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Abstracts

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Alphabetized by first author's last name

EFFECTS OF NATURALLY-OCCURRING AROMATIC COMPOUNDS AND RESIDUAL ACIDITY FROM DELINTING ON RHIZOSPHERE COLONIZATION OF BIOLOGICAL CONTROL AGENTS ON COTTON. E. M. Bauske, R. Rodríguez-Kábana, and P. A. Backman. Department of Plant Pathology, Biological Control Institute, Auburn University, AL 36849-5409.

The effects of furfural, benzaldehyde, and citral on cotton rhizosphere colonization of eleven bacterial biological control agents were determined in three greenhouse experiments. These compounds demonstrated ability to control pathogenic nematodes. Soil was treated with 0.35 ml/kg soil of each compound 10 days prior to planting with Deltapine 51 seed. The surface pH on half the seed in each experiment was increased from 2.3 to 5.4. Bacteria were applied as seed treatments and rhizosphere colonization was determined 12 days after planting. Seed-surface pH did not affect rhizosphere colonization in any experiment. Treatment with furfural reduced colonization of all strains from an average of 4.7 to 4.4 log cfu/g root. Citral affected colonization of only two strains (increasing colonization of one and reducing the other). Benzaldehyde adversely affected colonization of two strains. Results suggest that most of the biological control bacteria tested are compatible with citral and benzaldehyde.

EFFECT OF APPLICATION TIMING WITH A SHORT AND A LONGER RESIDUAL FUNGICIDE ON CONTROL OF PEANUT STEM ROT. T. B. Breneman, University of Georgia, Coastal Plain Experiment Station, Tifton, GA 31793-0748.

One application of a short (carboxin, 1.26 kg/ha) or longer (thiyluzamide, 0.56 kg/ha) residual fungicide was applied to Florunner peanut at 10-day intervals from 30-110 days after planting (DAP) in 1992 and 1993. Carboxin treatments had no effect on stem rot (*Sclerotium rolfsii*) or yield. Thiyluzamide applied from 30-100 DAP in 1992 and 30-70 DAP in 1993 significantly ($P < 0.05$) reduced stem rot and increased yield. Crop value was increased by applications from 30-100 DAP in 1992 and 30-50 DAP in 1993. The best disease control (74%) was from the 50 DAP application. The greatest increase in crop value (\$945/ha) and yield (1158 kg/ha) was from the spray at 40 DAP. Higher grades and reduced kernel damage resulted from some thiyluzamide treatments.

PEST MANAGEMENT OF TOMATILLO (*Physalis ixocarpa*): A POTENTIAL NEW VEGETABLE CROP FOR LOUISIANA. F. Can, R.A. Valverde, M.C. Rush, J.L. Griffin, Dept. of Plant Pathology and Crop Physiology, R. Story, Dept. of Entomology, and W.J. Blackmon, Dept. of Horticulture, Louisiana Agricultural Experiment Station, Louisiana State Univ. Agricultural Center, Baton Rouge, 70803.

Tomatillo, an important vegetable crop in Mexico and Central America, is being evaluated as a food crop in Louisiana. A 4-yr study indicated that virus diseases (physalis mottle, cucumber mosaic, and tomato spotted wilt viruses) were the major factor limiting production. Powdery mildew (*Erysiphe* sp.) and fruit rot (*Rhizoctonia solani*) were occasionally a problem on transplants or fruits in the field. The most important insect pests included fruit worm, aphids, flea beetle and thrips. Insecticides presently labeled for use on tomato were used and found to be effective for insect control. Greenhouse and field studies indicated that tomatillo has good tolerance to the herbicides Treflan, Devrinol, Poast and Fusilade. Maximum yields were obtained when plastic mulches were used.

REFLECTIVE MULCH CONTROLS VIRUS VECTORS AND INCREASES YIELD OF TOMATILLO (*Physalis ixocarpa*). F. Can, R.A. Valverde, M.C. Rush, Dept. of Plant Pathology and Crop Physiology, R. Story, Dept. of Entomology, and W.J. Blackmon, Dept. of Horticulture, Louisiana Agricultural Experiment Station, Louisiana State University Agricultural Center, Baton Rouge, 70803.

Tomatillo experimental plots were planted during the spring and fall of 1993 at the Burden Research Station in Baton Rouge. Tests were conducted to evaluate the effect of plastic mulches and insecticide application on virus vectors and yield of tomatillo. Virus diseases evaluated included: cucumber mosaic virus, physalis mottle virus, and tomato spotted wilt virus. The following treatments with and without insecticide were tested: non-mulched, black plastic, and aluminum-painted plastic. Aluminum-painted plastic mulch increased tomatillo yields up to 70-90% when compared with non-mulched plots. Moreover, yields increased further if insecticide was applied. Virus vector populations and virus disease incidence were significantly lower in insecticide-treated aluminum-painted mulched plots than in all other treatments.

FURTHER EVALUATION OF STEROL-INHIBITING FUNGICIDES FOR FOLIAR DISEASE CONTROL IN WHEAT. A. Y. Chambers, Dept. of Entomology and Plant Pathology, Univ. of Tennessee, Jackson, TN 38301-3200.

New sterol-inhibiting fungicides - flusilazole, tebuconazole, and fenbuconazole - were evaluated for control of leaf rust (*Puccinia recondita* f. sp. *tritici*), glume blotch (*Septoria nodorum*), and leaf blotch (*S. tritici*) of soft red winter wheat (*Triticum aestivum*) during 1990-93. The fungicides were compared to standard, registered fungicides propiconazole (a sterol inhibitor) and mancozeb plus triadimefon in field plots of 'Saluda' wheat at the West Tennessee Experiment Station, Jackson. In 1990-93, treatments of all fungicides significantly reduced severity of the diseases and significantly increased yields over no treatment. Flusilazole was comparable to the standard treatments in disease control and yields in 1990 while treatments of tebuconazole and fenbuconazole significantly improved disease control and yields over the standards. Treatments of flusilazole and fenbuconazole were similar to those of propiconazole and mancozeb-triadimefon in 1991; only treatment with tebuconazole significantly improved disease control and yields compared to the standard materials. There were no significant differences in disease control and yields among the five fungicides in 1992. Propiconazole provided less disease control but comparable yields to the other fungicides in 1993.

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THE EFFECT OF pH OF HOUSEHOLD BLEACH SOLUTIONS USED AS A SURFACE STERILANT FOR RICE SEED. S.-C. Chun and R. W. Schneider, Dept. of Plant Pathology and Crop Physiology, Louisiana Agricultural Experiment Station, Louisiana State University Agricultural Center, Baton Rouge 70803.

The effect of pH of 50% household bleach solutions (2.6% NaOCl)(Clorox, Oakland, CA), used as a surface sterilant on rice seeds (*Oryza sativa* L.), was tested from pH 2 to 9. Seeds were soaked for 2 hrs in the freshly prepared solutions that had been buffered at different pHs. After treated rice seeds were rinsed with sterile distilled water, they were plated on nutrient agar for detection of bacterial contamination and acidified potato dextrose agar for detection of fungal contamination then incubated at 32 and 28C, respectively. After 3 days incubation, the number of rice seeds contaminated and germinated was determined. Seed contamination rates were significantly reduced by bleach treatments below pH 7 (Bonferroni t-test, $P=0.05$). However, germination rates were significantly reduced between pH 3 and 5 (Bonferroni t-test, $P=0.05$). Considering both the efficacy of surface sterilization and the viability of seeds, bleach solutions should be buffered at pH 6 to 7. Unbuffered bleach has a pH of about 11.6. This effect is probably related to the influence of pH on the chemical state of chlorine compounds, particularly hypochlorous acid (HOCl).

THE INFLUENCE OF PH ON THE GROWTH OF *DISCULA* SPECIES IN LIQUID CULTURE. B. R. Cody, M. T. Windham, and R. N. Trigliano. Agric. Expt. Stat., University of Tennessee, Knoxville, TN 37932.

Thalli of three isolates of *Discula destructiva* Redlin and one isolate of an undescribed *Discula* species were grown in 125 ml flasks containing citrate-phosphate buffered liquid growth medium adjusted to pH 4, 5, 6 and 7. Each treatment was replicated five times and the experiment repeated. After two weeks, flask contents were filtered and dry weights of fungus were obtained. Growth of one isolate of *D. destructiva* and the undescribed *Discula* species isolate was reduced as pH of the media increased from 4 to 7. When growth at pH 4 and 7 are compared for these two isolates, increasing pH to 7 reduced growth 35% for *D. destructiva* and 49% for the isolate of the undescribed *Discula* species. Growth of the two other *D. destructiva* isolates were not affected consistently by pH treatments. When comparing growth at pH 4 and 7, raising pH to 7 reduced growth 15% for one isolate and increased growth 15% for the other isolate.

EFFECT OF TANK MIX COMBINATIONS OF PROPICONAZOLE AND CHLOROTHALONIL ON LATE LEAF SPOT OF PEANUT. A. K. Culbreath and T. B. Brennenman, University of Georgia, Coastal Plain Expt. Station, Tifton, GA 31793-0748.

A randomized complete block field experiment with four replications was conducted at Plains, GA in 1993. Ten treatments consisted of 0, 0.315, 0.63, 0.945, and 1.26 kg ai/ha of chlorothalonil (Bravo 720) applied alone and with 0.063 kg ai/ha of propiconazole (Tilt 3.6 EC). Fungicides were applied at 2 wk intervals. Both fungicide main effects were significant for leaf spot (*Cercosporidium personatum*) severity and pod yield. Fungicide interaction effects were significant for leaf spot severity. Final leaf spot ratings (Florida 1-10 scale) were 8.9, 7.9, 7.4, 5.4 and 3.5 (LSD = 1.0, $P \leq 0.05$) for chlorothalonil (0-1.26 kg/ha, respectively) alone, and 6.8, 4.8, 4.5, 3.8, and 3.3 (LSD = 1.0, $P \leq 0.05$) for the same rates of chlorothalonil plus propiconazole, respectively. Pod yields were 2986, 3791, 4052, 4060 and 4613 kg/ha for 0-1.26 kg/ha rates, respectively, of chlorothalonil alone and 3995, 4605, 4743, 4817 and 5167 kg/ha (LSD = 576, $P \leq 0.05$) for the same rates plus propiconazole. Yield increases with the addition of propiconazole to treatments of chlorothalonil with rates higher than 0.945 kg/ha did not correlate with similar increases in control of leaf spot or stem rot (*Sclerotium rolfsii*). Stem rot incidence ranged from 5.0 to 11.0% among treatments.

SPREAD OF BACTERIAL FRUIT BLOTCH OF WATERMELON IN THE GREENHOUSE. D. L. Hopkins, Central Florida Research and Education Center, University of Florida, Leesburg, FL 34748.

In four greenhouse experiments, spread of watermelon fruit blotch symptoms from a point source was evaluated, and the effects of overhead irrigation and irrigation from the bottom on rate of spread were compared. A single one-inch square plastic cell was planted with infected Charleston Gray seed in the center of 600 cells planted with healthy seed. The 4-week tests were run consecutively from March through August. With bottom watering, symptoms only spread to plants adjacent to the point source. With overhead watering, symptoms would often occur in plants located several inches from another diseased seedling. During the four tests, symptoms spread to 6%, 0, 24%, and 35% of the plants with overhead irrigation and to 0, 0, 1%, and 4% with bottom irrigation. With the overhead watering, daily low humidity appeared to be the most critical factor limiting the amount of spread. Daily high humidity and high-low temperatures did not appear to be correlated with amount of spread.

RESULTS OF FOURTEEN YEARS OF TESTING PROPICONAZOLE FOR CONTROL OF PEANUT DISEASES. J. C. Jacobi and P. A. Backman. Department of Plant Pathology, Auburn University, AL 36849-5409.

The fungicide propiconazole was evaluated in field trials from 1979-1993 for control of foliar and soilborne diseases of peanut. During 1979-1985, propiconazole (0.126 kg a.i./ha), was compared to chlorothalonil (1.26 kg a.i./ha), and an untreated control. Leaf spot incidence averaged 48.6, 37.1, and 81.0% for the propiconazole, chlorothalonil and untreated control treatments, respectively. Peanut rust was moderately severe in two trials, with rust severity significantly greater for propiconazole compared to chlorothalonil. No significant differences were observed between propiconazole and chlorothalonil in southern stem rot incidence or yield. Recent trials (1986-1993) have evaluated the use of block-spray programs of propiconazole and chlorothalonil. Here, leaf spot incidence averaged 43.4, 35.9, and 83.0% for the block-spray (propiconazole and chlorothalonil), chlorothalonil, and untreated control, respectively, while yield and southern stem rot incidence were not significantly different between the two fungicide treatments. In 1993, tank-mixes of propiconazole and chlorothalonil provided equivalent leaf spot control as compared to chlorothalonil alone.

IMMUNIZATION OF CABBAGE FOR LONG-TERM RESISTANCE TO BLACK ROT. K. Jetiyanon, P. A. Backman, and S. Tuzun, Department of Plant Pathology, Alabama Agricultural Experiment Station, Auburn University, AL 36849-5409.

Cabbage (*Brassica oleracea*) transplants were immunized with 0.2% v/v Silwet surfactant containing 10^9 cfu of either a weak pathogen, *Xanthomonas campestris* pv. *campestris* (Xcc isolate B-119), or an incompatible pathogen, *X. campestris* pv. *malvacearum*. Three weeks later, cabbages were challenged in the field with 10^6 cfu of a pathogenic strain of Xcc, also in Silwet. Immunized plants significantly suppressed development of black rot disease and populations of Xcc. *in planta* ($p \leq 0.05$) for at least five weeks after induction. Similar data were obtained for both greenhouse and field experiments. Immunized plants also resulted in an earlier induction of a hydrolytic chitinase/lysozyme enzyme, β -1,3 glucanase and osmotin as well as several other proteins. The results show that immunized plants produce defense proteins which suppress black rot disease progression in cabbage and suggest that immunization technologies for transplants can achieve durable resistance in field environments.

OPTIMIZING FUNGICIDE APPLICATIONS TO CONTROL GUMMY STEM BLIGHT OF WATERMELON. A. P. Keinath, Dept. Plant Pathology & Physiology, Clemson University, Coastal REC, Charleston, SC 29414-5341.

Gummy stem blight is a widespread, destructive disease of watermelon caused by *Didymella bryoniae* (anamorph *Phoma cucurbitacearum*). In fall 1991 and spring 1993, six and nine fungicide treatments, respectively, were applied weekly at labeled rates to watermelon cv. Charleston Gray in field plots. Areas under disease progress curves (AUDPC) were lowest for chlorothalonil plus benomyl in both years; gummy stem blight was reduced by 36.5% compared to nonsprayed plots ($P=0.01$). Effects of three application intervals of chlorothalonil plus benomyl on gummy stem blight development were evaluated on watermelon cv. Mirage in fall 1991 and 1993. Fungicides were applied full season (6 times), early (first half) or late (last half) season (3 times each), or not applied. In both years, all application intervals reduced AUDPC compared to no fungicide ($P < 0.01$). Both half-season intervals gave less disease control ($P \leq 0.05$) than the full season application. In 1993, weight of No. 1 melons from full season plots was increased by 96.5% and 211% compared to nonsprayed and late-season plots, respectively ($P \leq 0.01$). Regular fungicide applications are required to adequately control gummy stem blight on fall-grown watermelon in coastal South Carolina.

VALIDATION OF A FOUR ENVIRONMENTAL VARIABLE MODEL TO PREDICT LEAF RUST ON WINTER WHEAT IN MISSISSIPPI. M. Aslam Khan and L. E. Trevathan. Department of Entomology and Plant Pathology, Mississippi State University, Mississippi State, MS 39762.

Environmental data from three locations in Mississippi during 1986-90 were used to develop disease predictive models; data from Starkville during 1992-93 were used for validation. Leaf rust severity was measured as a dependent variable while monthly, weekly and daily maximum, minimum and average air and soil temperatures, rainfall, relative humidity, solar radiation, wind movement and dewpoint represented independent variables. Based on 5 yrs data, weekly max/min/ave air temperatures and rainfall from March to May explained 49% of the variability in disease development at Holly Springs. This model accounted for 91 and 81% of the variability in leaf rust development during 1987 and 1989 at Holly Springs and 95 and 65% during 1992 and 1993 at Starkville, respectively. Observed and predicted values were close for cultivars at both locations, but differed by year.

SUPPRESSION OF SEEDLING BLIGHT IN PEANUTS CAUSED BY *RHIZOCTONIA SOLANI* WITH SPRAY APPLICATIONS OF CHLORPYRIFOS AND IPRODIONE. T.A. Kucharek. Plant Pathology Dept., Univ. of Florida, Gainesville, FL 32611.

In Florida, seedling blight caused by *R. solani* has become problematic in recent years even with 100% usage of fungicidal seed treatments. In field tests in 1991 and 1992, a single application of chlorpyrifos 4E (CH) or iprodione 4F (IP) was applied as a 20-25 cm band over-the-row onto the soil prior to emergence of seed-treated peanuts. The surface area of tap roots with lesions was reduced with CH (4.7 L ha⁻¹) and IP (1.6 L ha⁻¹) by 49 and 38%, respectively (P=0.05) compared to the seed treatment alone. The number of wilted and dead seedlings was reduced with CH (4.7 L ha⁻¹) and IP (14.3 L ha⁻¹) by 52 and 71%, respectively (P=0.05). Young plant vigor ratings were concomitantly improved (P=0.05) in both tests. In 1993, a post-emergent application of IP (2.3 L ha⁻¹) to 14-day old peanuts reduced the number of dead plants by 75% (P=0.001) and the amount of bare space along the row (>15.2 cm) to 48 day-old plants by 67% (P=0.001). Because CH can be phytotoxic when applied to emerged plants, it was not tested.

DETECTION OF *MONOSPORASCUS CANNONBALLUS* IN ROOT TISSUE AND SOIL BY PCR-MEDIATED AMPLIFICATION OF THE ITS REGIONS OF rDNA. B. R. Lovic, R. D. Martyn, and M. E. Miller. Department of Plant Pathology and Microbiology, Texas A&M University, College Station 77843, and Weslaco 78596.

M. cannonballus is a soilborne ascomycete that causes a root rot/vine decline disease of muskmelon and muskmelon. This organism is difficult to detect in roots and in soil because the ascospores do not germinate, a conidial stage is unknown, and its morphology in culture is extremely variable. A detection method has been developed based on unique sequences within the ribosomal internal transcribed spacer regions (ITS) that have been determined to be both conserved in, and unique to *Monosporascus* spp. Five PCR primers derived from the ITS regions consistently amplified products of predicted sizes from diseased roots of muskmelon (Magnum 45) grown under greenhouse and field conditions in soil infested with *M. cannonballus* and from ascospores extracted from infested soil. Identity of the amplified products was confirmed by hybridizing Southern transfers of the amplification products separated by gel electrophoresis, with a digoxigenin-labeled portion of the *M. cannonballus* ITS. Ascospores of *M. cannonballus* were physically extracted from soil samples by sucrose flotation technique, crushed to release the DNA and subjected to PCR amplification. An equivalent of 10 spores per sample yielded a sufficient amount of PCR-amplified product to be detected by electrophoresis in ethidium-bromide stained gels. The detection limits of the described methods suggest their potential in diagnostics.

ASSOCIATION OF dsRNA WITH REDUCED AGGRESSIVENESS AND PHENOTYPIC VARIABILITY IN *MONOSPORASCUS CANNONBALLUS*. B. R. Lovic, V. A. Valadez, R. D. Martyn, and M. E. Miller. Department of Plant Pathology and Microbiology, Texas A&M University, College Station 77843, and Weslaco 78596.

The soilborne pathogen of cucurbits, *Monosporascus cannonballus*, displays extensive variation in virulence among isolates. Less virulent isolates exhibit reduced growth on standard media, form fewer perithecia, and appear degenerated. We hypothesized that avirulence was a consequence of inappropriate laboratory maintenance (Phytopathol. 83:467); however, we have now modified that because a change in phenotype and aggressiveness could not be produced by repeated transfers of a set of isolates over a 3-mo period. Also, avirulent, degenerated isolates were isolated from field-grown plants along with virulent, wild-type isolates. Electrophoresis of undigested genomic DNA from 30 wild-type and seven degenerated isolates revealed that all but one of the degenerated isolates harbored one to four low molecular weight nucleic acid fragments. In contrast, only one wild-type isolate displayed extra fragments. The low molecular weight fragments were digested completely by low-salt RNase treatment, while high-salt RNase treatment, restriction enzymes, or DNase had no effect, suggesting the fragments were dsRNA. The sizes of the dsRNA fragments were 2.0 kb in the isolate where a single band was observed, and varied from 2.0 to 3.1 kb for isolates that had up to four distinct fragments.

ULTRASTRUCTURE OF THE HOST-PATHOGEN RELATIONSHIP IN POWDERY MILDEW DISEASE OF CRAPE-MYRTLE. C. W. Mims and E. A. Richardson, Dept. of Plant Pathology and Dept. of Botany, University of Georgia, Athens, GA 30602.

This study examined the ultrastructural aspects of the host-pathogen relationship between the asexual stage of a powdery mildew fungus reported to be *Erysiphe lagerstromiae* and its host, crape-myrtle (*Lagerstromia indica*). The pathogen produced highly specialized haustoria in the epidermal cells of infected leaves. Each haustorium possessed a slender neck and an expanded body that formed numerous small, highly contorted branches. An extrahaustorial matrix and an extrahaustorial membrane (EM) separated the haustorium from the host cytoplasm. The EM was continuous with the host cell plasma membrane, but was thicker than the plasma membrane and, in certain regions, highly convoluted. Various gold-conjugated lectins and enzymes were used to characterize the host-pathogen interface.

ISOLATION, SEQUENCING, AND DISRUPTION OF THE cAMP DEPENDENT PROTEIN KINASE CATALYTIC SUBUNIT GENE IN *MAGNAPORTHE GRISEA*. T. K. Mitchell, Y. H. Lee, and R. A. Dean, Department of Plant Pathology and Physiology, Clemson University, Clemson, SC 29634

Magnaporthe grisea, the causal agent of rice blast disease, produces a specialized infection structure called appressorium to facilitate entry into its host. It was found, that cyclic adenosine monophosphate, cAMP, can induce the formation of appressoria on non-inductive hydrophilic surfaces. The primary target for cAMP in other organisms is a cAMP dependent protein kinase. This kinase acts as a second messenger to initiate phosphorylation / dephosphorylation cascades resulting in developmental changes. We have cloned the cAMP dependent protein kinase catalytic subunit gene from *M. grisea*. Sequence analysis indicates extensive amino acid identity between the cloned gene and conserved regions in other organisms. Southern analysis indicates that this gene exists as a single copy in *M. grisea*. Currently the gene is being disrupted to determine the kinase's affect on appressoria formation.

SHIFT IN THE EPIDEMIOLOGY OF TOBACCO BLUE MOLD RELATED TO CHANGING TRANSPLANT PRODUCTION METHODS. W. C. Nesmith, Plant Pathology Dept., Univ. of Kentucky, Lexington, KY. 40546.

One principle of plant pathology is that changing cultural practices often result in shifting disease potential. Tobacco transplant production is undergoing a major change from soil beds located on each tobacco farm to containerized production in greenhouses, including interstate commercial transplant movement. One particularly popular variation, the "float system", is centered around using a polystyrene foam tray which is subirrigated by floating on a bed of water and/or nutrient solution. Because of high potential for root diseases caused by phycomycetous fungi, metalaxyl is applied to the beds of water. In Kentucky, metalaxyl-insensitive *Peronospora tabacina* was confirmed from 29 float systems, including several involved in interstate movement of transplants. In eight cases, field outbreaks of metalaxyl-insensitive *P. tabacina* were connected to transplanting infected plants from float systems into the field. The potential for this new production approach to select and move inoculum of *P. tabacina* appears to be significant and will dictate changes in blue mold control strategies.

EFFECTS OF TEMPERATURE, LIGHT, AND MOISTURE ON PRODUCTION OF CONIDIA FROM SCAB LESIONS ON PECAN SHOOTS. K. L. Reynolds, Department of Plant Pathology, University of Georgia, Athens, GA 30602.

One-yr-old shoots with scab lesions caused by *Cladosporium caryigenum* were collected from unsprayed pecan (*Carya illinoensis* cv Desirable) trees. All new growth was removed, and the 1-yr-old wood was washed in deionized water amended with 0.1% Tween 20, cut into 2-cm sections, and lesions counted. Each section had 10-50 lesions, each approximately 1 mm in diameter. Washed sections were placed in petri dishes with moist filter paper or were air-dried and placed in petri dishes without moist filter paper. In one experiment, moist sections were incubated at 10, 15, 20, 25, or 30 C in continuous fluorescent light. In another experiment, moist and dry sections were exposed to continuous fluorescent light or continuous darkness at 25 C. After 3 or 7 days each section was washed in 2 ml deionized water with 0.1% Tween 20 and the conidia in the wash water counted with a hemacytometer. Sporulation per lesion was greatest at 15 C and least at 30 C. Sporulation was significantly higher on moist shoot sections than on dry sections and was highest on sections that were kept moist and exposed to continuous light and lowest under dark, dry conditions. Light alone had no significant impact on sporulation.

THE EFFECTS OF CHICKEN LITTER AND ASSOCIATED MICROORGANISMS ON *MELOIDOGYNE INCOGNITA*. C. Riegel and J. P. Noe, Dept. Plant Pathology, University of Georgia, Athens, GA 30602.

The effects of chicken litter and associated microorganisms on *Meloidogyne incognita* in cotton cv. DPL 50 were determined in microplots. Microplots with methyl bromide fumigated field soil were amended with four rates of litter and infested with *M. incognita*. Fungal, bacterial and nematode population densities were assayed at monthly intervals. Population densities of *M. incognita* second stage juveniles (J2) were negatively correlated with increasing rates of litter. Regression analysis indicated that midseason *M. incognita* numbers decreased from 57 to 1 J2/100 cm³ soil in a log-linear relationship with fungal colony counts. Final *M. incognita* counts decreased as bacteria and free-living nematodes increased. Fungi isolated from the litter included species of *Aspergillus*, *Fusarium*, *Mucor*, *Penicillium*, and *Trichoderma*.

PREPARING ALGINATE FILMS FOR DELIVERY AND EVALUATION OF ROOT KNOT NEMATODE INOCULUM. R. Rodríguez-Kábana, N. Kokalis-Burelle, and R. A. Sikora. Department of Plant Pathology, Auburn University, AL, and Institut für Pflanzenkrankheiten der Universität, Nussallee 9, D-5300 Bonn 1, Germany.

A method was developed for utilizing alginate films to deliver inoculum into soil and evaluate effects of soil conditions on the introduced inoculum. Eggs of *Meloidogyne incognita* were harvested from galled tomato roots (*Lycopersicon esculentum*), surface sterilized, suspended in 2% (w/v) aqueous sodium alginate, and applied to 2.5x5.0 cm polyvinyl chloride coated fiberglass screens (1.5 mm² mesh size) at a uniform thickness of 0.5 mm. The alginate solution was gelled by dipping in 0.25 M CaCl₂. Grids containing eggs were observed *in vitro* and egg development was evaluated. The number of immature eggs and eggs with first stage juveniles declined linearly over time while the number of empty egg shells, and hatched juveniles increased over time, indicating that the alginate gel did not interfere with development and motility of *M. incognita* juveniles. In a greenhouse experiment using cucumber (*Cucumis sativus*), the number of galls/g root was correlated with the number of eggs in alginate grids placed in each pot at planting.

USE OF ALGINATE FILMS FOR DELIVERY OF *MELOIDOGYNE INCOGNITA* INOCULUM AND EVALUATION OF MICROBIAL INTERACTIONS. R. Rodríguez-Kábana, N. Kokalis-Burelle, and R. A. Sikora. Department of Plant Pathology, Auburn University, AL, and Institut für Pflanzenkrankheiten der Universität, Nussallee 9, D-5300 Bonn 1, Germany.

Greenhouse experiments were performed to evaluate the use of alginate films for observation of interactions between soil microorganisms and *Meloidogyne incognita* eggs. Standard alginate (2% w/v) grids (2.5 cm x 5.0 cm x 0.5 mm) containing *M. incognita* eggs were buried in field soil containing organic amendments, incubated, removed from soil, rinsed with water, and observed and photographed using differential interference contrast microscopy. The number of immature eggs in grids from soil amended with chitin or flax seed meal were lower than in untreated soil; percent parasitized eggs was also greater in grids from amended soil than from untreated soil. When pine bark powder was added to soil the number of viable eggs was negatively correlated with pine bark rate while the opposite was true for the number of parasitized eggs. The number of parasitized eggs was significantly greater in soils planted with several aromatic plants than in soil planted to cotton (*Gossypium hirsutum*).

FIELD PERFORMANCE OF RICE LINES WITH NOVEL SHEATH BLIGHT RESISTANCE DERIVED THROUGH SOMACLONAL VARIATION. M.C. Rush¹, S.D. Linscombe², K.P. Seilhan², D.E. Groth², and Q.J. Xie¹. Departments of ¹Plant Pathology and Crop Physiology and ²Agronomy, and ³Rice Research Station, Louisiana Agricultural Experiment Station, Louisiana State University Agricultural Center, Baton Rouge, 70803.

A sheath blight resistant somaclone (LBLE-163) was generated from the susceptible cultivar Labelle. Lines generated by crossing an elite line selection (LSBR-5) from the somaclone with the commercial cultivar Lemont were selected, reselected and yield tested in the field through the period 1988-1993. Two advance lines have been in yield tests conducted by the breeding program for 3 years. These lines are significantly more sheath blight resistant than Labelle and Lemont and yield at the level of the newest commercial long-grain cultivars. In field plot tests they yielded 7500-8000 lb/A in the first crop and 3500-4500 lb/A in the ratoon crop. Additional crosses were made among sources of the resistance gene in LSBR-5 and recently released commercial long-grain cultivars in 1993. Crosses for a modified recurrent selection scheme to generate lines with LSBR-5 resistance combined with other sources of partial resistance were also made in 1993.

EFFECTS OF ADJUVANT AND APPLICATION METHOD ON FLUTOLANIL PERFORMANCE AGAINST SOILBORNE DISEASES OF PEANUT. K. W. Seebold and P. A. Backman, Department of Plant Pathology, Alabama Agricultural Experiment Station, Auburn University, AL 36849-5409.

Flutolanil was applied at a rate of 1.12 kg a.i./ha to peanut either alone or tank-mixed with the sticker-type adjuvants Soy-Dex or Bond, or the penetrating adjuvant Kinetic using a broadcast or an in-canopy delivery system. Effects on fungicide retention and efficacy against southern stem rot (*Sclerotium rolfsii*) and Rhizoctonia limb rot (*Rhizoctonia solani*) were evaluated. Fungicide retention and persistence were monitored using a bioassay system in which treated peanut limbs were challenged with *Rhizoctonia solani*. Fungicide efficacy against southern stem rot was evaluated after digging and inverting the two middle rows of each plot. Additionally, limb samples were taken from each plot and the number of *Rhizoctonia*-induced lesions per limb counted. Bioassay data indicated that sticker-type adjuvants slightly improved the retention of flutolanil as compared to flutolanil alone. Application method did not affect fungicide retention during the first three evaluation dates; however, slightly better flutolanil retention was observed with the in-canopy method for the last evaluation date. All flutolanil treatments significantly reduced the incidence of both southern stem rot and limb rot as compared to an untreated check plot, but no differences were observed among application methods or adjuvant types.

EVALUATION OF NIGHT APPLICATIONS OF FUNGICIDES FOR CONTROL OF SOUTHERN STEM ROT ON PEANUT. F.D. Smith, T.B. Brenneman, and B.G. Mullinix, Univ. of Georgia, Coastal Plain Expt. Station, Tifton, GA 31793.

Seed of Florunner peanut was planted at 112 kg/ha in a field with a history of southern stem rot (*Sclerotium rolfsii*). Fungicide applications were made on 12 Jul and 11 Aug 1993 using three D₂-23 nozzles per row that delivered 140 L/ha at 315 kPa. Day applications were made between 3 and 4 pm and night applications between 9 and 10 pm. Disease ratings of below-ground symptoms on 27 Sep indicated that all treatments, except propiconazole (0.25 kg/ha), provided significant control. Fluzinam (0.75 kg/ha), tebuconazole (0.21 kg/ha) plus Induce at 0.25%, flutolanil (0.56 kg/ha), cyproconazole (0.23 kg/ha), and tebuconazole alone provided 64, 59, 57, 54, and 48% control, respectively. Only fluzinam applications resulted in a significant increase in yield to 4,131 kg/ha, 29% more than untreated peanuts. Peanuts treated at night averaged 12% less disease and 6% higher yields than peanuts treated during the day, and these results were significant at *P*=0.05 and *P*=0.10, respectively. Spraying at night when peanut leaves are folded may improve fungicide penetration through the canopy.

RECURRENT SELECTION FOR RUST RESISTANCE IN TWO PEARL MILLET GERMPLASMS. H. Tapsoba, J. P. Wilson, and W. W. Hanna. University of Georgia and USDA-ARS Forage and Turf Unit, UGA Coastal Plain Experiment Station, Tifton, GA 31793.

Recurrent selection for rust resistance was performed in two pearl millet germplasms, Tift #2 and Tift #5. Four cycles of selection with intercrossing were made in the greenhouse after inoculation with bulk urediniospores of *Puccinia substriata* var *indica*. The proportion of resistant plants in each cycle increased significantly from the previous one in both germplasms. The original population and the four cycles of each germplasm were evaluated in the field. Mean final rust severities were reduced from 16.0% and 22.6% in the original Tift #2 and Tift #5, respectively, to 0.6% and 9.4% in the fourth cycles. Despite this improvement for the selected character, the field results show that for agronomic characters, such as plant height, number of culms/plant, flowering date, and head length, great variability was successfully maintained. For most of these characters a stabilization around the mean in the original population was observed in the fourth cycle of selection. These results show that recurrent selection may be used in managing pearl millet germplasm through selection for resistance to rust while maintaining considerable genetic diversity for other traits.

NEMATODE POPULATIONS IN A ROTATION PROGRAM WITH VELVETBEAN AND NEMATODE-HOST AND NON-HOST GRASS SPECIES. R. Vargas and R. Rodríguez-Kábana, Department of Plant Pathology, Auburn University, AL 36849-5409.

A field microplot trial was established to evaluate nematode populations in a rotation program utilizing nematode-suppressive and non-suppressive legumes, and nematode-host and non-host grass species. The rotation treatments consisted of velvetbean (*Mucuna deeringiana*) or cowpea (*Vigna unguiculata*) during the first phase, followed in phase two by oat (*Avena sativa*), wheat (*Triticum aestivum*), rye (*Secale cereale*), rye grass (*Lolium* sp.), clover (*Trifolium* sp.), hairy vetch (*Vicia villosa*), lupin (*Lupinus* sp.) or fallow. Phase three consisted of soybean (*Glycine max*). Soil and root samples were collected sequentially at approximately three month intervals, and soil populations of root-knot (*Meloidogyne* sp.), cyst (*Heterodera* sp.), spiral (*Helicotylenchus* sp.), stunt (*Tylenchorhynchus* sp.) and nonparasitic nematodes were assessed. Root-knot and stunt nematode populations in the second and third samplings were significantly lower in microplots previously planted with velvetbean than in plots with cowpea. Rotations with rye, oat and wheat decreased the population of root-knot nematodes. High populations of spiral nematodes were associated with microplots planted with velvetbean.

TOLERANCE VERSUS RESISTANCE IN FUSIFORM RUST OF LOBLOLLY PINE. C. H. Walkinshaw. USDA Forest Service, Box 500, Pineville, LA 71361-5500.

Loblolly pines have the ability to tolerate stem infections *Cronartium quercuum* (Berk.) Miyabe ex Shirai f. sp. *fusiforme* Burdsall and Snow. Infected trees have diameter growth similar to asymptomatic trees on the same site. Sporulation of the fungus occurs in these trees, some more than 100 years old. Rust-tolerance mechanisms were evident in rust-affected tissues. Compartmentalization of infections was seen in young seedlings, saplings and adult trees. Restriction of linear growth of galls was common in greenhouse and field infections. Fungal hyphae were partially enclosed in dead tissue. Pine families differed in their ability to restrict the pathogen and in their diameter growth. Unlike resistance that prevents gall formation, tolerance does not exert selection pressure on the rust pathogen since sporulation continues over many years.

PREMATURE DEFOLIATION OF BLACK LOCUST IN GEORGIA. E.C. Whiting and R.W. Roncadori, Department of Plant Pathology, Miller Plant Sciences, University of Georgia, Athens, Georgia 30602.

Black locust (*Robinia pseudoacacia* L.), a fast-growing leguminous tree species, is being evaluated as a source of biomass. Chlorotic leaflets and premature defoliation were observed on 95-100% of trees by the end of July in 1991 and 1992 in a progeny plantation near Greensboro, GA. Numerous dark brown spots (1-3 mm in diameter) and gray necrotic lesions along leaflet margins were present on the abscised leaflets. *Colletotrichum gloeosporioides* Penz. was associated with symptomatic leaflets. Inoculation tests confirmed pathogenicity. In 1993, an abnormally hot and dry year, similar symptoms to those in 1991 and 1992 were observed beginning in mid-June and by August 28 all trees were 25-50% defoliated. *C. gloeosporioides* was only present at low levels, suggesting that environmental factors alone may also limit the production of black locust in the Piedmont of Georgia.

REDUCTION OF PEARL MILLET GRAIN YIELD DUE TO RUST INFECTION. J. P. Wilson and W. W. Hanna, USDA-ARS Forage and Turf Unit, University of Georgia, Coastal Plain Experiment Station, Tifton, GA, 31793.

The effects of rust, caused by *Puccinia substriata* var. *indica*, on grain yield of the pearl millet hybrid 23DAEx8677 was evaluated in the field in 1992 and 1993. Treatments in 1992 consisted of inoculation, control, or fungicide protection (Bravo 720 @ 3.6 ml/L). Treatments in 1993 consisted of a control and 1 or 3 fungicide applications. Environmental conditions were unfavorable for rust development in 1992 and mean final severities ranged from 0 to 33%. No differences among treatments for yield or 500 grain weight were detected. Conditions were more conducive for rust in 1993, and mean final severities ranged from 36 to 96%. Grain yield and 500 grain weight of the control were reduced by 72% and 39%, respectively, of those yield components measured from plots with 3 fungicide applications. Indirect yield losses from lodging occurred in 1993. Lodging was greater in plots with severe rust infection, averaging 9% of culms, and increased markedly when rust severity exceeded 90% severity. *Fusarium moniliforme* and *Sclerotium rolfsii* were the predominant pathogens isolated from lodged culm samples.

EVALUATION OF CONSAN, SM-9 AND PHYTON 27 FOR THE CONTROL OF BROWN PATCH ON TALL FESCUE. Alan S. Windham, University of Tennessee, PO Box 110019, Nashville, TN 37222.

Consan (Del Tek Inc.), SM-9 (S.M.I. Corp) and Phytan 27 (Source Technology Biologicals, Inc.) were evaluated in greenhouse and field trials for the control of brown patch caused by *Rhizoctonia solani* Kuhn, on tall fescue (*Festuca arundinacea* Schreb.). In greenhouse tests conducted in 1992, Consan, SM-9 and Phytan 27 were not effective in controlling brown patch on K-31 tall fescue when applied preventatively (24 hr prior to inoculation with *R. solani*) or curatively (24 hr after inoculation) when compared to standard fungicides Chipco 26019 FLO (iprodione) and Eagle 40W (myclobutanil) (P=0.01). In a field trial initiated on June 6, 1993, disease severity in turf plots sprayed with Consan (1.0 fl oz/ 1000 sq ft) or SM-9 (1.1 fl oz/ 1000 sq ft) at 14 day intervals was not significantly different from the untreated control. Chipco 26019 FLO, Daconil 2787 Flowable (chlorothalonil), fluazinam 500F, and Eagle 40W applied at 14 day intervals and Fore Flowable (mancozeb) at 7 day intervals gave good to excellent control of brown patch (P=0.01).

AFLATOXIN ACCUMULATION IN MAIZE INFECTED WITH *ASPERGILLUS FLAVUS* AND *MELOIDOGYNE INCOGNITA*. G. L. Windham, N. Zummo, and W. P. Williams. USDA-ARS, Mississippi State, MS 39762.

The effect of *Meloidogyne incognita* on aflatoxin production by *Aspergillus flavus* on maize was studied in field microplots. Hybrids resistant (Mo18 X Mp313E) and susceptible (Mp68:616 X SC212M) to kernel infection by *A. flavus* were used in the study. Treatments included plants inoculated with *A. flavus*, or *M. incognita*, or both pathogens. An uninoculated control was also included in the study. Microplots were infested with *M. incognita* at a rate of 3,000 eggs per 500 cm³ of soil. Maize ears were inoculated with *A. flavus* at 6 days after mid silk using a side-needle inoculation technique to inject 9.0×10^6 *A. flavus* conidia over the kernels. Ears were harvested sixty days after mid silk and aflatoxin content was determined. Aflatoxin production in the *A. flavus* susceptible hybrid grown in *M. incognita* infested plots did not differ from plants grown in plots without the nematode. However, *A. flavus* resistant plants grown in nematode infested plots had aflatoxin production equal to the susceptible hybrids. This research indicates a need to develop a maize genotype with resistance to both pathogens.

FREQUENCY OF *DISCULA DESTRUCTIVA* REDLIN AND AN UNDESCRIBED *DISCULA* SPECIES FROM DOGWOOD TISSUE. M. T. Windham, E. K. Erbaugh, M. E. Montgomery-Dee, and R. N. Trigiano. The University of Tennessee Agricultural Experiment Station, Knoxville, TN 37901.

Cultures of *Discula destructiva* Redlin and an undescribed *Discula* species were collected from leaf or twig tissue that was symptomatic of dogwood anthracnose. Cultures were obtained from one location in MD (20 isolates), NC (22 isolates) and PA (5 isolates) and five locations in TN (131 isolates). Gallic acid agar plates were used to separate isolates as *D. destructiva* (agar-browning response) or *Discula* species (no response). Isolate population consisted of 8% *Discula* species and 92% *D. destructiva*. When origin of isolates was considered (leaf or twig tissue), 14.6% of *D. destructiva* isolates and 14.3% of *Discula* sp. isolates were obtained from symptomatic twigs. No undescribed *Discula* sp. isolates were obtained from MD, PA, or two locations in TN. In NC, 23% of isolates were the undescribed *Discula* sp and at locations in TN where the *Discula* sp. was found, frequency of isolation ranged from 10-23%.

TRANSFORMATION OF RICE WITH THE *BAR* GENE FOR PHOSPHINOTHRICIN ACETYL TRANSFERASE. Q.J. Xie¹, J. Oard², and M.C. Rush¹. Departments of ¹Plant Pathology and Crop Physiology and ²Agronomy, Louisiana Agricultural Experiment Station, Louisiana State University Agricultural Center, Baton Rouge, 70803.

A system was developed to transform rice with the *bar* gene which encodes for phosphinothricin acetyl transferase (PAT). This enzyme inactivates the herbicide phosphinothricin (PTT - BASTATM or IGNITETM). The *bar* gene was originally from *Streptomyces hygroscopicus*. Three plasmids, pDM302, pAHC25 and pBSL21 were used in these experiments. The gene is to be used as a marker for a novel recessive gene for sheath blight resistance generated through somaclonal variation in the susceptible rice cultivar Labelle (LSBR-5). The cultivar Lemont has been transformed for resistance to PTT. The cultivars Cypress, Katy, and Nipponbare and the sheath blight resistant lines LSBR-5 and URN-149 are putatively transformed. Phosphinothricin has also been reported to have fungicidal activity, including activity against *Rhizoctonia solani* the cause of rice sheath blight. The compound could not be used as a fungicide on rice unless the cultivar has been transformed for PAT activity.