • Easy to control with residual pre-emergence herbicides 	<ul style="list-style-type: none"> • Difficult to control with postemergence herbicides 	<ul style="list-style-type: none"> • Controlled by many soil-applied herbicides
	Common ragweed	<ul style="list-style-type: none"> • Germination requirements similar to soybean 	<ul style="list-style-type: none"> • Very competitive, especially on marginal ground 	<ul style="list-style-type: none"> • Controlled by many soil-applied herbicides
	Foxtails	<ul style="list-style-type: none"> • Fast-growing summer annuals 	<ul style="list-style-type: none"> • Competitive with Midwestern crops 	<ul style="list-style-type: none"> • Do not typically emerge from deep soil depths
	Giant ragweed	<ul style="list-style-type: none"> • Emerges from up to 5 inches deep in soil 	<ul style="list-style-type: none"> • Very competitive with Midwestern crops • Herbicide-resistance traits can transfer by pollen 	<ul style="list-style-type: none"> • Seed does not survive lying on soil surface • Long-term no-till will reduce soil seed bank
	Velvetleaf	<ul style="list-style-type: none"> • Long-lived seed • Erect summer annual that can grow 7 feet tall 	<ul style="list-style-type: none"> • Contains allelopathic chemicals that inhibit soybean growth • More common in atrazine prohibition zones 	<ul style="list-style-type: none"> • Susceptible to natural pathogen

(Continued)



Waterhemp

- 1 to 1.25 inches per day
- Rapid early-season growth allows seedlings to acquire more light than other weeds

- Emerges throughout growing season
- Can escape pre-emergence herbicides and postemergence applications without residuals
- Herbicide-resistance traits can transfer by pollen very quickly
- Major ability to infest fields; up to 1 million seeds per plant; seeds remain viable for up to 4 years

- Does not emerge from deep soil depths
- Short-lived in the soil seed bank (4-5 years)

Photos: Common ragweed, crabgrass, velvetleaf- David Marburger, University of Wisconsin-Madison; all others- Take Action on Weeds

SOIL SAMPLING AND FERTILITY

Grain crop yields, including soybeans, have increased in recent years. Don't follow a one-size-fits-all approach to nutrient management: higher yields mean more nutrients are used and will need to be replaced.

SOIL SAMPLING

Nutrient deficiencies aren't obvious until it's too late for a growing crop. Conley recommends taking soil samples in your fields every four years. Rotate which fields you

sample every year to keep costs manageable and reduce the time needed for sampling after harvest. Soil-test results provide important information about your field's nutrient levels and recommendations to achieve optimum nutrient levels.

Keep in mind that nutrient deficiencies aren't a quick fix. Spread fertilizer applications over several years to slowly build soil-nutrient levels and keep fertilizer costs manageable.

NUTRIENT REMOVAL

It's important to watch your bottom line. When cutting costs, remember that phosphorus (P) and potassium (K) are the most important nutrients to replenish for your next soybean crop. Table 4 depicts nutrient-removal rates on a per-acre basis with yields of 60 and 90 bushels per acre, showing just how much fertilizer a single soybean crop needs.

Use your soil-sample results and yield history to determine how much fertilizer you need to apply each year.

TABLE 4: PHOSPHOROUS (P₂O₅), POTASSIUM (K₂O) AND SULFUR (S) REMOVAL RATES IN SOYBEANS

Nutrient	Grain Yield (bu./acre)		
	40	60	80
P ₂ O ₅	29	43	57
K ₂ O	51	75	100
S	7	10	14

*Preliminary data from WSMB-funded nutrient uptake and partitioning research.





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Technical editing for this guide was led by Shawn Conley, Ph.D., University of Wisconsin-Madison and Damon Smith, Ph.D., University of Wisconsin-Madison. The United Soybean Board neither recommends nor discourages the implementation of any advice contained herein, and is not liable for the use or misuse of the information provided.