특 별 강 연

Challenges Presented by New Priorities in Agricultural Research

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The State Agricultural Experiment Station (SAES) system in the United States was created in 1887 as a unique federal-state partnership to support agricultural research. Over the past 109 years, this publicly supported agricultural research system has provided knowledge and technology to farmers and those in agricultural industries to help ensure a continuing supply of moderately priced food, forage, and fiber for the United States (U.S).. Public support continues today, with approximately 50% of funding coming from state, 31% from various federal agencies, and 19% from other sources.

Although the SAES system has been very successful for helping a strong agricultural industry and an affordable food and fiber supply, its mission-oriented research programs at Land Grant universities face significant challenges in changing structure of agriculture. The priorities of the SAES in the 1990s cannot be those of the 1880s. For example, when the SAES system was created in 1887, the public was mostly farmers, who would benefit directly from the investment in the unique federal-state agricultural research partnership. Now only about one-fifth of the gross national product and less than one-fifth of U.S. employment opportunities are associated with agriculture. Research agendas in the 1880s were set primarily by farmers. In the 1990s, research agendas are set by farmers and an increasingly concerned consumer group. Environmental concerns were largely nonexistent in the 1880s. Today such concerns are of paramount importance in agriculture and in guiding agricultural research.

Agricultural, corporate, scientific, political, environmental, and social communities are asking the SAESs to identify and to pursue a broadened range of research priorities. The priorities set by the Experimental Station Committee on Organization and Policy (ESCOP) for the agricultural research in 1994, indicate that future agricultural research must target four areas: the environment; sustainable production systems; economics of rural communities; and consumer interests - food safety and quality. Specifically, the priorities in these four areas include (listed with their ranking from the ESCOP list): 1) enhance air, soil, and water resources; 2) increase use of integrated and sustainable production systems; 3) enhance food safely; 4) protect plants for sustained productivity; 5) enhance agricultural and rural economies; 6) manage ecosystems to enhance biodiversity; 7) enhance animal genetic diversity and biological performance; 8) develop alternative plant management systems; 9) understand fundamental plant processes; 10) recover and use waste resources through agricultural systems; 11) use genetics to improve plants for the 21st century; 12) convert processing by-products to beneficial uses; 13) enhance food quality and value: 14) develop resource management decision systems; 15) increase the quality of animal-food products; 16) enhance the health and well-being of food animals; 17) target optimal nutrition for human health; 18) develop new or improved nonfood products; 19) strengthen social communities; 20) design foods for healthy human diets; 21) empower people for economic and social viability; and 22) promote healthy food choices.

The purpose of this talk is to review some important social changes and to identify specific challenges which must be met if SAES research is to continue to develop the knowledge base necessary for a sustainable, high-quality food and fiber system.

Mollecular determinants of biological control by rhizosphere bacteria

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Recent interest in the use of introduced seed-and root-colonizing bacteria for biological control and plant growth promotion is due to recognition of the need for greater sustainability in agriculture and public concerns about potential hazards associated with the use of synthetic pesticides. Technologies from molecular biology and genetics have given new insight into the underlying mechanisms by which beneficial plant-associated bacteria function and have allowed evaluation of the behavior of microbial inoculants in natural environments to a degree not previously possible. Our research indicates that antibiotics produced by beneficial strains of fluorescent *Pseudomonas* spp. in the rhizosphere of wheat have a key role in the suppression of certain soilborne pathogens, and that antibiotic-producing strains are enriched in certain naturally disease-suppressive soils. We have cloned and characterized biosynthetic loci for phenazine antibiotics and expressed the genes in heterologous strains of *Pseudomonas* from the roots of wheat. Knowledge of microbial plant-protective mechanisms can aid in the search for new agents adapted to particular crops or environments, in the rational development and use of more effective strain combinations, and directed strain improvement through genetic manipulation.

ULTRASTRUCTURAL ASPECTS OF WHITEFLY-TRANSMITTED GEMINIVIRUS INFECTRIONS

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Ultrastructural responses to the whitefly-transmitted subgroup III geminiviruses occurring world-wide will be discussed. The following cytopathic effects can be generalized as characteristic of the geminiviruses infections, 1) hypertrophy of the nucleolus 2) segregation of nucleolar components into discrete granuclar and fibrillar regions which were similar to those induced by certain carcinogens or antibiotics in animal cells, 3)occurrence of DNA-containing fibrillar rings in various sizes and numbers, and 4) appearance of virus particles either as loosely compacted aggregates or closely packed crystalline arrays. Most whitefly-transmitted geminiviruses occurring in natural hosts are phloem-limited and the major cytopathic effects occur in the nucleus. When a common host is infected doubly with phloem-limited bean golden mosaic geminivirus and non-phloem-limited tobacco mosaic tobamovirus, however, the geminivirus invades non-phloem tissues. In an experimental host of Euphorbia mosaic geminivirus, *Datura stramonium*, infection occurred regardless of cell types including mesophyll and epidermal cells. In addition, cells in early lesions of inoculated leaves revealed the presence of macrotubules containing geminate virus particles in the cytoplasm which were continuous with the plasmodesmata. This suggest that the macrotubules are involved in intra-as well as intercellular movement of the virus and that cell-to-cell movement of some geminiviruses occurs as assembled particles.