Achieving Growth Through Leadership

2011 RESEARCH REPORT

Funded by the Illinois soybean checkoff.
“For Illinois soybean checkoff-funded research to continue benefitting Illinois soybean growers and the world’s hungry population, it’s vital that the Illinois Soybean Association focuses on the future and the priorities of our new strategic plan.

For this reason, we have revised our Managed Research Areas (MRAs) for 2011 so that they better align with the biggest issues growers are facing today. This update places a stronger emphasis on weed and disease management to help increase yield. We also plan to place more emphasis on serving animal agriculture, our number one customer, by encouraging growers to raise higher quality soybeans with better protein and oil composition. We hope you’ll be as excited about these changes, which will ultimately improve your bottom line profitability, as we are!”

DEAN CAMPBELL
Farmer and Chairman of the ISA Supply Committee
Overview of Research Investments ................................................................. 2-3
Soybean Diseases and Insect Pests ................................................................. 4-5
Soybean Cyst Nematode ..................................................................................... 6-7
Weeds ................................................................................................................ 8-9
Soybean Germplasm and Breeding ................................................................. 10-11
Soy Nutrition and Food Science ................................................................. 12-13
North Central Soybean Research Program .................................................. 14
Biotechnology .................................................................................................. 15
Nanotechnology/Aquaculture ........................................................................ 16-17
Online Resources ............................................................................................ 18
Research Teams ............................................................................................... 19
ISA Board of Directors ................................................................................... 20-21

The Illinois Soybean Association Achieves Growth through Leadership...
**Yield. Quality. Profit.**

At the Illinois Soybean Association, we understand that both yield and quality impact the profit of your soybean harvest. That’s why we support research that helps grow your overall production and available markets by addressing the diseases and insects that attack your plants, weeds that infiltrate your field, genetics that enhance your beans and nutritional values that benefit your customers. We know that these efforts will pay off in increases to your bottom line.
Overview of Research Investments

In 2010, nearly half of your Illinois soybean checkoff dollars were invested in research initiatives. The projects – conducted by teams at the National Soybean Research Laboratory, University of Illinois at Urbana-Champaign, Southern Illinois University Carbondale, Western Illinois University and Illinois State University – focused on objectives set forth in the Illinois Soybean Association’s (ISA) mission statement. These included developing new methods and products to improve the quality and dependability of your soybeans, while also enhancing sustainability practices and your competitive edge in the global marketplace. They also addressed grower concerns related to improved yields, winning the fight against diseases, insect pests and weeds and identifying new and desirable genetic traits that assist with all of these efforts.

When evaluating and selecting the projects that would receive research funding, ISA farmer-leaders considered one important fact: “What’s in it for you?” That’s why this year’s report not only shares details on advancements in soybean production but also includes “Key Takeaways” for each area of research. This new feature was incorporated to provide quick, practical information you can use today. We’re confident you’ll agree that your Illinois checkoff dollars are at work for you!

THE MANAGED RESEARCH APPROACH

While the ISA invests some checkoff dollars in independent research intended to increase opportunities for greater soybean yields, better pest and disease control and expanded market options, about 43 percent of the 2010 budget went toward managed research areas (MRAs). Each MRA emphasizes a specific production problem. Selected on the basis of grower priorities, these research projects begin with the formation of teams comprised of growers, researchers and advisors familiar with state and national programs. Scientists, with expertise in the particular fields of study, lead each MRA team. Together, team leaders and members evaluate priorities, set team objectives and tailor research to meet the needs of Illinois soybean growers.

In 2010, the MRAs encompassed five priority areas:

1. SOYBEAN DISEASES AND INSECT PESTS
2. SOYBEAN CYST NEMATODE
3. WEEDS
4. SOYBEAN GERMPLASM AND BREEDING
5. SOY NUTRITION AND FOOD SCIENCE

Since Illinois comprises eight different soil types and five different soybean maturity groups, production research is customized to varied growing conditions. A network of 13 test fields and 40 sentinel plots covers the state. This network gives researchers access to data that is unique to each region to better assist growers statewide.

GROW. COMPETE. LEAD.

Established by the ISA, the Yield Challenge seeks to reward top soybean growers and identify innovative management practices used to produce the highest soybean yields across Illinois and the world. It also helps to promote profitable and sustainable agricultural practices.

The Yield Challenge brings together teams of growers who strategize and implement their own innovative management practices. They also collect and report data along the way that researchers, agri-businesses and growers evaluate for help in improving yield potential.

This year will be the second complete year of the Yield Challenge and promises to be another great success. In 2010 – the inaugural year of the competition – participants saw improved yields that were 5.2 percent higher than their standard plots, well above the target increase of 1.5 bushels an acre! They also provided useful feedback in a concluding grower survey. It revealed that 92 percent of respondents learned something from their Yield Challenge plots and 69 percent will adopt practices used on their Challenge plots in 2011. Get all the details about the Yield Challenge online at www.soyyieldchallenge.com.
ISA Research Funding FY 2010

<table>
<thead>
<tr>
<th>Project Description</th>
<th>Percentage</th>
<th>Expenditure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Competitive Grants</td>
<td>8.48%</td>
<td>$385,890.00</td>
</tr>
<tr>
<td>Weeds MRA</td>
<td>5.50%</td>
<td>$250,000.00</td>
</tr>
<tr>
<td>Glyphosate-Resistant Waterhemp</td>
<td>2.20%</td>
<td>$100,000.00</td>
</tr>
<tr>
<td>Soybean Disease &amp; Insect Pest MRA</td>
<td>14.08%</td>
<td>$639,250.00</td>
</tr>
<tr>
<td>Soybean Cyst Nematode MRA</td>
<td>5.50%</td>
<td>$250,000.00</td>
</tr>
<tr>
<td>North Central Soybean Research Program</td>
<td>6.60%</td>
<td>$300,000.00</td>
</tr>
<tr>
<td>Soy Nutrition &amp; Food Science MRA</td>
<td>5.73%</td>
<td>$260,000.00</td>
</tr>
<tr>
<td>Illinois Center for Soy Foods</td>
<td>0.82%</td>
<td>$37,394.00</td>
</tr>
<tr>
<td>VIPS Database</td>
<td>4.10%</td>
<td>$186,350.00</td>
</tr>
<tr>
<td>VIPS Disease Screening</td>
<td>5.50%</td>
<td>$250,000.00</td>
</tr>
<tr>
<td>Aquaculture Research</td>
<td>6.81%</td>
<td>$309,313.50</td>
</tr>
<tr>
<td>University Soybean Management Activities</td>
<td>0.02%</td>
<td>$851.90</td>
</tr>
<tr>
<td>Soybean Scholarship Program</td>
<td>5.42%</td>
<td>$246,000.00</td>
</tr>
<tr>
<td>Soybean Germplasm &amp; Breeding MRA</td>
<td>12.33%</td>
<td>$560,000.00</td>
</tr>
<tr>
<td>Patents &amp; Copyrights</td>
<td>0.44%</td>
<td>$19,782.00</td>
</tr>
<tr>
<td>Yield Challenge/MRA Coordination</td>
<td>7.81%</td>
<td>$354,728.14</td>
</tr>
<tr>
<td>Research Advisory Expenses</td>
<td>0.48%</td>
<td>$21,596.48</td>
</tr>
<tr>
<td>Biotechnology Issues</td>
<td>3.09%</td>
<td>$140,064.43</td>
</tr>
<tr>
<td>Research Funding Administration</td>
<td>4.10%</td>
<td>$42,544.12</td>
</tr>
</tbody>
</table>

TOTAL $4,540,006.53

MRA = Managed Research Area  VIPS = Varietal Information Program for Soybeans

ISA Expenditures FY 2010

<table>
<thead>
<tr>
<th>Funding Category</th>
<th>Expenditure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soybean Research Funding</td>
<td>$4,502,632.00</td>
</tr>
<tr>
<td>International Market Development Funding</td>
<td>$1,296,702.00</td>
</tr>
<tr>
<td>Information and Education Funding</td>
<td>$1,816,620.00</td>
</tr>
<tr>
<td>Domestic Marketing Funding</td>
<td>$2,802,828.00</td>
</tr>
<tr>
<td>Management and Clerical Costs</td>
<td>$701,009.00</td>
</tr>
</tbody>
</table>

TOTAL $11,119,791.00
Over the past year, researchers have focused on several projects meant to identify and evaluate resistance to various diseases affecting soybean crops. They involved screening soybean varieties and, when possible, field observations.

**TESTING SUDDEN DEATH SYNDROME RESISTANCE LEVELS**

As one of the most widespread and damaging fungal diseases of soybeans in Illinois, sudden death syndrome (SDS) can have a devastating impact on our state’s overall production. To aid farmers in the seed-purchasing process, scientists at Southern Illinois University (SIU) evaluated more than 1,400 varieties – from both private and public sources – for SDS resistance. This SDS-testing program is the only one of its kind in the United States and revealed that over half of commercial varieties in the later maturity groups (3.5-5) have some level of resistance to SDS. However, that number drops to less than 35 percent in early maturity groups. Overall, many cultivars with moderate to high resistance were identified, uncovering an important fact: SDS-resistant varieties are available to you today!

**MANAGING ROOT-KNOT NEMATODE**

Over the past six years, southern root-knot nematode (*Meloidogyne incognita*) has been found with greater frequency in Illinois. As one of the most devastating plant pathogens in the world, southern root-knot nematode is particularly destructive to soybean and other vegetable crops. An SIU research team focused on identifying resistance in commercial varieties and found that only 14 percent of all those tested have resistance to the pathogen. Although this seems like a low number, it confirms that this important trait is becoming more common in soybean cyst nematode-resistant varieties entered in the Illinois State Variety Testing program and demonstrates a growing concern for dealing with this problem. The results of this study were made available by the research team to help growers make variety decisions. It is available online at [www.soybeandiseases.info](http://www.soybeandiseases.info). They also distributed an annual report to all seed companies, numerous growers and several popular press publications.

*The primary goal of the Soybean Diseases and Insect Pests MRA is to deliver to soybean growers tested and useful pathogen and insect pest management strategies to enable informed decisions to optimize soybean yield.*
VIPS: A BROAD SPECTRUM OF INFORMATION

Favorable weather in the fall of 2010 helped many of the state’s soybean growers prepare for the coming spring, including selecting the soybean varieties to plant this season. When making those decisions, the Varietal Information Program for Soybeans (VIPS) can be a powerful tool!

VIPS allows growers to compare the varieties they were using with others at nearby locations, as well as multiple locations in their region and maturity group (MG) categories. Last year, average yields at testing locations ranged from 32.5 to 84.5 bushels per acre.

VIPS also features SCN-resistance data and disease ratings, along with seed protein and oil content. This handy online tool – at www.vipsoybeans.org – even offers customized searches. If you don’t have access to the Internet, you can just call (309) 663-7692 to have a paper copy mailed to you!

THE KEY TAKEAWAYS

1. Many commercial varieties in later maturity groups – over half – show resistance to SDS.


3. Non-biased varietal testing helps ensure growers have the most accurate information available.

EVALUATING LEVELS OF SOYBEAN CYST NEMATODE RESISTANCE

Hundreds of soybean varieties are marketed as resistant to soybean cyst nematode (SCN); however, there is little or no indication of actual resistance levels. Since soybean growers require this information to effectively manage SCN in their fields, researchers at SIU and the University of Illinois evaluated more than 530 varieties in greenhouse trials. Their findings showed the varieties with effective resistance to HG Type 0, while also revealing that most lines tested were not resistant to HG Type 2-. In fact, the study found that overuse of PI 88788 by seed companies may be adding to the problem. This issue emphasizes the importance of non-biased testing to ensure Illinois soybean growers have the best information possible when dealing with SCN.
Soybean Cyst Nematode (SCN) MRA

UNDERSTANDING INTERACTIONS BETWEEN SCN AND R. SOLANI

Until recently, the interactive effect of SCN and *Rhizoctonia solani* (*R. solani*) on soybean growth and yield was not well understood. To help soybean growers manage these infestations, University of Illinois (UI) researchers established field trials near Urbana, Carmi and Dixon Springs in the spring of 2010 to begin developing recommendations. Results indicate that both diseases can reduce soybean yields, but interactive effects of the two pathogens on soybeans were not observed. This outcome was due primarily to the magnitude of the effect of *R. solani*, which drastically reduced plant stand and root development. However, an experimental fungicide from Syngenta did provide adequate protection against the *R. solani* – even under heavy disease pressure.

DETERMINING SCN GENETIC RELATIONSHIPS

SCN virulence is a growing problem as SCN populations adapt and are selected to grow on SCN-resistant soybeans. With a rapid, DNA-based virulence test in place, soybean growers would be better positioned to choose the most effective SCN-resistant variety, protecting soybean yields in the long term. In order to develop such a test, researchers at UI began by constructing a phylogenetic tree mapping the relationships between inbred lines. This data will be crucial for maintaining pure SCN lines and choosing parental SCN for controlled crosses necessary for genetic analysis of SCN virulence.

SCN remains the most economically important pathogen of soybeans in Illinois. Researchers and Illinois Soybean Association advisors worked together to develop a strategic plan for dealing with the infection, aligning each designated project with a “high priority” item from that plan.
WHAT YOU NEED TO KNOW ABOUT SCN

1. SCN is the leading cause of soybean yield loss in North America and remains the most economically important soybean pathogen in Illinois.

2. Many growers don’t realize their fields are infested with SCN because there may be no visible symptoms. As a result, SCN can cause substantial yield loss.

3. Once present, SCN can never be eliminated. However, it can be managed through planting non-host crop rotations and SCN-resistant varieties to minimize loss.

4. SCN is not always visible on roots of infected plants.

DEVELOPING FASTER SCN DETECTION

Currently, six to eight weeks are required to test soybean varieties for their levels of resistance to SCN. Unfortunately, this time span is not conducive to performing the necessary resistance screening growers require for effective management of this pathogen. Through the testing of cultivars with different levels of resistance – compatible and non-compatible host – researchers at UI developed a method to assess infection of soybean roots by SCN with real-time quantitative PCR. Although they successfully shortened the time they could differentiate between resistant and non-resistant cultivars as well as highly resistant cultivars from the rest, they could not tell moderate and no resistance apart. This finding means that, for this specific purpose, a more sensitive method should be developed.

USING PHENYLALANINE TO REDUCE SCN VIRULENCE, IMPROVE SOYBEAN SURVIVAL

SCN feeding affects the Shikimic acid pathway and levels of aromatic amino acids in soybeans, making it necessary to find ways to minimize the impact of the pathogen. Researchers at UI sought to determine if phenylalanine or quercetin can effectively reduce SCN infection in young soybean plants. They found that SCN is, in fact, attracted to the treatments, which also slows the infection on culture plates and reduces SCN egg-laying capability. Additionally, the results showed that seed treatments will reduce the number of cysts formed in the plants, and when phenylalanine treatments are given at the appropriate developmental times, they may reduce infection, reducing crop and overall yield loss.

THE KEY TAKEAWAYS

1. An experimental Syngenta fungicide has demonstrated resistance to R. solani, even when interacting with SCN.

2. Researchers are mapping SCN genetics to help develop a rapid, DNA-based virulence test.

3. The use of phenylalanine and quercetin minimizes SCN infection and reduces reproduction.
Weeds MRA

INVESTIGATING GLYPHOSATE-RESISTANT WATERHEMP

A collaboration among four weed scientists from University of Illinois (UI) initiated an unprecedented research project investigating multiple aspects of glyphosate resistance in the Illinois waterhemp population. Field experiments conducted on approximately four acres of research plots where waterhemp is confirmed glyphosate resistant evaluated multiple herbicide application types. The response to glyphosate application rate and timing also were determined. The results of the experiments have been used to generate recommendations for management of this weed: 1) the use of full application rates of soil-residual herbicides; 2) an initial application of glyphosate before waterhemp exceeds three to five inches tall; 3) scouts seven days later to determine treatment effectiveness and if a subsequent application of diphenylether herbicide is needed and 4) the removal of any remaining waterhemp plants before they reach the reproductive stage.

ESTABLISHING THE IDEAL SEEDING RATE

Researchers from UI, Southern Illinois University Carbondale (SIUC) and Western Illinois University (WIU) attempted to answer the question, "Is the ideal soybean seeding rate dependent on weed control strategy?" To accomplish this goal, they analyzed a range of weed control tactics (from soil-residual herbicide followed by a herbicide to a total herbicide system) and seeding rates (from 50,000 to 150,000 seeds per acre) at three different locations. They discovered that there was no difference in soybean yield due to seeding rate or weed management system at the Macomb and Urbana sites. However, in at least one year (during the multi-year study) at all three locations, soybean yield was influenced by seeding rate with the 50,000 seeds per acre rate resulting in lower soybean yield than the 100,000 or 150,000 rate. Weed management system had little to no effect on soybean yield at Urbana and Macomb; however, weed control practices did affect yield at Belleville. They also found that delayed glyphosate application timing, which is commonly practiced, would have reduced soybean yield if conducted at the lower seeding rates.
MAXIMIZING WEED MANAGEMENT DOLLARS

When dealing with difficult-to-control and glyphosate-resistant weeds, growers want to make the best, most economical decisions possible. Scientists at UI and SIUC conducted a study to address this issue. The research goal was to determine the success of herbicide programs within three different cost ranges – $22 to $24, $34 to $36 and $46 to $48 per acre. They also evaluated the influence of different weed control tactics (preplant residual herbicides versus postemergence tank-mixtures with glyphosate) on weed control and return on investment. At all three locations, several low-cost herbicide programs resulted in soybean yields similar to medium- and high-cost programs. These findings suggest that, with proper herbicide selection, growers can manage difficult-to-control weed species and maximize soybean yield with lower-cost programs. The study also revealed that delaying the integration of another effective herbicide after glyphosate has already failed can lead to unnecessary herbicide costs, reduced soybean yields and insufficient weed control with weeds present at harvest.

The overall goal of the Weeds MRA is to provide soybean growers with the tools, management strategies and other pertinent information necessary to improve control of problematic weed species.

THE KEY TAKEAWAYS

1 Glyphosate-resistant waterhemp may be managed with a simple four-step process.

2 Seeding rates were found to have no impact on overall yield, except at lowest rate tested.

3 Lower-cost weed management programs can be just as effective as those in the medium- to high-cost range.
Hybridization with wild relatives of crops is an important tool for improving traits such as disease resistance, as well as improving production and yield. Researchers at the University of Illinois (UI) evaluated the *Glycine tomentella* x hybrid soybean lines for resistance to pathogens causing Phytophthora root rot, soybean rust and sudden death syndrome (SDS). Some of the lines showed deviations that were better than expected from the susceptible parent cultivar Dwight (the recurrent parent), which indicates that at least some of the disease resistance from *G. tomentella* was transferred to the lines. Of the 500 advanced backcrossed lines tested, several showed resistance to the pathogen causing Phytophthora root rot. Initial rust evaluations indicated that all 500 lines were susceptible, and further testing revealed that more than 80 lines (out of more than 600) were rust-resistant. The SDS evaluations showed that few of the derived lines had significantly less disease than Dwight.

**DEVELOPING NEW SOYBEAN VARIETIES**

During 2010, the UI and Southern Illinois University (SIU) soybean breeding programs continued their annual exchange of seed, which improves efficiency of both resistance programs. The UI program planted, maintained and harvested more than 11,000 four- and two-row plots, as well as planted and maintained another 14,000 plant rows of which half were harvested. The focus of the breeding effort was the development of varieties with soybean aphid resistance genes *Rag1* and *Rag2*. At the same time, the lines were being evaluated for and selected based on protein and oil content of the seed. The end result is that the UI breeding program released five soybean varieties for commercialization through licensing. The five lines – all with resistance to soybean cyst nematode (SCN) from PI 88788 – include the following:

1. LD06-16721 is an MG II conventional variety with aphid resistance gene *Rag1*.
2. LD06-30404Ra and LD06-30505Ra are both MG II RR1 varieties with *Rag1*.
3. LD04-11056H and LD04-13265 are MG III conventional varieties.

These five new varieties are in addition to the five that were released in 2009, all of which are among the first available to growers with the aphid-resistance gene. Currently, the UI Office of Technology Management is working on patent applications for the aphid-resistance genes *Rag1* and *Rag2*. 
INTEGRATING NEW GENETIC SOURCES INTO ELITE SOYBEAN GERMPLASM

Over the past year, researchers with the SIU breeding program evaluated more than 1,000 lines from MG III to V in six locations across southern Illinois for higher yield potential, disease resistance and improved composition. Their study included screening the lines and recombinant inbred line populations for resistance to SDS, SCN, frogeye leaf spot (FLS) and a recently identified disease caused by soybean vein necrosis virus. They also incorporated a new goal of focusing on soybean food traits – protein, oil and isoflavones content – for better food quality. The team’s efforts resulted in the release of a new germplasm line (LS03-4294) that has competitive yield and resistance to SDS, SCN (HG Type 0), FLS and stem canker, which they are currently working to register with the Journal of Crop Registrations and apply for Plant Variety Protection Act.

CLONING APHID RESISTANCE GENE RAG1 AND FINE MAPPING RAG2

To meet the three objectives of this UI project, researchers began by cloning two candidate Rag1 genes into the appropriate DNA vector for use in genetic transformation. After this complex process was complete, the clones were delivered to Tom Clemente, Ph.D., a collaborating scientist at the University of Nebraska. Clemente produced a small number of transformed soybean plants carrying the desired genes, which are currently maturing and are scheduled for testing in 2011. The team then investigated the expression of the Rag1 gene and checked for allelic diversity at the locus. To date, all Rag1 genotypes investigated contain the same allele. Finally, the researchers’ attempts to clone the Rag2 gene using the same methods as used for Rag1 failed. What they discovered is that the Rag2 gene is toxic to E. coli, which is the organism used to grow the clones. They are now exploring alternative methods for cloning the Rag2 gene.

GERMPLASM AND BREEDING Initiative

The Germplasm and Breeding Initiative (GBI) seeks to expand the genetic base of the North American soybean germplasm by exploiting new genetic sources. GBI researchers work to meet five main goals:

1. Improve levels of resistance to economically important diseases and pests in soybean germplasm.
2. Utilize perennial Glycine species by wide hybridization technology to integrate agronomically desirable traits into soybean germplasm.
3. Develop new soybean varieties and germplasm lines with improved yield, disease and pest resistance and composition.
4. Map the locations of genes from exotic soybean germplasm that can improve soybean yields.
5. Understand the agronomic characteristics that contributed to yield gain.

THE KEY TAKEAWAYS

1. Hybrids crossed with a wild relative of the soybean plant, G. tomentella, indicate that certain weed resistance traits will transfer to new lines.
2. Five new SCN-resistant soybean varieties and one new germplasm line were released in 2010.
3. Aphid resistance gene Rag2 is toxic to E. coli, which will require an alternative method to complete the related gene-mapping project.
Soy Nutrition and Food Science MRA

Every day, consumers are finding soy in more of the food products they buy. This prevalence is largely due to the extensive nutritional benefits of soy. Not only is it full of protein, fiber, vitamins, minerals, antioxidants, Omega-3 and Omega-6 fatty acids and all of the essential amino acids, but it also has the potential for improving overall health and fighting chronic diseases such as diabetes and obesity.

EVALUATING THE IMPACT OF SOY IN EARLY DIETS

The modern diet of Western society has detrimental effects on the overall health of the American public. A large contributor to this fact is obesity, which can be influenced by Igf2, a growth factor affecting fat metabolism and expression that is controlled by epigenetic imprinting. Preliminary research by a team at the University of Illinois (UI) indicated that consumption of soyfoods during the early stages of life – in utero and during lactation – induces epigenetic modifications that change Igf2 expression. They then focused on the benefits of consuming soy and soy bioactives to counteract the obsigenic effects of the “Western” diet. In future studies, the team hopes to locate the mechanisms that cause the modifications and the relationship between Igf2 and the accumulation of fat in the human body. This knowledge will be key in preventing obesity through the development of dietary soy interventions.

COMPARING EFFECTS OF MILK TYPES

To address obesity-related risk factors such as weight, fat accumulation, inflammation and antioxidant parameters, UI researchers compared the effect of consuming different types of milk. The tests were conducted using a low glycinin (high ß-conglycinin) soymilk (LGS), conventional soymilk (S) and bovine milk (M). They examined the biomarkers of oxidative stress, inflammation and body fat accumulation in a randomized, double-blind, placebo-controlled study of 64 healthy, overweight men. The subjects were divided into three groups and fed daily for three months with 500 milliliters of LGS, S or M. Throughout the study period, no changes were observed in either caloric intake or physical activity. The team concluded that LGS reduced oxidized low-density lipoprotein (LDL), which can cause inflammation in arteries that supply blood to your organs and other tissues, along with increased plasma adiponectin, which is associated with a lower risk of myocardial infarction in men. Due to this metabolic effect, LGS may be a useful dietary component to include in diets designed to improve the health of overweight individuals.
HELPING PREVENT OBESITY-RELATED DISEASES

Obesity and obesity-related diseases, including type 2 diabetes mellitus, nonalcoholic steatohepatitis and cardiovascular disease, are major public health concerns. Knowing the negative effects of these conditions, a Southern Illinois University (SIU) research term examined the unique anti-inflammatory effects of soy isoflavones. They conducted in vivo studies in obese Zucker rats to demonstrate how soy protein isolate with intact bioactive content can protect against systemic inflammation and related disorders. The results suggest that soy-based foods and ingredients represent potential therapies to prevent obesity-related disease through its anti-inflammatory actions. These findings signal a potential increase in demand for soybeans from the health and medical foods industry, potentially leading to a rise in the value of this crop.

REACHING OUT THROUGH THE ILLINOIS CENTER FOR SOY FOODS

The Illinois Center for Soy Foods (ICSF) program is managed through the National Soybean Research Laboratory (NSRL) and focuses on recipe development, sensory evaluations, consumer acceptance studies and foods-related research. They provide very positive representations of soyfoods, their ease of use and their healthy and nutritious attributes. Over the past year, ICSF completed several outreach efforts to promote the use of soy in diets, including:

1. Hosting a webinar through the School Nutrition Association that attracted more than 200 school food service industry decision makers, after which more than 40 percent of the attendees indicated that they planned to add soy to their menus.

2. Continuing discussion with an Oklahoma State University affiliated with the Oklahoma Choctaw tribe to work toward helping this population benefit from lower fat, higher protein soy ingredients.

3. Launching a revised website along with the NSRL sites to provide fresh content and regular updates. Now found at www.nsrl.illinois.edu/nutrition, the ICSF site provides links to recipes, general soyfood information and utilization, and downloadable sheets designed to encourage the use of soyfoods.

4. Developing prototype concept recipes for World Initiative for Soy in Human Health (WISHH) field projects and in-kitchen training for domestic and international participants at the 2010 International Soybean (INTSOY) Program course and extended workshop.

5. Working with dietetic students as interns on areas such as research, outreach and public service activities that will provide them with the knowledge they need as they move into their own fields of work.

THE KEY TAKEAWAYS

1. Preliminary research indicates that consumption of soyfoods in the early stages of life can help prevent obesity.

2. A diet that includes low glycinin soymilk may improve the overall health of overweight individuals.

3. Soy isoflavones demonstrate anti-inflammatory effects that can prevent common diseases among the obese.
North Central Soybean Research Program

The North Central Soybean Research Program (NCSRP) is a collaboration of 12 Midwest state soybean checkoff boards. Its role is to identify problems in soybean production, prioritize research that will benefit soybean growers and develop partnerships to discover and implement solutions. In 2010, NCSRP made great strides in research on the soybean aphid, found more genes for resistance to sudden death syndrome (SDS) and continued to explore variety selection and sampling to address yield loss from soybean cyst nematode (SCN).

Here are a few of the NCSRP successes that benefit you:

1. Enabled scientists to build a “genetic library” of more than 300,000 pieces of genetic information used by public and private labs to decode the mysteries of the soybean defense mechanisms. Checkoff funding by NCSRP and the United Soybean Board leveraged more than $5 million in federal funding for this novel research program. As a result, plant breeders can further identify genes and plant material to breed soybeans with better disease and insect resistance.

2. Coordinated an effective checkoff/university response to the arrival of Asian soybean rust in the United States. NCSRP also helped develop and distribute a unified set of management/response recommendations to U.S. soybean producers.

3. Provided resources, through the Plant Health Initiative, to train thousands of “first detectors” to accurately identify Asian soybean rust.

4. Funded the development of educational materials for soybean producers to manage Asian soybean rust.

5. Created awareness of the need for more SCN-resistant soybean varieties and founded the SCN Coalition, a visionary effort to deliver those varieties, involving seed companies, universities and checkoff partners.

6. Developed greenhouse and field techniques to screen soybean varieties for resistance against SDS, white mold and soybean aphids.

7. Developed an economic threshold for the soybean aphid of 250 aphids per plant that economists estimate will save soybean producers more than $1.2 billion over the next five years.
Biotechnology

With the ever-growing global population, researchers are devoting more time to finding ways to ensure we can feed the world. That’s why the Illinois Soybean Association (ISA) invests research funds in biotechnology efforts that are focused on enabling us to sustainably manage food production. Over the past year, these studies have helped widen hybridization options and protect the intellectual property of ISA-funded research projects.

EXPANDING HYBRIDIZATION OPTIONS

In 2010, University of Illinois (UI) agronomist Ram Singh was the sole inventor on a wide hybridization project (producing fertile crosses between wild and domestic soybean species), which received a U.S. patent. Singh’s research began in 2003, when he was working to help create a soybean rust-resistant seed variety. He started by crossing domestic soybeans with a distant cousin, the Australian weed *Glycine tomentella*, which is resistant to soybean rust. Although other researchers had failed in this area, Singh’s patented method involved taking pollen from the *G. tomentella* and moving it into the stigma of the soybeans. From there, immature seeds were cultured in artificial media to ensure full growth of the hybrid. His dedication has resulted in several subsequent backcrossings with soybeans, resulting in fertile hybrids resistant to pests like soybean rust. The UI Office of Technology Management is helping market Singh’s research to potential licensees, which will hopefully lead to commercialized use of his methods.

PROTECTING ILLINOIS SOYBEAN CHECKOFF-FUNDED INTELLECTUAL PROPERTY

ISA works diligently to ensure Illinois soybean checkoff funds are invested for the betterment of the Illinois soybean industry. For this reason, the organization has begun taking steps to protect the intellectual property that results from the research it supports.

Intellectual property is an income source all its own. Whether generating revenue from royalties or creating a competitive advantage, intellectual property assets can have long-term value for the Association and its researchers. Royalty funds can be reinvested in new projects, and intangibles (i.e., patents, copyrights, trademarks, etc.) can lead to growth and innovation in many areas of the industry – from research to product development. Currently, the National Soybean Research Laboratory helps identify and capture intellectual property opportunities for ISA, connecting commercial industry with researchers.

As an emerging and potentially valuable research area, biotechnology is one of the primary areas on which ISA is focusing its intellectual property protection efforts. This emphasis will allow ISA to best leverage Illinois soybean checkoff-funded research findings in the commercial market, which will ultimately deliver a higher return on investment and aid in evaluating the potential value of future projects.
Nanotechnology

Nanotechnology, which studies ways to affect matter on an atomic and molecular scale, benefits soybean growers by influencing the building blocks of the soybean and its composition. During this past year, the Illinois Soybean Association (ISA) joined the National Soybean Research Laboratory, University of Illinois (UI), National Science Foundation and a dozen other companies in a new partnership called the Center for Agricultural, Biomedical and Pharmaceutical Nanotechnology (CABPN). Some of the projects CABPN is considering funding include:

1. Developing the next generation of agricultural chemicals;
2. Working to understand the environmental impact of nanotechnology;
3. Improving livestock digestion; and
4. Implementing nanosensors in corn and soybean fields.

Aquaculture

Aquaculture remains the fastest-growing agricultural sector worldwide. However, the United States ranks only 14th in aquaculture production. This fact explains why we continue to be the second-largest importer of seafood – in order to meet consumer demand. Unfortunately, growth within the U.S. aquaculture industry is hindered by the availability of cost-effective aquafeeds. To reduce demand – and need – for more expensive fish meals derived from fish oils, ISA supports research at Southern Illinois University Carbondale (SIUC) that investigates the viability of using soy-based products as a replacement for fish meal. These efforts also could improve the environmental sustainability of aquaculture as well as resolve concerns about human food safety.

Over the past year, the research team conducted studies focused on:

1. Increasing utilization of soy-derived protein sources in aquaculture feeds;
2. Replacing fish meal with soy-derived proteins in feeds for cobia;
3. Testing consumer acceptability and nutritional value of hybrid striped bass raised on soy-based feed;
4. Implementing “traditional” and “designer” soy oils in aquaculture feeds;
5. Evaluating the effect of replacing dietary fish oil with soybean oil on production performance and fillet lipid and fatty acid composition of juvenile cobia; and
6. Investigating essential fatty acid requirements of cobia.
It is clear that domestic aquaculture production must grow to fill the widening “seafood gap.”

**USING SOY- DERIVED PROTEIN SOURCES IN FEEDS**

To date, most fish meal replacement research has focused on grain products commonly used in other livestock feeds (i.e., corn, wheat and soybean meals). Soybean meal, instead of soy derivatives, was originally targeted due to its ready availability and low cost, but contrary to what nutritionists had originally hoped, soybean meal has not replaced fish meal to the extent expected. As the price of fish meal continues to climb, soy derivatives such as soy protein concentrate and soy protein isolate are becoming more competitive financially. Plus, they offer several advantages over soybean meal, including higher protein-to-carbohydrate ratios and reduced antinutritional factors, which make them more suitable for carnivorous species like hybrid striped bass. Throughout a series of feeding trials, the SIUC research team found that soybean meal can be implemented at very high levels in hybrid striped bass feeds (more than 65 percent) but not as a complete replacement without reduced growth performance. Further testing indicated that growth performance and resilience can be restored through the addition of marine-derived or soy-derived phospholipids. They also found that soy protein concentrate and soy protein isolate are nutritionally valuable ingredients, but they require the addition of a feed attractant to address palatability problems, especially among very young juveniles.

**RESTORING FILLET QUALITY WITH SOY OIL**

Nutritional and medical communities recommend increasing human consumption of long-chain polyunsaturated fatty acids (LC-PUFA), and seafood remains the best source for these nutrients. Unfortunately, the use of alternative lipids in aquafeeds can reduce the level of LC-PUFA in the fillet. Preliminary studies have shown that using fish oil-based “finishing” feeds can restore this reduced LC-PUFA content. The SIUC research team selected three species – hybrid striped bass, rainbow trout and Nile tilapia – to use as models in conducting further studies focused on this area. The completed trials for the rainbow trout and Nile tilapia indicate that feeds based on high saturated fatty acid content soy oil yield equal production performance and minimize the loss of beneficial LC-PUFA. Similar results are expected from the ongoing hybrid striped bass trials. These findings are encouraging and instructive in that they illustrate the previously unacknowledged value of saturated fatty acid-rich lipids in aquafeeds. The team anticipates that using the saturated fatty acid-rich soy oil in subsequent trials will maximize restoration of the fillet quality.

An additional pilot study evaluated high saturated fatty acid, low alpha-linolenic acid and soy oil as a partial substitute for fish oil in largemouth bass feeds. This test’s results were very similar to those observed with the other species.

**THE KEY TAKEAWAYS**

1. Soy-derived phospholipids are useful in restoring the growth performance and resilience of striped bass that is typically lost when soybean meal is fed at high levels.

2. Fish feeds that include soy oils benefit from high-saturated fatty acids, which restore LC-PUFA levels and associated fillet quality.
Online Resources

GLYPHOSATE, WEEDS & CROPS
www.glyphosateweedscrops.org

ILLINOIS AGRICULTURAL PEST MANAGEMENT HANDBOOK
ipm.illinois.edu/pubs/iapmh/index.html

ILLINOIS CENTER FOR SOY FOODS
www.nsrl.illinois.edu/nutrition.html

ILLINOIS SOYBEAN ASSOCIATION
www.ilsoy.org

ILLINOIS SOYBEAN RUST
www.stopsoybeanrust.com

INTEGRATED PEST MANAGEMENT
www.ipm.uiuc.edu

INTEGRATED PEST MANAGEMENT WEED RESOURCES
www.ipm.uiuc.edu/weeds.html

LABORATORY FOR SOYBEAN DISEASE RESEARCH
www.soydiseases.illinois.edu

NATIONAL SOYBEAN RESEARCH LABORATORY
www.nsrl.illinois.edu

NORTH CENTRAL SOYBEAN RESEARCH PROGRAM
www.ncsrp.com

PLANT HEALTH INITIATIVE
www.planthealth.info

SCN MANAGEMENT
www.planthealth.info/scn_basics.htm

SOY CONNECTION
soyconnection.com

SOYBEAN DISEASES IN ILLINOIS
cropdisease.cropsci.illinois.edu/soybeans

SOYBEAN INSECT RESEARCH INFORMATION CENTER
insectweb.inhs.uiuc.edu/Soy/Siric/home.htm

SOYBEAN RESEARCH CHECKOFF DATABASE
www.soybeancheckoffresearch.org/index.html

SOYBEAN RUST
www.soyyieldchallenge.com

SOYCAM
www.soycam.com

SOYFOODS ASSOCIATION OF NORTH AMERICA
www.soyfoods.org

UNITED STATES DEPARTMENT OF AGRICULTURE
www.usda.gov

UNITED SOYBEAN BOARD
unitedsoybean.org

U.S. SOYFOODS DIRECTORY
www.soyfoods.com

VARIETAL INFORMATION PROGRAM FOR SOYBEANS
www.vipsoybeans.org

YIELD CHALLENGE
www.soyyieldchallenge.com
Research Teams

SOYBEAN CYST NEMATODE MRA

Program Coordinator
Billy Caldwell

Team Leaders
Jason Bond, Southern Illinois University
Terry Niblack, University of Illinois

Farmer Advisors
Dean Campbell, Coulterville
Dale Crawford, Sullivan
Duane Dahlman, Marengo
Dan Farney, Morton
Matt Hughes, Shirley
Ron Kindred, Atlanta
Wendel Lutz, Dewey
Lyle Wessel, Waterloo
Rowen Ziegler, LaHarpe

SOYBEAN NUTRITION & FOOD SCIENCE MRA

Program Coordinator
Billy Caldwell

Team Leaders
Bill Banz, Southern Illinois University
Keith Cadwallader, University of Illinois

Farmer Advisors
Dean Campbell, Coulterville
Pat Dumoulin, Hampshire
Dan Farney, Morton
C.W. Gaffner, Greenville
Karl Lawfer, Kent
Wendel Lutz, Dewey
Ed Mies, Loami
Doug Winter, Mill Shoals
Bill Wykes, Yorkville

SOYBEAN GERMLASM & BREEDING MRA

Program Coordinator
Billy Caldwell

Team Leaders
Brian Diers, University of Illinois
Stella Kantartzi, Southern Illinois University
Linda Kull, University of Illinois

Farmer Advisors
Dean Campbell, Coulterville
Dale Crawford, Sullivan
Duane Dahlman, Marengo
Dan Farney, Morton
Matt Hughes, Shirley
Ron Kindred, Atlanta
Karl Lawfer, Kent
Wendel Lutz, Dewey
Ed Mies, Loami
David Niekamp, Coatsburg
Mark Sprague, Hull
Doug Winter, Mill Shoals
Rowen Ziegler, LaHarpe

SOYBEAN DISEASES & INSECT PESTS MRA

Program Coordinator
Keith Smith

Team Leaders
Jason Bond, Southern Illinois University
Linda Kull, University of Illinois

Farmer Advisors
Dean Campbell, Coulterville
Mike Cunningham, Bismarck
Duane Dahlman, Marengo
Dan Farney, Morton
C.W. Gaffner, Greenville
Matt Hughes, Shirley
Ron Kindred, Atlanta
Wendel Lutz, Dewey
David Niekamp, Coatsburg
Ross Prough, Greenfield
Bill Raben, Ridgway
Mark Sprague, Hull
Lyle Wessel, Waterloo
Rowen Ziegler, LaHarpe

WEEDS MRA

Program Coordinator
Billy Caldwell

Team Leaders
Aaron Hager, University of Illinois
Bryan Young, Southern Illinois University

Farmer Advisors
Dean Campbell, Coulterville
Michael Cunningham, Bismarck
Duane Dahlman, Marengo
Dan Farney, Morton
C.W. Gaffner, Greenville
Donald E. Guinnip, Marshall
Matt Hughes, Shirley
Ron Kindred, Atlanta
Wendel Lutz, Dewey
Joe Murphy, Harrisburg
Ross Prough, Greenfield
Bill Raben, Ridgway
Mark Sprague, Hull
Lyle Wessel, Waterloo
Bill Wykes, Yorkville
ISA Board of Directors

**DISTRICT #1**
Karl Lawfer
Kent, IL

**DISTRICT #2**
Pat Dumoulin
Hampshire, IL

**DISTRICT #3**
Rowen Ziegler
LaHarpe, IL

**DISTRICT #4**
Bill Wykes, Secretary
Yorkville, IL

**DISTRICT #5**
Dan Farney
Morton, IL

**DISTRICT #6**
Rob Shaffer
El Paso, IL

**DISTRICT #7**
Mike Cunningham
Bismarck, IL

**DISTRICT #8**
David Niekamp
Coatsburg, IL

**DISTRICT #9**
Ed Mies
Loami, IL

**DISTRICT #10**
Dale Crawford
Sullivan, IL

**DISTRICT #11**
Wendel Lutz
Dewey, IL

**DISTRICT #12**
Mark Sprague
Hull, IL

**DISTRICT #13**
C. W. Gaffner
Greenville, IL

**DISTRICT #14**
Donald E. Guinnip
Marshall, IL

**DISTRICT #15**
Lyle Wessel
Waterloo, IL

**DISTRICT #16**
Doug Winter, Treasurer
Mill Shoals, IL

**DISTRICT #17**
Dean Campbell,
Asst. Secretary-Treasurer
Coulterville, IL

**DISTRICT #18**
Bill Raben
Ridgway, IL
AT-LARGE DIRECTORS

Ron Moore, Chairman
Roseville, IL

Matt Hughes, Vice Chairman
Shirley, IL

Joe Murphy
Harrisburg, IL

Ron Kindred
Atlanta, IL

Duane Dahlman
Marengo, IL

Ross Prough
Greenfield, IL
Achieving Growth Through Leadership