contained similar particles. Reactions of plant sap with an antibody to the isolate were highly predictive of plant symptoms. ToANV is a member of the picorna-like group of plant viruses and although it has a bipartite genome, is most similar to members of the family *Sequiviridae*.

***Phytophthora infestans* identified in archival potato tubers from Hoosfield plot trials of Sir John Bennet Lawes and Joseph Gilbert at Rothamsted, 1876-1901**

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We have previously examined the global migrations and evolutionary history of *Phytophthora infestans* in modern potato crops and identified the source and strain that caused the 19th century potato famine from archival materials. Our current objectives are to evaluate temporal changes in the genetic structure of populations of *Phytophthora infestans* in blighted tubers sampled over several years from the same soil fertility trials done at Rothamsted from 1876 to 1901. Ten replicated soil fertility treatments were applied to the potatoes, including combinations of manures and synthetic fertilizers. It is "assumed" that the pathogen populations were clonal and that no recombination occurred during this period. Thus far, ribosomal DNA was amplified and sequenced from 19 diseased tuber samples and *Phytophthora infestans* was confirmed in 10 samples. The type I haplotype has been identified from mitochondrial DNA sequences obtained from two samples. Further sequencing of the P2, P3 and P4 regions is being done to determine their mitochondrial haplotype. Quantitative PCR will be used to measure amounts of DNA in the blighted tubers and to relate to plot disease severity. The effect of soil fertility amendments on the amount of tuber blight will be determined. These experiments were done before development of synthetic fungicides and resistant potato varieties. Potatoes grown in the manured plots could be considered samples from one of the longest running "organic" soil amendment trials.

The effect of induced resistance in Monterey pines on infection by two fungal pathogens

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Previous studies have shown that *Pinus radiata* (Monterey pine) that has been infected with *Fusarium circinatum*, the cause of pitch canker, is less susceptible to subsequent challenge by the same pathogen. This reflects the induction of systemic induced resistance (SIR). It was an objective of the present study to determine if resistance induced by inoculation with *F. circinatum* also influences susceptibility to *Diplodia pinea*, a cause of shoot blight and cankers in many coniferous species. To this end, one-year old pines were inoculated on the upper stem with either *F. circinatum* or *D. pinea* or with water. Each treatment was applied to five replicate trees. Three weeks after inoculation, upper stems were cut off below the point of inoculation and lesion lengths were recorded. Each tree was then challenged by inoculation with *D. pinea*, and lesion lengths were measured three weeks later. As a positive control, a separate set of trees was challenged with *Fusarium circinatum*. In general, inoculation of pines with either of the two fungal pathogens resulted in reduced lesion sizes in challenge inoculations with *D. pinea*. Thus, the preliminary results of this study suggest that infection of Monterey pines with either *F. circinatum* or *D. pinea* may induce resistance to subsequent infection by *D. pinea*.

The role of cell surface organization in the virulence of *Fusarium graminearum*

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Cell surface proteins often aggregate into specialized membrane domains called rafts. The organization of these rafts is likely dependent on several gene products. The identification of these genes will uncover potentially efficacious antifungal targets that have the potential to simultaneously disrupt several cell surface proteins, some of which may be involved in pathogenicity. We are currently using a reverse genetics approach to characterize the role of several genes in cell surface organization and plant pathogenicity of *Fusarium graminearum*. Thus far, we have identified *mes1* (FG06680.1) as an interesting candidate. *Mes1* is a homologue of *mesA*, which is required for the stabilization of hyphal polarity in *Aspergillus nidulans*. Deletion of *mes1* in *F. graminearum* severely disrupts the shape of macroconidia and hyphae, the pattern of cell wall deposition, and the organization of sterol-rich rafts. Also, *mes1* mutants are less virulent when inoculated onto wheat heads. We also have begun assessing the function of *pls1* (FG08695.1), the sole tetraspanin in the genome of *F. graminearum*. Tetraspanins have been shown to aggregate in membrane rafts along with integrins and other signaling proteins in a variety of mammalian cell types, but their characterization in filamentous fungi is limited to their role during the infection process of appressorium-forming pathogens. Ultimately, we plan to exploit these mutants to identify resident raft proteins involved in early steps of plant colonization.

Induction of the jasmonic acid pathway and elevation of proteinase inhibitor II (*PINII*) expression as a response to tomato grafting

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Vegetable grafting is being adopted into U.S. production with success. We have demonstrated the utility of resistant rootstock to manage soilborne diseases indigenous in NC soils and to enhance crop productivity. Occasionally, self-grafted treatments display intermediate levels of disease, including vectored diseases, leading to the hypothesis that grafting alone could induce systemic host resistance to plant diseases and insects. A body of literature supports the induction of the jasmonic acid defense pathway and subsequent elevation of proteinase inhibitor II (*PIN II*) gene expression due to wounding, but little is known regarding the extent of elevated *PIN II* expression as it may impact pest control after a grafting procedure. Novel primers were developed for tomato and a quantitative RT-PCR protocol was developed to monitor the dynamics of *PIN II* after grafting. Primers were also designed to monitor actin 2/8 dynamics to normalize relative quantification of *PIN II* expression. *PIN II* was elevated 18 fold 24 hr after grafting in self-grafted treatments as compared to non-grafted controls. Elucidating the dynamics of systemic signaling between scion and rootstock and determining the impact of grafting on systemic signaling may impact future IPM strategies.

Grafting for soilborne disease management in organic heirloom tomato production

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Tomato grafting is an emerging technology in the US. Demand for vine-ripened organic heirloom varieties has increased but these cultivars are susceptible to an array of soilborne diseases. Field trials were implemented in 2005 and 2006 to investigate the utility of grafting to reduce soilborne disease and increase crop productivity,. CRA 66 and Hawaii 7996 rootstock genotypes provided complete control of bacterial wilt (*Ralstonia solanacearum*) in naturally-infested soils whereas terminal disease incidence in non-grafted treatments was 75%, and 79% in 2005 and 2006, respectively. Similarly, 'Maxifort' rootstock completely controlled fusarium wilt (*F. oxysporum* f. sp. *lycopersici*), and non- and self-grafted treatments had 46% and 50% disease incidence. Verticillium wilt is a severe limitation in the western region of NC due to the lack of resistance against race 2. Grafting with 'Maxifort' could be an alternative management tool for this disease through increased vigor. Grafting with resistant rootstock integrates the use of genetic resistance into a production system that previously had none and therefore may be a vital component in organic and transitional production of heirloom tomatoes.

Management of watermelon vine decline in Florida

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Squash vein yellowing virus (SqVYV), the causal agent of watermelon vine decline (WVD) in Florida, is vectored by the silverleaf whitefly *Bemisia tabaci* (Biotype "B"). Watermelon plants mechanically inoculated at different growth stages from transplant to fruit formation with SqVYV developed WVD symptoms. Field studies were conducted in the spring and fall 2006 seasons to confirm the role of this ipomovirus in WVD and to develop management strategies through control of the vector. Watermelon in field plots grown adjacent to virus-infected squash also developed symptoms typical of WVD including fruit rot. Watermelon plants grown in screened cages that prevented whitefly infestation remained asymptomatic. SqVYV was detected in plants showing WVD symptoms but not in plants grown in screened cages. Insecticide applications of imidacloprid at transplanting and followed by weekly applications of pymetrozine did not significantly control whiteflies or WVD in the spring. However, in the fall trial, insecticide applications reduced whitefly numbers and WVD incidence and severity on treated plants compared with non-treated plants. Many watermelon growers are now using insecticides to manage whiteflies for control of WVD.