CROP INSIGHTS

PIONEER
A DuPont Company

Maximizing Soybean Yields – Overcoming SCN, Disease and Insect Problems

by Steve Butzen, Agronomy Information Manager

Summary

- One reason soybean yields have lagged in recent years is the challenges from soybean cyst nematode (SCN), diseases and insects. Growers must overcome these challenges to maximize soybean yields.
- SCN has increasingly infested more fields throughout the U.S. Growers should test soils, select resistant varieties, rotate crops, rotate sources of resistance and reduce other stresses on the crop to minimize damage from this pest.
- Disease control begins with scouting to understand disease risks and their potential severity in each field. Variety selection, crop rotation, seed treatments and foliar fungicides are the best tools available to counter most disease threats.
- Management of soybean aphid or bean leaf beetle may be necessary for top yields. Scout diligently and treat with an insecticide if needed.
- Due to earlier planting and higher levels of crop residues, fungicide-insecticide seed treatments are becoming more common and merit testing by growers. Pioneer research has shown increased yields and profits with these products.
- Strobilurin fungicides applied at the R3 growth stage have consistently increased soybean yields in Pioneer studies. Including an insecticide in the tank was usually cost-effective.
- Consider establishing your own 5- to 10-acre high-yield plot to test new practices important to maximizing soybean yields. Any product or practice is fair game for testing in this plot.

Introduction

Over the last 25 years, U.S. average corn yields have increased by 1.6 percent per year while soybeans have only achieved a 1.27 percent gain per year. One reason for this discrepancy is likely the ever-increasing challenges to soybean production from soybean pests such as soybean cyst nematode, sudden death syndrome, brown stem rot, white mold, soybean aphid and bean leaf beetle. A previous *Crop Insights* addressed basic agronomic practices that could help increase soybean yields. This article will discuss overcoming pest obstacles to achieving top soybean yields and profits.

Severe SCN damage in drought-stressed field.

Soybean Cyst Nematode (SCN)

SCN has long been the chief nemesis of soybean production in the U.S. This tiny wormlike parasite has now spread to practically all important soybean production areas of the U.S. and is reaching economic levels in more and more fields. SCN may decrease yields substantially without inducing obvious symptoms. In fact, studies have shown in SCN-infested fields, yields can be reduced by over 30 percent without visible above-ground symptoms. Consequently, many fields are infested without the knowledge of the grower. Sampling fields with no symptoms is the only way to detect SCN before it becomes an economic problem.

When SCN is determined to exist at economic levels in a field, growers should implement a combination of management strategies for effective control. This involves continued soil testing to monitor SCN numbers or races, crop rotation, and use of appropriate resistant soybean varieties. Effective nematicides have not been an option in the past, but new products are being tested and may offer another management choice in the future.

If a single genetic source of SCN resistance is used repeatedly, race shifts can occur in a field. For this reason, nematologists recommend rotating sources of resistance, in addition to crop rotation and other management practices. Pioneer offers varieties with the Peking source of resistance, which can be rotated with the common PI 88788 source used in over 90 percent of soybean varieties currently available in the U.S. and Canada.

In addition to directly managing SCN, any practice which promotes good soybean health and growth also will help minimize yield losses from SCN. Avoiding low soil fertility, compaction, drought stress and other disease and insect pressures will enable soybean plants to better withstand the effects of SCN.

Using the latest breeding tools, including Accelerated Yield Technology (AYT™) and marker-assisted selection (MAS), allows Pioneer researchers to develop top-yielding varieties while incorporating genes for SCN resistance. These tools greatly improve the efficiency of selection and increase the rate of new product development.

Diseases

Soybean diseases are one of the most significant obstacles to achieving maximum soybean yields. Even worse, several diseases like sudden death syndrome and white mold appear to be spreading in major soybean states. Variety selection, crop rotation, seed treatments and foliar fungicides are the best tools available to counter most disease threats.

Sudden Death Syndrome (SDS)

Like soybean cyst nematode, sudden death syndrome (SDS) has spread northward from the southern U.S., with most Midwest states now affected. Symptoms of SDS usually do not appear until mid-summer or later in the Midwest, but infection occurs in the spring. Soil temperatures below 60 F are ideal for SDS infection. Like many other soil-borne root rots, SDS develops under cool, wet soil conditions and often appears first in low, poorly drained or compacted areas of the field.

Management options for SDS include scouting fields for SDS infection, selecting tolerant soybean varieties, avoiding early planting, improving field drainage, reducing compaction, evaluating tillage systems and reducing other stresses on the crop. Pioneer rates its varieties for tolerance to this damaging disease and offers 15 varieties with a 7 or 8 rating (on a scale of 1 to 9, 9 = best).

Other Diseases

In addition to SDS, soybeans face a number of other serious disease risks, including Phytophthora root rot (PRR), brown stem rot (BSR), white mold and frogeye leaf spot. Geographic location, seasonal growing conditions and soil type determine the presence and severity of these and other soybean diseases. When conditions are favorable for disease development, impact on crop yield can be significant, so these diseases must be successfully managed to maximize soybean yields.

Disease Management

Variety selection is often the best defense against soybean diseases. But for variety selection to be successful, growers must be aware of the disease risks on their fields, the potential severity of the disease, and the degree of resistance or tolerance in available products. In its product descriptions, Pioneer lists the specific genes for Phytophthora ***resistance*** incorporated into Pioneer® brand soybean varieties. Product literature also shows variety ratings for Phytophthora field ***tolerance*** and resistance or tolerance to brown stem rot, white mold and frogeye leaf spot. Your local Pioneer sales professional can help you select varieties with appropriate disease resistance ratings and other important traits for each field.

Soybean seedlings dying under high Phytophthora pressure. Seed treatments help provide early protection.

Seed treatments are another means of combating seedling diseases. Because of earlier planting and higher levels of crop residue on fields, soils generally are colder and wetter at planting, and seedling diseases have increased as a result. Consequently, more growers are seeing an advantage to fungicide seed treatments. Adding an insecticide to the treatment helps prevent insect feeding that provides an entry port for disease infection. Pioneer Agronomy Sciences researchers routinely test seed treatments in multiple locations each year.

In 36 site-years of Pioneer testing over four growing seasons, fungicide seed treatments (ApronMaxx® and Trilex® AL) delivered a 0.6 bu/acre yield increase (Figure 1). But when a fungicide-insecticide combination was used (CruiserMaxx® and Trilex AL + Gaucho®), the yield advantage jumped to 2.0

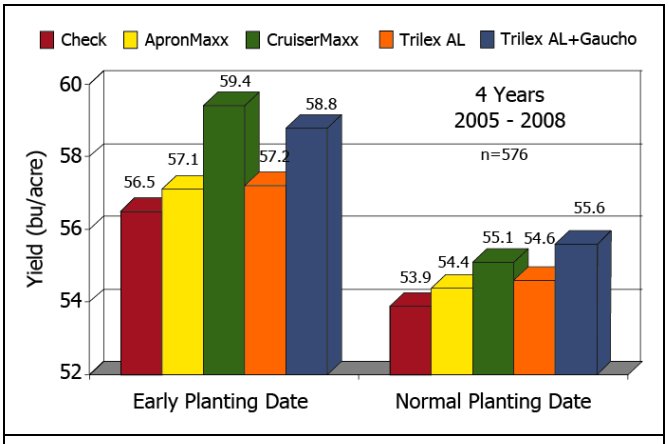

Figure 1. Average grain yield by treatment and planting date for all locations, 2005 to 2008. Results include 36 site-years with four replications and four varieties per location.

bu/acre. This represented a significant positive return on the seed treatment investment.

Foliar fungicide applications to both corn and soybeans have become more common in recent years. Pioneer agronomy researchers have tested foliar fungicides with and without an insecticide included in the tank. Results over five years of testing demonstrated that:

- Headline® applied at the R3 stage resulted in an average yield response of 3.7 bu/acre. A positive yield response was observed 78 percent of the time and an economic yield response 51 percent of the time (Figure 2).

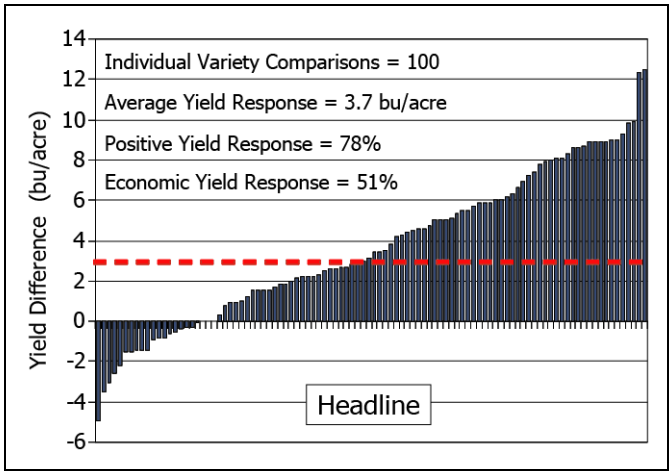

Figure 2. Yield response to Headline (2004-08)*.

*For Figures 2 and 3, values above the red line represent a positive return on investment (i.e., an economic response). For simplicity, the treatment cost (fungicide + application) per acre was estimated at the value of 3 bushels of soybeans.

- Quadris® applied at the R3 stage resulted in an average yield response of 2.9 bu/acre. Although the average yield response was lower than Headline, the positive and economic yield responses were very similar.
- Headline/Asana® applied at the R3 stage resulted in an average yield response of 5.5 bu/acre. A positive yield response was observed 90 percent of the time and an economic yield response 73 percent of the time (Figure 3). This treatment was only evaluated in 2007 and 2008.
- Quadris/Warrior® applied at the R3 stage resulted in an average yield response of 4.1 bu/acre. A positive yield response was observed 77 percent of the time and an economic yield response 59 percent of the time.

Insects

A decade ago, soybean producers worried little about insect pressure to their crop. Soybean aphids were unknown at that time, and populations of bean leaf beetles and other leaf defoliators usually remained below economic thresholds for treatment. In recent years, however, the soybean aphid has emerged as the primary insect pest of soybeans, and bean leaf beetle numbers have increased dramatically. In fact, some growers treated for both of these pests in recent years.

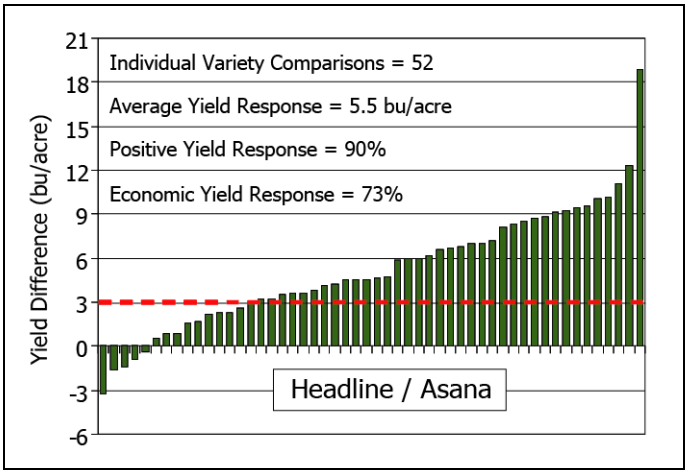

Figure 3. Yield response of Headline/Asana (2007-08).

Soybean Aphid

The soybean aphid has quickly become the major insect pest of soybeans in North America. From its first detections in areas near Lake Michigan in 2000, it has spread to virtually all soybean growing areas of the U.S. and Canada. Because yield losses often have been severe in untreated fields, growers are encouraged to actively manage for this damaging soybean pest. Outbreaks of soybean aphid generally have occurred in an every-other-year cycle, likely due to the dynamics of aphid and predator population levels.

No varietal resistance to soybean aphid is yet available in modern commercial varieties. Current management is by vigilant scouting and treating with an insecticide when required. Treatment decisions are difficult because of the rapid nature of aphid reproduction, and the interaction of aphid populations with natural enemies and weather conditions. However, researchers now have a better idea of the infestation levels that justify an insecticide treatment, and scouting procedures have been simplified to make this process more efficient.

As research on soybean aphids continues, new developments are expected to help reduce losses from this pest. For example, Pioneer and Kansas State University have developed a technique for screening soybean lines for their ability to naturally reduce the rate of growth, survival and reproduction of soybean aphids that feed on soybean plants. This type of

resistance is called "antibiosis." Pioneer has used this breakthrough technique to characterize and rate all current Pioneer® brand soybean varieties for this trait.

Aphid antibiosis ratings should be used by growers to help in determining field scouting priorities and insecticide application decisions. For example, when aphid scouting is recommended in an area, fields planted to a variety with a "Below Average" rating should be scouted first and with greater frequency than fields planted to varieties with "Average," "Above Average" or "Exceptional" scores.

Aphid antibiosis screening techniques also help Pioneer researchers identify superior sources of genetically based aphid resistance in soybean germplasm. Once identified, such sources will be used to incorporate aphid resistance or tolerance into new soybean varieties. Growers are encouraged to stay in contact with their Pioneer sales professional for new research developments and updated information on diagnosing and managing soybean aphids in their area.

Bean Leaf Beetle (BLB)

When winters are mild, BLB populations in soybeans may increase dramatically, resulting in increased leaf and pod feeding and virus incidence. Just-emerged soybeans are especially at risk to significant BLB feeding damage when beetle populations are high, especially when planted early and emerging first in an area. Later, during vegetative growth from the V2 stage to flowering, soybeans can tolerate considerable feeding, from 40 percent to 60 percent defoliation, without incurring yield loss. However, the second generation of beetles usually peaks during soybean pod-fill stages, resulting in "clipped" or damaged pods. Significant yield loss can occur at this time (usually during August in the Midwestern U.S.).

Scouting regularly for BLB and treating if necessary are recommended to address this problem insect. Scouting and treatment recommendations are based on the number of insects found per plant and the developmental stage of the crop. When beetle numbers are high, successful management of this insect is important to maximize soybean yields.

® ApronMaxx, CruiserMaxx, Quadris and Warrior are registered trademarks of a Syngenta Group Company.

® Asana is a registered trademark of DuPont.

® Gaucho and Trilex are registered trademarks of Bayer.

® Headline is a registered trademark of BASF.

® Optimize is a registered trademark of EMD Crop BioScience, Inc.

"Personal Best" Soybean Yield Challenge

Pioneer encourages soybean growers to test the concept of maximizing soybean yields by conducting their own "personal best" yield challenge on a 5- to 10-acre plot. Below are some tips to help maximize your plot yield.

- Choose ground not in soybean production for two or more years (to reduce diseases that build up over time). Select a highly productive, well-drained field (to reduce occurrence of Phytophthora, SDS and other root diseases).
- Conduct soil tests to determine P, K, and lime needs, and presence of SCN.
- Consult with your Pioneer sales professional to select the best soybean variety for your field. Consider yield, maturity, standability, disease resistance and other traits for your specific locality.
- Use fungicide-insecticide treated soybean seed to ensure full stand establishment. Also, apply a sterile-carrier soybean inoculant and Optimize® growth promoter.
- Plant soybeans in 7-inch or 15-inch rows. If white mold may be a problem, use 15-inch rather than 7-inch rows.
- Plant soybeans the last week of April or first week of May, depending on geographical location and disease risk. If SDS has been a serious problem in your field, delay planting until the first week of May.
- Scout newly emerged soybeans for bean leaf beetle (BLB) feeding and treat if needed to prevent stand and yield reduction. Scout for BLB throughout the season.
- Control weeds early to prevent competition with the soybean crop. Consider a fall herbicide application if winter or spring annual weeds are often a problem.
- Scout for diseases and apply a strobilurin fungicide (Headline® or Quadris®) at the R3 growth stage if diseases are present. Adding an insecticide to the tank also increased yields in Pioneer studies.
- Scout for soybean aphid and treat with an insecticide if necessary. Treatments applied between mid-July and early August have been most effective in research studies.
- Closely monitor soybean drying for a timely harvest. To avoid shatter losses, combine soybeans the first time seed moisture drops below 13 percent to 14 percent. Be sure combine is carefully adjusted and operated to avoid threshing losses.