Compiled 2012 Soybean Disease State Reports for February 2013 meeting, St Louis, MO

NCERA212 Soybean Disease Committee

2012 State report to NCERA-212 from Alabama

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Alabama soybean producers harvested 335,000 acres of soybeans with a new State record average yield of 45 bushels/acre. Yield from 2009-2011 averaged 43, 28 and 33 bushels/acre, respectively.

Approximately 55% of the soybeans in 2012 were double-cropped after wheat. A handful of growers planted soybeans in early August after drought-stricken corn was destroyed, and managed yields of 20-25 bushels/acre with a maximum yield of 45 bushels reported in North Alabama.

Soybean rust was a major problem in the Alabama in 2012. At least 500 acres of poorly-protected soybeans in Baldwin County near the Gulf Coast suffered yield losses that ranged from 40-60%. These fields were harvested approximately a month earlier than the normal crop for the area and were either sprayed too late with a fungicide or were not sprayed. Estimated yield losses were based on conversations with the growers and yield data collected from a large–scale fungicide strip test located in the immediate area.

We suspect yield losses from soybean rust occurred throughout the southern half of the state on double-cropped soybeans that were not sprayed with a fungicide. This is based on field observations from multiple commercial fields plus yield-loss data collected from a fungicide strip test conducted in central Alabama on late-planted soybeans.

Soybean rust was detected in all 67 counties in the state in 2012. The disease was not detected in Alabama in 2011, though scouting was terminated in mid-October that year. The pathogen likely moved into the state by the end of 2011 as it was found on kudzu in Baldwin County in January of 2012.

Cercospora leaf blight was a significant problem in south Alabamain 2012 though not as severe as in 2011. Aerial web blight caused minor damage in scattered fields across the state. Other diseases observed regularly included charcoal rot, southern blight, Septoria brown spot and target spot.

Frog-eye leaf spot was detected in scattered fields in North Alabama. Results from Dr. Carl Bradley's lab at the University of Illinois confirmed the presence of a strobilurin-resistant isolate of *Cercospora sojina* in a soybean field in Limestone County. This is the first report of frog-eye leaf spot resistance in Alabama.

Soybean Vein Necrosis Virus was confirmed for the first time in Alabama in 2012. The disease was observed in multiple fields in the northern region of the state. Bean pod mottle virus was detected at moderate levels in multiple counties in research trials in west-central Alabama. Soybean mosaic virus was also detected at very low levels in these tests.

NCERA 212 State Report – Iowa

Leonor Leandro, Daren Mueller, Alison Robertson, Greg Tylka, X.B. Yang

Disease prevalence

The major soybean problem in 2012 was soybean cyst nematode. Reproduction of SCN on PI88788 was greatly increased compared to previous years. No other major disease problems were observed. SVNV and some late SDS in central Iowa were two other diseases found. We also observed soybean dwarf virus for the first time on soybean.

RESEARCH PROJECTS

Oomycete pathogens of soybean

Funding: USDA-NIFA OSCAP (Oomycetes of Soybean) P.I. Brett Tyler

USB Soybean Seedling Disease P.I. Jason Bond and John Rupe

USB Search for novel resistance to Phytophthora sojae P.I. Saghai Maroof

Iowa Soybean Association Various P.I. Alison Robertson

Soybean seedlings were collected from six fields in Iowa in June 2012. Potential pathogens were isolated from symptomatic roots and sent to Martin Chilvers, MSU and Ahmad Fakhoury, Illinois for identification. Still waiting on results.

An on-line learning module to educate agribusiness about oomycete diseases of soybean was created in collaboration with Don Lee at UNL. We are waiting for continuing education credits to be approved by the National Certified Crop Advisors (CCAs) Board before the module is launched.

A survey of CCAs based in 18 states (12 states in the Midwest and six southern states) was done in collaboration with collaboration with Dr. Nicholas Kalaitzandonakes and James Kaufmann (U. of Missouri) in an effort to understand the prevalence of seedling diseases of soybean, their perceived ability to diagnose disease and management practices implemented. Stand loss due to seedling disease was second only to crusting. Seedling disease caused by P. sojae and Pythium spp. was encountered 77 and 76 percent of the time, respectively. Survey respondents were very confident in their ability to

diagnose seedling disease. Seed treatments and resistant varieties were the most commonly used management tools.

PowerPoint presentations introducing the project and summarizing results from the 2011 survey of soybean seedling disease that was shared with the Extension Network who included it in the various winter Extension meetings in their respective states. It is estimated that more than 5000 farmers and agribusiness personnel within the North Central region were reached.

An on-line learning environment that focuses on oomycete pathogens of soybean was developed with Dr Don Lee from UNL. We are waiting for continuing education credits to be approved by the National Certified Crop Advisors (CCAs) Board before the module is launched.

We have been evaluating the diversity of Avr1a from over 200 isolates of *Phytophthora sojae* recovered from disease soybeans in IA and OH. The number of copies of *Avr*1a ranged from zero to two among the isolates. Furthermore different levels of expression of the gene were detected among isolates. This is additional evidence that there is high level of variability for these *Avr* genes within these US populations.

We have identified three new QTL in soybean for partial resistance to *P. sojae.*

We evaluated commercial seed treatments at three locations in Iowa for seedling disease and pest management and also yield benefits. No disease or insect pressure occurred in the sites. This was likely due to later dates of planting as a result of waiting for treated seed and pre-plant fieldwork. There was no evidence of an effect of seed treatment on emergence at 14 and stand count at 28 days after planting (dap) at all but the Nevada early planting date location. Stand count was greater ($P<0.1$) for seed treated with Poncho/VOTiVO, Pioneer Premium and Inovate than naked seed.

There was evidence of an effect of seed treatment on yield at 3 of 4 locations. At Crawfordsville, seed treated with CruiserMaxx Plus, CruiserMaxx Plus + Avicta and Inovate yielded 3.5 to 4.9 bu/A compared to naked seed. At the Nevada early planting date, yield of seed treated with novate and metastar was 5.6 bu/A lower than the naked seed control. And at Nashua, CruiserMaxx Plus, CruiserMaxx Plus + Avicta and Inovate + Metastar and Pioneer Premium yielded 4.1 to 5.7 bu/A greater compared to naked seed.

SDS

Research focuses on the biology and management of soybean sudden death syndrome. Projects include: integrated management for SDS; development of high-throughput DNA-based gene silencing technology for soybean sudden death syndrome; identification of pathogenicity factors used by *Fusarium virguliforme* to cause SDS. Research also includes projects to determine phenotypic and genotypic variation in *Fusarium oxysporum* isolated from soybean roots. We also studied the effect of glyphosate and other herbicides on sudden death syndrome and yield.

Statewide fungicide trials

With partial funding from industry and soybean checkoff funds from the Iowa Soybean Association, we evaluated common foliar fungicides and insecticides at seven locations across Iowa in 2012 to determine yield response to an R3 (beginning pod set) application timing. Treatments (Table 1) consisted of an untreated control, fungicides alone, insecticides alone, fungicides and insecticides in combination and pesticide application based on aphid scouting (IPM). Disease was assessed when soybeans were at the R6 growth stage (full seed set). Soybean aphid populations were observed between R3 and R6, but soybean aphid populations did not reach threshold at any of the seven locations.

Yield varied across locations ranging from 33.9 to 64.6 bu/ac in the untreated control (Table 1). Differences were observed between pesticide treatments and the untreated control at the Ames and Armstrong locations (Table 1). *Foliar disease*. The most predominate disease found was Septoria brown spot. Septoria brown spot did not move into the upper canopy before R6 at any of the seven locations, so it likely had minimal impact on yield. *Soybean aphids* did not reach the threshold at any location. IPM treatments became an additional untreated control. *Seed moisture* ranged from 7.8 – 12.1 across locations, but did not differ more than a few tenths of a percentage amongst treatments within any location.

This is the first year we were able to evaluate fungicides under drier weather conditions. While individual products affected yields at certain locations, in general, all products had minimal significant effects on yield. There were very few diseases (and insects) at all seven locations, so benefits from pest management were not part of the equation. In 2012, positive yield responses to fungicides were below averages from previous years with more moisture.

Table 1. Yield response for foliar fungicides and insecticides treatments in 2012.

Treatment	Ames	Armstrong	Crawfordsville	Kanawha	McNay	Nashua	Sutherland
Untreated control[d]	64.6	51.3	48.5	33.9	43.5	56.8	55.8
Evito	69.1	52.2	47.8	30.6	38.6	60.4	58.3
Stratego YLD	61.1	52.8	49.9	34.85	40.1	56.5	56.6
Aproach	65.2	55.9	49.2	34.9	44.4	54.6	58.5
Topguard	65.5	49.4	48.8	39.9	42.3	53.8	59.0
Domark	67.3	56.5	48.6	32.5	42.5	60.8	56.2
Domark[b]	63.5	51.2	48.7	34.7	43.2	62.6	55.7
Headline	66.5	59.3	47.4	38.9	44.9	62.8	56.8
Quadris	71.6	48.4	47.2	29.4	37.0	62.4	56.9
Belay[b]	67.3	50.5	48.6	38.0	47.1	55.6	57.0
Leverage[a]	66.9	48.5	51.1	38.3	39.7	59.7	57.4
Fastac[b]	66.4	48.4	48.4	32.1	52.4	58.5	58.9
Stratego YLD + Leverage[a]	61.7	57.1	50.2	35.3	46.1	52.1	57.8
Stratego YLD + Asana[b]	64.7	41.3	48.6	35.5	45.9	57.3	57.1
Aproach + Asana[b]	68.4	53.5	51.9	36.1	50.4	60.5	57.8
Topguard + Declare	66.0	54.4	48.0	35.1	44.5	58.2	54.6
Headline + Fastac[b]	66.1	62.6°	47.7	32.6	43.2	57.5	57.0
Priaxor + Fastac[b]	66.4	51.7	47.3	33.7	43.8	54.2	56.6
Quilt Xcel + Warrior T[b]	72.7*	49.5	50.9	40.8	48.8	62.4	57.0
Overall LSD[e] (0.05)	7.5	12.3	NS	NS	NS	NS	NS
CV (%)	8.1	16.8	6.3	20.2	17.2	10.9	4.6

[a] Applied with COC 1% v/v [b] Applied with Non Ionic Surfactant (NIS) 0.25% v/v [d] Soybean aphid threshold was never reached so the IPM treatment became an additional untreated control [e] Least significant difference comparing all treatments * Significantly different from untreated control [o] Significantly different from insecticide alone equivalent NS – not statistically significant

Glyphosate and SDS

Dr. XB Yang and his lab are working on the issue of glyphosate effects on soybean sudden death syndrome. Greenhouse experiments confirmed the findings reported previous, which have been presented in conferences. We have been found recently to further investigate this issue.

Other projects

- USB Project to complement the Corn Systems CAP project – two graduate students looking at different aspects of soybean diseases within this larger project.
- White mold – evaluated Cobra, Contans and fungicides using on-farm trials; fungicide trials
- Phytophthora root rot

PUBLICATIONS

Books

Mueller, D.S., Wise, K.A., Dufault, N.S., Bradley, C.A., Chilvers, M.I. 2013. Fungicides for Field Crops. The American Phytopathological Society Press, St. Paul, MN.

Refereed publications and abstracts

Abdelsamad, N., Mbofung, G. C., Robertson, A. E., Liebman, M., and Leandro, L.F. 2012. Long-term crop rotations suppress soybean sudden death syndrome in Iowa.Phytopathology 475P

Abeysekara, N., Matthiesen, R., Cianzio, S., Bhattacharyya, M. and Robertson, A. 2012. Identification of quantitative trait loci for partial resistance to *Phytophthora sojae* in soybean. Phytopathology 102:S4.1

Diaz-Arias ,M. M., Leandro, L. F., and Munkvold, G. P. 2012. Frequency of isolation, aggressiveness, and impact on yield of Fusarium root rot species in soybean in Iowa. Phytopathology 322P

Ellis, M. L.' Diaz-Arias, M. M., Cruz, D. R., Munkvold, G. and Leandro, L. F. S. First report of Fusarium commune causing damping-off, seed rot, and seedling root rot on soybean (Glycine max) in the United States. Plant Disease (accepted)

Ellis, M. L.' Diaz-Arias, M. M., Leandro, L. F. S. and Munkvold, G. 2012. First Report of Fusarium armeniacum Causing Seed Rot and Root Rot on Soybean (Glycine max) in the United States. Plant Disease 96:2693.

Leandro, L. F. S., Robertson, A. E., Mueller, D. S., and Yang, X.B. Climatic and environmental trends observed during epidemic and non-epidemic years of soybean sudden death syndrome in Iowa. Plant Health Progress (accepted)

Leandro, L. F. S., Tatalovic, N. and Lucked, A. 2012. Soybean sudden death syndrome – advances in knowledge and disease management. CAB Reviews 7:053. doi:10.1079/PAVSNNR20127053

Leandro, L.F., Robertson, A.E., Mueller, D.S., and X.B. Yang. 2013. Comparison of environmental conditions during epidemic and non-epidemic years of soybean sudden death syndrome in Iowa. Plant Health Progress. Accepted November 2012.

Luckew, A., Cianzio, S. and Leandro, L. F. S. 2012. Screening method for distinguishing soybean resistance to Fusarium virguliforme in resistant by resistant crosses. Crop Science 52 (5): 2215-2223.

Matthiesen, R. Abeysekara, N., Robertson, A. and Maroof, S. 2012. Combining isolates to screen for novel sources of resistance to Phytophthora sojae in soybean. Phytopathology 102:S4.77

Mbofung, G. C. Y., Harrington, T. C., Steimel, J., Navi, S. S., Yang, X. B., and Leandro, L. 2012. Multiloci fingerprint analysis reveals genetic variability within Fusarium virguliforme population from Iowa. Canadian J. Plant Pathology 34:83-97.

Peltier, A.J., Bradley, C.A., Chilvers, M.I., Malvick, D.K., Mueller, D.S., Wise, K.A., Esker, P.D. 2012. Biology, yield loss, and control of Sclerotinia stem rot of soybean. Journal of Integrated Pest Management. 3(2):B1-B7

Robertson, A.E., Block, C.C., Hurburgh, C.R. and Shepherd, L.M. 2012. Effect of Goss's leaf blight severity on grain quality and on *Clavibacter michiganensis* subsp. *nebraskensis* seed infection. Phytopathology 102:S4.101

Rojas, A., Jacobs, J., Bradley, C.A., Esker, P.D., Giesler, L., Jardine, D., Nelson, B.D., Malvick, D. K., Markell, S., Robertson, A.E., Rupe, J.C., Sweets, L. Wise, K.A., Chilvers, M.I. 2012. Survey of oomycete species associated with soybean seedling diseases in the United States. Phytopathology 102 (Suppl): S5.8

Rojas, A., Jacobs, J., Bradley, C.A., Esker, P.D., Giesler, L., Jardine, D., Nelson, B.D., Malvick, D. K., Markell, S., Robertson, A.E., Rupe, J.C., Sweets, L. Wise, K.A., Chilvers, M.I. 2012. Survey of oomycete species associated with soybean seedling diseases in the United States. Phytopathology 102:S4.102

Smith, D.L., Watson, Q., Willis, D.K., German, T.L., Phibbs, A., Mueller, D.S., Dittman, J.D., Saalau-Rojas, E., Whitham, S.A. 2013. First Report of Soybean Vein Necrosis Disease Caused by *Soybean vein necrosis-associated virus* in Wisconsin and Iowa. Plant Disease. Accepted December 2012

Stewart, S. and Robertson, A.E. 2012. A modified method to screen for partial resistance for *Phytopthora sojae* in soybean. *Crop Science* 52:1181-1186

Tatalovic, N., Tylka, G. L., and Leandro, L. F. 2012. Effect of watering on the dynamics of Heterodera glycines and Fusarium virguliforme interaction in soybean roots. Phytopathology 448P

Extension publications

Sisson, A., Mueller, D., Robertson, A., Hodgson, E., Schaefer, K., Licht, M., and McGrath, C. 2012. Early Season Corn Scouting. Iowa State University Extension: CSI 0017.

Sisson, A., Mueller, D., Robertson, A., Hodgson, E., Schaefer, K., Licht, M., and McGrath, C. 2012. Mid-Season Soybean Scouting. Iowa State University Extension: CSI 0007.

Sisson, A., Mueller, D., Robertson, A., Hodgson, E., Schaefer, K., Licht, M., and McGrath, C. 2012. Late Season Soybean Scouting. Iowa State University Extension: CSI 0008.

Mueller, D. and Sisson, A. Scouting White Mold in Soybean. Iowa State University Extension: CSI 020. September 2011.

Other impacts or activities

Trainings

Soybean Disease Diagnostics and Management Clinic, ISU Extension

Annual crop scouting competition, 35 students and leaders attended

Presentations

Soybean seedling disease biology and manageemnt. Soybean Disease Diagnostic and Management Workshop, August, Boone, IA (20 attendees)

Soybean seedling diseases and seed treatments. Iowa State University Seed Treatment Workshop. July. Ames, IA (25 attendees)

Facts and fiction: Fungicides on the Iowa Landscape. Pheasants Forever. January. Des Moines, IA (40 attendees)

Managing Goss's wilt in corn and SDS in soybean. North Central Iowa Crop & Land Stewardship Clinic. January. Fort Dodge, IA (166 attendees)

Newsletter articles

Robertson, A. and Munkvold, G. 2012. Seedling diseases reported in corn and soybean. ICMNews. www.extension.iastate.edu/CropNews/2012/0516robertson.htm

Robertson, A. 2012. Nineteen species of *Pythium* associated with damped-off soybeans in Iowa. ICMNews. www.extension.iastate.edu/CropNews/2012/0501robertson2.htm

Robertson, A., Mueller, D., Wiggs, S and Hodgson, E. 2012. 2011 Evaluation of fungicide and insecticide seed treatments on soybean in Iowa. ICMNews. htp://www.extension.iastate.edu/CropNews/2012/0222robertsonhodgsonmueller

Mueller, D., **Robertson, A**., Wiggs, S., Hodgson, E and O'Neal, M. 2012. Evaluation of foliar fungicides and insecticides on soybean in 2011. ICMNews. http://www.extension.iastate.edu/CropNews/2012/0103mueller.htm **2012 Illinois Report – NCERA 212**

2012 Illinois Report – NCERA 212

St. Louis, MO, February 13, 2013

Carl A. Bradley & Glen L. Hartman

2012 Soybean production in Illinois:

A total of 9,050,000 acres of soybean were planted in the state. The overall average state yield was 43 bu/A, which was the lowest reported in recent years.

Soybean research projects in the Bradley lab:

Pathogen Biology

- Participated in the Oomycete CAP project, to characterize oomycete pathogens from Illinois soybean fields
- Participated in the NCSRP/USB funded soilborne fungi project, to characterize soilborne fungal pathogens that affect soybean seedlings in Illinois
- Initiated research to evaluate the sensitivity of *Rhizoctonia solani* isolates from soybean to commonly-used fungicide seed treatment active ingredients
- Reported on the genetic diversity of a *Cercospora sojina* isolate collection
- Reported on the occurrence of QoI fungicide-resistant *C. sojina* isolates in the U.S.

Disease Management

- Conducted foliar fungicide + insecticide trials at multiple locations in Illinois
- Conducted fungicide seed treatment trials to evaluate their effectiveness in managing Rhizoctonia root rot and seedling blight
- Conducted seed-applied nematicides trials to evaluate their effectiveness in managing soybean cyst nematode

Disease Losses

- Conducted a survey of university soybean pathologists to determine the amount of soybean yield that is lost due to diseases in the U.S.

Soybean research projects in the Hartman lab:

Pathogen/Pest Biology

- Characterized *Pythium* spp. from soil samples in Illinois
- Reported on the response of soybean fungal and oomycete pathogens to the phytoalexins, apigenin and genistein
- Reported on pathogenic variation of *Phakopsora pachyrhizi* isolates on soybean in the United States from 2006 to 2009
- Reported on the anastomosis of germ tubes and nuclear migration of nuclei in germ tube networks of the soybean rust pathogen, *Phakopsora pachyrhizi*
- Analyzed the genetic diversity and possible origins of *Phakopsora pachyrhizi* isolates in the United States

Epidemiology of Diseases

- Developed a multiplexed immunofluorescence method to identify and determine the viability of *Phakopsora pachyrhizi* urediniospores
- Reported on for the first time, *Colletotrichum chlorophyti* causing soybean anthracnose

Soybean Resistance

- Completed review on resistance and virulence in the soybean-*Aphis glycines* interaction
- Identified diverse soybean accessions with temperature-sensitive resistance to *Tobacco Streak Virus*
- Mapped soybean rust resistance in soybean accession PI 561356 and completed SNP haplotype analysis of the *Rpp1* region in diverse germplasm
- Analyzed soybean gene expression when exposed to *Fusarium virguliforme* phytotoxin(s)
- Developed a cut-stem inoculation technique to evaluate soybean for resistance to *Macrophomina phaseolina*

Peer- Reviewed Publications for 2012

Bradley, C. A., Wood, A. Zhang, G. R., Murray, J. E., Phillips, D. V., and Ming, R. 2012. Genetic diversity of *Cercospora sojina* revealed by amplified fragment length polymorphism markers. Canadian Journal of Plant Pathology 34:410-416.

Hill, C. B., Chirumamilla, A., and Hartman, G. L. 2012. Resistance and virulence in the soybean-Aphis glycines interaction. Euphytica 186:635-646.

Hobbs, H. A., Jossey, S., Wang, Y., Hartman, G. L., and Domier, L. L. 2012. Diverse soybean accessions identified with temperature-sensitive resistance to Tobacco Streak Virus. Crop Science 52:738-744.

Jiang, Y. N., Haudenshield, J. S., and Hartman, G. L. 2012. Characterization of Pythium spp. from soil samples in Illinois. Canadian Journal of Plant Patholgoy 34:448-454.

Jiang, Y. N., Haudenshield, J. S., and Hartman, G. L. 2012. Response of soybean fungal and oomycete pathogens to apigenin and genistein. Mycology: An International Journal of Fungal Biology 3:153-157.

Kim, K. S., Unfried, J. R., Hyten, D. L., Frederick, R. D., Hartman, G. L., Nelson, R. L., Song, Q., and Diers, B. W. 2012. Molecular mapping of soybean rust resistance in soybean accession PI 561356 and SNP haplotype analysis of the Rpp1 region in diverse germplasm. Theoretical and Applied Genetics 125:1339-1352.

Radwan, O., Li, M., Calla, B., Li, S., Hartman, G. L., and Clough, S. J. 2012. Effect of Fusarium virguliforme phytotoxin on soybean gene expression suggests a role in multidimensional defence. Molecular Plant Pathology DOI: 10.1111/mpp.12006.

Twizeyimana, M., and Hartman, G. L. 2012. Pathogenic variation of Phakopsora pachyrhizi isolates on soybean in the United States from 2006 to 2009. Plant Disease 95:75-81.

Twizeyimana, M., Hill, C. B., Pawlowski, M., and Hartman, G. L. 2012. A cut-stem inoculation technique to evaluate soybean for re- sistance to Macrophomina phaseolina. Plant Disease 96:1210-1215.

Vittal, R., Haudenshield, J. S., and Hartman, G. L. 2012. A multiplexed immunofluorescence method identifies Phakopsora pachyrhizi urediniospores and determines their viability. Phytopathology 102:1143-1152.

Vittal, R., Yang, H., and Hartman, G. L. 2012. Anastomosis of germ tubes and nuclear migration of nuclei in germ tube networks of the soybean rust pathogen, Phakopsora pachyrhizi. European Journal of Plant Pathology 132:163-167.

Yang, H. C., Haudenshield, J. S., and Hartman, G. L. 2012. First report of Colletotrichum chlorophyti causing soybean anthracnose. Plant Disease 96:1699.

Zhang, X. C., Freire, M. C. M., Le, M. H., De Oliveria, L. O., Pitkin, J. W., Segers, G., Concibido, V. C., Baley, G. J., Hartman, G. L., Upchurch, G., Pedley, K. F., and Stacey, G. 2012. Genetic diversity and origins of Phakopsora pachyrhizi isolates in the United States. Asian Journal of Plant Pathology DOI: 10.3923/ajppaj.2012.

2012 Indiana State Report for NCERA 212

Kiersten Wise and Teresa Hughes

Purdue personnel involved with soybean disease activities: Kiersten Wise, Teresa Hughes, Virginia Ferris, Jamal Faghihi, Gail Ruhl, and Tom Creswell

In 2012, approximately 5.1 million acres of Indiana cropland was in soybean production. The average yield was 43.5 bu/A, which was down slightly from 2011, when average yields were 45 bu/A.

The impact of foliar and soil-borne diseases of soybean was minimal in 2012. Drought conditions were severe, and hot, dry conditions persisted through much of the growing season. Foliar diseases such as brown spot, frogeye leaf spot, and downy mildew were present, but at low levels throughout the state. Sudden death syndrome (SDS) was observed only in the northwest corner of Indiana, and was not yield limiting. Charcoal rot was statewide, and may have limited yield in some fields. Soybean vein necrosis virus (SVNV) was confirmed for the first time in Indiana in 2012, and was present state-wide. The impact of this disease on yield is not known. Personnel participated in monitoring for soybean diseases, including soybean rust, and distributed disease observations through the ipmPIPE commentary and the Purdue Pest and Crop Newsletter.

Soybean research:

Research on foliar fungicide applications on soybean showed similar results in multi-location trials conducted in Indiana in 2012. These findings showed that yield increases can occur due to fungicide applications in low-disease pressure environments on soybean, but ultimately the most profitable soybean production systems did not include foliar fungicides.

Indiana also participated in the multi-state soybean seedling sampling projects to determine the prevalence and distribution of soil-borne fungi and fungal-like organisms associated with seedling blight.

Collaborative work continues on the role of soybean SDS in fields with soybean cyst nematode (SCN). 2012 research indicates that areas planted to soybeans with a PI88788 source of resistance (susceptible to certain genetic types of SCN) have a higher risk for SDS development. These findings influence management recommendations to soybean producers, and additional research is necessary to understand how SCN populations may affect genetic resistance to SDS.

Extension Publications:

Ruhl, G. and Wise, K. 2012. Symptoms of soybean vein necrosis linked to a new Tospovirus. Purdue Pest and Crop Newsletter. Issue 23.

Wise, K. 2012. Sudden death syndrome in soybean appearing in Indiana. Purdue Pest and Crop Newsletter. Issue 21.

Wise, K. 2012. Fungicide applications in soybean: Risk vs. Reward. Purdue Pest and Crop Newsletter. Issue 19.

Wise, K., and Hughes, T. 2012. Scout soybean fields for charcoal rot. Purdue Pest and Crop Newsletter. Issue 16.

KANSAS

2012 ANNUAL REPORT NCERA-212

February 2013

Kansas Personnel: Doug Jardine (Soybean Pathology - Extension), Chris Little (Soybean Pathology - Research), Tim Todd (Nematology), Harold Trick (Plant Biotechnology), Bill Schapaugh (Soybean Breeding)

Production Summary: Kansas soybean producers harvested 3.75 million acres of soybeans in 2012 with an average yield of 27 bushels per acre. This is the same number of acres as was harvested in 2011. The 2012 yield was down 9 bushels from the 2011 state average yield of 32 bushels and down 21 bushels from the record 2009 average of 44 bushels per acre. Following a wet start to the growing season, most of the state suffered from high heat and drought conditions. Some late season rains in north central and northeast Kansas however, allowed yields in those areas to be closer to the long term averages. Estimated statewide losses from charcoal rot were 15 percent. This is the highest level of charcoal rot since 1998. The total yield lost estimate for soybean diseases was 20.1 percent in 2012, which is 7.5 percent above the 17 year average. In addition to charcoal rot, seedling blights were responsible for an additional four percent yield loss. SCN caused an estimated one percent yield loss. Losses for all other diseases were estimated at zero to trace levels although there was some significant SDS in a few irrigated fields in the Kansas River Valley. Results of a statewide SCN soil survey indicated that approximately 18 percent of Kansas soybean fields are currently infested with SCN. Soybean vein necrosis was identified in southeastern Kansas.

Kansas Research Update (Chris Little)

I. Charcoal rot

USB Collaborative Charcoal Rot Project: *Charcoal Rot Cultivar Evaluation Using Adapted and Exotic Sources of Resistance:* In order to standardize methodology for disease assessment across geography, Kansas and four other states (AR, IL, MO, and TN) are participating in the multi-state screening program. There were seventeen entries comprising maturity groups III to V. Soybeans were grown in a non-irrigated environment. Extreme drought stress and high temperatures during July and August promoted charcoal rot in southeast Kansas. Precipitation through plant growth was relatively low compared to July and August of the 2008 to 2010 seasons. This was also the case in 2011, but generally precipitation

increased in September and temperature stress decreased. Severity ratings, root and stem colonization, and stem discoloration data are still being collected.

Kansas participated in the *in vitro* phaseolinone toxin screen (Fakhoury and Bond) and the greenhouse pipette tip assay (Hartman et al.) to screen varieties from the field screen and others as needed. The toxin assay did not work for us, but we are planning to repeat in 2013 with fresh toxin. However, the cut-tip assay was successful. Data for the first replication of this experiment is presented in Figure 1. The relationships (Spearman's ρ) between the cut-tip assay results in the growth chamber and disease severity in the field for 2012 are shown in Figure 2.

Figure 1. Cut-tip pathogenicity assay (following Hartman et al.) to compare seventeen soybean varieties from the 2012 USB charcoal rot test for resistance to *M. phaseolina* at 7 days post-inoculation (7 DPI). The isolate used was obtained from soybean stem debris at Ashland Bottoms Research Farm in Manhattan, Kansas. Each mean (+/- SD) is for three to six seedlings.

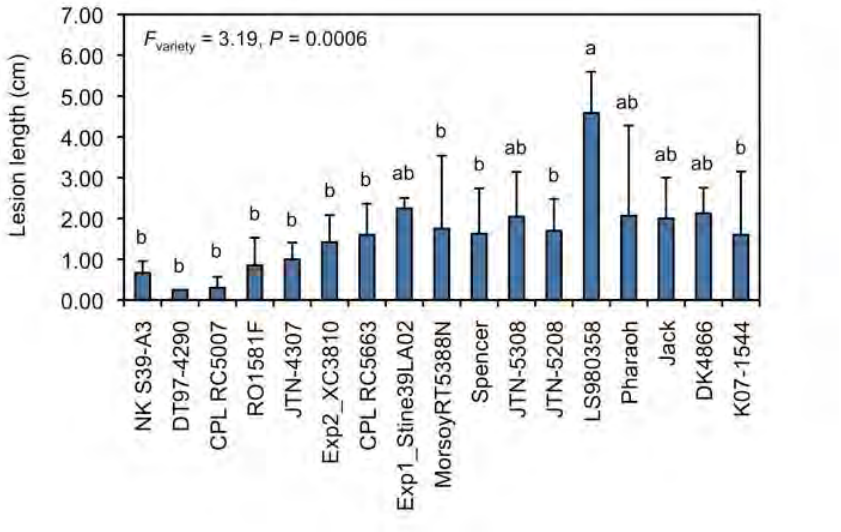
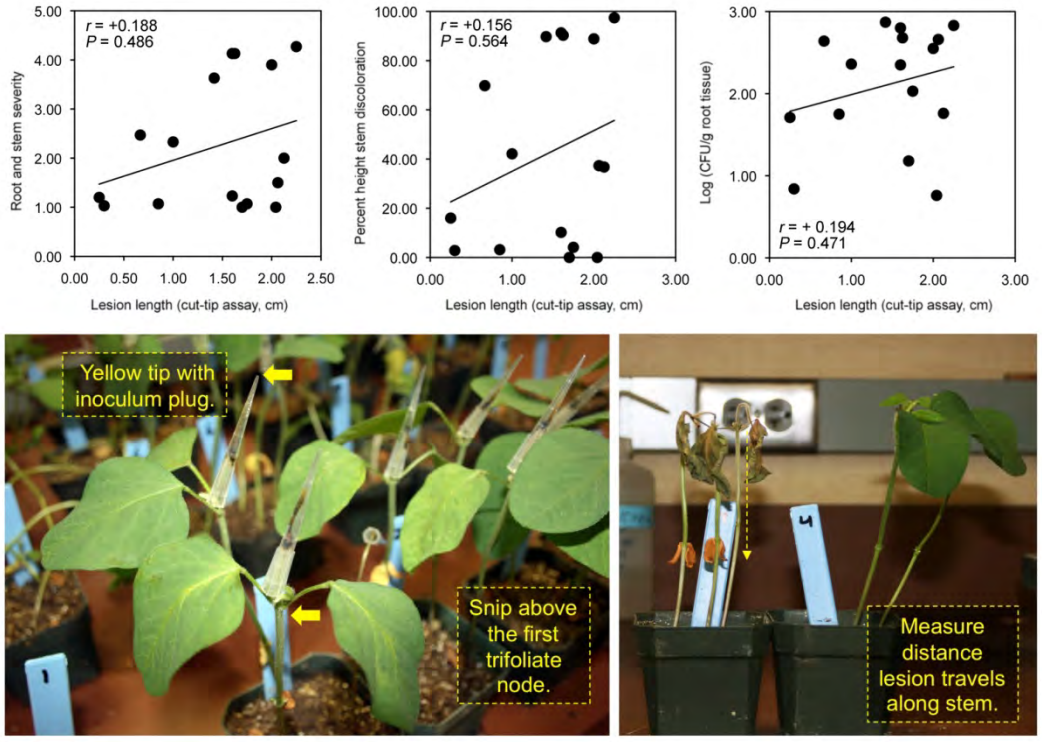


Figure 2. Relationships between charcoal rot field severity, *M. phaseolina* CFUs, and the cut-tip assay (top panel). Seedlings were snipped above the first trifoliate node and an inoculum plug in a yellow tip placed on the wounded stem (left, bottom panel). The distance the lesion traveled along the stem was then measured (right, bottom panel) (resistant, left; susceptible, right). Outlying values were not removed for this analysis.



II. Seedborne fungi/seedling diseases

<u>USB/NCSRP Collaborative Seedling Diseases Project: *Identification and Biology of Seedling Pathogens of Soybean*</u>:

(Objective 1) *Identify fungi responsible for causing seedling blights of soybean. For the regional study, collection of soybean seedlings from Kansas is underway.* Six sites (Manhattan, Topeka, Rossville, Scandia, Belleville, and Columbus, Kansas) were sampled in May and June 2012. Twenty-five isolates were obtained from diseased seedlings from each site (150 isolates total) and sent to SIU for further processing. These (and additional) isolates are being identified at KSU using ITS and α-elongation factor PCR at the same time. During the identification process, isolates are also being fed into the pathogenicity assays (below).

(Objective 3) *Characterize the biology of seedling pathogens and develop assays for inoculation.* In order to test the pathogenicity of *Fusarium* isolates, a seed imbibement assay has been developed for purposes of inoculation. Briefly, seeds are soaked in *Fusarium* spore suspensions (2.5 x 10^5 conidia/ml) to imbibe inoculum. A modified rolled towel technique is being used to compare pathogenicity of *Fusarium* spp., with emphasis upon *F. proliferatum* and *F. equiseti*. With this technique, germination, hypocotyl length, fresh weight, and seedling disease index data may be collected. We have found that the rolled towel assay is the most useful and high-throughput for our lab. See examples of the rolled towel assay, seedling disease index scale, and pathogenicity of selected isolates in Figure 3. Use of the seed imbibement and planting in the greenhouse can yield similar data (Figure 4).

(Objective 4) *Identify the impact of environmental conditions on seedling pathogens and epidemiology.* The effects of pH and temperature upon seedling disease are currently being tested using the rolled towel pathogenicity assay described above. Temperature is being modified using a growth chamber. pH is being modified using various buffer solutions (from 5.5 to 7.5) and using these solutions to soak the rolled towels. Table 1 shows an example of results from an initial temperature experiment.

Figure 3. *Rolled towel seedling disease pathogenicity assay.* (A) Examples of the rolled towel assay. (B) The seedling disease severity index (DSI = [0A+1B+2C+3D]*100/6T, where A, B, C, and D are the number of seedlings corresponding to the 0, 1, 2, and 3 severity categories and T is the total number of seedlings multiplied by the maximum disease rating; modified from Asran and Buchenauer, 2003). *Note that clear lesions develop on seedlings as a result of the rolled towel inoculation technique. (C) Response of two hosts (soybean and corn) to *Fusarium* isolates from soybean using the rolled towel assay and DSI.

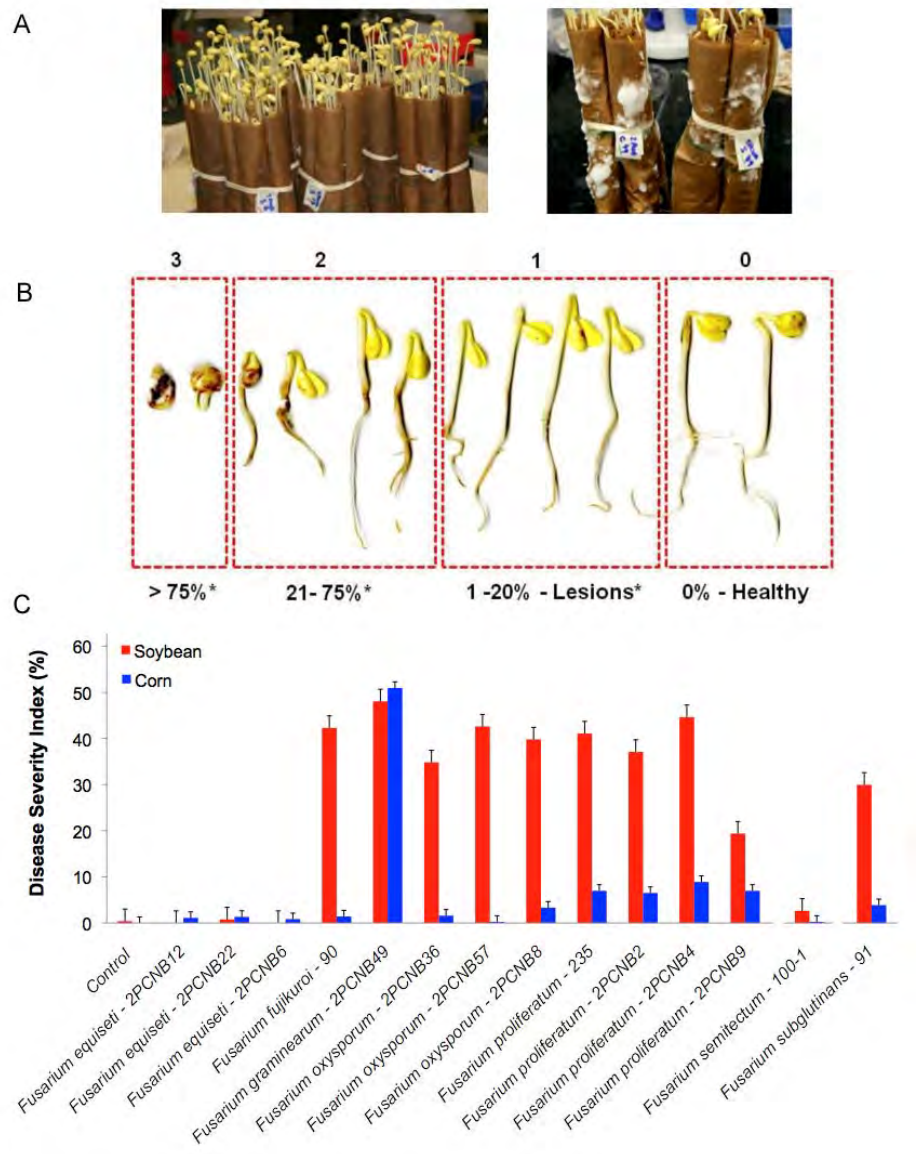


Figure 4. *Greenhouse pathogenicity assay.* Response of two hosts (soybean and corn) to *Fusarium* spp. at 12 days post-planting. In controls, seeds were imbibed with sterile distilled water for 4 hrs. In inoculated treatments, seeds were imbibed with 2 x 10^5 conidia/ml for 4 hrs. In this experiment, *F. graminearum* serves as a positive control.

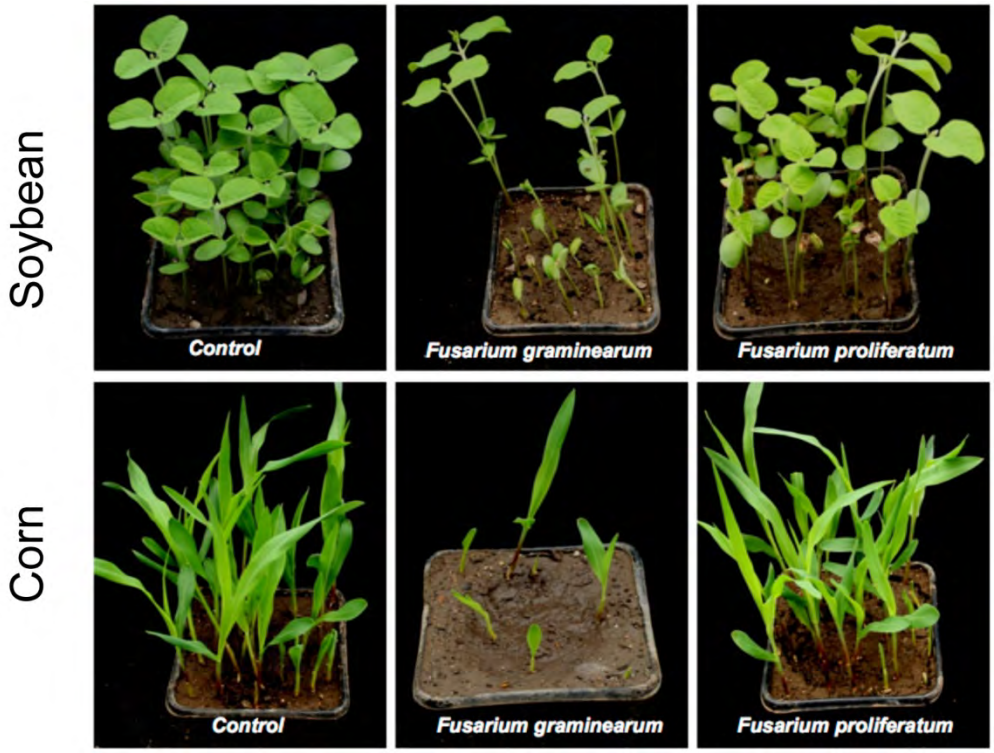


Table 1. Effect of temperature upon disease severity index using the rolled towel pathogenicity assay.

Treatment	Isolates	20°C	25°C	30°C	Mean
Control*	--	0.37	0.40	0.41	0.39 e
Mock**	--	0.39	0.40	0.38	0.39 e
F. equiseti	3	0.46	0.38	0.33	0.39 e
F. fujikuroi	3	37.11	42.77	47.58	42.49 ab
F. graminearum	3	48.25	50.42	47.15	48.61 a
F. oxysporum	3	36.32	39.05	36.32	37.23 bc
F. proliferatum	4	33.04	35.53	36.60	35.06 cd
F. semitectum	6	2.18	2.35	2.42	2.31 e
F. subglutinans	3	27.83	31.44	30.55	29.94 d
Mean	--	20.66	22.53	22.41	

**Control* = non-inoculated seed; ***Mock* = seed imbibed with sterile-distilled water.

II. Publications and Abstracts:

Mengistu, A., Arelli, P.A., Bellaloui, N., Bond, J.P., Shannon, G.J., Wrather, A.J., Rupe, J.B., Chen, P., Little, C.R., Canaday, C.H., Newman, M.A., and Pantalone, V.R. 2012. Evaluation of soybean genotypes for resistance to three seedborne diseases. Plant Health Progress: Online (DOI: 10.1094/PHP-2012-0321-02-RS).

Mengistu, A., Arelli, P.A., Bond, J.P., Shannon, G.J., Wrather, A.J., Rupe, J.B., Chen, P., Little, C.R., Canaday, C.H., Newman, M.A., and Pantalone, V.R. 2011. Evaluation of soybean genotypes for resistance to charcoal rot. Plant Health Progress: Online (DOI: 10.1094/PHP-2010-0926-01-RS).

Pedrozo, R., and Little, C.R. 2012. Identification and characterization of soybean seedborne fungi in Kansas. Phytopathology 102: S4.91

Pedrozo, R. and Little, C.R. APSnet Image of the Week (February 14-28, 2012). "Phomopsis seed decay."

APS publication number: FI00147; http://www.apsnet.org/publications/imageresources/Pages/FI00147

.aspx

2012 Michigan Report – NCERA 212
St Loius, February 2013

Martin Chilvers, Research Plant Pathologist, MSU

2012 Soybean production in Michigan and soybean diseases:

2.00 million acres of soybean were sown in 2012 and 1.99 million acres were harvested (up 50,000 acres on 2011). Average state yield was 43 bu/A down 1 bu/A (2%) on 2011 with a total state production of 85.6 million bushels, up slightly on 2011 (USDA-NASS), but below the state yield and production record of 46 bu/A and 91.5 million bushels respectively, recorded in 2006. Corn was more severely affected by the adverse conditions across the state with an average yield of 133 bu/A down, 20 bu/A (13%) on 2011.

Crop production across the state was hindered by the drier than normal conditions. An earlier spring allowed planting to be completed earlier than normal, and rainfall was sufficient for germination and establishment. Hot and dry weather arrived in June and lasted throughout the summer. Southern most regions of the state were affected most severely by a lack of moisture; mid-Michigan and areas up into thumb saw more rainfall. Harvest conditions were close to ideal and harvest was conducted in record time (USDA-NASS).

With regards to disease, soybean vein necrosis associated virus (SVNaV) was prevalent across Michigan, and was present in nearly every field examined late in the season. Presence of the causal agent was confirmed with ELISA. A single field was observed with symptom of top-dieback, stunting and purpling of the stem, this was confirmed as a being caused by a Phytoplasma. Soybean sudden death was present and severe in particular areas, including southern locations under irrigation and northern regions that received flooding rains during reproductive stages. Some fields were also observed with Fusarium root rot. Phytophthora root rot was documented across the mid and west of the state, and charcoal rot was prevalent. Soybean seedling diseases were present in some fields, but at greatly reduced prevalence and severity than in 2011. Soybean cyst nematode is prevalent in Michigan, being found in approximately 50% of fields, and was of particular concern in 2012 given the droughty conditions.

2012 soybean research projects in Michigan:

- Integrated management of oomycete diseases of soybean and other crop plants [Tyler (PI) Chilvers (Co-PI)
- Identification and biology of seedling pathogens of soybean [Bond (PI) Chilvers (Co-PI)
- Mapping distribution of soybean sudden death syndrome caused by *Fusarium virguliforme* and assessment of pathogen virulence and fungicide sensitivity to facilitate management and breeding efforts (Chilvers)
- Improved management of Sclerotinia stem rot in the north central region [Esker (PI) Chilvers (Co-PI)]
- Breeding soybeans for multi-disease resistance (Wang)
- Fungicide and biological control of Sclerotinia stem rot (Kirk)
- Biological control of Sclerotinia stem rot (Hao)
- Predicting Sclerotinia stem rot (Hao)
- NCRSP irrigation effects on SDS and field screening methods (Chilvers)
- Michigan SCN survey (Bird)

Refereed articles and reports in 2012-13

Peltier, A.J., Bradley, C.A., Chilvers, M.I., Malvick, D.K., Mueller, D.S., Wise, K.A., Esker, P.D. 2012. Biology, yield loss, and control of Sclerotinia stem rot of soybean. Journal of Integrated Pest Management 3(2):B1-B7.

Chilvers, M.I. and Serven, B.L. *Submitted Nov-12-12*. Foliar fungicide efficacy on brown spot of soybeans in Michigan, 2012. Plant Disease Management Reports.

Mueller, D., Wise, K., Dufalt, N., Bradley, C. and Chilvers, M.I. (Edited) 2013. Fungicides for Field Crops. APS Press. 120 pages.

Chilvers, M.I. 2012. Molecular diagnostics in plant disease diagnostic clinics…what's the status? (Editorial) Fungal Genomics and Biology. 2:e102. doi:10.4172/2165-8056.1000e102

Chilvers, M.I., Warner, F.W., Jacobs, J.L. and Wang, J. 2012. Efficacy of nematicide and fungicide seed treatments for soybean cyst nematode and soybean sudden death syndrome in Michigan, 2011. Plant Disease Management Reports. 6:ST003

Chilvers, M.I., Jacobs, J.L. and Boyse, J.F. 2012 2012. Triazole foliar fungicide efficacy on Septoria brown spot in soybeans in Michigan, 2011. Plant Disease Management Reports. 6:FC026

Extension articles in 2012-13

Chilvers, M.I. Phytoplasma (aster yellows) identified on Michigan soybeans. MSU Extension News, Oct, 4, 2012.

Chilvers, M.I. Soybean vein necrosis-associated virus (SVNaV) confirmed in Michigan. MSU Extension News, Sep, 13, 2012. Picked up by Plant Management Network Sept, 20, 2012. http://www.plantmanagementnetwork.org/pub/php/news/2012/SVNaV/

Chilvers, M.I. Management of soybean white mold: iTunes podcast now available. MSU Extension News, July, 30, 2012.

Chilvers, M.I. et al. Drought: Implications for near-term management decisions in field crops – Fungicides: To spray or not to spray? MSU Extension News, July, 5, 2012.

Chilvers, M.I., Jacobs, J., and Rojas, A. Multiple *Pythium* species associated with soybean and corn seedling disease in Michigan. MSU Extension News. May, 1, 2012.

Chilvers, M.I. Soybean seedling disease study. Webcast, hosted at University of Nebraska Lincoln. Apr, 4, 2012. View...

Robertson, A. and Chilvers, M. Soybean seedling disease study. Developed PowerPoint file in conjunction with Dr. Alison Robertson, Iowa State University to introduce the NIFA-CAP soybean oomycete project and provide introduction to soybean seedling diseases. The file was distributed to the oomycete extension network for use in winter meetings. Jan, 11, 2012.

NCERA-212 Minnesota State Report for 2012

Report prepared by D. Malvick, February 12, 2012

Department of Plant Pathology, University of Minnesota, St. Paul

Univ, of Minn. Faculty Who Committed Significant Time Focused on Soybean Disease Research

Dr. Senyu Chen. Southern Research & Outreach Center. Waseca, MN (nematology)

Dr. James Kurle. Dept. of Plant Pathology. Univ. of Minnesota

Dr. Dean Malvick. Dept. of Plant Pathology. Univ. of Minnesota

Dr. James Orf. Dept. of Agronomy and Plant Genetics. Univ. of Minnesota (breeding)

Minnesota Soybean Production and General Disease Status Report for 2012.

The harvested acreage of soybean in Minnesota's decreased to 6.9 million in 2012, while corn production increased to 8.3 million acres. The average state soybean yield was 43.9 bushels per acre, which is up 4 bushels/acre from 2011. Soybeans were produced in Minnesota from the Canadian border to the Iowa border, which includes maturity groups ranging from 00 to 2.3.

The precipitation pattern in Minnesota in 2012 was similar to 2011, in that rainfall was frequent and above average at most locations from May into July, and then the rain nearly stopped in much of the state for the remainder of the growing season. This resulted in drought stress on soybean in many areas, although not enough to greatly suppress yields. The other important result of the dry conditions was suppression of significant disease development. Thus in both 2011 and 2012, the incidence and severity of soybean diseases was lower than has been common over the past decade in most of Minnesota. Soybean disease problems that were noted in scattered areas include seedling diseases, Phytophthora rot, BSR, SDS, and SCN.

Selected Minnesota Research Projects in 2012

- Phytophthora root rot. A statewide survey of *Phytophthora sojae* pathotypes present in Minnesota is in progress.
- Fusarium root rot. Research is in progress on characteristic of different species pathogenic to soybean in Minnesota and on methods to work with these pathogens.
- Sudden death syndrome. Research was done on field evaluation methods for resistance to SDS and on the genetics of resistance.
- White mold. Studies of white mold focused on fungicide evaluations and methods to create adequate disease pressure for these evaluations.

- Soybean cyst nematode. Research has continued on assessing the spread of SCN in Minnesota and on characterizing resistance in different soybean genotypes.
- Pod and stem blight (*Phomopsis*). Research has continued on pathogenic and other phenotypic characteristics of pathogen population in Minnesota.
- Dual infection by *F. virguliforme* and *P. gregata* appears to be fairly common in MN fields, and we are working to understand this interaction in greenhouse studies.
- Seedling diseases of soybean. Research has been conducted on oomycete and other pathogens of soybean seedlings across Minnesota,
- Soybean fungicidal seed treatment studies were focused on evaluation of products for SDS and *Rhizoctonia* management.
- J. Kurle and by J. Orf, (soybean breeder) continue to collaborate on identifying and breeding for resistance to SCN, *P. sojae, Fusarium virguliforme, Fusarium solani*, *Phialophora gregata*, and *Sclerotinia sclerotiorum.*

Selected Minnesota Soybean Disease Publications and Abstracts – 2012

Peer-reviewed Research Articles

- Kolander, T.M., Bienapfl, J.C., Kurle, J.E., and Malvick, D.K. 2012. Symptomatic and asymptomatic host range of *Fusarium virguliforme*, the causal agent of soybean (*Glycine max*) sudden death syndrome. Plant Disease 96:1148-1153.
- J. C. Bienapfl, C. M. Floyd, J. A. Percich, and D. K. Malvick. 2012. First report of *Clonostachys rosea* causing root rot of soybean in the United States. Plant Disease. 96:1700.

- Peltier, A.J., Bradley, C.A., Chilvers, M.I., Malvick, D.K., Mueller, D.S., Wise, K.A., Esker, P.D. 2012. Biology, yield loss, and control of Sclerotinia stem rot of soybean. Journal of Integrated Pest Management. 3(2):B1-B7.
- Chen, S., Kurle, J., Sun, M., Naeve, S., Wyse, D., and Stahl, E. 2012. Preceding Crops Affected Soybean Iron-deficiency Chlorosis and Vesicular-arbuscular Mycorrhizal Fungi in Soybean Cyst Nematode Infested Fields. Crop Sci. doi: 10.2135/cropsci2012.03.0170; Published online 8 Oct. 2012. 53:1-10.
- Gillitzer, P., Martin, A.C., Kantar, M., Kauppi,K.L., Dahlberg, S., Lis, D., Kurle, J., Sheaffer, C., and Wyse, D. 2012.Optimization of screening of native and naturalized plants from Minnesota for antimicrobial activity. Journal of Medicinal Plants Research. 6:938-949.

Abstracts and Posters

- Malvick, D. K., Curland, R. D., Ishimaru, C. A. 2012. Widespread distribution of Goss's bacterial leaf blight and wilt of corn and potential variation in virulence of *Clavibacter michiganensis* subsp. *nebraskensis* in Minnesota.
- Sorur, A. Y., Warner, Reinhardt, A., T., Pfaff, M., Bond, J. P., Leonardo, L, Malvick., D.K, Fakhoury, A.

M.. 2012. Profiling microbial communities in soils of SDS-infested sybean fields using next-generation sequencing.

- Rojas, A., Jacobs, J., Bradley, C. A., Esker, P. D., Giesler, L., Jardine, D., Nelson, B. D.,. Malvick, D. K, Markell, S., Robertson, A. E, Rupe, J. C, Sweets, L., Wise, K. A., Chilvers, M. I.. 2012. Survey of oomycete species associated with soybean seedling diseases in the United States.
- Anderson, G., Zumwalde, C., Brose, I., and Kurle, J.E. 2012. Increase in *Phytophthora sojae* virulence and number of pathotypes in Minnesota in the period 1984 to 2011. Phytopathology. 102(Suppl. 5):S5.1.
- Barbeau, A., Martin, A., Anderson , G., Kurle , J. E., Wyse, D., Use of in-vitro and colorimetric techniques to assay extracts from indigenous plant species for antifungal properties. Phytopathology. 102(Suppl. 5):S5.1.

NCERA 212 Soybean Diseases

Missouri State Report- 2012

2012 Production Summary (data from Missouri Agricultural Statistics Service):

The 2011 season ended with Gene Danekas, Director of the Missouri Agricultural Statistics Service stating, "The end of a very unusual growing season is welcomed after late planting, floods, drought and hail,". Neither Gene nor I thought that 2012 could be as challenging as the 2011 season had been. Gene was the wiser- he retired. Although the 2012 season started off reasonably well it soon escalated into a year of unprecedented weather. Records and "near" records were set for high temperatures, drought, low relative humidity, high evapotranspiration rates, high solar radiation, number of consecutive days above 90, number of days with no measurable precipitation, number of days between rain events, high overnight temperatures and on and on. For the four month May through August period, the average rainfall for the state was 8.25 inches, making it the fourth driest since 1895. The average temperature was 76.1 F, the third hottest on record behind 1934 and 1936.

For the first time in four years, conditions were warm and dry early in the season and by the end of April soybean planting had begun in all districts in the state, 10 days ahead of 2011 and normal. Continued warm, dry weather throughout the state meant that by May 20, 65 percent of the soybean crop was planted, 19 days ahead of 2011 and 20 days ahead of normal. Planting remained from 20 to 24 days ahead of average until planting was completed. Crops didn't begin to decline until then end of June and the first of July. By July 1st high temperatures with no precipitation across most of the state took its toll on crops as all crops declined in condition. From the first of July until the end of August the soybean crop declined with hope that rain could still turn it around.

The remnants of Hurricane Isaac brought rains to some parts of the state at the end of August. These rains and subsequent September rains helped soybean pod fill across much of the state. The result was an estimated 155.2 million bushels of soybeans produced. Though the lowest total since 2003, the soybean crop fared better than originally predicted. The average yield, at 29.5 bushels per acre (about three-fourths average), was also the lowest since 2003. Of the 5.4 million acres planted in 2012, 5.26 million acres were harvested. Many double crop soybeans were never harvested. Yields across the state ranged from 0.0 bu/A to close to 100 bu/A.

2012 Soybean Disease Summary:

For the second year in a row, weather, especially extreme weather conditions, was the major problem during the growing season.

Although April had above average precipitation the remainder of the year was unusually warm and dry so there was limited development of early season seedling blight and root diseases. Phytophthora root

rot was evident in low levels in some fields. Rhizoctonia root rot and Fusarium root rot were more prevalent than in 2011 but not severe early in the season.

Foliage diseases were neither widespread nor severe. Septoria brown spot was unusually low in both incidence and severity. Frogeye leaf spot was also quite low in incidence and severity. Downy mildew came in quite late in the season but during September was very prevalent in the upper canopy of many fields. Soybean rust was not confirmed in Missouri during the 2012 season.

Soybean cyst nematode continues to be a major problem in soybean production throughout the state. Growers seem to believe that resistant varieties have controlled SCN. Although there have been documented cases particularly in the southwest region of the state of SCN populations achieving high reproduction rates on PI-88788 varieties.

Symptoms of sudden death syndrome were not particularly widespread in areas in which this disease is usually a problem. It showed up later than expected and was not as severe as expected.

The most unusual disease issue of 2012 was the extremely widespread occurrence of soybean vein necrosis virus. This virus had been reported from seed production fields in southeast Missouri for several years prior to 2012 but in 2012 it was found in soybean production fields throughout the state. Although the incidence was quite high both in number of fields with symptomatic plants and in the number of plants showing symptoms within a field, the severity on infected plants appeared low. Thrips levels were also unusually high in soybean fields throughout the state.

Research Summary:

Soybean seed treatment trials were conducted at the Bradford Research Center near Columbia. The earliest planting date with a variety that had a poor “Phytophthora package” had some losses from Phytophthora seedling blight. Other trials with varieties that had both resistance genes and field tolerance had 95% emergence even at the earliest planting dates. But drought took its toll on trials at Bradford. The early planted Phytophthora trial was dead by the end of August. Other trials suffered with plants stunted, off-color and senescing prematurely. Yields on these trials ranged from 6.0 bu/A to 28.0 bu/A.

Missouri participated in the North Central Soybean Research Program’s funded research trial “Improving Management of Soybean Cyst Nematode through Extension Demonstration and Outreach Phase II. Seed treated with five of the seed treatment nematode protection products as well as the untreated check was planted at two locations. There were not statistically significant differences in nematode population levels or yield at either location.

2013 Report to NCERA-212 from Nebraska

Loren J. Giesler

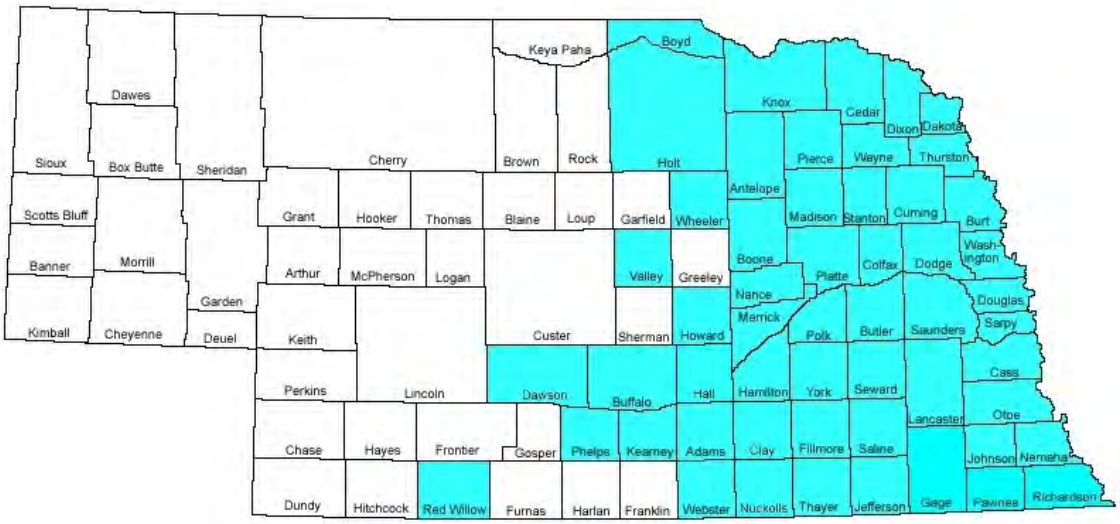
In 2012, Nebraska soybean producers harvested 4.99 M acres of soybean with an average yield of 41.5 bu./A. This was down from yield averages in 2011 (53.5 bu./A). Our record state average yield was 54.5 bu./A (2009). Approximately 46% of our production is irrigated. The yield differences in the two cropping systems in 2011 was 13.2 bu./A increase from irrigation. Once again in 2011, timely rains reduced irrigation costs for many of our producers. Overall, in 2012 we had very low disease pressure across Nebraska and drought was our greatest concern.

Even though we had overall very dry conditions, we did have some heavy rain events in mid-June which resulted in significant levels of Phytophthora in many fields. The cycle of dry-wet-dry was observed to result in more Phytophthora. Other diseases observed in 2012 were Brown Stem Rot and SDS (very few fields). More fields were impacted with Brown Stem Rot in 2012 then the last several years. Overall dry conditions resulted in more Fusarium Wilt and Charcoal Rot later in the season. In addition to disease issues there were also many fields treated for spider mites in 2012. Interactions of folair fungicide and insecticides with spider mite populations was a common question for growers. In our foliar fungicide trials we did not observe any consistent effects on spider mite populations when we had infestations at two of our four trial locations. Foliar diseases were overall low in 2012. We continue to see frogeye leaf spot spreading and is mostly in our southeastern portion of the state.

Soybean Cyst Nematode (SCN): An SCN sampling project has been funded for eight years by the Nebraska Soybean Board. Over the last seven years of this program we have detected SCN in 28 new counties in Nebraska. Every year we have found several producers with very high SCN populations (over 30,000 eggs/100cc soil) in their fields that do not know they have the problem. This program will continue in 2013.

We are in our third year of performing variety evaluations for SCN resistant varieties similar to evaluations done at Iowa State University by Dr. Greg Tylka. Our goal with this program is to have field evaluation data, with yield and SCN reproduction factors for all entries.

Distribution of Nebraska counties with confirmed SCN as of March, 2013.



Herbicide Effects on SCN Reproduction on Alternative Hosts: A graduate student in Weed Science finished and published a study on herbicide timing and the effect on SCN reproduction on henbit. One interesting observation has been that glyphosate treated henbit resulted in lower SCN egg numbers compared to plants treated with 2-4-D at the same time (citation listed below).

Werle, R., Bernards, M., Giesler, L. and Lindquist, J. 2013. Influence of Two Herbicides on Soybean Cyst Nematode (*Heterodera glycines*) Reproduction on Henbit (*Lamium amplexicaule*) Roots. Weed Technology 27:41–46.

Foliar Fungicide Use in Soybean: We continue to see significant use of fungicides in soybean production in absence of disease management needs. This was down due to dry condition in 2012. In 2011 we conducted standardized trials at our four Soybean Management Field Day locations and observed consistent yields increases. This was not the same in our 2012 sites. This field day series is funded by our Nebraska Soybean Board.

Effects of R3 foliar fungicide and insecticide applications on soybean yield at multiple locations in NE in 2012.

	(Yield bu/A)				
Treatment and Rate/A	**David City**	**Lexington**	**O'Neill**	**Platte Center**	**Average**
Non-treated	17.2	71.7	34.7	45.6	42.3
Headline 6 fl oz/A	15.6	67.4	29.7	48.0	40.1
Headline 6 fl oz/A + Respect 3 fl oz/A	17.5	71.3	30.7	49.9	42.3
Priaxor 4 fl oz/A	17.4	67.1	32.8	49.3	41.7
Priaxor 4 fl oz/A + Respect 3 fl oz/A	16.4	63.3	33.9	50.0	40.9
Quilt Xcel 10.5 fl oz/A	21.4	72.0	32.1	47.5	43.3
Quilt Xcel 10.5 fl oz/A + Warrior II 1 fl oz/A	19.7	64.4	32.3	49.3	41.4
Stratego YLD 4 fl oz/A	20.8	68.0	32.8	46.0	41.9
Stratego YLD 4 fl oz/A + Leverage 360 2.8 fl oz/A	18.0	64.9	34.0	48.1	41.2
Topguard 7 fl oz/A	21.0	75.3	33.0	51.7	45.3
Topguard 7 fl oz/A + Declare 1 fl oz/A	17.6	76.6	32.3	47.8	43.6
Evito 2 fl oz/A	18.6	78.4	34.0	51.0	45.5
Evito 2 fl oz/A + Hero 5 fl oz/A	19.4	66.9	29.9	51.2	41.8
Hero 5 fl oz/A	17.8	68.6	31.8	47.9	41.5
LSD (α=0.1)	NS	10.4	4.1	5.3	3.3
LSD (α=0.25)	4.5	7.2	2.8	3.7	2.3
Average of Fungicide Treatments (2,4,6,8,10,12)					42.95
Average of Fungicide + Insecticide Treatments (3,5,7,9,11,13)					41.88

2012 NORTH DAKOTA ANNUAL REPORT NCERA-212

February 2013

SOYBEAN DISEASE RESEARCH IN NORTH DAKOTA

Personnel: Berlin Nelson, soybean pathologist and Sam Markell, row crop extension pathologist.

The soybean acreage in North Dakota in 2012 was approximately 4.7 million acres. It was an unusually dry year, but soybean yields were relatively good at an average of 34 bu/A. Investigations on seedling diseases, root rots, and soybean cyst nematode are a major emphasis of research in this region. The importance of *Pythium* species as pathogens of soybean in the region was investigated over a two year period. Other research on soil borne pathogens examined the effect of *Fusarium tricinctum* on growth of soybean in the field. Cooperation with the soybean breeder also was continued to identify breeding lines with resistance to *Phytophthora* root rot. Evaluating dry bean for resistance to soybean cyst nematode (SCN) was continued since dry beans can be in rotations with soybean. A study on weed hosts of SCN was also continued. To estimate the distribution of soybean stem pathogens in North Dakota, an area frame survey of soybean fields in North Dakota was conducted in coordination with the National Agriculture Statistical Service (NASS) – North Dakota Field Office. In each of 120 fields, 20 6 inch long piece of stem were cut in September, and sent to the Department of Plant Pathology at NDSU for analysis. To evaluate nematicide seed treatments on SCN, three uniform field trials were established in Richland and Cass counties on SCN infested ground. In other studies, experimental fungicide seed and foliar products were evaluated for control of multiple diseases in field studies, including; three fungicide *Rhizoctonia* seed treatment trials, four fungicide white mold trials, two fungicide general disease/plant health trials, and two additional nematicide seed treatment trials.

Soybean roots and soil samples were collected from 87 fields in North Dakota in 2011 and isolation of *Pythium* was conducted on selective medium. In 2012, the identification of *Pythium* was achieved from morphological features and molecular techniques to amplify a portion of the 18S and 28S region of ribosomal DNA. Twenty four *Pythium* species out of 2,656 isolates were identified including well-known species such as *P. ultimum*, *P. debaryanum*, *P. sylvaticum*, and *P. perplexan* and some more obscure species such as *P. oopapillum*, and *P. kashmirense* . There were 560 isolates that could not be identified to species. Soil from each field is being analyzed and correlations between soil properties and *Pythium* species will be evaluated. Field tests showed that *F. tricinctum* infected soybean roots and caused significant damping-off of seedlings and discoloration/lesions on tap roots of adult plants. However, mean plant height and dry weight of plants at R4 growth stage was not significantly affect by the pathogen. In laboratory experiments some isolates of *F. tricinctum* were unable to infect seedling roots

or showed reduced ability to infect the plant. Ninety accession of the core collection of *Phaseolus vulgaris* from the Plant Introduction Center in Pullman, WA, that showed resistance to soybean cyst nematode HG type 0, were also evaluated for resistance to HG type 2.5.7. Resistance was considered an accession with a female index of 10 or less. The results showed that many accessions that were resistant to HG 0 were susceptible to HG 2.5.7. A few accessions were resistant to both HG types. These results demonstrate that there is an interaction of dry bean genotypes with biotypes of SCN, similar to the interaction of soybean with SCN. Of the 48 weed species evaluated as hosts of SCN, only three species, biennial wormwood, field pennycress and henbit had at least one collection with a female index of 10 or greater. These would be considered hosts of SCN. There were 16 other weed species that had a female index of less than 10 but greater than 0 in one or more of the collections. These would be considered poor hosts of SCN. On 29 of the weeds there was no evidence of reproduction of SCN on the roots. The weeds tested were the most common weeds found in North Dakota. The results thus far indicate that there are only a small number of weed species that SCN could reproduce on in the field and add significant cyst populations back into the soil. In the 2012 disease survey, preliminary data suggests that Charcoal Rot and Brown Stem Rot may be widespread in the state. The nematicide seed treatments studies established in 2012 showed differences in egg levels and presence of cysts, although yield differences were elusive. The experimental seed treatment fungicides resulted in increased stands over the non-treated seeds in the presence of *Rhizoctonia*, and differences among products were detected. White mold did not develop in other trials; data was not taken.

Publications Refereed Journals:

Hobbs, H. A., Domier, L. L. and Nelson, B. D. 2012. First Report of Alfalfa mosaic virus and Soybean dwarf virus on Soybean in North Dakota. Plant Dis. 96:1829

Nelson, B.D., Bolton , M. D., Lopez-Nicora, H. D., and Niblack, T. L. 2012. First confirmed report of *Heterodera schachtii* in North Dakota. Plant Dis. 96:772.

Abstracts

Ameen, G., del Rio-Mendoza , L., Nelson, B. D. 2012. Characterization of *Sclerotinia sclerotiorum* sensitivity to metconazole in North Central United States. Phytopathology 102:S4.4

Poromarto, S. H., Nelson, B. D., Goswami, R. S., Welsh, M. 2012. Reproduction of soybean cyst nematode on accessions of the core collection of *Phaseolus vulgaris*. Phytopathology 102:S4.93

A. Rojas, J. Jacobs, C. A. Bradley, P. D. Esker, L. Giesler, D. Jardine, B. D. Nelson, D. K. Malvick, S. Markell, A. E., Robertson, J. C. Rupe, L. Sweets, K. A. Wise, and M. I. Chilvers. 2012. Survey of oomycete species associated with soybean seedling diseases in the United States. Phytopathology 102:S4.102

Zitnick-Anderson, K. and Nelson Jr., B. D. 2012. Characterization and identification of *Pythium* from soybean roots in North Dakota. Phytopathology 102:S4.145

Zitnick-Anderson, K., and Nelson Jr., B. D. 2012. Stimulation of sexual structure production by Pythium. Phytopathology 102:S4.145

Knodel, J., McMullen, M., Markell, S., Ashley, R., Endres, G., Waldstein, D., Larson, C., and Nelson, D. 2012. Integrated pest management survey for insect and disease pests of oilseed crops in North Dakota. Proceedings of the 7th International IPM Symposium. Memphis, TN. March 27-29, 2012.

Qiu, C. and Nelson, B. D. 2012. Genetic Variation and Aggressiveness of *Sclerotinia sclerotiorum* in the United States. Proceedings of the 2012 Sclerotinia Initiative Annual Meeting, Bloomington, MN, January 18-20, 2012.
http://www.ars.usda.gov/SP2UserFiles/ad_hoc/54000000WhiteMoldResearch/2012/2012%20Sclerotinia%20Initiative%20Meeting%20Booklet3.pdf

Popular Press articles:

Nelson, B., and *Markell, S.* 2012. A season for SCN. The North Dakota

Soybean Grower Magazine 1(2):16-17.

Extension Activities (Sam Markell):

2012 – Extension Presentations				
Date	**Title**	**Location**	**Event**	**Estimated Number of Participants**
9/5/12	Soybean Cyst Nematode (SCN)	Wyndmere, ND	SCN field day	40
7/31/12	White Mold Disease: Prevention Strategies for Success	Coldwater, MI	Farm Journal Soybean College	100
7/19/12	White Mold, Blackleg, Aster Yellows and SCN	Langdon, ND	Langdon Research Extension Center Field Day	120

2012 – Extension Presentations				
Date	**Title**	**Location**	**Event**	**Estimated Number of Participants**
7/19/12	White Mold, Blackleg, Aster Yellows and SCN	Langdon, ND	Langdon Research Extension Center Field Day	120
7/18/12	Plant Disease Clinic	Minot, ND	North Central Research Extension Center Field Day	5
7/17/12	Soybean Cyst Nematode	Carrington, ND	Carrington Research Extension Center Field Day	50
7/13/12	Field Crop Diseases: Sunflowers, soybeans, and dry beans	Fargo, ND	Bismarck State College Students	20
7/13/12	Field Crop Diseases: Soybeans	Fargo, ND	Wahpeton State School of Science Students	20
6/6/12	Diseases and Plant Pathology	Fargo, ND	New Agent Training	20
3/22/12	Diseases of Soybean and Dry Beans	Fargo, ND	Eastern Crop Scout School	100
3/7/12	Soybean Disease in NC/NW ND	Minot, ND	Western Crop Scout School	150
2/21/12	Soybean Cyst Nematode and Pathology Questions	Fargo, ND	2012 Annual Northern Soybean Expo	10
2/15/12	Dry Bean Anthracnose and Soybean Cyst Nematode	Grand Forks, ND	International Crop Expo	50
2/10/12	ND and MN Soybean Disease Issues	Fargo, ND	Advanced Crop Advisors Workshop	50

2012 – Extension Presentations				
Date	**Title**	**Location**	**Event**	**Estimated Number of Participants**
2/10/12	ND and MN Soybean Disease Issues	Fargo, ND	Advanced Crop Advisors Workshop	40
2/8/12	SCN: A devastating pest and it's friends – Section 2	Fargo, ND	Pioneer ONE conference	50
2/8/12	SCN: A devastating pest and it's friends – Section 1	Fargo, ND	Pioneer ONE conference	30
2/8/12	Update on ND/MN Diseases	Fargo, ND	2012 ND Ag Consultants Annual Meeting	35
2/1/12	Soybean Cyst Nematode: Where it is	Grand Forks, ND	Best of the Best in Wheat and Soybean Research and Marketing	261
1/31/12	Hands On: Soybean Cyst Nematode	Moorhead, MN	Best of the Best in Wheat and Soybean Research and Marketing	175
1/31/12	Soybean Cyst Nematode: What and Where	Moorhead, MN	Best of the Best in Wheat and Soybean Research and Marketing	175
1/27/12	Soybean Cyst Nematode and White Mold of Soybean	Jamestown, ND	Getting it right-Soybeans	53
1/26/12	Soybean Cyst and Root Rots of Soybean	Oakes, ND	Getting it right-Soybeans	53
1/25/12	Soybean Cyst, Plant Health and Root Rots of Soybean	Langdon, ND	Getting it right-Soybeans	54
1/9/12	SCN: Distribution Basics and Management	Mantador, ND	Richland County Ag Days	50

2012 – Extension Presentations				
Date	**Title**	**Location**	**Event**	**Estimated Number of Participants**
1/5/12	Anthracnose	New Rockford, ND	Anthracnose Meeting	35
1/4/12	Dry Bean Crystal Ball: Diseases	Devils Lake, ND	Lake Region Round Up	60

NCERA212 – Soybean Disease Committee

Ohio State Report - 2012

Personnel:

Anne Dorrance, Professor, Soybean Research, Extension Specialist for Field Crops
Andika Gunadi, Graduate Research Assistant, M.S. December 2012
Chrissy Balk, Graduate Research Assistant, M.S.
Bhupendra Achyara, Graduate Research Assistant, M.S.
Diane Plewa, Graduate Research Assistant, Ph.D.
Anna Stasko, Graduate Research Assistant, Ph.D.
Sungwoo Lee, Graduate Research Assistant, Ph.D. (2013)

Damitha Wickramasinghe, Research Associate
Clifton Martin, Research Associate
Chandra Phelan, Research Aide
Charlotte Smith, Research Assistant

Terry Niblack, Professor and Chair, Nematologist
Pierce Paul, Assistant Professor, Extension Specialist for Field Crops
Feng Qu, Assistant Professor, Virologist
Chris Taylor, Assistant Professor, Pathogen-Host Interactions
Terry Graham, Professor, Metabolomics of soybean
Leah McHale, Assistant Professor, Soybean Geneticist, Dept. of Horticulture and Crop Science
Rouf Mian, USDA-ARS, Soybean Geneticist, Dept. of Horticulture and Crop Science

General conditions

Yields were surprisingly good in 2012 in many areas of the state due to drought conditions that lasted through the end of July. There were 4,580,000 acres harvested during 2012 with an average of 47 bu/A.

Yields in some areas of the state topped 80 bu/A on non-irrigated land. Seedling diseases were rare as the crop emerged erratically, but the seed did not rot, it just sat there. Stand count data is anomaly – where final stands were higher than V1 counts. One 80 acre field was a total loss on the west side of the state, heavy rains developed following the drought to a field that had no drain tiles, and was planted to 2 varieties, one with the Rps1c and Rps1k but no partial resistance. Soybean cyst nematode was identified in more fields and charcoal rot was prevalent this year in Southern Ohio. SDS was apparent in a handful of fields later in the season with high SCN populations; several locations have SCN populations are well above 20,000 eggs/cup of soil. Sclerotinia was spotty and only reported from NE Ohio. Frogeye leaf spot was present on highly susceptible varieties – late in the season.

Research Summary

- We completed the second year of the extension-research NCSRP funded project which evaluated the efficacy of seed treatments on SCN populations in 3 locations: Wood, Erie, and Sandusky Counties in 2012. In addition, a seed treatment rate by Phytophthora resistance was evaluated at 2 locations.
- In a collaboration with the Robertson lab at Iowa State, SSR markers were used to evaluate population diversity of populations. Diversity within the Iowa population could only be detected with the sequencing apparatus.
- Resistance QTL with smaller effects, especially those from the susceptible parent, were not consistently detected with the three isolates or the two phenotypic assays. Basic and composite interval mapping identified a major Conrad QTL on chromosome 18 and two on 19 that were detected with all three isolates and both phenotypic assays.
- Four genomic regions were associated with genetic control of decreased plant injury and higher yield under flooded conditions. Two of these regions were also associated with partial resistance to *P. sojae.* This indicates that genes for both flooding tolerance and resistance to P. sojae are necessary to reduce injury and yield loss under soil water logging and can contribute to increasing soybean productivity on soils prone to flooding
- Our findings indicate a complex defense network with multiple mechanisms underlying QTL from Conrad conferring resistance to *P. sojae*. SNP markers derived from these candidate genes can contribute to fine mapping of QTL and marker assisted breeding.
- Putative QTL were identified from Conrad on chromosomes 8, 13, 15, and 16, and one putative QTL from Sloan were mapped. The QTL identified in this population were not the same as those that confer resistance to *P. sojae*, thus different loci are required for resistance to these two seedling pathogens.
- Two new species of *Pythium* which are pathogens of corn and soybean in Ohio are described. *Pythium schmitthenneri* sp. nov. and *Pythium selbyi* sp. nov. both have morphological and sequence characteristics that place them in Clade E1 of the genus *Pythium*. These new species were widely dispersed throughout the soybean and corn producing regions in Ohio, making their characterization critical for management.

Publications:

Wang, H., Wijeratne, A., Wijeratne, S., Lee, S., Taylor, C., St. Martin, S.K., McHale, L., and Dorrance, A.E. 2012. Dissection of two soybean QTL conferring partial resistance to *Phytophthora sojae* through sequence and gene expression analysis. BMC Genomics.2012, 13:428. DOI: 10.1186/1471-2164-13-428.

Costamilan, L.M., Clebsch, C.C., Soares, R.M., Seixas, C.D.S., Godoy, C.V., and Dorrance, A.E. 2012. Diversity of *Phytophthora sojae* pathotypes from Brazil. European J. of Plant Pathol. DOI: **10.1007/s10658-012-0128-9.**

Nguyen, V.T., Vuong, T.D., VanToai, T., Lee, J.D., Wu, X., Mian M.A.Rouf, Dorrance, A.E., Shannon, J.G., and Nguyen, H.T. 2012. Mapping of quantitative trait loci associated with resistance to *Phytophthora sojae* and flooding tolerance in soybean. Crop Sci. 52:2481-2493.

Ellis, M.L., Wang, H., Paul, P., St. Martin, S.K., McHale, L., and Dorrance, A.E. 2012. Identification of soybean genotypes resistant to *Fusarium graminearum* and genetic mapping of resistance quantitative trait loci in the cultivar Conrad. Crop Sci. 52:2224-2233.

Ellis, M.L., Paul, P.A., Broders, K.D., and Dorrance, A.E. 2012. Two new species of *Pythium*, *P. schmitthenneri* and *P. selbyi* pathogens of corn and soybean in Ohio. Mycologia 104*:* 477-487.

Wang, H., St. Martin, S.K., and Dorrance, A.E. 2012. Comparison of phenotypic methods and yield contributions of quantitative trait loci for partial resistance to *Phytophthora sojae* in soybean. Crop Science 52:609-622.

Luster, D.G., McMahon, M.B., Edwards, H.H., Boerma, B.L., Lewis Ivey, M.L., Miller, S.A., and Dorrance, A.E. 2012. Novel *Phakopsora pachyrhizi* extracellular proteins are ideal targets for immunological diagnostic assays. AEM 78:3890-3895.

Ontario Report NCERA-212, February 13-14, 2013

Albert Tenuta, Field Crop Pathologist, OMAF, Ridgetown, ON
Horst Bohner, Soybean Agronomist, OMAF, Stratford

Summary

Soybeans were the largest row crop in Ontario in 2012 with a record 2.65 million acres being seeded. Acreage could again increase significantly in 2013 if soybean prices remain high. Relatively early seeding was achieved due to the mild winter, dry soil conditions and favourable temperatures. Most of the crop was seeded during the first two weeks of May with a few acres being seeded in April. Short periods of rain during May delayed planting for some growers, but these delays were not long. Soil moisture levels however were limited in certain areas of the province leading to poor seed germination and emergence problems in these dry regions. Rainfall was sporadic and in certain areas rainfall levels were significantly below normal resulting in a premature harvest and unfortunately low yields (less than 20 bu/ac in the most affected fields). For those areas that did receive timely showers yields were better than expected and some growers reported record high yields. In a few cases yields over 80 bu/ac were reported and 2012 was the highest yielding soybean year on record for the province (47 bu/ac). Early planting into dry conditions, a relatively long summer along with warm night time temperatures, and timely showers in late summer contributed to these exceptional yields. Soybean genetics continue to improve as well as increased use of SCN resistant varieties continues and should be given some credit for the exceptional yields. Visit www.gosoy.ca for the 2012 soybean performance trial information. Foliar diseases were minimal and white mould levels were very low. No significant soybean aphid populations developed but two spotted spider mites were widespread and reduced yield potential in heavily infected fields.

The 2012 season will be remembered as the best soybean year the province has ever experienced. The largest acreage planted along with record yields and exceptional prices all contributed to the most profitable soybean growing season in memory for those growers that were able to catch a few timely showers.

Planting

The early spring of 2012 was dry so a few fields were seeded by mid-April, although the majority of the crop was planted during the more traditional May planting window. Seeding very early with short season varieties reduced yields compared to seeding longer day varieties. A few replants were necessary on heavy soils or where partially germinated seed dried out. Because winter wheat harvest was earlier than normal considerable soybean double cropping was attempted in 2012. Double crop success was variable and dependent as expected on rainfall and planting date with some fields not making any seed while others yielded as high as 40 bu/ac in the southwest.

Growing Season

Emergence of the crop was affected by dry conditions. Planter units outperformed drills in this regard, mostly because of deeper seed placement. During much of July the province experienced high temperatures in conjunction with near record low precipitation. This lack of moisture and high temperature coincided with the plant's vegetative growth and early reproductive development. However, significant yield losses do not generally occur unless moisture stress continued into the R4 (full pod) growth stage. The majority of soybean yield is set during the last week of July and during the month of August in Ontario. Growing conditions during that time have more impact on yield than growing conditions during the early stages of plant development. By the end of July many fields, especially in the central region appeared to be in tough shape. August and September had better weather conditions. As this period of time coincided with the plant's reproductive growth stages, much of the soybean crop was able to make a recovery. In some ways this was similar to what happened in 2011. This growing season again showed how the indeterminate growth habit of soybeans allows the crop to take advantage of favourable environmental conditions late in the season.

Soybean Pests and Diseases

Most soybean pest and disease levels were lower than normal for the bulk of the province with the exception of spider mites. Severe stippling causing yellowing, curling and bronzing of leaves could be seen in affected areas during the summer. Some fields were left unchecked reducing yields. Root diseases such as Fusarium wilt, brown stem rot, and charcoal rot were more prominent this year than usual due to the dry conditions and high temperatures.

Aphid pressure was low in 2012. Red headed fleabeetle were widespread but only a handful of fields reached threshold levels. Japanese Beetle caused some defoliation problems that required action in a few fields.

White mould was not a significant problem this summer. A lack of moisture during early flowering reduced the incidence of white mould. Soybean Vein Necrosis Virus was confirmed for the first time in much of southwestern Ontario.

Sudden Death Syndrome was reported in areas in the south, as well as sandier soils, because of dry conditions and traditionally higher levels of Soybean Cyst Nematode (SCN). Population levels of new SCN types continue to increase but to date resistance sources PI88788 and Peking are performing well.

Harvest

Harvest started early but was then interrupted by about three weeks of wet weather. Yields were reported to be as low as 8 bu/ac in dry areas and as high as 80 bu/ac in areas with good moisture and growing conditions. Mature green seed was an issue for some of the earliest harvested fields but the majority of the crop had good seed quality with little disease.

Challenges and Opportunities for 2013

Relatively high prices and good yields in 2012 is expected to push acreage higher again in 2013. Shorter crop rotations will mean soybean growers have to be vigilant in selecting disease resistant varieties, scouting their crop, and applying inputs when required. Low soil tests for potash continue to be a significant concern for high yield potential. Excessive tillage resulting in soil erosion and spring tillage compaction are also issues that could become a problem in 2013.

2012 Tennessee Report – NCERA 212

Melvin Newman (retired) & Heather Young Kelly (Field Crops Plant Pathologist)

2012 Soybean production in Tennessee:

A total of 1.26 million acres of soybeans were planted in the state in 2012, down 30,000 acres from 2011. The overall state average yield was 38 bu/A, which was 6 bu/A more than the previous year.

Soybean research projects:

At the University of Tennessee, the efficiency of commercial fungicides to manage FLS was monitored in two locations; Milan and Dyersburg. Despite the hot and dry growing season frogeye leaf spot (FLS) was able to develop to severe levels on the highly susceptible cultivar Asgrow 4703 to evaluate different classes of fungicides and different application timings. Both locations have had strobilurin resistant FLS identified in 2011 and 2012, but both strobilurin- sensitive and resistant populations are present in the fields. As expected, fungicides containing only a strobilurin were not effective in controlling FLS when 25% or more of the population was resistant to strobilurin fungicides, but fungicides with different chemistries, such as triazoles, succinate dehydrogenase inhibitors, and methyl benzimidazole carbamates, did reduce FLS severity.

2012 Wisconsin Report – NCERA 212

St. Louis, MO; February 2013

Damon Smith, Extension Plant Pathologist, University of Wisconsin-Madison

University of Wisconsin-Madison personnel involved in soybean disease extension and research: Damon Smith, Craig Grau, Shawn Conley, Carol Groves, John Gaska, Brian Hudelson, Ann MacGuidwin, Kyle Willis, Chase Fritz, Quinn Watson

Wisconsin Department of Agriculture, Trade and Consumer Protection personnel involved in soybean disease research: Anette Phibbs

2012 soybean production in Wisconsin

In Wisconsin a total of 1.71 Million acres of soybeans were planted in 2012 with 1.70 million acres harvested. Planted acreage was up in 2012, from 1.62 millions acres in 2011. Statewide average yield was down 5 bushels per acre in 2012 compared to 2011 at 41.5 bushels per acre. Total soybean production was down 6 percent from 2011 at 70.6 million bushels.

Abnormally high temperatures and lack of rain resulted in moderate to severe drought for much of the state of Wisconsin in 2012. In general disease pressure was low in soybean with the exception of virus-induced diseases and several reports of charcoal rot. Late summer rains occurred in a very timely manner resulting in better than anticipated soybean yields.

2012 soybean disease research efforts and research publications

Damon Smith arrived in the department of Plant Pathology at The University of Wisconsin-Madison on September 1, 2012. During the short time after his arrival effort was made to move quickly to build a sound soybean disease research program. Several research studies were initiated in that time:

1. Determining the Importance of Soybean Vein Necrosis Disease in Wisconsin
2. Verification of insect transmission of *Soybean Vein Necrosis-associated Virus* and detection *in planta*
3. Determining the Importance of *Phytophthora sansomeana* on soybean in Wisconsin
4. Continued development of Sclerotinia stem rot-resistant soybean germplasm

5. The effect of light quantity and quality on apothecial development in the plant parasitic fungus *Sclerotinia sclerotiorum*

The research program made excellent progress in just three months working to identify the cause of a new disease of soybean observed during the 2012 field season. With assistance from Dr. D. Kyle Willis and others at The UW and also Iowa State University the presence of *Soybean Vein Necrosis-associated Virus* in soybean was confirmed in Wisconsin.

With the assistance of Anette Phibbs at the Wisconsin Department of Agriculture, Trade and Consumer Protection, *Phytophthora sansomeana* was discovered on soybean for the first time in the state. Currently efforts are underway to complete Koch's postulates using the isolates that were recovered.

Additionally, an overhaul of the Field Crops Pathology website (http://fyi.uwex.edu/fieldcroppathology/) was conducted and is used to deliver research-based information about field crops including soybean. The website now consists of a homepage that not only describes what the Field Crops Pathology program does at the University of Wisconsin-Madison, but also provides a portal for retrieving the latest field crops disease information. The main portion of the homepage is updated regularly (~every two weeks) to provide timely articles in field crop pathology. Other sections of the website are broken down by the major field crops (soybean, corn, wheat, and alfalfa) in the State of Wisconsin and consists of useful information such as fact sheets and disease profiles for specific diseases.

2012 soybean disease-related publications

Peer-reviewed

Smith, D.L. Fritz, C. Watson, Q. Willis, D.K. German, T.L. Phibbs, A., Mueller, D., Dittman, D., Saalau-Rojas, E., Whitham, S.A. 201x. First Report of Soybean Vein Necrosis Disease Caused by *Soybean vein necrosis-associated virus* in Wisconsin and Iowa. Plant Dis. *In press.*

Abd-Elmagid, A., Garrido, P.A., Hunger, R., Lyles, J.L., Mansfield, M.A., Gugino, B.K., Smith, D.L., Melouk, H.A., Garzon, C.D. 201x. Discriminatory simplex and multiplex PCR for four species of the genus *Sclerotinia*. *Journal of Microbiological Methods in press*.

Extension

MacGuidwin, A. and Smith, D.L. 2012. Soil Testing for Nematodes. Soy Sentinel. Vol. 9. No. 3.

Smith, D.L. and Willis, D.K. 2012. A New Virus of Soybean Confirmed in Wisconsin. Wisconsin Crop Manager. http://ipcm.wisc.edu/wcm/ October 18, 2012.

Smith, D.L. and Phibbs, A. 2012. New Phytophthora spp. Causing Root Rot on Soybean in Wisconsin. Wisconsin Crop Manager. http://ipcm.wisc.edu/wcm/ October 2.