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ABSTRACTS

INOCULUM DOSE AND VERTICILLIUM INFECTION PATTERNS IN DIFFERENT WISCONSIN POTATO CROP ENVIRONMENTS. S. S. Adams and D. I. Rouse Dept. of Plant Pathology, Univ. of Wisconsin, Madison, WI 53706

Field experiments were conducted at Hancock and Rhinelander, WI in 1984 to determine how inoculum densities of Verticillium dahliae affect seasonal infection patterns in Russet Burbank potato crops grown in different environments. Treatments were established by incorporating different amounts of a dried and ground fungal-rye mixture, containing microsclerotia from a virulent isolate, into plots at planting. Sample discs from harvested stem segments were incubated on selective medium to determine the percentage of vascular bundles infected at 10 cm intervals up canopy stems. Both yield losses and areas under average 'whole-stem' infection curves were maximal at 15 or more propagules per gram of assayed soil. At the highest doses, Hancock infection levels rose to 45% 90 days after crop emergence (DAE), and Rhinelander infection levels peaked at 25% 75 DAE. Treatments of 5 ppg produced peak infection levels of 30% at Hancock and 10% at Rhinelander but no yield losses.

EVALUATION OF COMPONENTS OF RESISTANCE TO ASCOCHYTA FABAE ON FABIA BEANS (Vicia fabae). F.H. Ali and C.C. Bernier, Department of Plant Science, University of Manitoba, Winnipeg, Manitoba, Canada, R3T 2N2.

Incubation period, mean lesion diameter, lesion number and disease efficiency (sporulating lesions/total lesions) were assessed in the field (on stems and leaves) of four susceptible inbred lines and the cultivars Erfordia (susceptible) and Ackerperle (moderately susceptible). Plants were inoculated 6 weeks after planting with each of the isolates A, B, C, X, Y and Z of A. fabae. Mean lesion diameter and lesion number on the stems and leaves of some line-isolate combinations were lower in value than those of Erfordia and Ackerperle. In some line-isolate combinations, lesion diameter decreased as lesion number increased. ANOVA showed a significant line by isolate interaction, confirming that some degree of specificity exists between the lines and some isolates. None of the components were effective against all isolates on any one line. Isolates also expressed different degrees of aggressiveness, with A and Y being the most aggressive.

EFFECTS OF Rhizoctonia solani AG3 AND POTATO SEED SOURCE ON TUBER YIELD. N.A. Anderson and P.J. Zambino. Department of Plant Pathology, University of Minnesota, St. Paul, MN 55108.

Rhizoctonia solani AG-3 was studied in 1981-1984 at the Sand Plains Research Station of central Minnesota. Experiments had a randomized complete block design with split-plot restrictions. Main plots were seed source (disease tested vs. certified seed). Sub plots were paired rows of each of three cultivars Kennebec, Norland, and Russet Burbank. One row of each pair was inoculated with three infested corn kernels per seed piece. Disease-tested seed increased yields in the 4 years an average

of 18.6%. Inoculation decreased total tuber yield 5.2, 28.5, and 11.4% in 1981, 1982 and 1983, respectively. In 1981, inoculation reduced yields in Norland and Russet Burbank. In 1982, yields were reduced more in inoculated rows when certified seed was used; yields were only reduced in disease tested seed of Russet Burbank. Inoculation did not decrease yields in 1984, but resulted in more tubers with irregular, knobby shapes, or deeply recessed eyes.

OPTIMIZATION OF FACTORS AFFECTING CELLULOSE HYDROLYSIS AND SUGAR FERMENTATION BY FUSARIUM STRAINS. Antonios A. Antonopoulos and Edward G. Wene, Argonne National Laboratory, Energy and Environmental Systems Division, Argonne, IL 60439.

Selected Fusarium strains have the ability to decompose cellulose and ferment both 5- and 6-carbon sugars to ethanol. Among the factors that affect cellulose hydrolysis and ethanol production in liquid cultures are temperature, pH, dissolved oxygen concentration, nutrients, and substrate levels. Attempts were made to optimize these factors for higher rates of cellulose hydrolysis and ethanol production. The optimum combination of factors for cellulose hydrolysis was temperature of 30 C, pH 5.3, a cellulose concentration of 1%, and use of ammonium nitrate as a nitrogen source. Ethanol production was optimized without pH control and a starting pH of 5.5, an aeration rate of 0.05 V/V-min, and use of recycled inoculum.

EPIDEMIOLOGY AND SEED TRANSMISSION OF GOSS'S WILT IN CORN.

J.A. Biddle, E.J. Braun and D.C. McGee. Dept. of Plant Pathology, Seed and Weed Sciences, Iowa State University, Ames, IA 50011.

In greenhouse and field experiments, using leaf inoculated corn plants, which became systemically colonized by Corynebacterium michiganense subsp. nebraskense (CMN) it has been possible to generate infected seed. Preliminary data indicate a maximum of 4% seed infection. During winter months of 1983/84 and 1984/85 periodic field sampling of corn leaf debris infested with CMN was carried out. Although populations of the bacterium declined, to 6% of the initial in 1983/84 and 83% of the initial in 1984/85, they were still substantial at planting time in the spring. A milder winter in 1984/85 may account for the difference in survival of CMN between the two seasons. Both infected seed and corn residues may potentially serve as sources of primary inoculum in the spring.

PRESENCE OF L-ASPARTATE IN CULTURES OF BIPOLARIS MAYDIS RACE T INCUBATED ON L-ASPARAGINE. T. W. Bischoff and M. O. Garraway. Dept. of Plant Path., The Ohio State Univ., Columbus, OH 43210.*

Bipolaris maydis race T was incubated in a liquid medium containing 2 g/l glucose and either 4 g/l of L-asparagine (L-asn) or L-aspartate (L-asp) for 72 or 96 hrs at 28 C on a reciprocal shaker (100/min). After 72 hrs ammonium (NH₄⁺) levels were 14.3+2.5 with L-asn and 1.9+1.9 μmoles/ml with

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L-asp. By 96 hrs NH_4^+ levels were 20.5 ± 5.0 $\mu\text{moles/ml}$ with L-asn while remaining constant with L-asp. To test the possibility that NH_4^+ accumulation on L-asn was accompanied by the formation of L-asp, we collected culture filtrate after 72 and 96 hrs and analyzed them chromatographically. Chromatograms were run in butanol-acetic acid water (63-27-10, v/v/v) and developed with ninhydrin and hydroxyquinoline in methyl cellulose. Spots were detected coinciding with L-asp in cultures with L-asp and coinciding with L-asp and L-asn in cultures with L-asn. The data indicate that NH_4^+ accumulation in cultures of *B. maydis* race T on L-asn was accompanied by the formation of L-asp in the culture filtrate.

DEVELOPMENT OF ENHANCED IMMUNOASSAYS FOR THE DETECTION OF LETTUCE MOSAIC VIRUS. Angelita G. Dolores-Talens & John H. Hill. Plant Pathology, Seed & Weed Sciences. Iowa State University, Ames, Iowa. 50011.

Standard enzyme-linked immunosorbent assay (s-ELISA) with alkaline phosphatase-IgG as the detection antibody (Ab) and p-nitrophenylphosphate (NPP) as substrate; biotin-avidin ELISA (b-ELISA) with biotinylated-IgG as detection Ab, avidin-AP as the enzyme marker, and NPP as substrate; and enzyme-linked fluorescent assay (ELFA) with AP- and β -galactosidase-IgG (β Gal-IgG) as detection Abs with 4-methylumbelliferyl phosphate (MUP), and 4-methylumbelliferyl- β -galactopyranoside (MUG), respectively, as fluorogenic substrates were used to detect lettuce mosaic virus (LMV) using polystyrene microtiter plates and polystyrene beads as the solid phase. LMV was detected at minimum concentrations of 5ng/ml and 25ng/ml when s-ELISA was used in the bead- and plate methods, respectively. With the b-ELISA, LMV was detected at concentrations of 2ng/ml in the bead-method, and at 25ng/ml in the plate method. Using the ELFA bead-method, virus concentrations of 1ng/ml were detected when either the substrate MUP was used for AP or MUG for β Gal. The use of a fluorogenic substrate and beads as the solid phase can enhance sensitivity for detection of LMV.

RESPONSE OF SUNFLOWERS TO CULTURE FILTRATES FROM PHOMA MACDONALDII. P. Donald, C. Hartman, J. Venette, G. Secor, Dept. of Plant Pathology, North Dakota State University, Fargo, ND 58105.

Phoma macdonaldii is parasitic on sunflower (*Helianthus annuus* L.) and can cause premature ripening. *P. macdonaldii* produces a toxic metabolite in culture which may be useful as a proxy character to use in identification of resistant germplasm. Sterile filtrates from a North Dakota strain of the fungus grown in potato dextrose broth or Czapek broth for one month, inhibited root elongation of sunflower seedlings. Filter-sterilized broth incorporated into tissue culture medium inhibited growth of hypocotyl derived callus of disease susceptible sunflowers. Calli exposed to the metabolite turned necrotic while those exposed to the sterile growth medium remained green and viable. Tissue culture screening using the metabolite may be a method to identify resistant sunflower varieties and germplasm.

ULTRASTRUCTURE OF FUSARIUM KERATITIS. D.K. Dueker, J.A. White, and M.F. Brown. Dept. of Ophthalmology and Dept. of Plant Pathology, University of Missouri-Columbia 65211.

Fusarium solani is the number one cause of fungal keratitis (infection of the cornea) in humans in the U.S. We induced the disease in rabbits by inoculating the cornea with conidia of *Fusarium solani*. Three hours after inoculation, the corneal epithelium sloughed off around the point of inoculation and leukocytes accumulated on the surface of the exposed collagen stroma. By six hours, conidia had begun to germinate within the stroma and leukocytes were migrating into the infected area. At 18 hours, all viable conidia had germinated, hyphae were actively growing within the cornea, and dissolution of the collagen matrix was evident. By 24 hours, most conidia and hyphae had been attacked by leukocytes and phagocytosis was well under way. Ultimately, the fungus was eliminated, the corneal epithelium regenerated, and there was a partial regeneration of the collagen matrix.

A BOOLEAN ALGEBRAIC APPROACH TO MODELING PARASITE:HOST:ENVIRONMENT SPECIFICITY. T. M. Shehab ElDin and L. E. Browder, USDA-ARS, Department of Plant Pathology, KSU, Manhattan, Kansas 66506.

A Boolean algebraic approach to modeling specificity is

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proposed. A definitive parasite genotype and a definitive host genotype form a definitive aegricorpus genotype. This genotype functions in a definitive environment to produce a definitive aegricorpus phenotype, related to resistance in some cases and to susceptibility in others. Nondefinitive at one or more factors results in nondefinitive phenotype. Models with one set and with three sets of corresponding gene pairs in definitive and nondefinitive environments will illustrate different characteristics of the system. Five formulae that describe expansion of the proposed model are used to calculate the following parameters: total no. of individuals, no. of aegricorpus genotypes, no. of phenotypes, no. of individuals with nondefinitive phenotype, and expected ratio of phenotypes.

INFLUENCE OF TIMING OF DRY PERIODS INTERRUPTING CONTINUOUS DEW ON INFECTION OF ONION BY *Botrytis squamosa*. K.L. Everts and M.L. Lacy, Dept. of Botany and Plant Pathology, Michigan State University, East Lansing, MI 48824.

Onion plants inoculated with dry conidia of *Botrytis squamosa* in a setting tower were placed in a dew chamber for an initial dew period of 2-12 hr, then given a 2-hr dry period followed by 12-22 hr of additional dew. Plants received 24 hr of dew in a 26 hr period. The only variable was the timing of the dry period. Control plants received 24 hr continuous dew. Conidial germination was observed after 2 hr, appressorium formation after 4 hr, and lesion formation after 10 hr of continuous dew. Two hour dry periods after 6 hr of initial dew resulted in the greatest reductions in appressorium and lesion formation. Histological observations of leaf samples revealed that, by 6 hr, most conidia had germinated, many had begun to form appressoria, but none had yet formed lesions. Conidia with developing germ tubes and appressoria were evidently more vulnerable to drying than nongerminated conidia or conidia whose germ tubes had penetrated host tissue.

SAMPLING SOIL PATHOGENS IN FIELD PLOTS. Leonard Francl, Dept. of Plant Pathology, University of Missouri, Columbia, MO 65211.*

Sampling accuracy is determined by the density, stratification, and spatial dispersion of the soil pathogen, by the soil sampling intensity and pattern, subsampling method, and extraction consistency, as well as by human error. The soybean cyst nematode (SCN), *Heterodera glycines* Ich., was sampled in three 50 m² plots by taking 275 single-core samples per plot in a lattice pattern before and after primary cultivation. SCN density strata ran parallel to the former plant rows with highest densities in the rows and, before cultivation, in the middle furrows. Spatial dispersion of SCN was aggregated. Population clusters of 1 to 3 m in length were present before cultivation. A trend of increasing spatial variance as area was enlarged suggested that smaller plots could be sampled more accurately than the 50 m² plots. It was estimated from the data that sampling these 50 m² plots with four subsamples drawn from each mixed bulk sample of 35 cores had about an 80% probability of measuring the SCN density within 25% of the true mean.

"LEAF TATTERS" - A MALADY OF UNKNOWN CAUSE OF OAKS. R.J. Green, Jr., Professor, Department of Botany & Plant Pathology, Purdue University, Lafayette, IN 47907.

In 1983, a previously unreported malady of white oak *Quercus alba*, was observed in northcentral Indiana. The symptoms include a reduction in the interveinal leaf blade tissue followed by partial or complete leaf necrosis. Second flush leaves are variable in form and reduced in size. Symptoms begin in the lower part of the crown and are progressive in succeeding seasons. In one location, 50% of trees with total crown involvement in 1984 failed to leaf out in 1985. No trees under observation have recovered, to date. Although symptoms occur primarily on white oak, other oak species are also affected. Attempts to associate a specific causal agent with the symptom complex through field observations, laboratory isolations, EM micrographs, grafting and seed transmission have been inconclusive. However, the progressive nature of symptoms on affected trees and within stands suggests an infectious agent of some type.

ANTAGONISTIC ACTIVITY OF *Bacillus subtilis* AGAINST THREE VASCULAR WILT PATHOGENS. G. Gregory, L. R. Schreiber, N. Roberto and J. Ichida, USDA, 359 Main Road, Delaware, Ohio.

Several isolates of *Bacillus subtilis* were recovered from American elms (*Ulmus americana* L.) that showed remission of

Dutch elm disease symptoms following inoculation with *Ceratocystis ulmi*. These bacteria inhibited hyphal growth of *C. ulmi*, *C. fagacearum*, and *Verticillium dahliae* on potato dextrose agar (PDA) and on elm, maple, and oak extract agar bioassay plates. Antagonism of *B. subtilis* isolate, FS94, to *C. ulmi* resulted from two antibiotics of this isolate produced on PDA. These have been purified by high pressure liquid chromatography and are now being chemically identified. Bioassays with several microorganisms including *C. ulmi*, *V. dahliae*, *Penicillium chrysogenum*, *Fusarium solani*, *Hansenula wingei* and *B. subtilis* indicate that our antibiotics differ in activity from *B. subtilis* antibiotics mycosubtilin, iturin A and bacillomycin L. Rifampicin and streptomycin-resistant double mutants have been developed to test survival and distribution of *B. subtilis* isolate FS94 in oak, elm, and maple.

GENOTYPIC VARIATION IN SENSITIVITY OF WHEAT TO A TOXIN PRODUCED BY *HELMINTHOSPORIUM SATIVUM*. M. C. Hawes, R. W. Stack & S. G. Pueppke. Dept. Plant Pathology, Univ. Missouri, Columbia 65211 & North Dakota State University, Fargo, ND 58105

We used a root cap cell assay to measure sensitivity of wheat cultivars to *H. sativum* toxin, and compared relative toxin sensitivity with susceptibility of the plants to *Helminthosporium* root rot. Cells were washed from roots in water and adjusted to 1000/ml of Murashige-Skoog salts. Freshly isolated cells were 90 to 100% viable and remained so for at least 48 hr. Toxin induced cell death was more rapid at 33 C than at 25 C. A 1:100 dilution of partially refined toxin was used to compare sensitivity of cells from six cultivars that differ significantly in susceptibility to root rot. Toxin sensitivity of isolated root cap cells was highly correlated with toxin sensitivity of whole seedlings as judged by a root growth inhibition assay. However, toxin sensitivity was not correlated with susceptibility of the plants to *Helminthosporium* root rot.

REACTIONS OF SIX SWEET CORN HYBRIDS AT VARIOUS STAGES OF GROWTH TO *PUCCINIA SORGHII*. J. M. Headrick and J. K. Pataky. Dept. of Plant Path., Univ. of Ill., Urbana, IL 61801.*

Six sweet corn hybrids differing in generalized resistance to common rust, caused by *Puccinia sorghi* Schw., were planted weekly for eight consecutive weeks and inoculated simultaneously. Significant differences in rust severity, measured as percent leaf area infected, were observed for hybrid, growth stage, and the hybrid by growth stage interaction. Older plants of all hybrids, particularly those which had tasseled, were more resistant to rust than were seedlings. The relative resistance of the hybrids was consistent over the eight growth stages with one exception. Gold Cup was not significantly different from the most susceptible hybrid tested, Florida Staysweet, during the seedling stage; however, as an adult plant, Gold Cup was not significantly different from the most resistant hybrid, Miracle. The ranking of the other five hybrids over all growth stages in order from susceptible to resistant was: Florida Staysweet, Stylepak, Jubilee, Sugar Loaf and Miracle.

USE OF VISUAL ASSESSMENT AND ELISA TO EVALUATE THE REACTION OF WHEAT CULTIVARS TO WHEAT SOILBORNE MOSAIC VIRUS. Robert M. Hanger and John L. Sherwood, Plant Pathology Department, Oklahoma State University, Stillwater, OK 74078.

Field reactions of 12 winter wheat cv. to WBSMV were evaluated visually and by ELISA. Ten plots/cv. with 10 plants/plot were assessed 3 times during Spring, 1985. A disease severity index (Wis. Agr. Exp. Stn. Bull. 531, 1958) based on symptoms was calculated for each cv. Disease severity indices (DSI) of <6% were associated with the resistant cv. Hawk and Newton. DSI of the other cv. ranged from 24 to 60% and decreased with each assessment. ELISA readings of Hawk and Newton initially below or near control readings increased with each assessment. ELISA readings of the other cv. increased with the second assessment but decreased with the final assessment and approximated the last readings of Hawk and Newton. DSI indicate that severity of WBSMV is reduced while ELISA indicates that the virus concentration in resistant cv. approaches that of susceptible cv. as the season progresses.

HERBICIDE-INDUCED LEAKAGE OF CARBONACEOUS MATERIALS FROM UNGERMINATED FUNGAL PROPAGULES. I. Isakeit and J.L. Lockwood,

Department of Botany and Plant Pathology, Michigan State University, East Lansing, MI 48824-1312.*

Ungerminated ¹⁴C-labeled propagules of *Cochliobolus sativus* and *Rhizoctonia solani* were incubated on a bed of sand through which sub-lethal concentrations (20-100 ppm) of four herbicides were percolated for 3 hours. Atrazine, linuron, trifluralin and paraquat increased exudation of labeled compounds from conidia of *C. sativus* by 31%, 27%, 69%, and 237%, respectively, over the basal exudation rate. After withdrawal of paraquat, the exudation rate was twice that of the basal rate, but when the other herbicides were withdrawn, exudation dropped to the basal rate. These herbicides had no effect on subsequent germination of the conidia. Paraquat and trifluralin increased exudation from sclerotia of *R. solani* by 97% and 19%, respectively, over the basal exudation rate.

PARTIAL CHARACTERIZATION OF WHEAT SPINDLE STREAK MOSAIC VIRUS AND ITS INVOLVEMENT IN A DISEASE OF WINTER WHEAT IN KANSAS. T. L. Kendall and S. A. Lommel, Department of Plant Pathology, Kansas State University, Manhattan, Kansas 66506.

Wheat soilborne mosaic virus (WSBMV) and wheat spindle streak mosaic virus (WSSMV) have been confirmed as the etiological agents of a soilborne virus disease complex of winter wheat in Kansas. WSSMV and WSBMV particles were identified by immunosorbent specific electron microscopy (ISEM) and enzyme linked immunosorbent assay (ELISA). A field isolate of WSSMV has been partially characterized. Purified virus preparations were obtained by extraction of infected field grown tissue with liquid nitrogen, 0.5 M sodium borate, pH 9.0, and clarification by low speed centrifugation. Supernatant was adjusted to 2.0% Triton X-100 and the virus concentrated by two cycles of differential centrifugation through 20% sucrose pads. Purified WSSMV had a buoyant density of 1.284 in CsCl. A molecular weight of 53.5 Kd for WSSMV capsid protein was determined by SDS polyacrylamide gel electrophoresis.

INVOLVEMENT OF LIPID PEROXIDATION IN THE DEVELOPMENT OF BACTERIALLY-INDUCED HYPERSENSITIVE REACTION. L. Dale Keppler and Anton Novacky. University of Missouri, Columbia, Missouri 65211.*

Concurrent increases in electrolyte leakage and membrane depolarization suggested alteration of cellular membranes of cucumber cotyledons infiltrated with *Pseudomonas syringae* pv. *pisi*, a hypersensitive reaction (HR) inducing bacterial pathogen. Separation of the two membrane potential (E_m) components indicated that the passive component was primarily affected. We tested the possibility that lipid peroxidation is the mechanism by which the passive component of E_m was affected during the HR. Lipid peroxidation and electrolyte leakage were followed and compared in cotyledons treated with the following live or heat-killed bacteria: 1) *Pseudomonas syringae* pv. *pisi* (HR inducing incompatible pathogen); 2) *Pseudomonas syringae* pv. *lachrymans* (compatible pathogen); 3) *Pseudomonas fluorescens* (a saprophyte). Lipid peroxidation and electrolyte leakage increased significantly in only the HR inducing combination.

GIBBERELLA ZEAE (Group II) AND FUSARIUM SPECIES OCCURRING ON SCABBY WHEAT IN MINNESOTA. I. Kommedahl, R.D. Wilcoxson, E.A. Ozmon, (University of Minnesota, St. Paul) and C.E. Windels, (University of Minnesota, Crookston).

From 9340 wheat grains collected from 19 different fields in 12 counties in southern Minnesota and the Red River Valley in 1984, surface disinfected (1% NaOCl, 30 sec), and placed on pentachloronitrobenzene-peptone agar, then transferred to noncommercial potato-dextrose agar (PDA), 10 species of *Fusarium* were isolated and identified using the manual developed by Nelson, Toussoun and Marasas, 1983. The species and the percentage of grains infected per species were as follows: *F. graminearum*, 83.6; *F. poae*, 8.2; *F. acuminatum*, 2.4; *F. moniliforme*, 1.8; *F. equiseti*, 1.6; *F. sporotrichioides*, 1.3; *F. oxysporum*, 0.5; *F. semitectum*, 0.4; *F. avenaceum*, 0.1; and *F. culmorum*, 0.1. Of 7845 cultures of *F. graminearum* isolated, 99.8% produced perithecia either on PDA or carnation-leaf agar, indicating that the *F. graminearum* (*Gibberella zeae*) isolates were predominantly in Group II--isolates that also cause stalk rot of corn.

cDNA CLONING AND PRELIMINARY ANALYSIS OF WHEAT STREAK MOSAIC VIRUS RNA. S. A. Lommel and T. L. Kendall, Department of Plant Pathology, Kansas State University, Manhattan, Kansas 66506.

A 2.1 Kb cDNA fragment (pWSM-8) representing a fifth of the

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wheat streak mosaic virus (WSMV) genome was cloned in *Escherichia coli* using a modification of the RNase H-DNA polymerase I mediated second strand synthesis of Gubler and Hoffman (Gene [1983] 25:263-269). Oligo dT was used to prime cDNA synthesis from poly A⁺ WSMV RNA. Double stranded cDNA was oligo dC-tailed and annealed with Pst-I restricted oligo dG-tailed pBR322. The viral origin of the recombinant plasmid was confirmed by Southern blot hybridization using a randomly primed WSMV cDNA probe. The orientation of the clones was determined by partial restriction maps of pWSM-8 and two shorter clones. It was concluded that all clones were derived from the 3' end of the WSMV RNA template. Nick-translated pWSM-8 is being used as a probe in dot blot hybridization assays to screen wheat germplasm material for WSMV resistance.

AN INHIBITION SOLID-PHASE RADIOIMMUNOASSAY COMPARED TO OTHER MEASURES OF *ASPERGILLUS REPENS* IN STORED CORN. S. L. Martin and J. Tuite, Purdue University, West Lafayette, IN 47907.

Corn kernels at 17% moisture initially free of fungal infection were inoculated with conidia of *Aspergillus repens* and stored at 26C for 55 days. Fungal development and kernel deterioration were assayed periodically by eight measures: kernel germination, fungal infection, number of fungal propagules, blue eye, visible sporulation, CO₂ evolution, ergosterol content, and inhibition solid-phase radioimmunoassay (ISPRIA). All measures except blue eye were significantly correlated with each other and with storage length. ISPRIA detected five ug of conidia per ml of corn extract with a log-linear response to 1000 ug per ml and preparation was simple and rapid. Because of ISPRIA sensitivity and its high correlations with more time-consuming methods it may be a useful research method for determining the growth of a fungal species in corn kernels.

PATHOGENICITY OF BROME MOSAIC VIRUS (BMV) TO CORN. Aurelio Martos, O.P. Sehgal and L. Darrah. University of Missouri, Columbia, MO 65211.*

Sporadic incidence of BMV in field corn (*Zea mays* L.) has been observed at the Univ. of Missouri Agronomy Research Center at Columbia during the past several years. To identify source(s) possessing resistance, thirty selected inbreds were inoculated with the corn-BMV isolate in a greenhouse. These inbreds were classified in four groups based upon symptoms and disease severity. I. Highly susceptible-local and systemic necroses, wilting and death; inbreds include, CI21E, H55, Oh7A. II. Moderately susceptible-linear bright yellow streaks on leaves, marked stunting, infrequently lethal necrosis; inbreds C0109, B73. III. Tolerant-mild mosaic or mottle, stunting, no necrosis; inbred Va35. IV. Resistant- no symptoms nor virus detected (by infectivity assays and ELISA) in the inoculated plants; inbreds B84 and N7A. To study the inheritance of resistance to BMV, a diallel set of crosses among CI21E, Oh7A, B84, and N7A is being made. F₂ progenies will be tested in the greenhouse to determine whether resistance is qualitatively (mono- or digenic) inherited.

ALTERATIONS IN LEAF PROTEINS ACCOMPANYING SOUTHERN BEAN MOSAIC VIRUS-INDUCED NECROSIS IN *PHASEOLUS VULGARIS* L. cv. 'PINTO'. F. Mohamed and O.P. Sehgal, University of Missouri, Columbia, MO 65211.*

Soluble proteins from healthy and SBMV-infected primary 'Pinto' leaves were analyzed with sodium dodecyl sulfate-polyacrylamide gel electrophoresis. The diseased tissue contained two additional proteins, MW 36000 and MW 21000. Two proteins, MW 17000 and MW 15000, were present in amounts 3 to 5 times greater in the diseased than in the healthy tissue. The MW 21000 and MW 17000 proteins have been purified to electrophoretic homogeneity. Neither protein interferes with the early stages of SBMV infection. Preliminary studies indicate that infection of 'Pinto' leaves with three other plant viruses (producing hypersensitive reaction) cause protein changes similar to those induced by SBMV.

CONCENTRATION AND INFECTIVITY OF MAIZE DWARF MOSAIC VIRUS IN NATIVE GREAT PLAINS GRASSES. M. K. Palomar and S. G. Jensen, Univ. of Nebraska and USDA-ARS, Lincoln, NE 68583-0722.

The susceptibility of native Great Plains grasses to maize dwarf mosaic virus strains A and B and their relative virus titer were investigated. Little bluestem (*Andropogon scoparius*),

big bluestem (*A. gerardi*), sand bluestem (*A. hallii*), prairie cordgrass (*Spartina pectinata*), indiangrass (*Sorghastrum nutans*), prairie sandreed (*Calamovilfa longifolia*), eastern gamagrass (*Tripsacum dactyloides*) and sand lovegrass (*Eragrostis trichades*) were susceptible to both strains of the virus while sideoats gama (*Bouteloua curtipendula*) was susceptible only to strain A. All were more readily infected by strain A than by strain B in greenhouse tests. All gave mosaic symptoms except switchgrass which showed irregular stripes. No correlation was noted between susceptibility to infection and virus titer. A positive relationship existed between virus titer and infectivity of the sap of these grasses. Most of the grasses had less virus than sorghum (*Sorghum bicolor*) but sand lovegrass and prairie cordgrass had more. Likely virus reservoirs were identified.

EFFECTS OF DUAL INFECTION WITH MAIZE DWARF MOSAIC VIRUS AND *PUCCINIA SORGHII* ON SWEET CORN. C. J. Pazur, Cleora J. D'Arcy and J. K. Pataky, Department of Plant Pathology, University of Illinois, Urbana, IL 61801.

The effect of dual infection with maize dwarf mosaic virus (MDMV) and *Puccinia sorghii* on sweet corn was assessed in 1984 for six cultivars: Florida Staysweet, Gold Ring, Jubilee, Midway, Sugarloaf and Sundance. The experiment was arranged as a split plot with 4 replications of a 6 by 2 by 2 factorial with cultivars as main plots and 4 pathogen treatments (virus, rust, dual infection and control) as subplots. Twenty plants from each subplot were sampled. MDM did not appear to affect rust severity. In plots with 100% MDM incidence, yields were reduced from 8.5% to 41%. In plots ranging from 11% to 34% rust severity at anthesis, yields were reduced from 0% to 26%. In plots with dual infection, yields were reduced from 13% to 52.7%. No significant interaction among MDM and rust was exhibited for yield; however, some quality characteristics such as ear height and tip fill showed a detrimental synergistic response to the presence of both pathogens.

EVALUATION OF SEEDLING INFECTION OF BARLEY WITH *Ustilago nuda* Alan R. Pierce, Associate Scientist and Roy D. Wilcoxson, Professor, Department of Plant Pathology, University of Minnesota, St. Paul, MN 55108

A method for inoculating barley seedlings with *Ustilago nuda* after Kavanagh (1961, *Phytopathology* 51: 175-177) was modified and evaluated for potential use in routine screening for resistance in barley cultivars. Variables tested were inoculum viability, inoculum concentration, seedling coleoptile length, and vacuum pull technique. It was concluded that to achieve infection, freshly prepared inoculum, coleoptiles no longer than 4mm, and at least one vacuum hold were necessary.

EFFECT OF LATE SEASON MATURATION RATE ON SOYBEAN QUALITY. L.D. Prober & T.S. Abney, Department of Botany & Plant Pathology, Purdue University, USDA-ARS, W. Lafayette, IN 47907*

Late season maturation rates (days between R7 and R8) and fungal infection of pod and seed by the *Diaporthe/Phomopsis* complex and *Cercospora kikuchii* were determined for 65 soybean (*Glycine max*) germplasm lines in 1984. Nearly equal numbers of entries, ranging in maturity from 95 to 137 days, were selected because of high or low levels of fungal seed infection in previous years' tests. Pod and seed infection data were based on natural conditions for *Diaporthe/Phomopsis* and conidial inoculations in R2 for *C. kikuchii*. Planting mature (R8) pods and seeds on PDA revealed that there was ample pod inoculum of these fungi for potential seed infection, and confirmed the differences in seed infection observed in previous years. Plant Introductions 417274, 416921, 417303, 417460, 404169A, 417046, and 416946 had high levels of resistance. Entries with good seed quality had 8.8 to 10.7 days between R7 and R8 whereas entries with poor seed quality had 9.6 to 16.5 days.

VEGETATIVE COMPATIBILITY GROUPS IN *CYTOSPORA KUNZEI*. Tyre Proffer, Dept. of Botany and Plant Pathology, Michigan State University, 48824-1312*

Vegetative compatibility groups (vc-groups) in *Cytospora kunzei* can be demonstrated by pairing conditioned isolates on potato dextrose agar and observing the reaction along the line of contact of the expanding colonies. Using this method 443 isolates of *C. kunzei* were examined. The isolates were taken

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from 172 cankers on 112 trees (primarily *Picea* spp.) located in Michigan. From that collection, 34 single vc-groups and 8 multi-merge vc-groups were identified. At least 6 loci appear to control vegetative compatibility in *C. kunzei* based on the number of observed vc-groups, providing that there are only 2 alleles at each locus. Examples of isolates within a common vc-group originating from different species of *Picea* and from distant geographical areas were noted. Additional studies indicate that vc-groups do not segregate during conidia formation.

A LABORATORY TECHNIQUE TO EVALUATE INFECTION OF GREEN ASH BY GLOEOSPORIUM ARIDUM. Scott C. Redlin and Robert W. Stack, Dept. of Plant Pathology, NDSU, Fargo, North Dakota 58105.

Anthraxnose, caused by *Gloeosporium aridum* (Ell. & Holw.), causes extensive defoliation on green ash (*Fraxinus pennsylvanica* Marsh.). Casual observations by the authors and others suggest that a fraction of the wild population shows useful resistance. An excised leaf disc technique may be a suitable tool for resistance screening of green ash. Leaf discs (18 mm dia.) were removed from healthy green ash leaves, surface disinfested and placed into wells cut in water agar in petri dishes. Treatments applied to the abaxial (uppermost) surface of leaf discs included unwounded, cut with a scalpel, and : burned with a heated metal rod. Inoculum was applied in aqueous suspensions of 625 to 1.2×10^5 conidia per leaf disc. After nine days incubation at 20 C, greatest lesion size occurred on discs wounded by burning and inoculated with 1.3×10^4 conidia. The rapid screening of large numbers of genotypes for disease resistance may be possible with this technique.

REGIONAL DISTRIBUTION OF MACROPHOMINA PHASEOLINA IN SOILS OF 112 COMMERCIAL FIELDS IN MISSOURI. S.M. Rosenbrock, T.D. Wyllie, and C.H. Canady; Dept. of Plant Pathology, University of Missouri-Columbia 65211.

Charcoal rot is a serious problem in Missouri. In developing a predictive model from commercial plantings, data is being collected from six areas in Missouri. Soils were sampled Spring and Fall 1984 and Spring 1985 for microsclerotia (MS) of *Macrophomina phaseolina* per gram/soil. Areas were located by miles north and west of a point 35 miles east of the southeast corner of Missouri. Analysis of the means for northwest, northeast, west central, east central, southwest, and southeast were significant; Spring 1984 (19, 37, 26, 11, 53, and 45), Fall 1984 (12, 48, 52, 22, 85, and 44), and Spring 1985 (8, 49, 49, 20, 66, and 37), respectively. The lowest MS means are in the northern areas and the highest means are in the east central area. Temperature by location interaction appears to be a more significant factor in the north than in the south. This research was supported, in part, by a Missouri Soybean Merchandising Council grant.

SOYBEAN LEAF BLIGHT AND SEED INFECTION CAUSED BY ISOLATES OF CERCOSPOORA KIKUCHII OF DIVERSE ORIGIN. R.L. Sanders and T.S. Abney, Dept. Botany & Plant Pathology, Purdue University, and USDA-ARS, W. Lafayette, Indiana 47907. *

Forty-two soybean seed isolates of *Cercospora kikuchii* from 19 States were tested for their ability to cause both foliar blight and purple seed stain of soybeans. Soybeans were inoculated at R2 (full bloom) growth stage with 3.3×10^7 conidia/ml H₂O. All isolates produced high levels of foliar blight but different levels of seed infection; rates of symptom development varied among isolates. Isolates which caused more rapid blight development also caused higher levels of purple seed stain. Six of the isolates caused <10% seed infection; 17 isolates caused 20-50% infection; and 19 isolates caused > 50% infection on 'Amsoy 71' seed. Geographic origin of the soybean isolates was not an indicator of virulence. *Cercospora* isolates from corn and peanut produced only low levels of seed infection.

INVESTIGATIONS INTO THE MICROPROPAGATION OF PATHOGEN FREE PRUNUS BESSEYI. G.W. Shaffer, S.J. Stefan, D.F. Millikan, and W.H. Shaffer. Dept. of Plant Pathology, University of Missouri-Columbia, Columbia, MO 65211.

Prunus besseyi is used as a root stock for dwarfing peach trees. However, most strains originated from one selection which was virus infected. Studies were conducted to determine if *P. besseyi* could be grown using meristem tip cultures to produce virus-free plants. Murashige and Skoog medium and Anderson medium were compared. Quarter strength

Anderson medium supplemented with sucrose (30 g/l), PVP (20 g/l), and benzyl amino purine (2 mg/l) gave optimum growth of shoot tips. The use of filter paper bridges gave superior results for growth of excised buds in the first weeks of growth. After 2 weeks on bridges, the explants were transferred to solid medium for best results. *P. besseyi* was successfully grown *in vitro* through Stage I. Growth through successive stages is under investigation.

POLYMER FILMS: A NEW APPROACH TO CONTROL OF APPLE SCAB. I. GREENHOUSE STUDIES. W.H. Shaffer and J.A. White. Department of Plant Pathology, University of Missouri-Columbia, Columbia, MO 65211.

The feasibility of using antitranspirant polymer films as a replacement for conventional fungicides in the control of apple scab was studied under greenhouse conditions. The compounds tested included Wilt Pruf[®], Vapor Gard[®], AKFS-84, and the fungicide, Dithane M-45[®]. These compounds were sprayed on pot-grown 'Red Delicious' apple trees with a hand sprayer. The 2 youngest leaves were then inoculated with conidia of *Venturia inaequalis* and placed in a mist chamber at 18°C for 18 hr. After 21 days, 81% of the control leaves showed symptoms of scab infection, compared with 59% for AKFS-84, 20% for Wilt Pruf[®], 5% for Vapor Gard[®], and 4% for Dithane M-45[®]. All three polymers and Dithane M-45 provided significant (P=0.05) control of apple scab. Field experiments are being conducted to determine if these polymers are equally effective under field conditions.

CORRELATIONS BETWEEN VIRULENCE FREQUENCY OF UROMYCES APPENDICULATUS (PERS. WIGER VAR. APPENDICULATUS AND PUSTULE SIZE ON PHASEOLUS VULGAPIS L. Meher Shaik and James R. Steadman. Department of Plant Pathology, University of Nebraska, Lincoln, 68583-0722.

The relationship between virulence and pustule size was analyzed for 21 closely related races of bean rust identified in Jamaica using the seven Harter and Zaunmeyer (J. Agric. Res. 62:717-731) differential bean cultivars. Frequency of virulent reactions (immune or necrotic spots) was positively correlated with that of pustule-grade 3, < 300µm, (r=0.788, P<0.01) and grade 4, 301-499µm, (r=0.674, P<0.01) but not with grade 5, >500µm. The same relationship between virulence and pustule sizes existed among U.S. races 38-57 recently identified by Staveland (Plant Disease 68:95-99) using the 7 differentials and 12 additional ones. However, U.S. races 1-35 did not exhibit the same trend. Among these races virulence was not correlated with grade 3 but was positively correlated with grade 4 or 5. When dry bean races were analyzed separately from snap bean races, only a positive correlation between virulence and grade 5 was found among the snap bean races.

RELATIONSHIP OF BARLEY SEEDLING INFECTION TO COMMON ROOT ROT OF PLANTS IN THE FIELD. Robert W. Stack. Dept. Plant Pathology, No. Dak. St. Univ., Fargo 58105.

A major problem in detecting resistance in barley to common root rot, caused by *Helminthosporium sativum*, has been the need to test adult plants under field conditions. A seedling test which adequately predicts field response is very desirable. Barley lines of known and differing field susceptibility to common root rot were planted in *H. sativum*-infested soil in the greenhouse. After 3 to 4 weeks, stands were counted and plants were lifted and roots washed. Subcrown internodes were examined individually under the dissecting microscope for size and number of lesions. Three seedling disease components correlated significantly to field disease but none sufficiently so to be directly usable. Overall seedling disease severity was best correlated with lesion density and incidence of infected plants. Seedling screening by disease measurements, even very precise ones, does not appear to satisfy the predictive needs of a resistance breeding program.

MICROPROPAGATION OF BLACK WALNUT, JUGLANS NIGRA L. S.J. Stefan, and D.F. Millikan. Department of Plant Pathology, University of Missouri, Columbia, MO 65211.

Factors associated with the establishment of shoot-tip-meristem cultures of black walnut, *Juglans nigra* L., have been determined. Initial lethal browning can be controlled by treating the tissues with an antioxidant (0.01 M Na Diethyldithiocarbamate) prior to dissection, washing the excised tips with sterile distilled water for five hours, and placing the tips on half-strength DKW liquid medium (HortScience 19:507) supplemented with 2% soluble PVP. Growth and proliferation of established cultures have

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been maintained as long as 10 months on solid medium, producing five succeeding subcultures. One-half strength DKW medium supplemented with 4.0 mg/l of BAP, 2.0 g/l of 2ip, 1×10^{-6} mg/l of GA₃, and 2% coconut milk is superior to other tested media (MS, Anderson, Woody plant). The addition of casein hydrolysate at 25 mg/l, 50 mg/l, or 100 mg/l produced a short, dense type of growth but increased the number of subcultures obtained per culture at all three concentrations. Factors permitting rooting and acclimatization of shoots obtained *in vitro* are under current investigation.

INHERITANCE OF RESISTANCE TO PYRENOPHORA TERES IN F₃ PROGENY OF THREE BARLEY CROSSES. Linda M. Treeful, Roy D. Wilcoxson and Donald C. Rasmusson, University of Minnesota, St. Paul, 55108.

F₃ seedlings of three barley (*Hordeum vulgare*) crosses were evaluated for resistance to *Pyrenophora teres*, the cause of net blotch. The crosses were Robust X JR4T-2, Robust X M76-160 and M76-160 X M46. JR4T-2 and M76-160 were the resistant parents. Seedlings at the two leaf stage were inoculated with a single-spored isolate of *P. teres* collected in Minnesota in 1983. A total of 91-100 families per cross were tested with 20 - 40 plants per family. In each cross F₃ families segregated in a 1:2:1 ratio with chi-square values of 0.02, 0.07 and 0.13, respectively, and p values greater than 0.90. The data suggest that resistance to net blotch is controlled by one gene in the resistant cultivars.

ENZYMATIC DESTAINING OF CALCOFLUOR TREATED LEAF TISSUE YIELDS HIGH CONTRAST FLUORESCENT RESOLUTION OF FUNGAL COLONIZATION. A.T. Trese and D.C. Loschke. Depts. of Plant Pathology, Univ. of Missouri, Columbia, 65211, and Univ. of Florida, Gainesville, 32611.*

We developed a staining procedure that produces high contrast resolution of *Helminthosporium* spp. mycelia in corn leaf tissue. Infected tissue is cleared and stained in 0.01% calcofluor, autoclaved for 8 minutes in 0.5 N KOH, embedded in a thin layer of agarose on a glass slide, and then partially digested with cellulase. *H. carbonum*, *H. maydis*, and *H. turcicum* infection sites in a variety of corn genotypes, including cultivars near isogenic with respect to Ht1 and Ht2, were viewed with an epifluorescence microscope. In each parasite-host combination staining enabled visualization of all mycelia, from the point of penetration to the periphery of the colony. The high contrast enabled us to measure total hyphal length in susceptible versus resistant interactions of corn with *H. turcicum*. This technique may also prove adaptable to other fungus-plant interactions.

EFFECTS OF GLUCOSE ON THE FERMENTATION OF XYLOSE BY *FUSARIUM OXYSPORUM*. Edward G. Wene and Antonios A. Antonopoulos, Energy and Environmental Systems Division, Argonne National Laboratory, Argonne, IL 60439.

Hemicellulosic sugars are a major component of hydrolyzates of lignocelluloses. The efficient fermentation of D-xylose, the predominant hemicellulosic sugar, is therefore a determining factor in the economic feasibility of utilizing lignocelluloses for ethanol production. *Fusarium oxysporum* efficiently ferments up to 2% D-xylose solutions to ethanol under aerobic conditions. However, increased concentrations of D-xylose are not efficiently fermented, and in the latter stages of these fermentations, ethanol concentrations decrease. The addition of D-glucose to greater than 2% D-xylose fermentations enhances ethanol production. The addition of 2% glucose to 4.5% xylose fermentations increased the ethanol yield from 0.22 g/g xylose to more than 0.32 g/g xylose utilized. The addition of glucose increased the ethanol yield of up to 7% xylose fermentations. Studies continue to elucidate the role of glucose in xylose fermentations by *Fusarium* strains.

POLYMER FILMS: A NEW APPROACH TO CONTROL OF APPLE SCAB. II. SCANNING ELECTRON MICROSCOPY. J.A. White and W.H. Shaffer. Dept. of Plant Pathology, University of Missouri-Columbia 65211

In order to study the mechanism by which certain polymer films reduce apple scab infection, we sprayed the leaves of pot grown apple trees with the polymers described in Part I. The youngest leaves were then inoculated with conidia of *Venturia inaequalis*. Samples of the inoculated leaves were taken at

regular intervals and were processed for scanning electron microscopy. Examination of polymer-coated leaves revealed that the films were unbroken and more or less uniform. None of the films permanently occluded the stomata. Conidia germinated freely on polymer-coated leaves and growth of germ tubes was not inhibited. Appressoria produced on coated leaves were similar in morphology to controls. After 7 days, sub-cuticular growth of the fungus was evident in the controls, but was markedly reduced in the polymer-coated leaves. We postulate that the polymer films provide a physical barrier that prevents the fungus from penetrating the cuticle.

STRAWBREAKER IN KANSAS WHEAT. William G. Willis, Dept. of Plant Pathology, Kansas State University, Manhattan, KS. 66506

Wheat strawbreaker caused by *Pseudocercospora herpotrichoides* is a serious disease in the Pacific Northwest but has not been reported previously from the central Great Plains. Traces were found in Lincoln Co. in 1980, Harvey Co. in 1981 and Montgomery Co. in 1983. In 1984 it was widespread and severe with positive identifications from 23 central and eastern counties with the most severely affected area in south central around Wichita. Weather records were compared to the "climatic potential" developed by Bruehl in Washington (Bruehl et al. Washington Exp. Sta. Bull. 694, 1968). Deviations from normal mean daily temperatures and precipitation at the Wichita airport were, Feb. +6.30F and +.38 in., Mar. -3.40F and +5.56 in., and Apr. -4.50F and +1.41 in. The "climatic potential" calculated by their formula exceeded that in areas in Washington where strawbreaker is regularly severe. Apparently *Pseudocercospora* survives long periods at low levels in Kansas wheat fields and with favorable weather can reach severe levels.

RESPONSE OF BLUEGRASS CULTIVARS TO NECROTIC RING SPOT. G. L. Worf, J. S. Stewart and R. C. Newman. Departments of Plant Pathology and Horticulture, University of Wisconsin-Madison, WI 53706.

Bluegrass and turf-type perennial ryegrass cultivars were planted in September, 1982, in large replicated blocks on two sod farms to evaluate their "patch disease" susceptibility. Symptoms developed in mid-July at one, late August 1984, at the other site and were rated on the basis of 0 (no disease) to 10 (100% diseased). Crown and root isolations yielded *Leptosphaeria korrae*, the incitant of necrotic ring spot. Cultivars with few or no symptoms included Adelphi, Majestic, Merion, Midnight, Mystic, Park, Vantage and Wabash. Burke, Columbia, Georgetown, Glade, Haga, Nassau, Ram I, Sydsport, and especially Trampas showed many patches of disease. Baron, Eclipse, H-7, I-13, Merit, Newport and N535 were intermediate. None of four perennial ryegrasses showed symptoms. Examinations for pathogens and host responses will be continued over the next two years.

SOMACLONAL VARIATION OCCURRING IN DISEASE RESPONSE OF REGENERATED CELERY PLANTS FROM CELL SUSPENSION AND CALLUS CULTURES. J.C. Wright and M.L. Lacy, Dept. of Botany and Plant Pathology, Michigan State University, East Lansing, MI 48824.

Whole plants of celery cultivars 'Florida 683' and 'Tall Utah 5270 HK' were regenerated from cell suspensions and from callus cultures. Leaves of these somaclones were inoculated with spore suspensions of *Cercospora apii* and *Septoria apicola* and with a cell suspension of *Pseudomonas cichorii*. Somaclones were then placed in muck soil containing *Fusarium oxysporum* f. sp. *apii* Race 2. Variable disease responses to all pathogens were observed, ranging from highly resistant to highly susceptible. Similar ranges of disease response occurred in plants whether they were regenerated from cell suspensions or from callus tissue. Several somaclones that appeared to be highly resistant to each organism were obtained, primarily from plants regenerated from cell suspension cultures.

POPULATIONS OF *MACROPHOMINA PHASEOLINA* IN COMMERCIAL FIELDS AS AFFECTED BY CROP SEQUENCING. T.D. Wyllie and S.M. Rosenbrock, Dept. of Plant Pathology, University of Missouri-Columbia 65211.

It is possible to manage soil populations of *Macrophomina phaseolina* in experimental rotation plots. Predicting crop rotation effects on the fungus in soil in commercial plantings is less reliable. Six areas in Missouri

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totalling 112 commercial fields having soybeans (SB) among their crop-sequencing schedules are being sampled. SB, SB double cropped (DC) with wheat, corn, milo, and others are among the crop sequences being studied. The effect of crop sequencing is expressed in the second and third years and is dependent upon field location. In areas where wheat DC with SB is a practice, DC significantly resulted in higher populations of microscler-

otia (ms) than all other crop sequences. Significance ranged from 0.08 to 0.003 when comparing 1984 and 1985 spring numbers of ms, respectively, to the 1982 and 1983 crops. Increases in ms observed in soil are likely related to increased survivability of ms in soybean residue protected by wheat. This research was supported, in part, by a Missouri Merchandising Council grant.