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Screening for Herbicide Resistance Marestail and Lambsquarters in No Till Soybean Production Systems

Steve Gower (project leader), Christy Sprague, Michigan State University
Cost will be reimbursed on a billing basis at a rate of $30.00 per sample analysis

This project has an objective of identifying, through a grower submitted sample suspecting resistance from a field situation, a mature seed head to be analyzed in a greenhouse grow-out for any glyphosate and/or ALS resistance.

This is a continuing project with results of the 2004 resistance testing indicating:
- 18 marestail populations tested with no resistance found for either glyphosate or triazine herbicides and all 18 showing resistance to ALS.
- 10 common lambsquarter populations tested with no resistance found for glyphosate or ALS herbicides and only 2 slowing resistance to triazine.

Effect of Low Soybean Populations on Weed Competitiveness in Soybean

Karen Renner (project leader), Christy Sprague, Dana Harder, Michigan State University
Approved funding level up to $17,000

This research objective is to determine if there is an advantage in weed control by planting narrow row soybeans with higher plant populations within a row spacing. General recommendations are for greater yield and increased weed control, plant soybeans in narrow rows at a higher plant population. With the seed cost for glyphosate resistant varieties approaching $35.00 per 50lb unit, increased populations may washout an off setting increase in yield. The research will determine if a low population can be planted in differing row widths and still maintain weed control and profitability.

This is a continuing project with results from 2004 indicating:
- Soybean yields were greater in 15” rows or less regardless of weed pressure.
- Soybean seed cost at higher seeding rates was recovered by greater yields in 7.5” and 15” rows regardless of weed pressure.
Investigating Common Lambsquarter Control Failures with Glyphosate in Roundup Ready Soybean
Christy Sprague (project leader), Christine DiFonzo, Karen Renner, Dana Harder
Michigan State University
Approved funding level up to $15,000

The overall goal of this research is to understand what factors are affecting common lambsquarters control with glyphosate, especially in regards to the insect-weed interactions that have limited management of common lambsquarters. Research objectives include: 1) Determine the extent and distribution of weed management failures due to insect larval feeding. 2) Determine the affect glyphosate application and timing has on this weed control, and 3) Determine the impact larval feeding has on glyphosate efficiency and common lambsquarter growth and development.

This is a continuing project with 2004 results indicating:
- Insect larval tunneling by both fly maggots and beet petiole boars were common throughout Michigan
- Life cycle of the stem boring insects coincide with the glyphosate applications
- More research is needed to determine how, if at all, insect infestations influences glyphosate lambsquarter control

MSU Diagnostic Services Free SCN Soil Testing/Communications
George Bird (project leader), Fred Warner, Michigan State University
Approved funding level up to $12,000

Diagnosticians at MSU will provide free SCN soil testing for SCN presence and provide grower recommendations for management practices in the event of a positive identification. The overall analysis results will be made accessible to growers through meetings/mailings/etc. indicating counties of concern.

In 2004 the FREE grower submitted SCN sampling/Analysis program resulted in over 1,000 being submitted with 67% positive for SCN with 32 counties participating.

Soybean Cyst Nematode Research and Grower Awareness/Communication Technology
George Bird (project leader), Fred Warner, Michigan State University,
Approved funding level up to $13,000

Researchers will address three components of SCN research meaningful to growers. They are: 1) Research to continue to monitor the rate of change of SCN types (formerly race) to exposure to different sources of SCN resistance in ways that will
assist in the development of future SCN management systems for increased grower profitability, 2) Continue the third year of a three-year project designed to increase soil quality at two SCN-infested sites in ways that will reduce or possibly eliminate crop loss risk to SCN. 3) Determine if crop yield loss in Michigan due to SCN is increasing, decreasing, or remaining the same.

A brief 2004 result of SCN research indicates: Data is conclusive that SCN invested fields can be “brought” back into profitable production but one should be cognizant of SCN types present, sources of resistance, and manage accordingly.

Determining Optimum Spray Timing for Soybean Aphid
Christina DiFonzo (project leader), Mike Jewett, Michigan State University
Approved funding level up to $11,000

Aphid research has well documented its life cycle, insecticide efficacy, and control action levels. What we lack is an understanding of spray timing – when and how frequently is the optimum time to treat to maximize yield?

This research will address spray timing at 6-10 sites across Michigan’s soybean producing area (depending on aphid populations). Small plots will be “cut out” of larger farmer fields through the help of County MSUE agents. Lorsban 4E or Furadan will be applied over different weeks of the season and different stages of soybean plant growth stages. Most likely, treatment will begin in early July and continue through late August.

This is a continuing project with very little data available from 2004 research because of low soybean aphid pressure.

Impact of Foliar Fertilization on Soybean Aphid Numbers and Crop Yield
Christina DiFonzo (project leader) Michigan State University; Carrie Laboski, Soil Science, Eileen Cullen, Entomologist, University of Wisconsin; Matt O’Neil, Department of Entomology, Iowa State University; Cooperating County MSUE, Approved funding level up to $15,000

Researchers will address two concepts in soybean production. They are: 1) The increasing interest in using foliar applications of nutrients to increase soybean yield in high management environments and 2) Investigate the claim that foliar feeding can be used as a means to reduce soybean aphid damage because proper nutritioned plants can compensate for aphid damage.

This is a continuing project which experienced low soybean aphid pressure in 2004 while indicating:
- With low aphid pressure, the effect of foliar fertilizer interaction with the aphid was not evaluated
- Soybeans were taken to a final yield with no significant difference based on fertilization
Soybean Cyst Nematode Resistant Variety Plots in Michigan

Ned Birkey (project leader), Mark Seamon, Bruce Mackeller, Phil Kaatz, Mike Score, Michigan State University
Approved funding level up to $12,000

Through large scale on-farm demonstration plots, SCN resistant varieties submitted by commercial seed companies will be evaluated for both yield and any build-up of SCN numbers where each variety is grown. Susceptible check varieties will be included and evaluated for SCN build-up and resultant yield. SCN counts will be recorded where each entry is grown at planting (soil), at mid season (on roots) and at harvest (soil) as well as yield data for each variety.

Best Management Practices for Michigan Soybean Production

Betsey Dierberger (project leader), Michigan State University
Approved funding level up to $4,400

This on-farm research and demonstrations will contribute over time to definitive answers to questions such as planting depth, planting speed, soybean maturities, row spacing, etc. Research will be grower based not experimental plot designs.

Effect of Recently Released Rhizobium Seed Inoculants and Experimental Neoicotinod Seed Applied insecticides on Soybean Growth and Grain Yield

Kurt Thelen (project leader), Dechun Wang, John Boyse, Michigan State University
Approved funding level up to $27,500

This research objective is to evaluate commercially available soybean inoculates, an experimental class of systemic seed applied insecticides (neonicotinanoids) and seed applied fungicides for effect on soybean growth, insect pressure and yield under Michigan conditions. The innoculum and systemic insecticide effect will be compared with and without seed applied fungicide.

The 2004 results are not conclusive with only two years of research. There continued to be a trend with increased yield when using inoculant with no adverse interaction from seed applied fungicide.
Use of Near Infra-Red Technology to Field-Map Soil Organic Carbon in a Michigan Corn/Soybean Field and Determine Relationships to Landscape, Soil, and Grain Yield

Kurt Thelen (project leader), Alexandra Kravchenko, Michigan State University
Approved funding level up to $13,000

The goal of this research is to validify the hypothesis that soil Carbon (C) variability can be quantified and accurately mapped for efficient site specific improvement in soil C management to benefit agriculture inputs such as fertilizer and pesticides as well as soil management techniques for reduced erosion, improved soil quality, and reduced pest problems. Specific objectives are: 1) Quantify the spatial variability of soil C on a whole field basis using NIR technology and 2) Use NIR generated soil C field maps to estimate C sequestration capacity.

This is a continuing project with 2004 results indicating:
- Much more data is needed to assure a high degree of correlation for assurance in making management decisions

The Effect of Animal Waste and Tillage on Soybean Based Crop Rotations from an Agronomic, Economic, and Environmental Viewpoint for Cash Crop, Livestock, and Dairy Businesses

Tom Van Wagner (project leader) Lenawee Soil Conservation District
Approved funding up to $9,000

This six year project at the Center For Excellence evaluates four crop rotation production systems using five different tillage methods in a twelve row cropping methodology. The four rotations include eleven acre plots of the following: corn - soybean, soybean - wheat, corn - wheat, and corn - corn with tillage being; deep tillage, no-till with gypsum, chiseled, strip-till, and no-till with out gypsum. Each production system will be evaluated from an economic and agronomic perspective as well as the benefits of each in terms of the environmental efficiency of the use of animal waste.

Animal Wastewater Recycling Conservation Project

Tom VanWagner (project leader), Lenawee Soil Conservation District
Approved at a three-year funding level up to $20,000

The project will research: 1) The design and implementation of a closed water recycling system applicable to individual dairy farms throughout Michigan that will turn wastewater from the milk house, silage leachate, and storm water run off into irrigation water through subsurface irrigation, 2) Proper monitoring of irrigation water, holding ponds, and soil nutrients and 3) monitor surface/groundwater pollutants that may eventually enter the Great Lakes Watershed Basin.
This is the second year of the project with the first year (2004) being devoted to the construction of the holding pond, installation of the ground tile and water control structures within the field along with needed pumping installations.

Speciality Soybean Breeding and Soybean Germplasm Enhancement for Michigan Environment

Dechun Wang (project leader), John Boyse, Michigan State University
Approved funding level up to $67,500
($5,000 of supplemental funds from the MCIA is included in the funding)

This is a long term project with crosses made yearly with subsequent evaluation for desired quality traits. Crosses are made, grow outs are implemented, selections are made, and those with desirable traits are advanced. Project objectives include: 1) Develop newer, higher guiding, disease resistant, large seed, clear hilum edible-type soybean varieties, 2) Develop vegetable soybean (edamame and out-of-pod green soybean) varieties, and 3) Enhance soybean germplasm adaptable to Michigan by incorporating resistance to white mold, SCN, viruses, aphids, and rust.

This is a long term project with crosses made annually with subsequent evaluations for desired quality traits. Crosses are made, grow outs are implemented, selections are made and those with desirable traits are advanced.

Introgress Aphid Resistance from Exotic Germplasm to Elite Michigan Soybean Germplasm

Dechun Wang (project leader), Christine DiFonzo, Michigan State University
Approved funding level up to $10,000

With the identification of antibiotic resistance to the soybean aphid now complete based on the earlier research, this project objectives are: 1) Characterize the antibiotic resistance to soybean aphid in the two resistant soybean P.I.’s identified earlier and 2) introgress the antibiotic resistant cultivars into elite Michigan adaptable soybean germplasm.

2004 progress was significant with the following results:
- Six P.I.’s with believed aphid resistance were crossed and evaluated for resistance
- Four of these P.I.’s exhibited satisfactory resistance
- Types of resistance of the four selected were determined with two of major importance
- Crosses were made between the resistant populations to determine the genetics of resistance.
Screen Soybean Germplasm for Resistance to Soybean Rust

Dechun Wang (project leader), Ray Hammerschmidt, Michigan State University
Hiraigu Chen, Jiangsu Academy of Agricultural Science
Approved funding level up to $21,000

This cooperative research project’s objectives are to: 1) Further refine the method for rapid and larger-scale screening in a nursery for rust resistance, 2) Continue the one to two rust nurseries in China for Michigan’s breeding and research on rust resistance and 3) Screen for soybean rust Chinese germplasm that is adaptable to Michigan’s soybean growing environments. An obvious overall goal is to develop germplasm with rust resistance so Michigan soybean producers will have resistant varieties available in the event soybean rust becomes a production challenge in Michigan.

2004 was the first year of successful screening of P.I.’s in the newly developed nurseries in China using a successful rust screening method. Nineteen accessions showed resistance to soybean rust which will be tested again in 2005 as well as placed in a crossing block to begin determining the genetic resistance mechanism.

North Central Soybean Research Program Research

Management of the Soybean Aphid in the North Central States

Participating universities: University of Minnesota, Michigan State University, Purdue University, The Ohio State University, North Dakota State University.

This group of soybean aphid researchers has developed most of the aphid management information used by soybean producers and crop advisors today. The current economic threshold of 250 aphids per plant was realized through a multi-state cooperative research effort coupled with the efforts of Extension entomologists throughout the soybean belt. This collaborative approach as has been awarded the coveted 2005 Entomology Educational Project Award.

The research team will continue to validate insect threshold levels (because environment plays a critical role) and determine environmental and cultural practices that influence aphid populations. Additionally, they will screen soybean cultivars for insect resistance and continue to investigate biological control strategies. The research team has recently been expanded to include states in the Great Plains because the soybean aphid continues to expand its area of influence to the Great Plains as well as Kentucky and Tennessee.
Biological Control of the Soybean Aphid

*Participating universities: Purdue University, University of Illinois, Iowa State University, Michigan State University, University of Minnesota, USDA/ARS, University of Wisconsin*

Implementing a biological control program for the aphid may reduce the chances of a devastatingly large population of aphid from appearing. The soybean aphid, *Aphis glycines*, is dramatically less damaging in its native areas of Asia because of the presence of several beneficial insects not present in the United States. Discovering and introducing these benign predators can reduce the economic impact experienced by U.S. soybean producers. Successful biological control programs have been implemented in many other crops around the world. Specifically, this research program will: 1) determine the potential for establishment, safety and compatibility of imported natural enemies of the soybean aphid; 2) educate growers on the potential of using biological control to manage soybean aphid; and 3) develop a regional release program to provide biological control options to soybean producers in the Midwest.

A Rapid Test for Resistance-breaking Populations of Soybean Cyst Nematodes

*Participating universities: University of Illinois, Iowa State University, Kansas State University, Purdue University, University of Minnesota, University of Wisconsin and USDA/ARS, Jackson, TN*

This project will develop and test a quick, reliable, and economical PCR method to characterize soybean cyst nematode (SCN) populations. Commercial adoption of the HG system for identifying SCN populations will need a quick method of typing SCN populations to aid soybean growers in their selection of soybean varieties for planting. This project will provide the method to quickly and cost-effectively determine HG types.

A Standardized Resistance Evaluation Protocol for Soybean Cyst Nematode

*Participating universities: Southern Illinois University and University of Illinois*

These researchers will develop a standardized method for evaluating soybean resistance to SCN through a regional collaboration of nematologists, plant pathologists, and plant breeders from the public and private sector. The industry is currently not using a common protocol to test host resistance to SCN. This initiative will develop the unified protocol that will increase research efficiency and in turn create a faster “to market” method to benefit soybean yields.
Development of Management Strategies to Control Major Soybean Virus Diseases in the North Central Region

*Participating universities: Iowa State University, USDA/ARS/University of Illinois, University of Kentucky, University of Nebraska, South Dakota State University and the University of Wisconsin.*

This is one of the most prolific initiatives funded by the NCSRP. This ongoing project allows researchers to continue to develop information on viruses that attack soybeans and create management strategies to minimize yield loss.

This highly experienced team has discovered most of what we know today about the soybean virus complex. In fact, many current best practices were generated from this research, including application timing of insecticides, etc. Researchers will leverage their existing knowledge to advance this project in 2005.

Regional Evaluation of Potential New Soybean Variety Resistant to White Mold

*Participating universities: University of Wisconsin, University of Illinois, Purdue University, Iowa State University, Michigan State University, University of Nebraska, North Dakota State University, The Ohio State University and South Dakota State University.*

This ongoing project is a collaborative effort to manage white mold. The multi-state researchers will identify higher and more environmentally stable forms of resistant public soybean germplasm so they can characterize elite white mold forms of resistant lines for response to other yield-limiting pathogens. This research helps soybean breeders evolve stronger, more resistant soybeans so producers can enjoy higher yields.

Limiting Losses to *Phytophthora sojae* in the North Central Region

*Participating universities: The Ohio State University, University of Illinois, USDA/ARS/Purdue University, Iowa State University, Kansas State University, Michigan State University, University of Minnesota, University of Missouri, University of Nebraska, North Dakota State University, South Dakota State University.*

Phytophthora root and stem rot, caused by the fungus *Phytophthora sojae*, contributes to the second-largest yield loss from disease in the U.S., second only to SCN. Researchers will continue to look for genetic resistance to *P. sojae* in soybean, characterize the populations of *P. sojae* populations in the North Central States, and evaluate current cultural practices to minimize soybean yield loss.
The Application of New Technologies to the Control of Sudden Death Syndrome

Participating universities: Southern Illinois University, University of Illinois, Iowa State University and Purdue University

This project is a multi-state, multi-disciplinary collaborative research effort to develop accurate methods that can be used by soybean breeders to screen germplasm for SDS resistance. The project will test the pathogenicity of F. solani f.sp. glycines (FSG) isolates to find the best isolates for screening, identify root phytochemicals that alter resistance to SDS and identify soil organisms that attack FSG isolates. The project's goal is to develop new technologies and biotechnology studies that can reduce soybean yield losses due to SDS.

Managing Frogeye Leaf Spot and Charcoal Rot in the North Central Region

Participating universities: Southern Illinois University, University of Illinois, Iowa State University, USDA/ARS/Purdue University, Kansas State University, University of Missouri, Mississippi State University and University of Georgia

Provide technical information on frogeye leaf spot and charcoal rot diseases for publishing on the Plant Health Initiative website. The objective of this seven state research proposal is to develop additional information on two soybean diseases, frogeye leaf spot and charcoal rot, which are expanding in the North Central region. This project will specifically:

1. Determine prominent races of C. sojina and pathotypes of M. phaseolina
2. Develop standard screening procedures
3. Evaluate genetic resistance in released varieties and elite germplasm
4. Expand gene identification and variety development
5. Initiate pathogen collection and storage

Sentinel Plots to Monitor the Spread of Asian Soybean Rust in the United States

Twenty states will plant and evaluate sentinel plots to monitor the movement of soybean rust. This important work is a part of the National Advanced Warning Network that alerts producers to the spread of rust into an area, giving growers timely risk assessments and support in decision-making process.

Fungicide Management for Soybean Rust
Participating universities: USDA /ARS/ University of Illinois, University of Nebraska, University of Kentucky, Mississippi State University, South Dakota State University and Louisiana State University

One of two significant projects on Asian soybean rust, the goal of this project is to develop recommendations for using fungicides to minimize yield loss due to rust. Researchers will: 1) evaluate application methods, nozzle types and pressures needed to maximize canopy coverage; 2) study the effects of tank-mixing insecticides and fungicides on insect populations, fungi control and soybean yields; and 3) evaluate the efficacy of fungicide performance.

**Soybean Asian Rust Magazine Insert**

A cooperative project between NCSRP and the United Soybean Board.

Develop and distribute a magazine insert entitled Soybean Asian Rust: Research Update to soybean growers throughout the United States. The brochure provides information on soybean rust symptoms and best management options for rust control.

**Elevating Seed Protein Content in the North Central USA Soybean-Growing States**

Participating universities: University of Nebraska, USDA/ARS/Iowa State University, University of Nebraska, University of Illinois, University of Minnesota and USDA/ARS/Soybean Genomic & Improvement Laboratory

The goal of this multi-state project is to increase the protein content of soybeans. Higher protein content will positively influence demand for soy-based food products and increase market growth potential.

The specific objectives are to: 1) backcross the LG-1 gene for higher protein into 12 varieties grown in the North Central Region with maturity groups ranging from 00 to IV, 2) identify and tag several other genes that produce higher protein seed content, and 3) attempt to clone the DNA sequence of the LG-1 gene for higher seed protein content.

**Plant Health Initiative**

The Plant Health Initiative creates a private/public consortium in the North Central Region focused on issues related to improving the health of the soybean plant. The award-winning website, www.planthealth.info is a clearinghouse of soybean management information and is considered an authority that researchers, breeders, and producers can depend upon.