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Where will the next Norman Borlaug come from? A U.S. perspective of plant pathology education and research.

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Plant Protect. Sci., 45 (2009): 125-139

[fulltext]

Plant diseases can be traced back almost as far as recorded history. Numerous ancient writings describe plagues and blasts destroying crops and modern civilization still faces many plant disease challenges. Plant pathology has its roots in botany and notable scientists such as Tillet, Prevost, and deBary already had concluded microscopic organisms could cause plant diseases before Robert Koch established the rules of proof of pathogenicity with sheep anthrax. Plant pathologists can be credited with helping improve crop yields and food production throughout the world. However, at a time when there are increasing challenges to crop production, some that potentially may increase the severity or distribution of plant diseases, the training of future plant pathologists appears to be declining, at least in the United States. The ability of the U.S. Land Grant University (USLGU) system to attract and train future generations of plant

pathologists may be at risk. Recent data from university plant pathology departments collected by The American Phytopathological Society (APS) documents a decline in the number of students completing advanced degrees in plant pathology, departments with fewer faculty with a diverse expertise in applied plant pathology, fewer stand-alone, single discipline departments of plant pathology, a reduced ability of many departments to offer specific curricular aspects of plant pathology, and a demographic profile that casts an ominous prediction for an unusually large number of faculty retirements over the next decade. The impact of these factors could be a shortage of highly skilled, applied plant pathologists in the U.S. in coming years. The affect also may be felt globally as fewer international students may receive pre-doctoral and post-doctoral training in plant pathology in the U.S. as faculty retire and are not replaced. On the other hand, this likely will create greater opportunities for universities around the world to take leadership in many aspects of plant pathology education. While a decline in students and young faculty trained in applied and field level specialties of plant pathology (mycology, bacteriology, plant nematology, forest pathology, epidemiology, etc.) is occurring, those trained in the cellular and molecular host-pathogen interactions specialties appear to be increasing. Many plant pathology faculty hired at USLGUs in the last decade are trained in molecular biology and received their Ph.D. degree in a field other than plant pathology. They are now applying those skills to research numerous aspects of host-pathogen interactions of model pathosystems. A shift to a greater research emphasis on molecular host-pathogen interactions over the last decade is evidenced by the number of research articles published in the three APS journals; Plant Disease, Phytopathology and Molecular Plant-Microbe Interactions (MPMI). From 1985 to 2007, there has been a decline in the number of articles published in Plant Disease (– 29%) and Phytopathology (– 36%) and a steady increase in those published in MPMI since its inception in 1990 (+111%). With new research tools come new research questions. The tools of molecular biology have allowed us to look deeper into questions than ever before and provided us with a perspective not before seen. As we dissect and decode the genomes of the world ’ s most notorious plant pathogens we get closer and closer to alleviating the global losses and human suffering caused by plant diseases. New “ designer crops ” with engineered traits for drought and cold tolerance, pest resistance, increased levels of micronutrients, healthier oils such as omega fatty acids, and plant-derived pharmaceuticals are all on the horizon. Research in the future likely will focus on new problems, traditionally seen as outside the discipline of plant pathology. The impact of climate change on plant diseases will be significant. As many parts of the world become warmer and drier some plant diseases likely will increase in severity. Pathogens are likely to migrate and survive in more northern latitudes greatly expanding their range and diseases exacerbated by abiotic stresses such as drought and salinity will increase. Plant pathology will continue to evolve as a multidisciplinary science. These changes will open up many new research opportunities. Plant pathology will play a bigger role in global food security. Research into the molecular and cellular interactions of symbiotic and endophytic organisms will help provide answers to food-borne illnesses caused by E. coli and Salmonella and how these and other human pathogens become established in plants in the field. Plant pathologists will team up with biomedical and aeronautical engineers, nanotechnologists, and computer scientists to develop microsensory technology to detect the introduction and spread of pathogens for biosecurity, diagnostics and epidemiological modeling purposes. Traditional areas of plant disease management and the use of biologicals for disease control also will benefit from a better understanding of the molecular and cellular processes and the similarity of virulence mechanisms and pathogen effectors between plant, insect, and vertebrate pathogens likely will bring new insights into human diseases. And last, but not least, there likely will be a resurgence in plant disease management and epidemiological research as the world’s dependence on biofuels increases and results in new diseases on intensively cultivated plant species used for biomass production.

Keywords:
the American Phytopathological Society – APS; U.S. Land Grant University; plant pathology education; applied plant pathology; future of plant pathology

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