

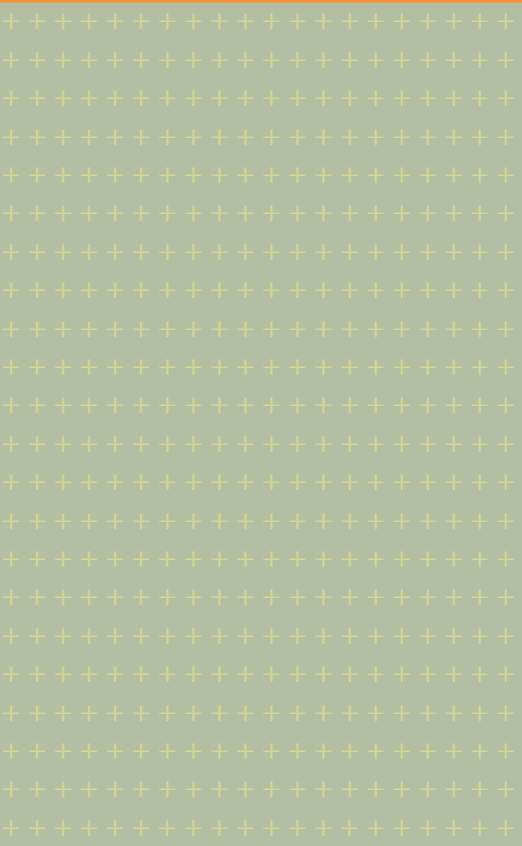
2010



Photo: United Soybean Board

# Research

## *Initiatives*



***Your soybean checkoff.  
Finding solutions to production problems through  
cooperative research and coordination.***



*The North Central Soybean Research Program was established in 1993 by state checkoff organizations in the North Central states. The program's mission is to maximize producer returns by coordinating research efforts across state boundaries, minimizing regional duplication of research expenditures and assuring regional research projects are targeted at problems of the North Central soybean producer.*



## From the president

*Our goal is to help soybean producers be more profitable by investing in research that improves soybean health. The North Central Soybean Research Program (NCSRP) has seen exciting achievements over the years as a result.*

*This is my first year serving as president of NCSRP. A farmer from Kalamazoo County, Mich., I have served on the NCSRP board since 2006. I raise soybeans, corn, wheat, oats, snap beans and seed corn on my fourth generation farm. I have served on the Michigan Soybean Promotion Committee since 1997 and was president of the Kalamazoo County Farm Bureau for five years.*

*I'm honored to be elected president of NCSRP. I look forward to helping drive the collaboration of the 12 states involved in the program. NCSRP is important because it deals strictly with production issues at the farm level in a collaborative way. Any time you combine efforts and pool resources, you have a more efficient process.*

*Partnerships make NCSRP successful. Besides the demonstrated cooperation of the 12 member states that make up this coalition, the cooperation of other stakeholders, like the United Soybean Board and the researchers at our nation's land grant universities, is what makes our successes possible.*

*In the future, we will continue to build on those partnerships. This will enable us to focus on the short-term and long-term challenges that soybean farmers face now, and in the future.*

*Thank you for the opportunity to serve you and for your continued support of this important coalition.*



*Ed Cagney  
President,  
North Central  
Soybean Research  
Program*

# NCSRP

## Partnerships without borders



*Photo: Karen Simon*

*Research partnerships are invaluable in bringing the professional research community together with producers and other groups toward the common goal of improving yield.*

The "P" in NCSRP could just as well stand for "partners." Partnering and partnerships are central to all that NCSRP does.

NCSRP itself is a partnership of 12 Midwest states which together produce 85 percent of United States soybeans. The farmer leaders of the checkoff organizations in those states started with a vision of what collaboration could accomplish, and, since joining forces in 1993, have gained an even broader vision of effective partnering.

The North Central states share the belief that a key component of improving yield is maintaining a leadership role in national research activity and that, rather than

waiting for a problem to show up in the Midwest, it is better to continually monitor for emerging diseases and insects. NCSRP's role is to identify problems in soybean production, prioritize research that will benefit soybean farmers and develop partnerships to discover and implement solutions.

One way NCSRP provides leadership is by participating in professional scientific organizations previously comprised solely of academic researchers.

"Our involvement in the research community has reinforced our belief in the value of partnerships," comments David Wright, director of research for NCSRP. "By being involved in professional organizations which in the past have been limited to faculty at land grant universities, we are able to better understand research capabilities, and, as a result, solve problems more quickly by teaming researchers from different universities to collaborate on research projects critical to soybean producers.

"The NCSRP board has shown creativity in forming coalitions to solve problems," Wright says. "We join with different partners for each project, though the partners typically include the United Soybean Board (USB), coalition states and land grant universities."

An example of complex ongoing collaboration is illustrated by the partners doing soybean aphid research. While NCSRP and USB each have their own research and complement each other, "the

need for a solution to this problem is so great, neither organization can nor should work on it alone," Wright says.

When the soybean aphid was discovered in Wisconsin in 2000, the board knew it needed to address the challenge posed by the invasive pest, which had originated in Asia but was new to U.S. farmers. A team led by David Ragsdale of the University of Minnesota was assembled to study the biology of the aphid and develop chemical control measures.

Since then, aphid research has expanded to include work on genetic resistance to aphids as well as novel control measures such as releasing beneficial insects to keep aphid populations low.

"The work on aphids is a partnership both in organizing and funding," Wright says. "NCSRP helped develop best management practices for farmers to minimize the impact of the soybean aphid."

NCSRP's aphid research team has developed an economic threshold to guide farmers in the use of insecticides for cost-effective control of aphids. NCSRP has also distributed hundreds of pages



*Photo: Iowa State University*  
*NCSRP research is improving yield by improving soybean production practices.*

of biotypes of soybean aphids which have already overcome the genetic resistance of resistant varieties just entering the market. Those emerging biotypes could negate advances made by other research and underscore the need for continued research to discover new sources of resistance to soybean aphids.

"We need to address this issue of new biotypes very quickly because, without a solid foundation of resistance genetics, farmers will continue to rely on insecticides to manage populations," says Wright.

Sometimes collaboration involves unusual partnerships. Probably NCSRP's most unique partnership to date was the work on soybean rust that included the University of Florida and the southern states.

Centered in the panhandle of Florida, where rust is known to overwinter, the partnership ultimately produced 80 scientist years of research to discover the best ways to manage soybean rust through fungicide use, along with how the environment affects rust spore development and distribution.

In an additional partnership with southern states, rust sentinel plots were developed so Midwest farmers now have peers, as well

as university professionals, in the South who act as an advance warning system to lessen the impact of soybean rust in the Midwest. These sentinel plots, along with mobile scouting, help experts stay aware of the movement and severity of the potentially devastating disease.

Thanks to NCSRP's proactive approach to research and developing best management practices, Midwest farmers' fear of devastating yield loss from Asian soybean rust has been minimized. Additional problems being addressed by similar measures include frogeye leafspot, a soybean disease that impacts production in both the North and the South.

New partnerships come into existence as new initiatives are developed. Currently, for example, because NCSRP leadership sees a need to improve yield and yield stability in soybean growing areas, especially those impacted by adverse growing conditions such as too much or too little water, it is looking at a potential project to explore water use efficiency, resilience and yield stability. Though the project is not yet funded, the board hopes to assemble a team of researchers to address this important issue.

Wright says, "These are all examples of the great achievements being made by farmers' investing money in the right research programs and discovering the right partnerships. Thanks to the foresight, creativity and open-mindedness of its board, NCSRP has become a trusted leader and partner in many facets of research, working to safeguard present soybean production and prepare for the future."



*Research in aphid characteristics and secretory proteins is leading to a clearer understanding of host plant/insect interactions and may lead to additional management options.*

of information (including an award-winning publication) to certified crop advisors and farmers on the management of soybean aphids.

Recently, the NCSRP board has partnered with the Ohio Soybean Council and the Wisconsin Soybean Marketing Board to address the issue of emerging

# The SDS partnership between NCSRP and USB



Photo: United Soybean Board

*Research partnerships are invaluable in bringing the professional research community together with producers and other groups toward the common goal of improving production yield. Education and information sharing is an important part of the collaboration process.*

Now among the top four yield-robbing soybean diseases, Sudden Death Syndrome (SDS) continues to spread and intensify. Though southern areas have been dealing with SDS for almost 25 years, it is relatively new in the northern soybean production region, having been confirmed in Minnesota and Wisconsin in 2005 and Michigan in 2006. And it spreads to new counties each year.

NCSRP and the United Soybean Board (USB) have partnered on a multi-faceted SDS research and education program aimed to minimize yield loss. It will make new discoveries about how the pathogen causing SDS impacts the growth and development of the soybean plant.

“Considering how yield loss to SDS has grown, it made sense for NCSRP to partner with USB in this project, similar to our partnerships regarding numerous other diseases and pests, rather than the individual organizations working at it

alone,” says David Wright, director of research for NCSRP.

Checkoff-funded research throughout the North Central region is targeted at multiple aspects of the SDS challenge:

## **SDS genotypes**

Scientists are dealing with questions about whether there are multiple races of SDS. Research shows there are more than a dozen different genotypes of *Fusarium virguliforme*, the pathogen that causes SDS, and studies show some isolates are more aggressive than others. Scientists don’t yet know why, but they are getting close.

## **Two areas of attack**

Scientists are also learning more about how and when SDS infects soybean plants.

A multi-state team is focused on gaining information as to how the SDS pathogen infects the soybean root. They have found it enters the root within four days of germi-

nation, though severe symptoms may not show up until after flowering. However, leaf symptoms can show up at the one-leaf stage.

“We still have a lot to learn about the link between the root and foliar phases of the disease,” says Leonor Leandro of Iowa State University.

X.B. Yang of Iowa State University has found the pathogen needs to colonize the plant’s vascular system for the toxins to be transported to the leaves.

“If the fungus is only in the outer root tissues, it is possible to get root rot but not leaf symptoms,” Leandro says.

Seedlings are especially vulnerable. As plants get older, they become less susceptible to the fungus penetrating the vascular system.

Scientists don’t know whether the soybean plant becomes susceptible again later in the season, but there may be another stage of infection that occurs after flowering. “In fact, it seems flowering is favorable for the appearance of foliar symptoms,” Leandro explains.

## **Resistant varieties**

Researchers agree planting resistant varieties is important, and developing new varieties with resistance to SDS is a priority.



Photo: United Soybean Board

*Improving the genetic potential of soybeans in competitive and high quality cultivars for commercial production is an important goal in defining innovative genetic strategies that result in better yielding soybeans.*



Photo: Iowa State University

*Soybean plant health is a critical component of a profitable soybean production system. Understanding and identifying diseases and pests is critical to the continued profitability of soybean producers.*

"As part of the NCSRP project, we've mapped two specific genes responsible for SDS resistance, and we've bred them into different soybean varieties," says Brian Diers of the University of Illinois. "We will now test how much we improve resistance with these different backgrounds. The genetic markers used in mapping genes should help breeders increase their speed in developing SDS-resistant varieties."

Breeding for SDS resistance is challenging because field tests are difficult. "The soil environment is more complex in the field than the greenhouse," says Diers.

"It's a tough pathogen to control in a complex environment," says Jason Bond of Southern Illinois University, "but through NCSRP research, scientists have improved inoculation techniques and developed new screening protocols, necessary tools to help public and private companies develop better SDS-resistant varieties."

As SDS has moved northward, an urgent need has developed for earlier maturity varieties with resistance to SDS. Silvia Cianzio of Iowa State University, who recently released a new breeding line with improved resistance to SDS in maturity group 2, says, "Private companies are licensing the line to breed into their elite cultivars. We also have a number of new breeding lines in our pipeline, and our

hope is that, every year, we will be able to release new germplasm.

"It's extremely important that we continue to look for new sources of resistance," Cianzio adds, "because resistance only lasts as long as it takes for the fungus to adapt to it."

## Ongoing Research

"SDS is so challenging because we may be dealing with two completely different resistance mechanisms: one in the roots and one controlling foliar symptoms," Cianzio says. "Researchers have found not all cultivars with infected roots show foliar symptoms."

According to Bond, "The majority of resistance in soybean varieties is the type that protects against foliar symptoms. The pathogen still infects the root, but it does not appear to harm the soybean plant."

Root resistance is more difficult. Bond believes there's root resistance in older cultivars, but the donor varieties are agronomically poor. "That is stepping back in terms of yield progress, but there's also the argument that letting the SDS pathogen build up in the roots increases the amount of the pathogen in the soil."

Geneticists all agree they need to continue efforts to develop better SDS-resistant varieties – especially for farmers in northern growing areas.

## Grower education

Besides planting resistant varieties, management practices can also minimize the impact of the disease.

NCSRP has released a publication to increase grower awareness of SDS and suggested management practices designed to reduce yield loss from this growing problem. The "SDS Update" has been sent to

nearly 200,000 growers throughout the 12-member-state region. The publication gives practical advice to help farmers identify and manage the disease. It can also be downloaded from [www.planthealth.info](http://www.planthealth.info), or printed copies can be obtained at no cost by calling 800-383-1423.

## Identifying SDS

*The same conditions which lead to high yields are also conducive to the development of SDS. Those are fields with high fertility and water availability, suited for early planting. Because SDS causes foliar symptoms, it's easier to see that there's a problem compared to soybean cyst nematode (SCN), for instance. However, SDS looks similar to brown stem rot (BSR) and stem canker so farmers need to know the difference.*

***In identifying SDS, NCSRP researchers offer five suggestions:***

***(1) Watch for foliar symptoms.***

*Foliar symptoms can appear early but most often are visible after flowering.*

***(2) Split the stems to determine whether the problem is SDS or Brown Stem Rot (BSR).***

*If the center of the stem is brown, it is BSR; if white, it is SDS.*

***(3) Dig roots, also, to determine between SDS or BSR.***

*While not always present, if there is blue-colored sporulation, this indicates the presence of the pathogen that causes SDS.*

***(4) Note that SDS symptoms appear earlier than BSR.***

***(5) Be aware that stem canker is not as common as SDS.***

*Stem canker can occur in the same year and fields as SDS. In addition to foliar symptoms, stem canker will often have cankers on the lower stem, and defoliation is not as pronounced as with SDS.*

# SCN Increasing yield through SCN management



Photo: Iowa State University

Strip trials were conducted in producer fields at multiple locations in each state. In the spring and again in the fall, samples were taken to see how populations changed.

Soybean cyst nematode (SCN) is soybean producers' number one yield robber, costing more than an estimated \$1.5 billion nationwide in 2009. It silently reduces yield, often without visible symptoms.

Extension plant pathologists from the North Central states organized an education initiative to deliver a consistent message on SCN management. Their goal was to establish on-farm demonstration plots in and provide usable information for all 12 of the North Central states, showing the effects of SCN-resistant sources on field populations.

Loren Giesler from the University of Nebraska, who served as co-leader of the project, says there were varying levels of issues to address. "In some states, generally to the east, hearing about SCN is old news. Many of those growers tested for SCN long ago. They plant resistant

varieties and have forgotten anything else regarding SCN management. Our goal was to remind them that managing SCN goes beyond planting a variety labeled as SCN-resistant. For those farmers, the questions should be, 'Yes, I have SCN, so what is the population doing? Is it a type that reproduces on the varieties I'm raising?'

"In states to the west, SCN is new, and farmers need to answer the question, 'Do I have SCN?' For them, the demonstration's purpose was to show what SCN looks like and what the issues are. Those growers need to test to find out if they have SCN and to what degree."

The overall goal of soybean farmers is always to increase yield. To do so, they should choose the highest yielding soybean varieties available, but they should not forget SCN management.

"We realize farmers are trying to manage many things, but we want them to remember to check for SCN every few years," says Giesler.

For project consistency, the same field protocol was followed in all the states. Strip trials were established in producer fields at multiple locations in each state. At every location a susceptible variety was planted, in addition to varieties representing the three main sources of resistance to SCN. In the spring and again in the fall, soil samples were taken and sent to Terry Niblack of the University of Illinois to see how populations changed through the season.

According to Niblack, having the demonstrations in growers' fields has been key to the project's impact; the way to convince farmers is to have them actively involved. "It is one thing to sit in a room and hear an Extension person tell you what you should do. It's another thing to actually see it working in the field."

Anne Dorrance of Ohio State University says, "The producer cooperators have been outstanding. We couldn't have done this if they hadn't let us put a susceptible variety in their fields."

In 2008, team members delivered SCN information to more than 5,000 participants through a total of 30 field days and 33 indoor educational programs. In 2009, Extension programs on SCN were delivered to more than 11,000 participants through 56 field days and 80 indoor education programs.

Ohio farmers have driven across the state to see a demonstration of susceptible and resistant varieties next to each other. "In one particular case, it was a perfect night as we dug up



Photo: G.R. Noel, USDA-ARS

*Research demonstrations in producer fields result in farmers' firsthand experience with recognizing the potential for yield loss within their own fields.*

roots," Dorrance recalls. "Everyone in the group was able to see the cysts on the roots. It was as though light bulbs came on as they were able to connect the dots. Seeing truly is believing."

Farmers have also been able to see SCN populations vary within a field as nematodes tend to sit in pockets. "We've had farmers say, 'I know I have cysts, but they have not shown up in sampling. Now I know why,'" Dorrance says.

The demonstration shows clearly the earlier maturity in infected areas, as well as accompanying yield loss. "Having a resistant variety next to a susceptible variety gives a good handle on the yield difference, as much as 20 bushels per acre," Dorrance says.

Besides field demonstrations, a "Cyst Management Guide" was published, and 300,000 copies have been distributed throughout 12 states and Canada.

While it has been an educational demonstration, the project also involved research. "We've never before run tests in so many states, so this is helping us fine-tune recommendations for managing SCN," Dorrance says. "The 'Guide' prescribes a general management plan, based on the number of cysts

in a sample, but we have learned recommendations for individual states vary with the different soil types."

When results for 2009 were compiled, data showed yield consistently increased with use of resistant varieties though response varied significantly among locations. Yields were highest for varieties utilizing the PI88788 source of resistance.

Besides yield checks, SCN reproduction factors were also calculated, based on SCN populations at planting and at harvest.

Niblack explains there are basically two types of nematodes in the soybean belt: Type 0 (Race 3) and Type 2, the nematode most adapted to resistant varieties of soybeans. Type 2 is also the most common type of SCN, accounting for 44 percent of locations sampled in 2009.

"What we found in the demonstration plots was not unexpected," Niblack says. "If susceptible varieties are planted, nematode numbers go up. And if we plant resistant varieties with the PI88788 source of resistance where there are Type 2 nematodes, the numbers go up. If we plant soybeans with Hartwig or Peking sources of resistance, the nematode numbers go down."

"The main thing farmers throughout the soybean belt need to know is nematodes are adapting to soybean varieties with the PI88788 source of resistance. We usually don't need to run a type test to know which SCN type farmers have," Niblack says. "We'll know if they're planting a resistant variety and the number of nematodes is increasing."

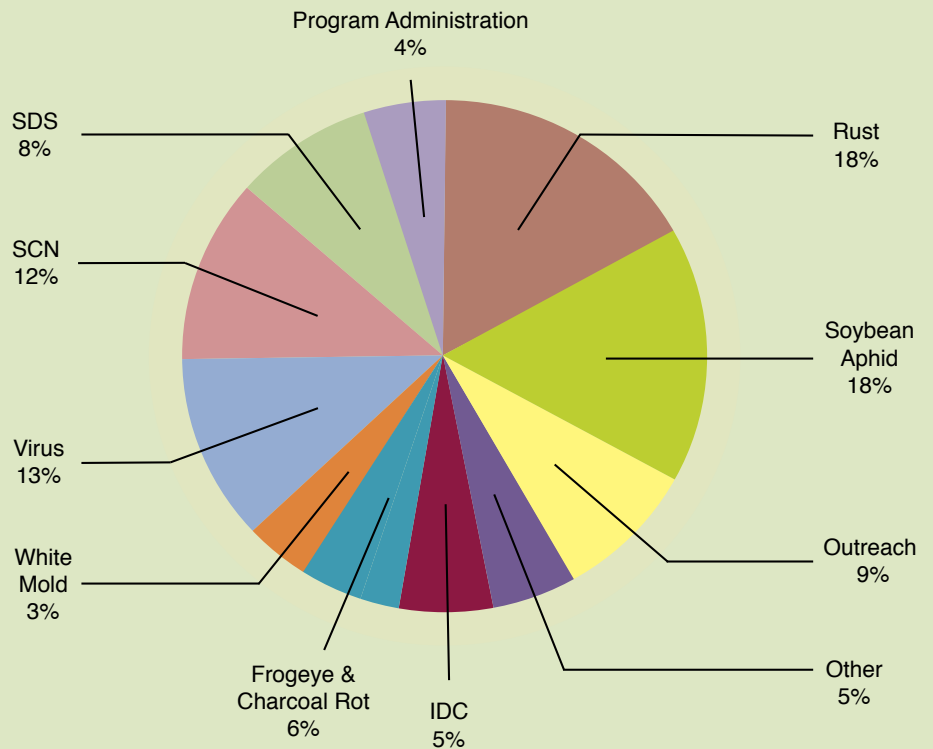
Niblack says adaptation occurs when resistant genetics are misused, as has been the case with PI88788. "It's been planted over and over, and nematodes have adapted. That's why we need soybean breeders to come up with other sources of resistance," she says.

"But an important message for farmers is even planting different varieties with the same source of resistance is effective," Niblack adds. "Different varieties have different levels of resistance and different combinations of resistant genes, even if they have the same source of resistance. Nematodes adapt to the variety before they adapt to the source of resistance so the main thing is to avoid planting the same variety over and over.

"Ultimately, this demonstration says farmers need to hear the message that they need to keep sampling," Niblack says. "It's the only way to know if nematodes in their fields have adapted to the resistant varieties they're using."

Dorrance says, "The demonstration project provides evidence that farmers need to be conscientious in their choice of a variety and stay aware of SCN numbers. They won't get rid of cysts completely, but they need to manage the population."

# FY 2010 Budget Allocation



## Plant Health Initiative

The Plant Health Initiative is focused on issues related to improving the health of the soybean plant. The website, [www.planthealth.info](http://www.planthealth.info), is a clearinghouse of soybean management information and is considered a valuable resource that researchers, breeders and producers can depend upon.

## [www.planthealth.info](http://www.planthealth.info)

Thank you for your support of NCSRP!

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Funded by the soybean checkoff

