The Kentucky Agricultural Experiment Station

108th Annual Report 1995

College of Agriculture
University of Kentucky • Lexington, Kentucky 40546

To His Excellency,
Hon. Paul Patton
Governor of Kentucky

I herewith submit the one hundred and eighth annual report of the Kentucky Agricultural Experiment Station for the period ending December 31, 1995. This is done in accordance with an act of Congress, approved March 2, 1887, entitled, "An act to establish Agricultural Experiment Stations, in connection with the Agricultural Colleges established in the several states under the provisions of an act approved July 2, 1862, and under the acts supplementary thereto," and also the act of Kentucky State Legislature, approved February 20, 1888, accepting the provisions of the act of Congress.

Very respectfully,

C. Oran Little, Director
Lexington, Kentucky
June 30, 1996

Contents

Purpose

As a Land Grant institution, the University of Kentucky is responsible for serving the people of the Commonwealth of Kentucky. The College of Agriculture, with its research, teaching, and Extension activities, has developed a structure and organization to provide the mandated Land Grant services in agriculture and related areas.

The Kentucky Agricultural Experiment Station has been providing research results to farmers for more than 100 years. The continued growth of Kentucky agriculture attests to the benefits of applying new knowledge and technology to the agricultural production process. Much of the research leading to increased quantity and improved quality of Kentucky's agricultural output was performed by the Experiment Station. Also, College researchers address problems of agribusiness, consumers, international trade, food processing, nutrition, community development, soil and water resources, and the environment.

Although much Experiment Station research has immediate application to agricultural problems, scientists are also involved in basic research, generating new information to help solve present and potential problems. The ability of Kentucky producers to be competitive in domestic and world markets requires an expanded base of knowledge in emerging areas of research applicable to agriculture.

This Annual Report summarizes Experiment Station research highlights for 1995. Lists of the faculty, research projects, and publications completed during the year are also provided.

The research programs of the Kentucky Agricultural Experiment Station have benefitted Kentucky's agriculture over the past century, and the results of present and future research will continue to serve Kentucky's primary industry.

AGRICULTURAL ECONOMICS

Research in agricultural economics involves such diverse subjects as improving profitability of Kentucky agriculture and agribusiness, enhancing competitiveness in international trade of food and fiber products, and assisting in the revitalization of rural communities.

Enhancing Agricultural Profitability

Analysis of more than 500 farms participating in the Kentucky Farm Business Analysis program revealed that 1994 was a marginal year, financially. Returns varied around the state and by enterprise. Net total returns were positive for the three groups in Western Kentucky, but they were negative for the three groups located in the Central part of the state. Net returns for producers in the Central and Eastern part of the state were negatively impacted by lower livestock prices. The operator's share of net farm income (showing the financial rewards for the operator, their equity capital, and their management input) was positive for all six groups in the state.

Research on crop insurance and disaster insurance showed more than 10,000 U.S. farmers now use the Group Risk Plan, developed and refined at UK. This county-based insurance program can be improved by private companies offering individual protection when the county yield does not trigger a payment. Other research has demonstrated that crop insurance and disaster assistance encouraged farmers in marginal regions of the country to plant additional acres of field crops, often conflicting with the Conservation Reserve Program.

The potential impact of sexed-semen technology on the beef cattle industry measured likely price effects at different levels of technology adoption. An adoption rate of 25% would result in less than a 1% long-run price reduction for feeder steers, fed steers, and fed beef. Beef cattle price reductions between 2.5 and 4.5% would be expected with a 50% technology adoption rate.

A producer decision-making model addressing agricultural machinery replacement issues was developed and has the capability of finding the least cost strategy for assisting producers in deciding between an overhaul versus trading machinery. The model can also be used to evaluate farm structure investment decisions, such as whether to build a greenhouse.

Two studies evaluated the U.S. burley tobacco program and the effect of possible higher excise taxes on cigarette consumption. One study evaluated the Tobacco Improvement Act of 1985 and its impact on the industry. The second study reported that a $.75 per pack excise tax would reduce U.S. cigarette consumption by 15%, reduce burley use by $84 million, and net the federal government $50 billion over five years, while reducing state tax receipts by more than $1 billion.

The changing status of the Farm Credit System and the changing structure of rural finance was evaluated. Research results are being used to provide public

policy alternatives for revising Farmer Mac's charter. A second finance study developed a "credit scoring" checklist for improving the efficiency of making agricultural loans, particularly for smaller farmers.

An analysis of diet and health awareness among U.S. households revealed that consumers perceived a linkage between fat consumption and heart problems. Awareness was negative among rural, black, and Hispanic households. Age, education, and having a female as head of the household were important factors governing the use of nutrition information and efforts to reduce sugar and salt intake.

Other research focused on alternatives for enhancing the quality and integrity of applied agricultural economics research to help improve research accountability. The authors suggested that the relationship between research methodology and quantitative methods should become a formal component of study in agricultural economics.

Competitiveness Through International Trade

Research on dairy policy and trade between the U.S. and European Community (E.C.) found that dairy policies in the two trading blocs are interconnected, even though each country/bloc made independent policy decisions. Changes in policies in the E.C. caused a decline in U.S. stocks, driving U.S. dairy prices upward while making prices more volatile.

Trade research examined the demand for meat and fish in Japan with implications for U.S. food exports. One important finding was that the demand for beef in Japan is highly sensitive to changes in the price of fish, an important substitute for meats. A study revealed that American beef producers must move their beef quality more towards wagyu beef if the U.S. is to expand market share. U.S. beef cannot effectively compete with Australian beef on the basis of price, but American beef is competitive on the basis of quality.

One possible way to improve the quality of U.S. beef in Japan is through enhanced transportation quality or higher degrees of fat marbling. Work in the Japanese meat market revealed that the Japanese have paid little attention to health studies; thus, American red meat producers should focus advertisements in Japan on the quality of U.S. meat, not on promotions relating to diet and health care.

Tobacco trade research showed that the U.S. market for burley is more competitive than the international market, suggesting that government policies reducing price supports would provide more benefits to the industry (including manufacturers and dealers) than a tariff or quota. But domestic burley producers would suffer short run losses from reductions in the price support.

The global competitiveness of U.S. food processors was examined and results suggested that the food processing industry has increased its presence in the global market relative to other manufacturing industries in recent years. However, the food industry is still less involved in international trade than most manufacturing sectors of the U.S. economy.

Revitalizing Rural Communities

A study of recreation at Corps of Engineer reservoirs in Kentucky and Tennessee looked at the impact of water quality on visitation to the reservoirs. "Poorer" water resulted in fewer visits by swimmers and boaters, but fishing improved. These estimates can be used to compare the benefits from generating hydropower when considering renewals of dam licenses. Models were also used to estimate the recreational demand for white water paddling.

A recent study identified the state- and county-level variables influencing the location of food manufacturing establishments across the nation. Other research suggested that while traditional industrial recruitment efforts are useful, they can have a greater impact if they are part of an integrated strategy designed to improve worker skills, providing appropriate infrastructure and assisting communities and companies in developing networks. This information can be used by public officials to identify strategic strengths and weaknesses of individual counties in attracting new food processors.

A related study provided earnings and employment multipliers associated with various food processors in Kentucky. These multipliers can be used to compare the economic impacts of different types of processors and to estimate expected returns to industry development incentives. The Community Reinvestment Act was analyzed as a rural finance strategy.

The consequences of reform in rural and urban school districts in terms of changes both in educational revenues and expenditures is being examined within the context of the Kentucky Educational Reform Act (KERA). A related analysis examined how systemic inequality has changed with the school finance system. It was noteworthy that counties with higher baseline test scores in 1991-92 also had higher per capital incomes in 1993.

Research Projects

An Analysis of Finance Efficiency and Socioeconomic Influences in Urban and Rural Public Schools — *S.J. Goetz and D.L. Debertin*

Analyzing the Future International Competitiveness of the U.S. Food Industry — *M.R. Reed, M.A. Marchant, and L.L. Mather*

Benefits and Costs in Natural Resource Planning — *R.C. Ready*

Changing Patterns of Food Demand and Consumption Behavior — *B.W. Bobst*

Development of Multiobjective Decision Criteria Models for Agricultural Investment Appraisal — *A. Pagoulatos and D.L. Debertin*

Economic Analysis of Biotechnological Innovations in the U.S. Beef Cattle Industry — *B.W. Bobst*

Economic and Environmental Impacts of Water-Quality Protection Policies on Kentucky Agriculture — *H.H. Hall and J.R. Skees*

An Evaluation of International Markets for Southern Commodities — *M.A. Marchant and M.R. Reed*

Evaluation of Public Policy Alternatives Designed to Help U.S. Cash Crop Farmers Manage Risk — *J.R. Skees and H.H. Hall*

Regulatory, Efficiency and Management Issues Affecting Rural Financial Markets — *D. Freshwater*

Rural Economic Development Alternatives in the New Competitive Environment — *S.J. Goetz and D. Freshwater*

AGRONOMY

The Department of Agronomy conducts research to improve the productivity and quality of crops, and to manage and sustain soil and water resources. Our efforts span the range from the most fundamental, discovery research to practical field testing. We investigate systems ranging in scale from the molecular (for example, studies of plant genetics or soil chemistry) to the ecosystem (for example, studies on the profitable management of complex cropping systems). Examples of significant research accomplishments during 1995 are listed here.

- We released a new soft red winter wheat variety which will be marketed under the name "Foster." The variety has outstanding yield potential, excellent test weight and disease resistance, and superior milling and baking quality.
- "Quickstand" bermudagrass was recently released as a vigorous, winter hardy variety that can be vegetatively established for sports turf applications. It is resistant to Spring Dead Spot and has a finer texture than other winter hardy bermudagrasses.
- Standardized testing of red clover varieties, coupled with educational programs, has resulted in a documented increase in the use of improved varieties. The estimated value of increased forage production for 1995 was in excess of $10 million for Kentucky.
- A major research and demonstration project, funded by the Robinson Trust, was initiated in Eastern Kentucky. The initiative includes research on management of herbaceous species on surface mined land. Anticipated benefits of the program include enhanced erosion control, wildlife habitat, biomass energy and livestock production.
- The "Soybean Tissue Culture and Genetic Engineering Center" is a joint project of the University of Kentucky, The Ohio State University, and the University of Georgia. Three different protocols for moving foreign genes have been developed and implemented by the Center. The first products of the Center are transgenic soybean lines carrying the Bean Pod Mottle Virus-Coat Protein which confers resistance to this pathogen.
- We continue to progress in manipulation of soybean oil quality. We recently developed transgenic soybean somatic embryos with more than a two-thirds reduction in saturated fatty acid content. These are now being regenerated for use in breeding new varieties.
- Research in Kentucky has compared poultry litter with commercial fertilizer for corn, wheat and tall fescue. Poultry litter can be an effective and efficient source of nutrients for these crops. Four to six tons per acre of litter on corn produced yields equal to the standard nitrogen fertilizer treatment. Litter also improves fertility of soils by increasing pH, phosphorus and potassium.
- We are evaluating the use of GPS (global positioning systems) to vary corn populations within a field according to topsoil depth. These studies on preci-

sion agriculture are conducted in collaboration with the Kentucky Corn Promotion Council. Our data show that, under some conditions, varying the corn population may increase income by as much as $33/acre.

- We have conducted four years of research evaluating constructed wetlands as a component of residential wastewater treatment. Several pollutants were reduced by the wetland treatment: nitrogen by 55%, phosphorus by 45%, BOD by 80%, and fecal bacteria by 99%. As a result the quality of discharge water is much improved.
- Long-term research and educational programs on no-tillage systems continue to evaluate best management practices for crop production, soil conservation and protection of water resources. With the support of these programs, Kentucky farmers now lead the nation in percentage of cropland which is no-tilled. In 1995, this was 47% of row-cropped land.
- Hay storage research with tall fescue showed that yield losses during outside storage of twine-tied bales can be reduced more than two-thirds by inside storage or solid plastic binding material. If such practices were universally adopted in Kentucky, the increase in hay value would exceed $140 million annually.
- Although the concept of seed vigor has long been accepted, no practical standard vigor tests have been used for marketing. Studies in our laboratories have led to the standardization of the accelerated aging vigor test for soybean. This test will accurately predict seedling emergence under a wide variety of field conditions. It has been approved as one of the first vigor tests recommended by the International Seed Testing Association.
- Soybean seed quality is often uncertain because the seed deteriorates more rapidly during storage than seed of other grain crops. A computer model has been used to accurately predict declines in germination during storage through two planting seasons. The model was accurate across a wide range of soybean varieties, including seed lots with physical injury and seed infection by *Phomopsis longicolla*.
- Although a small fraction of wells in Kentucky have nitrate concentrations higher than the EPA's maximum contaminant level, we did not detect a direct link with rate of nitrogen fertilizer used on crops. Intensive assessment of water quality in agricultural regions of Kentucky revealed little statistical correlation between nitrate content of groundwater and the rate of nitrogen fertilizer used in the immediate area. Herbicide use did lead to detection of these chemicals in groundwater, yet a very high percentage of samples contained concentrations below standards established by EPA.

Research Projects

Alkaloid Accumulation in *Acremonium coenophialum* Infected Tall Fescue —*L.P. Bush*

Altering Ergot Alkaloid Biosynthesis by the Acremonium Endophyte of Tall Fescue — *C.L. Schardl, M.R. Siegel and L.P. Bush*

Ameliorative Designs to Improve the Efficiency of Constructed Wetlands Treating High Metal Load Acid Mine Drainage in the Rock Creek Watershed — *A.D. Karathanasis*

Analysis of MRNA Polyadenylation and Metabolism in Plants — *A.G. Hunt*

Analysis of the Effects of Allels at the A and B Alkaloid Loci in Transgenic *Nicotiana tabacum* Genotypes — *G.B. Collins and A.G. Hunt*

Assessing Transport of Colloid Bound Herbicides and Heavy Metals to Groundwater —*A.D. Karathanasis and R.E. Phillips*

Assessment of Constructed Wetlands for Animal Waste Treatment — *W.O. Thom, Y. Wang and J. Dinger*

Bacterial Dissimilation of Nitrate to Ammonium in Batch and Chemostat Culture — *M.S. Coyne*

Behavior, Fate and Bioactivity of Acetolactate (ALS)-Inhibiting Herbicides — *M. Barrett and W.W. Witt*

Biochemistry and Molecular Biology of Sesquiterpene Cyclase and Squalene Synthetase for Tobacco — *J. Chappell*

Biorationals from Nicotiana Production and Antifungal Activity — *M.T. Nielsen and B. Kennedy*

Breeding and Development of Soybean Varieties for Kentucky — *T. Pfeiffer*

Breeding Burley Tobacco for Improved Pest Resistance and Productivity — *M.T. Nielsen, B.S. Kennedy and P.D. Legg*

Breeding Improved Wheat, Oats and Barley for Kentucky — *D. VanSanford*

Cellular and Molecular Biology Initiative in Dark Tobacco — *G.B. Collins*

Characterization and Modification of Heavy Metal Accumulation in Plants, with Emphasis on Tobacco — *G.J. Wagner*

Characterization and Modifications of Metabolism Leading to Sucrose Ester Acyl Constituents Important to Natural Insect Resistance in Tobacco — *G.J. Wagner*

Characterization of a Plant Polya Polymerase — *A.G. Hunt*

Characterization of Phytoalexin and Sterol Biosynthetic Genes in Tobacco — *J. Chappell*

Characterization and Classification of Kentucky Soils — *A.D. Karathanasis and R.I. Barnhisel*

Classifying Soils for Solute Transport as Affected by Soil Properties and Landscape Position — *E. Perfect*

Control of the Formation of Natural trans-2-Hexenal and cis-3-Hexenol — *D.F. Hildebrand*

Corn Breeding and Genetics: White Endosperm, Food Quality Inheritance, and Hybrid Performance — *C.G. Poneleit*

Correlation and Calibration of Crop Yields with Soil Test Levels of Major Nutrients — *W.O. Thom*

Cropping and Planting Systems to Allow Economic Canola Production — *J.H. Herbek and L.W. Murdock, Jr.*

Dark Tobacco Breeding Genetics and Management — *P.D. Legg*

Determine if Chlorophyll Measurements Can Predict Nitrogen Needs of Wheat — *L.W. Murdock, Jr.*

Development of a Basic Soil Morphology Training Course for Onsite Sewage Disposal Treatment System Personnel — *A.D. Karathanasis*

Development of a Soybean Tissue Culture and Genetic Engineering Center — *G.B. Collins and P. Moore*

Development of Efficient Tissue Culture and Genetic Engineering of Soybean — *G.B. Collins and R. Dinkins*

Development of Efficient Tissue Culture Systems for Introducing Useful Foreign Genes into Soybeans via Genetic Engineering — *G.B. Collins*

Development of an Efficient Transformation Regeneration System for Soybean *(Glycine max)* — *G.B. Collins*

Direct Vegetation of Fly Ash — *R.I. Barnhisel*

Distribution of Constituents Within Tobacco Leaf — *H.R. Burton*

Does Kentucky Need an Early Maturing Soybean Variety Trial? — *L.J. Grabau*

Effect of Nitrogen Management and Variety on Protein Quantity and Quality — *D. VanSanford*

Effects of Suckering Practices on Growth Characteristics — *J. Calvert*

Environmental and Genotypic Control of Assimilate Allocation in Grain Crops — *D.B. Egli*

Environmental and Morphological Determinants of Field Curing Rates of Legume Hay — *M. Collins and N.L. Taylor*

Establishing an Advanced Techniques Course in Biotechnology — *J. Chappell*

Establishing the Value of the Phosphorus and Potassium Contained in Poultry Litter for No Till Corn — *J.H. Grove, M. Rasnake, D.C. Ditsch and W.O. Thom*

Evaluation of Burley Tobacco Varieties — *M.T. Nielsen, J. Calvert and B.S. Kennedy*

Evaluation of the Effects of Different Tobacco Vein Mottling Virus Genes on the Susceptibility of Burley Tobacco to Potyviruses — *A.G. Hunt, M.T. Nielsen and W.C. Nesmith*

Field Application of Pyrite Microencapsulation Technologies for Controlling Pyrite Oxidation and Acid Mine Drainage Production — *V.P. Evangelou and R.E. Phillips*

Forage Crop Breeding to Improve Yield and Quality — *N.L. Taylor*

Foreign Gene Introduction Into Soybean — *G.B. Collins and R. Dinkins*

Formation/Stabilization of the Water Oxidizing Complex: Polypeptide/Secondary Donor Requirements — *G.M. Cheniae*

Formulation Enhanced Transport of a Soil Applied Herbicide — *V.P. Evangelou, L.M. McDonald*

Fungal Pathogen Resistance in Dark Tobacco — *M.T. Nielsen*

Genetic Engineering of Dark Tobaccos: A Subproject of Cellular and Molecular Biology Initiative in Dark Tobacco — *J. Chappell*

Genetic Control of a Putative Multiple Pesticide Metabolizing Cytochrome P450 — *M. Barrett*

Genetic Engineering of Soybeans for Increased Oil Content and Epoxy Fatty Acid Accumulation — *D.F. Hildebrand*

Genetic Engineering of the Isoprenoid Biosynthetic Pathway in Plants — *J. Chappell*

Green River Food Corn Total Quality Management Program — *G. Henson, J.H. Herbek and M.C. Smith*

HHMI Initiative Teacher Research — *T.D. Phillips*

Improved Fertilizer Use Efficiency and Environmental Soundness in Burley Tobacco Production — *J.L. Sims*

Improved Management of Legume Cover Crops for Sustainable Grain Crop Production — *W.W. Frye*

Improving Soybean Technology Transfer in Kentucky — *J.H. Herbek and M.J. Bitzer*

Improving Switchgrass Productivity as a Biofuel Crop — *M. Rasnake*

Improving the Magnesium Nutrition of Burley Tobacco to Enhance Plant Growth and Usefulness of Cured Leaf — *J.L. Sims and J.H. Grove*

Increased Desaturation of Soybean Triacylglycerol — *D.F. Hildebrand*

In Vitro and *In Vivo* Studies of mRNA 3' End Formation in Plants — *A.G. Hunt*

Isolation and Determination of Activity of Nicotine Demethylase in Tobacco — *L.P. Bush*

Isolation of Sclareol/Labdenediol Synthase — *G.J. Wagner*

Kinetics and Thermodynamics of Adsorption-Desorption in Binary and Ternary Soil Colloid Systems — *V.P. Evangelou*

Maintenance of Seed of Trifolium Species — *N.L. Taylor*

Management of Weedy Vines in Corn — *W.W. Witt and C. Slack*

Manure Applied to Shallow Well Drained Soils Improving Groundwater Quality — *J.H. Grove*

Mechanisms for Vacuolar Storage/Sequestration of Cd, Zn, Mn, Ni — *G.J. Wagner*

Mechanisms of Transport Leading to Vacuolar Storage Sequestration of Zn, Cd and Mn Storage Sequestration — *G.J. Wagner*

Mineralogy and Charge Properties of Readily-Dispersible Fractions from Selected Soils and Sediments — *A.D. Karathanasis and R.I. Barnhisel*

MOA #13814 with Natural Resources and Environmental Protection Cabinet Division of Water — *A.D. Karathanasis*

Modeling Transport of Colloid Bound Herbicides and Heavy Metals to Groundwater — *A.D. Karathanasis*

Modifying Recombination Rates in Soybean and Assessing the Effect on Breeding Progress — *T. Pfeiffer*

Molecular Dissection of Metabolic Channels for Sterol and Sesquiterpene Metabolism in Tobacco — *J. Chappell*

Multiplicative Models for Genotype x Environment Interaction — *P.L. Cornelius*

Nicotine Synthase and Nicotine Demethylase — *L.P. Bush*

On-Farm Testing of Early Maturing Soybeans — *L.J. Grabau*

Phenology, Population Dynamics, and Interference: A Basis for Understanding Weed Biology and Ecology — *W.W. Witt and L.A. Weston*

Plant, Animal and Environmental Factors Limiting Intake of Grazing Beef Cattle — *C.T. Dougherty*

Plant Exploration in Western United States to Collect Annual and Perennial Native Trifolium Germplasm for Crop Improvement — *N.L. Taylor*

Plant Genetic Rsource Conservation and Utilization — *N.L. Taylor*

Population Improvement and Line Development of White Endosperm Maize — *C.G. Poneleit*

Potential for Crop Residue to Restrict Herbicide Movement in Surface Water from Corn and Soybean Fields — *W.W. Witt*

Potyvirus Replication and Pathogenicity — *A.G. Hunt*

Predicting Changes in Corn Seed Quality During Storage — *D.M. Tekrony*

Production of Transgenic Soybean with Resistance to Soybean Mosaic Virus — *S.A. Ghabrial and G.B. Collins*

Program Assessment of Constructed Wetlands for Animal Waste Phase II — *W.O. Thom, Y. Wang and J. Dinger*

Program Continued Monitoring of Ameliorative Designs to Improve the Efficiency of Constructed Wetlands Treating High Metal Load Acid Mine Drainage in the Rock Creek Watershed — *A.D. Karathanasis*

Refining Components of an Early-Planted, Early-Maturing Soybean Cropping System — *L.J. Grabau*

Regulatory Control of Alkaloid Levels and Senescence in Tobacco Leaves — *D.F. Hildebrand*

Remediation of Acid Drainage through Surface Coating of Fe Sulfide — *V.P. Evangelou*

Restoration of Altered Lands — *R.I. Barnhisel*

Restoration of the Productivity of Prime Farmland Following Surface Mining — *R.I. Barnhisel*

Review and Taxonomic ID of Western US Trifolium Collection from 1994 — *N.L. Taylor*

The Role of Lipoxygenase and Lipoxygenase Mediated Products — *D. Hildebrand and J. Kuc*

Root Cell Wall and Plasma Membrane Physico Chemical Characterization of Mn Tolerant and Mn Sensitive Genotypes — *V.P. Evangelou and M.T. Nielsen*

Seed Biology and Technology Investigations — *D.M. TeKrony and D.B. Egli*

A Silica/Fly Ash Based Technology for Controlling Pyrite Oxidation — *V.P. Evangelou*

Soft Red Winter Wheat Breeding and Variety Development for Kentucky — *D.A. VanSanford*

Soil Nitrate Testing to Improve in Use Efficiency and Reduce Residual Nitrate Under Corn and Wheat — *J.H. Grove, D.A. VanSanford and C.G. Poneleit*

Somatic Cell Genetics of Crop Plants — *G.B. Collins*

Soil Classification System for Southern Region Based on Water and Chemical Flow — *R.E. Phillips*

Soil Survey Characterization and Environmental Impact Assessment of Daniel Boone National Forest Ecosystems — *A.D. Karathanasis*

Soybean Genetic Engineering for Increasing Monounsaturated Fatty Acid Ratios — *D. Hildebrand and G.B. Collins*

Soybean Genetic Engineering of Soybeans for Increased Value — *D.F. Hildebrand*

Soybean Tissue Culture and Genetic Engineering Center — *G.B. Collins*

Studies of a Novel Pathway for the Biosynthesis of Straight and Branched, Odd and Even Length, Medium-Chain Fatty Acids in Plants — *G.J. Wagner*

Studies to Reduce Cadmium Accumulation in Tobacco and Research toward Extending the Uses of Tobacco — *G.J. Wagner*

Targeting of the Cd-Chelator Metallothinein to the Plant Cell Wall and Root Tissue using Re-

combinant DNA Methodology — *G.J. Wagner*

Understanding and Manipulation of Lipid Biosyntheses in Plants — *D. Hildebrand*

Update of Best Management Practices Manual for Surface Coal Mining Kentucky Nonpoint Source Management Program — *R.I. Barnhisel*

Using Early Maturing Soybean Varieties to Help Manage Soybean Cyst Nematode — *L.J. Grabau*

Utilization of Coal Combustion By Products in Agriculture and Reclamation — *W.O. Thom*

Utilizing Seed Vigor as a Component of Seed Quality — *D.M. TeKrony*

Varying Corn Populations According to Soil Type and Depth of Topsoil — *M.J. Bitzer, R.I. Barnhisel and J.H. Grove*

Winter Annual Root Development and the Scavenging of Residual Soil Nitrate — *J.H. Grove, R.L. Blevins and D. Zourarakis*

Yield Evaluation of Alfalfa Varieties — *L. Lauriault*

Yield Potential and Long Term Effects of No Tillage on Wheat Production — *L.W. Murdock, Jr., J.H. Herbek and J.R. Martin*

ANIMAL SCIENCES

Over the years the Animal Sciences department has used multidisciplinary efforts to maintain and expand research on all aspects of animal production systems for a number of farm animal species. We are now moving into a new era with the development of a new farm.

Although past priorities will still receive attention, animal systems research will evolve with a more holistic approach to solving the problems of Kentucky livestock producers. More multidisciplinary focus groups will face the impact of research on the environment, sustainability of agricultural practices and social concerns. However, we can never eliminate research on production efficiency. When production is too inefficient to be economically sound, we cease to produce.

Our new farm will provide a workplace to accomplish these goals. It will allow for more effective dissemination of information and further mesh the efforts in our teaching, Extension and research programs.

Food Science

Prooxidants (*e.g.,* iron) naturally present in meat were found to be partially responsible for functionality (solubility, water-binding, gelation) differences between light and dark poultry meat products. Washed poultry meat and beef surimi exhibited marked protein denaturation and functionality losses during frozen storage. However, mixing washed muscle mince with cryoproctants (sucrose, sorbitol) successfully prevent these quality deteriorations.

Phage peptides have been used to decrease phage proliferation in lactic cultures. Broths inoculated with 1% *Lactococcus lactis* ssp. Lactis C2 and then Phage c2 were inoculated into one non-peptide-containing control broth and one peptide-containing broth. Cells in broth containing no peptides lysed faster than cells in broth containing peptides. Culture growth in medium containing peptides increased before lysis. Lysis rates were essentially the same for broths with and without peptides.

The palatability of restructured steaks from steers finished on alfalfa pasture was compared with those finished on grain. Steaks made with salt/phosphate and calcium alginate as binders but without an antioxidant became rancid after three months storage. However, steaks prepared the same way but also containing an antioxidant and flavoring agent had excellent flavor for the six-month storage period. These data indicate the importance of adding both an antioxidant and flavoring agent to restructured steaks from beef originating from cattle finished predominantly on pasture or a forage legume.

Dehydroabietinal, not previously reported in soy products, is associated with commercial soy protein isolates at levels that exceed the aldehydes typically associated with lipid-oxidation (*e.g.,* hexanal). The flavor profile and threshold of dehydroabietinal indicates that it is a significant contributor to the undesirable

flavor of soy protein isolates which has persisted as the single greatest technical impedient to the increased usage of soy protein in human foods.

Non-Ruminant Nutrition

Supplementing a low protein, corn based diet with lysine, tryptophan, threonine and methionine resulted in optimal growth in pigs and resulted in a marked decrease in the nitrogen and phosphorus excretion. Spray-dried porcine plasma and beef plasma increased feed intake and growth rate in early-weaned pigs. The immunoglobulin fraction appeared to be responsible for the improvement in pig performance resulting from the plasma. Pigs responded more to plasma when kept in a conventional nursery than when housed in an off-site, very clean nursery.

New information has been generated on the bioavailability of phosphorus in feedstuffs commonly fed to pigs. This new information allows nutritionists to more precisely formulate diets to meet the pigs' available phosphorus requirement. Inclusion of microbial phytase in the diet improved the utilization of dietary phosphorus in diets and reduced the phosphorus in the manure. A high level of copper or zinc, when added to pig starter diets, improved growth rate and feed intake; and chromium picolinate added to diets increased the rate of lean tissue accretion in finishing pigs.

In horses, dietary supplementation of alpha tocopheryl acetate was necessary to maintain serum and muscle alpha tocopherol levels during a 90-d exercise conditioning period. Also, soluble dietary fiber (SDF) produced lower plasma protein concentration during dehydration than horses receiving a diet low in SDF. It was concluded that dietary fiber can affect the amount of water in the hind gut that is available to replace water lost in sweat.

A brown shell egg laying strain of pullets exposed to 15 hours of light per day starting at 15, 16 or 17 weeks of age showed few differences among lighting treatments. Photostimulation started at 15 weeks of age resulted in increased egg production but decreased egg weight during the early phase of the production cycle compared with photostimulation started at 17 weeks. The results indicate no economic benefit of early lighting.

Ruminant Nutrition

It was demonstrated that cysteamine administration can be used to produce a somatostatin-deficient model in sheep for studying physiological effects of somatostatin. Dose and time dependent responses to cysteamine have been demonstrated for somatostatin, growth hormone and insulin. Solubilization of vitamin A in coconut oil prior to oral administration resulted in major reductions in preabomasal losses of vitamin A. Protection was dose dependent between 0 and 35 g of oil per dose. Safflower oil was not effective. Including monensin in the diet did not affect vitamin A losses.

Incorporation of rumen bypass fat into alfalfa-based lactation diets increases milk dry matter and fat, but protein is decreased. Incorporating 3.7% of this ru-

men bypass fat into fescue-based ewe lactation diets increases milk dry matter, fat and energy production. Milk fatty acid composition is altered, so nursing lambs grow faster and more efficiently than those nursing unsupplemented ewes.

Daily gains of yearling Beefmaster x Angus steers grazing endophytic Kentucky 31 tall fescue increase linearly with energy supplementation levels of 0, .2, .4 and .6% of body weight daily. As the grazing season progressed through spring and early summer, metabolic and physiologic effects of grazing endophytic tall fescue were altered by energy supplementation. The greatest benefit was received from the .6% body weight supplement.

Data on the influence of ruminal or abomasal starch hydrolysate infusion on pancreatic exocrine secretion and blood glucose in steers suggest small intestinal carbohydrate may negatively impact pancreatic alpha amylase secretion. This is in contrast to results in non-ruminants and may suggest regulatory limitations to small intestinal starch digestion in ruminants. Other research indicates Na/glucose cotransport responds to luminal complex carbohydrate in ruminants. The magnitude of these changes will be useful in determining limits to small intestinal carbohydrate assimilation in ruminants.

Microbiology

The percentage of lactose-positive isolates susceptible to 12 antimicrobials was lower ($P < .01$) in pigs in a herd 22 years after withdrawal of all antimicrobials than for isolates obtained 12 years after withdrawal. These results suggest that antibiotic resistance has become more prevalent in bacteria from pigs in this herd even though antimicrobials have not been used for more than 22 years.

A screening technique has been developed which can be used to evaluate direct-fed microbial feed supplements for ruminants. Studies have identified a specific group of microorganisms which can be used as to enhance the production of beef cattle fed high concentrate diets. These organisms provide the basis for a patent application and are currently being used to develop a commercial feed supplement for use in feedlots.

The digestion of cellulose is a defining characteristic of ruminants, and one of the initial steps in the metabolism of cellulose carbohydrates is transport of small sugars across the bacterial cell membrane. *Clostridium thermocellum*, an anaerobic thermophile, was used as a model organism for studying uptake of sugars derived from the degradation of cellulose. Separate ATP-dependent mechanisms were characterized for the uptake of glucose and for cellobiose and longer cellooligomers. A common uptake system for cellobiose and cellooligomers has not been previously described in bacteria. This knowledge will be useful in manipulating cellulolytic ruminal bacteria and ultimately influencing animal performance.

Physiology and Genetics

Research designed to lead to new procedures to reduce embryonic mortality has demonstrated in sheep and cattle that the amount and temporal relationships

of ovarian hormones secreted are critical. The effects of progesterone and estradial on the activity of several critical uterine enzymes has been elucidated.

Holstein heifers on a Cu-adequate or Cu-insufficent diet from 60 days prepartum to 160 days postpartum were evaluated for measures of Cu status and inflammatory responses. Plasma ceruloplasmin (Cp) in +CU heifers reached peak levels at calving and declined as lactation progressed, but Cp in -Cu heifers remained unchanged. Blood superoxide dismutase dropped dramatically postpartum in both groups. No treatment differences in whey cytokine response to endotoxin challenge were seen, but whey serum albumin and somatic cell counts (day 2) tended to be greater in -CU heifers. Cu insufficiency may influence clinical responses in heifers.

When bred to Angus bulls and managed on endophytic fescue, Brahman sired first-calf cows weaned calves that were 14.2 kg heavier than calves from contemporary first-calf Simbrah sired cows.

Research Projects

Acid-Base Balance and Mineral Requirements of Dairy Cattle — *R.W. Hemken*

Amino Acid Sources and Concentrations for Swine — *G.L. Cromwell*

Antimicrobial Resistance and Plasmid-Mediated Virulence Attributes of Fecal Colonic Bacteria from Pigs — *B.E. Langlois*

Beef Cattle Grazing: Endophyte-Infected Tall Fescue with Alfalfa and Water Quality in Stream Pasture — *B.T. Larson*

Bioenergetics of Nutrient Transport and Growth of Gram-Negative Ruminal Microorganisms — *H.J. Strobel*

Comparison of Forage Finishing Systems, Carcass Traits and Processing Technologies — *W.G. Moody*

Effect of Additives and Processing Methods on Culture Agglutination and Cheese Yield — *C.L. Hicks*

Endocrine Mechanisms Contributing to Establishment of Pregnancy in Ruminants — *W.J. Silvia*

Endocrine Regulation of Prostaglandin in $F_2\alpha$ Secretion in Sows — *L.A. Edgerton*

Enhancing Food Safety through Control of Foodborne Disease Agents — *B.E. Langlois*

Evaluation of Beef Cattle Germplasm Resources Involving Additive and Nonadditive Genetic Effects — *F.A. Thrift*

Evaluation of Tall Fescue in Dairy Cattle — *J.A. Jackson*

Functional Properties of Food Proteins — *Y.L. Xiong*

Genetic and Phenotypic Aspects of Cow Productivity Using Field Records Collected on Angus Cattle — *D.K. Aaron*

Hydrolyzed Feather Meal as a Supplement for Lambs Consuming High Concentrate or High Roughage Diets — *D.G. Ely*

Improving Harvested Forages for Ruminants — *G.E. Mitchell, Jr.*

Increased Efficiency of Sheep Production — *D.G. Ely*

Maximizing Efficient Use of Forage Dry Matter by Beef Cattle Grazing Tall Fescue — *D.G. Ely*

Metabolic Relationships in Supply of Nutrients for Lactating Cows — *D.L. Harmon*

Nutrition and Exercise on Development of Horse Skeletal and Muscular Tissue and Subsequent Performance — *L. Lawrence*

Nutritional Systems for Swine to Increase Reproductive Efficiency — *G.L. Cromwell*

Optimizing Digestion and Absorption in the Ruminant Small Intestine — *D.L. Harmon*

Requirements and Bioavailability of Phosphorus for Swine — *G.L. Cromwell*

Resistance to Mastitis in Dairy Cattle — *R.J. Harmon*

Synergistic Microbial Interactions for Stimulating Cellulolytic Activities and Ruminant Production — *K.A. Dawson*

Skeletal Problems in Poultry — *A.H. Cantor*

Synchronization of Estrus in Gilts — *L.A. Edgerton*

BIOSYSTEMS AND AGRICULTURAL ENGINEERING

Biosystems and Agricultural Engineering research is directed toward solving existing and emerging engineering-related problems found on Kentucky's farms and forests, as well as developing methods of protecting foods and other farm products which are consumed or utilized by the public. Six broad areas of interest are pursued.

Machine Systems design involves development and evaluation of basic machine systems through the application of theoretical and applied mechanics. A fully-automated burley tobacco harvesting and curing system has been developed and is being tested on the Experiment Station farms. A mechanical spearing machine has been developed and demonstrated to farmers. A commercial version of the wire-strung portable frame system was used on a limited number of farms throughout the burley producing area. A two-row mechanical tobacco topper was shown to significantly reduce labor. An electric powered tobacco stripping aid is under-going on-farm evaluations.

Techniques for targeted herbicide application using GIS/GPS and reflectance sensors are being researched. A significant effort is in the area of robotics and machine vision as a support technology for machine systems for harvesting, grading, and automated control of field machinery. The effects of soil compaction created by heavy machinery on water infiltration, ground water movement, and plant growth are being studied.

Bioenvironmental engineering involves applying sound engineering, agricultural, and ecological principles to solving problems dealing with the management and care of our natural resources. Research efforts include better methods of controlling and managing soil erosion through the development of better mathematical models to be used as design tools by engineers. A 4,000-acre watershed is being used to investigate the fate and transport of agricultural chemicals on a karst watershed. Research efforts are directed toward protecting ground water resources and rebuilding land disturbed by surface mining activities and landfills.

Bioprocess Engineering involves optimization of equipment, sensors, and control algorithms for processes which use living cells or subcomponents of cells as bioreactors or biocatalysts. The cells typically employed include microbes, plant tissue cells, or mammalian cells and may be modified through biotechnology. Current research in this area includes optimizing the fermentation of *Aspergilllus* to produce extracellular enzymes for use as additives in animal feeds. The enzymes produced include a cellulase and hemicellulase to aid in cellulose digestion, and a phytase to increase the efficiency of inorganic phosphorus use and reduce the phosphorus excreted by the animal. Another current research project is investigating the use of whole cells in organic solvents to catalyze reactions.

Structures and Environment involves the design of farm structures and environmental control systems for plant and animal production, feed storage and processing centers, residences, and utility buildings. Research efforts are directed toward reducing infiltration into residences, better management of animal waste, improved design of grain storage systems and structures, improved environmental control within poultry and swine growing facilities, computer-aided design methods for dairy facility design, and the development of alternative structures for curing burley and dark tobacco. Evaluation of a low-cost field curing structure for dark air-cured tobacco showed satisfactory curing during the 1994 and 1995 seasons.

Crop Processing research involves applying basic engineering sciences, particularly heat and moisture transfer processes, to the processing, storage, and handling of farm products. Management protocol has been developed for curing burley tobacco in wire-strung portable frames over sod for dry, wet and normal curing seasons. In each type of year, the tobacco cured on the portable frames was shown to be equivalent to conventional barn cured burley.

Food Engineering involves applying engineering principles to achieve efficient production and high standards of quality during processing, packaging, storage, and distribution of food products. A milk coagulation sensor has been developed using fiber optics and light reflectance that improves the control of cheese making. The sensor is being evaluated in this country and several foreign countries. Experiments have been conducted that show the applicability of using light reflectance as an aid in making cottage cheese.

Other on-going research which has basic implications in more than one of the areas mentioned above includes developing a profitable beef-forage production system through computer modeling, and modeling growing swine. Research is underway to identify ways of reducing the health and accident risk for farm workers and youth.

Meteorological research will improve the understanding and use of weather-related agricultural management models in the southern region. The Ag Weather Center provides: weekly Kentucky weather summary for the National Weather Service for the Weekly Divisional Averages (WDA) for the Palmer Drought Index Model and dissemination on the National Weather Wire System; and, Kentucky rainfall, temperature and deviation from normal maps are created daily for various time periods using the Geographical Information System (GIS) and made available on the World Wide Web.

Research Projects

Agricultural Pesticide Handling and Application Technology Demonstrations — *S.G. McNeill*

Analysis and Management of Misting Systems for Tunnel Ventilated Broiler Housing — *R.S. Gates*

Assessment of the Hydrologic Response of Reclaimed Surface Mined Lands in the Appalachian Coal Region — *R.C. Warner*

BMP Equine Waste Demonstration Project — *R.C. Warner*

Comparison of Integrated Electronic Controllers to Conventional Staged Thermostatic Control in Large Broiler Houses — *R.S. Gates*

Constructed Wetlands for Treatment of Pesticides and Nutrients from Greenhouses — *R.C. Warner*

Demonstration of Constructed Wetlands for Residential Properties — *R.C. Warner*

Design Data for the 1, 2½, and 5% Occurrences of Extreme Dewpoint Temperature with Mean Coincident Dry-Bulb Temperature — *D.G. Colliver*

Design and Demonstration of a Low-Pressure Low-Flow Irrigation System for Nurseries' Containerized and Ball and Burlap Areas — *R.C. Warner*

Determination of Design Weather Parameters International Locations — *D.G. Colliver*

Determination of Straw Properties and Air Flow Through an Upflow Biomass Gasifier — *W.E. Murphy*

Development and Evaluation of a Model for an Active Gas Collection System at Municipal Landfills — *R.C. Warner*

Development of a 3-Axis Manipulator for Harvesting of Fruit and Vegetable Crops — *S.A. Shearer*

Development of Geographical Information Systems (GIS) in the UK College of Agriculture — *K.T. Priddy*

Development of Near-Real Time Weather Station at Woodford County Research Farm — *K.T. Priddy*

Development of Profitable Beef-Forage Systems for the Southern Region — *L.W. Turner*

Development of the SEDCAD$^+$ - Version 4 (Sediment, Erosion, Discharge by Computer Aided Design) Model — *R.C. Warner*

Development of a Trickle Irrigation Design and Specification Program — *R.C. Warner*

Development of Weather-Related Insect Forecast Model Output in Geographical Information System (GIS) Format — *K.T. Priddy*

Dynamic, Probabilistic Modeling of Respiratory Disease in Livestock — *L.W. Turner*

Effect of Ozone on the Storage Life of Refrigerated Fruits and Vegetables — *F.A. Payne*

Effectiveness of Sediment Basin Dewatering Systems — *R.C. Warner*

Energy Savings from Combined Natural-Forced Ventilation Systems for Greenhouse Retrofits — *R.S. Gates*

Enhanced Design of Burley Spearing Machine — *G.A. Duncan*

Enhancing Growth of High Volume Trees — *R.C. Warner*

Estimating the Impact of Commercial Building Occupancy and Hot Water Needs in Sizing Ground Source Heat Exchanger Fields — *W.E. Murphy*

Evaluation of a Bag-Type Geothermal Ground Heat Exchanger — *W.E. Murphy*

Facility Design and Testing for Closed System Plant Micropropagation — *R.S. Gates*

Fluid Power Drives for Agricultural Field Machinery — *S.A. Shearer*

GPS Tracking of Animal Position for Improved Pasture System Design/Layout — *L.W. Turner*

The Impact of Agricultural Systems on Surface and Ground Water Quality — *G.K. Felton*

Improved Information Delivery by Developing Internet Gopher/Web Server in the UK College of Agriculture — *K.T. Priddy*

Improved Quality and Efficiency of Burley Tobacco Market Preparation — *L.G. Wells*

Improvements to Burley Spearing Machine — *G.A. Duncan*

Interior Environment and Energy Use in Poultry and Livestock Facilities — *R.S. Gates*

Inventory of Constructed Wetlands for Residential Treatment Systems — *R.C. Warner*

Knowledge-Based System for Single Stem Greenhouse Rose Production — *R.S. Gates*

Landfill as a Bioreactor — *R.C. Warner*

Mechanics of Granular Solids — *I.J. Ross*

Milk Coagulation Sensor Development — *F.A. Payne*

Model Development and Verification of a Tubular Trickle Irrigation System to Increase Water Application Efficiency — *R.C. Warner*

Modeling of Heat Transfer from U-Tube Heat Exchangers for Ground-Source Heat Pumps — *W.E. Murphy*

Modeling Responses of Growing Pigs — *L.W. Turner*

Nighttime Ventilation Strategies for Summer Heat Stress Relief in Broilers — *R.S. Gates*

Physical and Bioremediation of Hazardous Waste Contained Soils through Incorporation of Coal Fines and In Situ Environmental Management — *R.C. Warner*

Reducing Heat Stress in Dairy Cows Through Forced Evaporative Cooling — *L.W. Turner*

Reducing Nitrogen, Phosphorus and Ammonia Erosion in Swine Waste Through Diet Manipulation — *L.W. Turner*

Sensor Development for Cottage Cheese and Yogurt Culture — *F.A. Payne*

Sequences of Extreme Temperature and Humidity for Design Conditions — *D.G. Colliver*

Site-Specific Management of Nutrients on Agricultural Lands — *S.A. Shearer*

Stabilization of Embankments on AML Slopes Using Soil Bioengineering Techniques: A Field Evaluation of Cost-Effectiveness — *R.C. Warner*

Stress-Strain Modeling of Wheel Compaction Incurred During Restoration of Prime Farmland — *L.G. Wells*

Subsurface Leaching Potential of Animal Waste Holding Ponds as a Function of Soil Moisture and Compaction — *R.C. Warner*

A System for Reconstruction or Rehabilitation of Rooting Media for Growing High Value Trees — *L.G. Wells*

Systems for Providing and Controlling Interior Environments for Poultry and Livestock Housing — *R.S. Gates*

Targeted Herbicide Applications Using GIS/GPS and Reflectance Sensors — *S.A. Shearer*

Testing of Time Integrated Variable Control in Tunnel Ventilated Broiler Housing — *D.G. Overhults*

Time Integrated Variable Control Strategies for Animal and Plant Environments — *R.S. Gates*

Utilization of Commercially Composted Waste to Reduce the Transport of Herbicides to Surface and Ground Water — *R.C. Warner*

ENTOMOLOGY

Research in Entomology is directed toward understanding insects and related arthropods and their interaction with plants and animals. The ultimate goal is the development of more effective and environmentally benign management tactics and strategies for pest species.

Physiology, Biochemistry, and Molecular Biology

Parasitic wasps are being studied to characterize genes that disrupt the insect immune system or for the presence and identification of chemicals that might be useful novel agents to control pest insects. A specific kind of cell associated with the immature stages of a wasp secretes a peptide that interferes with the synthesis of some kinds of proteins of the tobacco budworm. This peptide is one of at least four found in the fraction that causes this inhibition.

The most abundant protein in this fraction has been isolated and a partial amino acid sequence has been determined. Based on these sequences, two degenerate oligonucleotides were constructed and used to amplify cDNAs from mRNA taken from these cells. The sequence of the cloned cDNA encodes all of the amino acids known from the peptide sequence analysis, thus indicating that the gene for this protein has been isolated. Studies will be directed toward the expression of this gene, the determination of known biological activity, and the association with insect growth.

A family of genes being evaluated is from an unusual group of viruses, polydnaviruses, that are required for wasp survival. These immunosuppressive genes contain a copy of a cysteine-motif that we believe to be involved in the functional activity of the proteins. We have also implicated a protein from the oviduct of the female reproductive tract in immune suppression. The cDNA encoding this protein has been isolated and some functional studies of the protein have been reported. These genes are being expressed in recombinant systems to produce and purify protein for detailed functional analyses.

A new initiative underway is developing an improved understanding of the biochemical effects associated with immune suppression.

Ecology, Behavior, and Evolution

In the cockroach *Nauphoeta cinerea*, male pheromones attract females. Females discriminate among males as potential mates using odor cues. We have shown that there is considerable quantitative and qualitative variation among males in the blend of the pheromone that they produce. This variation reflects the influence of genetic differences among males, the influence of the environment, and the influences of social experiences. In addition, sexual development and the pheromone varies among males. Communication in another cockroach,

Gromphadorhina portentosa, involves acoustic cues. The signal produced by males of this species also varies in part because of genetic differences.

Genetically based variation in sex pheromone signalling and response in the cabbage looper moth results in assortative mating. This type of variation could result in reproductive isolation between different pheromone types of moths, and possibly resistance to synthetic pheromones when these are used to disrupt mating. In the black cutworm moth, we have determined that a third pheromone component improves the effectiveness of trapping dramatically. This discovery could help in efforts to detect or monitor populations of this pest species. In the southern masked chafer, all immature stages produce the same chemicals that are used by the adult female as a sex pheromone. This information should help us to identify the pheromone, which could then be used to monitor populations of adult males and thus assess the risk of future turfgrass damage caused by grubs.

A three-year field study was completed which demonstrated a negative interaction between lady beetles and an entomopathogenic fungus in the control of tobacco aphids. Lady beetles actually interfere with biological control of this aphid species as exclusion experiments demonstrated. The study also showed that common spray adjuvants such as surfactants are fungicidal and also reduce biological control of aphids.

The use of aerial videography was successful in detecting remote tire piles that are potential breeding sites for mosquito species that are vectors of human and animal diseases.

Field and laboratory experiments on six lines of transgenic field corn that produce Bt toxin showed no adverse effects on two key predator species, *Orius insidiosus* and *Coleomegilla maculata*.

Field experiments with sweet corn addressed the influence of pollen and a weed species (hophornbeam copperleaf) on the ecology of the predator *Coleomegilla maculata.* Predation by this species on corn earworm eggs was reduced during peak pollen shed, apparently because predators were temporarily diverted from carnivory to feeding on the abundant pollen grains. *Coleomegilla maculata* densities and predation rates on corn earworm eggs were higher in sweet corn plots containing hophornbeam copperleaf than in plots without this plant species.

Japanese beetles were shown to exploit feeding-induced plant volatiles as aggregation kairomones, thereby revealing the mechanism by which the most egregious damage occurs. Response of beetles to constitutive and feeding-induced volatiles of resistant and susceptible plants was investigated to provide insight on how polyphagous folivores locate preferred host plants. Analyses of within-tree heterogeneity in leaf quality and flight behavior of Japanese beetles explained the basis for the characteristic top-down feeding pattern of this pest tree canopies.

Heterorhabditis bacteriophora, Strain 'Oswego', a parasitic nematode of the clover root curculio was released and recovered from a red clover field during 1995. *Bathyplectes anurus* was the predominant larval parasite of the alfalfa weevil during 1995. The first adult potato leafhopper caught by sweeping and sticky

traps occurred on April 25 and May 3, respectively. All instars of potato leafhopper nymphs moved up the plant as it matured. Tests to evaluate PLEX, an expert system for potato, were significantly taller (LSD P=0.05) in the insecticide treated plots with no significant difference in yield.

Spiders and pest insects were sampled on 23 organic vegetable farms in central Kentucky. When all the collected specimens have been identified, multivariate statistical techniques will be used to determine whether relationships exist between the composition of the spider fauna, farm characteristics, and densities of insect pests.

Ongoing research into the dynamics of the food web of the forest-floor leaf-litter community has revealed two major findings: 1) experimental enhancement of the resource base produces large increases in the densities of fungivorous insects and mites, which leads to increased densities of predacious arthropods (spiders, centipedes and beetles); and 2) several types of insect prey are low-quality food for a common wolf spider — a diet of these insects leads to lowered growth rate and increased mortality. Both findings improve our understanding of the roles played by generalist predators in complex food webs.

There are 350 nurseries and 687 nursery dealers licensed in the state. Of these approximately 300 were inspected last year. Trapping surveys were conducted for Oriental beetle, old world bollworm and the tomato looper. One Oriental beetle was recovered; other results were negative. A visual survey was done for pine shoot beetle with negative results. A total of 1,290 Federal Phytosanitary Certificates, 14 Federal Re-Export Certificates, 3 Processed Plant Certificates, and 30 State Phytosanitary Certificates were issued.

Pest Management

Behavioral studies of black cutworms on golf courses revealed the ways that cultural practices, including clipping removal, topdressing, and use of resistant grasses, can be used to manage this pest with reduced use of insecticides.

Several new commercial ear tags were tested for their efficacy against the ectoparasites of cattle. These included tags containing organophosphates, synthetic pyrethroids or combinations of the two. The majority of these resulted in greater than 90% horn fly control and 60% face fly control when applied about June 1, and lasted from 12 to 15 weeks. Resistance by hornflies to pyrethroid reduced the effectiveness of the pyrethroid tags. It was found that alternating the pyrethroid tags every 1-2 years with the organophosphate tags reduced the resistance and extended the use of some pyrethroid tags. However, face fly control with organophosphate tags is not as good as with the pyrethroid tags. Pour-on the back ready-to-use Permethrin formulation resulted in 4 weeks horn and face fly control and may be a method to avoid rapid horn fly resistance build-up. No resistance to face flies has been detected.

A model that incorporates simple population dynamics and biological controls into economic thresholds was parameterized with historical field data on aphids and alfalfa weevils. The model can be fitted to typical scouting data and

incorporated into traditional computer-based decision tools resulting in reduced pesticide applications while simultaneously reducing risk of crop losses to insect pests.

The first state-wide field study of a termite bait in Kentucky was initiated. The new method for controlling termites is being evaluated on 30 homes with persistent termite problems. The approach is predicted to afford superior results using a fraction of the pesticide load currently employed with conventional treatments.

A state-wide survey of people's attitudes toward pests, pesticides and pest control practices was completed. Results are being used to influence how pest control is performed in homes, schools, restaurants and public buildings throughout Kentucky and the nation.

Research Projects

Acoustic Communication in a Subsocial Invertebrate — *A.J. Moore*

Biological Control of Arthropod Pests (NCR 125) — *G.C. Brown*

Biological Control of Selected Arthropods and Weeds (S-267) — *K.V. Yeargan*

Biology and Management of Insects Attacking Urban Landscape Plants — *D.A. Potter*

Biology, Ecology, Economics and Population Management Strategies for Muscoid Flies Affecting Cattle (NC 154) — *F.W. Knapp*

Characterization of Biologically Active Secretory Products From Teratocytes of *Microplitis croceipes* an Endoparasite of the Tobacco Budworm — *D.L. Dahlman*

Collaborative Research: The Role of Fluctuating Asymmetry in Sexual Selection — *A.J. Moore*

Control Processes in a Terrestrial Food Web: Trophic Interactions of a Generalist Predator — *D.H. Wise*

Damage Thresholds Risk Assessment and Environmentally-Compatible Management Tactics for White Grub Pests of Turfgrass — *D.A. Potter*

Determinants of Resistance of Woody Landscape Plants to the Japanese Beetle — *D.A. Potter*

Development of Entomopathogens as Control Agents for Insect Pests (S-240) — *G.L. Nordin and G.C. Brown*

Development and Integration of Entomopathogens into Pest Management Systems — *G.C. Brown*

Development of Sustainable IPM Strategies for Soybean Arthropod Pests (S-255) — *K.V. Yeargan*

Ecology and Management of European Corn Borer and Other Stalk-Boring Lepidoptera — *G.C. Brown*

Effect of Groundcovers and Mulching Materials on Weed and Japanese Beetle Grub Infestation in Woody Ornamental Production Systems — *D.A. Potter*

Empirical Evaluation of Dynamic Systems Theory in Entomological Laboratory Systems — *G.C. Brown*

Epidemiology and Insecticidal Control of Barley Yellow Dwarf of Wheat — *D. Johnson*

Evaluation of the Southern Region IPM Program — *B.C. Pass*

The Genetics and Evolution of Behavioral Plasticity in Reproductive and Social Behavior of the Cockroach, *Nauphoeta cinerea* — *A.J. Moore*

The Genetics of Sexual Selection in *Nauphoeta cinerea* — *A.J. Moore and K.F. Haynes*

Gypsy Moth Survey — *B.C. Pass*

Impacts of Spiders in Food Webs of Crop and Forest-Floor Ecosystems — *D.H. Wise*

Indigenous Biological Control: Assessing Predator Impact on Pest Populations and Factors Affecting Predator Abundance — *K.V. Yeargan*

Insect Stress: Multitrophic Interactions Between Parasites, Pathogens and Allelochemicals — *D.L. Dahlman*

Interactions Between Non Insecticidal Control Techniques for Tobacco Aphid Management — *G.C. Brown, G.L. Nordin and D. Hildebrand*

Isolation of Biologically Active Secretory Products from an Endoparasite — *D.L. Dahlman*

Kentucky's Agricultural Pesticide Impact Assessment Program — *L.H. Townsend*

Mechanism and Regulation of Polydnavirus Replication — *B.A. Webb*

Molecular Characterization of the KDR type Mutation in the German Cockroach — *K. Dong*

Molecular Dissection of Polydnavirus Functional Activities — *D.A. Potter*

A New Approach to Understanding Food Webs of the Forest-Floor Arthropod Community — *D.H. Wise*

Nursery Inspections — *J.T. Collins and B.C. Pass*

Pathogenicity, Transmission and Introduction of a Cytoplasmic Polyhedrosis Virus to Fall Webworm, *Hyphantria cunea* (Drury) Populations in Kentucky — *G.L. Nordin*

Pesticide Impact Research and Data Analysis — *B.C. Pass*

Physiological and Ecological Relationships Affecting Biting Flies and Ticks on Pastured Cattle (S-242) — *F.W. Knapp*

Plant Pest Survey Detection Cooperative Agriculture Pest Survey — *P.M. Dillon*

Redundancy in Chemical Communication: Evolution of Sex Pheromone Blends — *K.F. Haynes and A.J. Moore*

Semiochemical Mediation of Reproductive Behaviors in Moths — *K.F. Haynes*

Sexual Selection and Plasticity in Social Behavior and Signals — *A.J. Moore and K.F. Haynes*

Simple Dynamic Models for Incorporating Biological Control Agents into IPM Decision Making — *G.C. Brown*

Surveillance of *Aedes albopictus* in Kentucky — *G.M. Beavers*

Spatial Dynamics of Leafhopper Pests and Their Management on Alfalfa (NC-193) — *B.C. Pass*

A Systematic Study of the Kentucky Conopidae (Diptera) — *P.H. Freytag*

Translation Factors from a Parasitic Wasp and Its Virus — *B.A. Webb*

Yield Potential and Long-Term Effects of No Tillage on Wheat Production — *D. Johnson*

FORESTRY

Kentucky's forest resources support timber, clean water, recreation, and diverse habitat which sustains many species. Increased pursuit of these resources creates conflicting social, economic, and political interests, which must be resolved for the betterment of the resource. The research objectives of the Department of Forestry are to create the base of knowledge which will enable the Commonwealth to achieve sustained utilization of its renewable forest products and support wise stewardship of Kentucky's forest lands.

Dynamic programming and simulation have been used to develop optimal stand management guidelines to assist the landowner in understanding the relationship between various management practices and economic returns. Responses to initial stand density, site quality, and intermediate harvest practices have been determined for shortleaf pine and yellow-poplar. Dynamic programming models have shown that, due to recent industry expansion and use of low-quality yellow-poplar in eastern Kentucky, landowners can increase the value of yellow-poplar stands 4-15% through improvement thinnings which harvest small and poor-quality trees. Shorter rotations may also make it possible for landowners to realize returns from yellow-poplar more than once in a lifetime.

Foresters and other natural resource managers are becoming ever more dependent upon computerized information systems as a means of determining optimal management decisions. A high-level, abstract, global information model for forest resources has been completed. This model can be used as a skeleton for planning and design of forest databases. Research into methods of database planning and design have resulted in a set of recommendations for organizations attempting such projects. Finally, research into design and implementation of temporal databases has resulted in a model of a temporal forest inventory data structure which will allow the database to model the temporal aspects of forest change.

Ten-year growth and yield results show that implementing a crop-tree release in small sawtimber white oak stands can increase the growth and tree grade of residual crop-trees relative to untreated stands. The increased growth and tree grade associated with released trees positively influences the value of residual trees and provides a reasonable treatment which forest owners can use to increase the value of their timber resource.

Controlled fire is being used in upland oak-pine forests to control incursion of white pine in the understory. Analysis of these situations has shown that controlled ground fires are an effective means of killing white pine trees under ten feet tall with minimal combustion of the organic material contained in the forest floor. Nutrient cation pools are little impacted, although a short-term increase in N availability has been detected. This research has shown that fire can be effectively used under controlled situations to manage future species composition of forest stands in Kentucky.

Comparison of growth and stem quality parameters of 19 year-old progeny from superior and control northern red oak mother trees indicates that rigorous

phenotypic selection of trees in natural stands may not be an efficient method of parent tree selection for northern red oak. This result has direct implications for tree improvement programs, allowing them to select phenotypically above-average trees from a stand rather than having to implement a costly and rigorous search for regionally superior phenotypes.

The impact of several silvicultural practices on fauna populations in the mixed mesophytic forest has been examined over a four-year study. Most reptile species exhibited positive response to timber harvest regardless of specific silvicultural prescription; however, most amphibian species were negatively influenced by timber harvest. Populations of several songbird species were increased by one or more silvicultural prescriptions, but populations of three species (acadian flycatchers, red-eyed vireos, and ovenbirds) declined. Continued analysis will focus on the impact of timber harvest upon critical species habitat characteristics.

Research on the propagation and establishment of Paulownia, a high value tree species, has provided a cost-effective method for establishment of plantations in Kentucky. Evaluation of a number of artificial regeneration systems has shown that float-tray seedlings coupled with one-foot tall tree shelters can be used to successfully establish Paulownia. Research on surface-mined sites has also shown that this system coupled with hardwood bark mulch or other soil amendment can increase initial seedling survival by over 100% compared to untreated seedlings.

Growth and survival of northern bobwhite quail was evaluated in response to diets containing endophyte-infected Kentucky 31 tall fescue seed. Birds fed tall fescue lost more weight and had lower nutritional balances than those fed known preferred wild foods. Infected tall fescue seed when fed as part of a complete diet did not affect quail reproduction. However, when fed as the only ingredient in the diet, tall fescue does not meet nutritional requirements for growth or maintenance.

Weed control to avoid competition for soil resources is an essential aspect of the management of Christmas tree plantations. Analysis of herbicide applications, sawdust mulch, and rubber tire mats showed that all treatments were effective in controlling weed growth, with no impact upon tree growth and form. However, significant differences in soil character were observed among treatments. Herbicide applications and rubber mats were associated with reduced soil microbial biomass, organic matter, total nitrogen, and cation availability. Sawdust mulch was associated with higher soil microbial biomass and soil water availability. These results suggest that weed control methods should be chosen for their impacts on soil characteristics and economic feasibility.

Kentucky's coal and electric power resources are constrained by the abundance of high sulfur coal which may not comply with clean air standards. The introduction of wood into the coal stream of a power generating facility has been shown to reduce SO^2 emissions. Wood waste biomass, including wood industry processing residue, timber removed in advance of surface mining, and logging slash left in the woods following timber harvest, has been analyzed to determine its availability for co-firing electricity generating plants. In most cases, sufficient

waste biomass is generated within 100 miles of TVA power plants to co-fire them with 5% wood waste. Acquisition and transportation costs are exceeded by the value of the fuel and mitigation of air pollutant production. However, the fragmented nature of wood waste supplies will require significant developments in wood accumulation and delivery systems in order for wood waste to be reliably built into power generation systems.

Research Projects

Development of Conservation Strategies for Forest Dwelling Wildlife Dependent upon Topographic Habitat Features — *M.J. Lacki*

Economic Assessment of Surface Mine Reclamation — *J.M. Ringe*

The Effects of Forest Management Practices on Forest Nutrient Status — *M.A. Arthur*

Effects of State Interval Size and Number of Predictors on Dynamic Programming Solutions in Forestry — *M.H. Pelkki*

Evaluation of Differential GPS Positioning Accuracies in Forestry Applications — *C.J. Liu*

Indicators of Ecosystem "Quality" in the Mixed Mesophytic Forest — *P.J. Kalisz*

Intraspecific Phylogeography of Plant Mitochondrial DNA — *D.B. Wagner*

HORTICULTURE AND LANDSCAPE ARCHITECTURE

Integrated Crop Management

The Controlled Water Table irrigation system (CWT) was used for pot chrysanthemum and hydroponic lettuce production. Quality chrysanthemums were produced in 15 cm pots with the water table 5 cm below the bench surface and the trough placed at the end of a 3 m bench. Lettuce head size was related to the distance from the water table maintained 0 cm below the bench; solution analysis indicates that nutrient concentration also is affected by distance from water table.

Long-term field research has resulted in expanded labels for certain herbicides to include minor use crops such as woody and herbaceous landscape plants. Research results also supported successful petition for Special Local Needs, 24C, labels for Dual® herbicide for bell pepper and cabbage transplants and Curbit® and Command® herbicides for curcurbit production in Kentucky.

Four bell pepper cultivars were identified with resistance to bacterial leaf spot under epidemic conditions of the disease. Sixteen cultivars and breeding lines were evaluated at two locations in 1995 for horticultural characteristics and disease resistance in a joint effort with the Department of Plant Pathology. This disease has decimated Kentucky's pepper production acreage.

A new research/demonstration project uses scouting and makes insecticide treatments according to action thresholds in processing tomatoes. Reductions from 10 sprays to 2 were possible without any reduction in yield or quality. The Tomcast disease management system using a remote datalogger was also set up and demonstrated.

Crop Improvement

The first DNA and protein sequence for an important class of enzymes responsible for the post-translational modification of several proteins critical for normal growth and development in both plants and animals was discovered and patented. The molecular basis for the absence of trimethyllysyl residues in Ribulose-1,5-bisphosphate carboxylase/oxygenase (Rubisco) from some plant species was determined to be a consequence of 3' alternative mRNA splicing of Rubisco LSMT transcripts, which results in the inclusion of a 12 nucleotide (4 amino acid) insert which completely inactivates enzyme activity. These discoveries offer significant possibilities for controlling plant growth.

Growth of economically important pathogenic microorganisms such as *Botrytis* on strawberries was inhibited by naturally occurring volatile compounds. Many of the test compounds were metabolized by the fruit, at low temperatures, to form new volatile products with different chemical and biological properties. This knowledge provides a basis for selecting additional natural products, from

the hundreds of as-yet untested compounds, with both low phytotoxicity and potential for protecting plant-derived foods from fungal and bacterial infection.

Sorgoleone is a natural product of *Sorghum spp*. which exhibits phytochemical activity. Exposed plants exhibit marked chlorosis. The site of action of sorgoleone has been determined to be the QB binding site within photosystem II. Membrane binding studies with thylakoids isolated from resistant and susceptible cells show that sorgoleone is strongly competitive with other photosynthetic inhibitors such as atrazine. Some selectivity in crop and weed species has been shown at low concentrations, indicating potential for use in weed management systems.

Continuing studies on the diverse drought resistance traits of strawberry plants indicates: 1) membrane stability is one component of resistance as shown by electrolyte leakage from drought stressed leaf disks; 2) *in vitro* screening of seedlings on polyethylene glycol can discriminate among species; and 3) the root system of strawberry plants senses drought stress and signals the leaves, perhaps by the production and transport of ABA from root to leaf. These result in the closing of the stomates and a reduction in water loss via transpiration. This mechanism may help breeders modify drought stress in commercial cultivars.

Activity of the primary enzyme of sugar metabolism in apple fruit, sorbitol dehydrogenase (which converts sorbitol to fructose and is the enzyme most responsible for fruit quality), may be sensitive to sorbitol level. This suggests a greater source-sink interaction than has previously been observed in apple as well as other fruits. Also, enzyme activity was recovered from fruit at a much earlier age than previously reported.

Differences in compositions of trichome secretions among genetic lines of *Lycopersicon pennellii*, a wild species of tomato, were documented. Trichome secretions from *L. pennellii* are not highly repellent to spider mites. These secretions may deter colonization through tactile senses, but probably do not deter colonization via olfactory senses. N-Hydrocarbons having chain lengths from 8 to 22 carbon atoms were assayed for repellency to two-spotted spider mites (*Tetranychus urticae* Koch). The C16-C18 hydrocarbons were most repellent. Smaller and larger hydrocarbons were much less repellent. The EC_{50} for n-hexadecane, the C16 hydrocarbon was equal to that of the most repellent natural products isolated from trichome secretions in *L. Hirsutum.* The implications of the work are: 1) hydrocarbons can be repellent; 2) branching and double bonds are not required for repellency; 3) presence of oxygen in the molecule is not required for repellency; 4) size of the molecule is important; and 5) the degree of differentiation in repellency of trichome secretions among accessions of *L. hirsutum f. typicum* will be less than their chemical diversity.

An adventitious shoot regeneration system using zygotic and somatic embryos was developed for *Cercis canadensis,* eastern redbud. This is a significant step for recovering genetically transformed woody plants.

The activity of L-isoaspartyl methyltransferase was established in *Lycopersicon esculentum* 'New Yorker' tomato seeds. This enzyme may play a role in seed aging and germination. Priming with KNO_3 did not affect the L-

isoaspartyl methyltransferase activity in non-aged seeds but restored activity in aged seeds primed in KNO_3 to near the level of non-aged seeds. During germination, enzyme activity remained constant for 48 hr post-imbibition and then declined suggesting the enzyme was developmentally regulated and inactivated or degraded as the radicle emerged.

Horticulture faculty cooperate in a national project evaluating fruit rootstocks under various environmental conditions and production systems in an effort to find better adapted fruit rootstocks for Kentucky. Plum rootstocks recently developed in France on soils similar to Kentucky's heavy clay soils offer the potential for expanding the fruit industry in Kentucky to include this crop. Our 1994 semi-dwarf apple rootstock planting is the first trial in Kentucky to be trained to the French vertical axe system. It also includes a number of new stocks, along with some that have performed well in previous plantings at UK. The mortality of trees on M.26 (40% survival) differed significantly from trees on the other 5 rootstocks (98% survival). The chief advantage of a Dutch slender spindle system for apples is early production while reducing labor inputs. Early production allows growers to quickly establish orchards with newer, more profitable cultivars. Blueberry, grape, Asian pear, blackberry, raspberry, and peach variety performance information is also available.

Environmental Regulation of Plant Growth and Development

Extensive evaluations of the production technology for single stem roses were completed. A knowledge-based fuzzy inference system (FIS) was developed to manage the greenhouse environment for optimum energy utilization and optimum rose growth. This system utilized biological feedback, rose crop status, to balance the best rose production temperatures based on published models of rose growth and the calculated energy costs for those temperatures. The FIS was able to adapt the best rose growing conditions to two greenhouses that had different solar inputs and different energy use patterns to grow similar roses during these different greenhouse conditions. The FIS demonstrated that knowledge of greenhouse energy consumption can be a helpful input to the best management practices for greenhouse cut rose production.

Landscape Architecture

As a planning model for the utilization of drastically disturbed lands is developed, we are designing and incorporating into the system a data base of information for the decision making process. We are currently cooperating with a number of federal, state, and local agencies to integrate and consolidate data into useful information at various levels.

A wildlife management system was developed on approximately 31,000 acres including the Starfire Mine site and the University of Kentucky Robinson Forest. A large percentage of the land is being actively mined or has been reclaimed.

This is the first agreement in Kentucky involving the University of Kentucky, the Kentucky Department of Natural Resources and a private coal company, Cypress-Amax.

An extensive Geographic Information System data base utilizing geo-referenced coordinates being developed for the new College of Agriculture Animal Research Center will help determine land use and plan research facilities. This system will allow tracking of all events that may impact the land and its ability to support animal and crop production; it serves as a prototype with application to all agricultural land.

Research Projects

All American Selection Trial Garden for Annual Flowering Plants — *S. Bale*

Antimicrobial Properties of Naturally Occurring Volatile Compounds from Plants — *T.R. Kemp*

Blackberry and Raspberry Cultivar Evaluation — *G.R. Brown and D. Wolfe*

Composted Yard Trash as a Container Medium Component — *D.L. Ingram and B.R. Roach*

Control of Root Outgrowth by Copper Hydroxide in Capillary Mat Plug Production — *R.L. Geneve and J.W. Buxton*

Daylily Cultivar and Production System Evaluation — *W. Dunwell*

Densities and Secretions of Trichomes on *Lycopersicon* — *J.C. Snyder*

Developmental and Environmental Influences on Carbohydrate Partitioning in Fruit Crops — *D.D. Archbold*

Evaluation of Bacterial Leaf Spot-Resistant Pepper Cultivars and Breeding Lines in Epidemic and Disease-free Environments — *B. Rowell, R.T. Jones, and W. Nesmith*

Evaluation of Cut Flower Species for Adaptability to Improved Greenhouse Production Practices and Extended Postharvest Life — *R.G. Anderson*

Evaluation of Scab-Immune Apple Cultivars Using IPM and Organic Techniques — *J.G. Strang*

Fall Vegetable Greenhouse Production — *D. Spalding, R. Anderson, B. Rowell*

Fertilization Systems for Field-Grown Nursery Crops — *D.L. Ingram*

Field Performance of Herbaceous Perennial Plants — *W. Dunwell*

Herbicide Evaluations in Vegetable Crops and Woody and Herbaceous Ornamentals — *L.A. Weston and R.E. McNiel*

Integrated Crop Management Program for Apples — *J. Hartman, G.R. Brown, D. Wolfe, and R. Bessin*

Interaction Between Ethylene and Polyamines During Seed Germination and Early Seedling Growth — *R.L. Geneve*

Knowledge-Based Manufacturing System for Optimization of Greenhouse Rose Production — *R.G. Anderson and R.S. Gates*

The Landscape of Main Street: An Assessment of the Urban Landscapes of Kentucky's Main Street Towns — *N. Crankshaw*

Light, Temperature and CO_2 Effects on Carbohydrate Metabolism in Bedding Plant Seedlings — *J.W. Buxton*

Mechanism and Sinificance of Post-translational Modifications in the Large Subunit of Ribulose Bisphosphate Carboxylase/Oxygenase — *R.L. Houtz*

Nitrogen Cycling in Strawberry — *D. Archbold and C.T. MacKown*

Peach Tree Cultivar Evaluation for Hardiness — *J.G. Strang and D. Archbold*

The Physiological Bases for Alleopathic Interference of Sorghum spp. as Mediated by Sorgoleone — *L.A. Weston and J.S. Pyrek*

Planning Model for the Development of Mountaintop Removal-Valley Fill Mining Sites — *T.J. Nieman*

Plant Interactions in Minimum Tillage Vegetable Production Systems — *L.A. Weston*

Post-Translational Modifications in Ribulose Biosphosphate Carboxylase/Oxygenase — *R.L. Houtz*

Pot-in-Pot Tree Production Practices for Kentucky — *R.E. McNiel*

Rootstock and Interstem Effects on Pome and Stone Fruit Trees — *G.R. Brown*

Seedless Table Grape Cultivar and Training System Evaluation — *G.R. Brown and D. Wolfe*

Southeast Tree Fruit Cultivar Evaluation — *G.R. Brown, D. Wolfe, J.G. Strang, and R.T. Jones*

Supersweet Corn Cultivar Evaluations — *J.G. Strang, R.T. Jones, J. Snyder, D. Slone and D. Lowry*

Sustainable N Management: Intensive Crop Production and Improved Water Quality — *D.C. Ditsch, R.T. Jones, R.C. Pearce, and J.H. Grove*

Technical and Economical Efficiencies of Producing and Marketing Landscape Plants — *R.E. McNiel*

Thornless Blackberry Training System Evaluation — *G.R. Brown and D. Wolfe*

Use of Natural Volatile Compounds for Control of Microbial Spoilage and Quality of Strawberry During Modified Atmosphere Storage — *D. Archbold, T.R. Kemp, B. Langlois, and M. Barth*

Use of the Tomcast Model for Disease Management in Processing Tomatoes — *B. Rowell, R. Bessin, and W. Nesmith*

NUTRITION AND FOOD SCIENCE

(College of Human Environmental Sciences)

The Department of Nutrition and Food Science is supported by the Agricultural Experiment Station at the University of Kentucky through research support and salary of five faculty and one chairperson, with joint appointments and projects in the KAES. Their research focuses on nutrition in relation to eating disorders, cardiovascular disease, cancer, nutrient-drug interactions, postharvest physiology and aging.

Cardiovascular Disease

Kentuckians are experiencing a high incidence of nutrition-related health problems, such as atherosclerosis, which may be due to overconsumption of fat. Endothelial cell dysfunction is considered to be a critical event in the etiology of atherosclerosis. Thus, the preservation of endothelial structure and function is a prerequisite for normal control of vascular permeability properties, mediation of both inflammatory and immunologic responses and the general "communication" between blood-borne cells and abluminal tissues. Many of these properties can be influenced by proteoglycans present in vascular tissues.

Data suggest that linoleic acid can adversely alter proteoglycan metabolism, which may be related to an imbalance in eicosanoid synthesis patterns. These events could be sufficient to disrupt normal endothelial barrier function, initiate smooth muscle migration and proliferation, and result in other metabolic dysfunctions associated with the etiology of vascular diseases such as atherosclerosis.

Cancer

The main goal of our research is to determine the mechanisms by which peroxisome proliferators induce hepatic tumors in rodents. We have examined the effects of peroxisome proliferators on hepatic eicosanoid concentrations *in vivo* and *in vitro*. We found that the peroxisome proliferator ciprofibrate decreased the concentrations of prostaglandins E_2 and $F_2\alpha$ and thromboxane B_2 in the liver, whereas the peroxisome proliferator PFDA, which inhibits enzymes that metabolize these metabolites, had a lesser effect. Since eicosanoids function in signal transduction pathways related to cell proliferation as well as other cellular functions, their alteration by peroxisome proliferators is likely to have major cellular effects. In collaborative studies, we found that dietary vitamin A inhibited the cocarcinogenic effects of PCBs, and that the herbicide dicamba (Banvel) is a peroxisome proliferator in rats.

Manganese-superoxide dismutase (Mn-SOD) plays an important role in attenuating free radical-induced oxidative damage. It is possible that altered ex-

pression of Mn-SOD may alter the expression of other antioxidant enzymes and the status of non-enzymic antioxidant systems. To examine this possibility, the status of important antioxidant systems was assessed in the tissues of B6C3 mice, cloned to express human Mn-SOD in multiple organs, and their non-transgenic littermates. The results obtained suggest that altered expression of human Mn-SOD does not systematically alter redox status of the mice.

Alcohol

Acetaminophen (APAP) or APAP-containing analgesic drugs are commonly used analgesics and antipyretics. Tylenol, the most popular preparation of APAP in the U.S., can be obtained without prescription. Although APAP is a safe drug at therapeutic doses, long-term use of APAP or large doses of APAP can cause hepatic necrosis. The mechanism of APAP hepatotoxicity is not clear. The objective of this study was to study the effects of APAP on major antioxidant defense enzymes and to examine whether alteration of endogenous antioxidant defense capability and oxidative stress were associated with cytotoxicity. The findings suggest that a decline in the endogenous antioxidant defense capability was associated with cell injury and that oxidative stress may be involved in APAP-induced hepatocyte injury.

Eating Disorders

We have studied the hypothesis that "one fundamental component of normal and pathophysiological neuroregulation of food intake involves variation of histamine, histamine receptor concentrations and/or histaminergic activity in the central nervous system." Based on recent work in our laboratory, we have expanded our original hypothesis to include the observation that male and female histaminergic responses are significantly different, thus offering a possible insight into the preponderance of female anorexics.

Several preliminary conclusions can be drawn from our current work: the H_1 receptor is involved in physiological responses to imbalanced and/or restricted diets; female rats normally have higher H_1 receptors than male rats; diet composition affects receptor levels in a gender-specific manner; bioperiodicity is present in central H_1 receptor trafficking; parameters of periodicity are gender-specific and modified by diet.

Research Projects

Dietary Vitamin E/Fat Oxidative Damage — *C.K. Chow*

The Histaminergic System and Eating Disorders — *L.P. Mercer*

Lipid Mediated Endothelial Injury — *B. Hennig*

Mechanism of Hepatocarcinogenesis by Peroxisome Proliferators and Influence of Dietary Antioxidants — *H.P. Glauert*

Nutrient-Alcohol/Oxidative Drug Interaction — *L.H. Chen*

PLANT PATHOLOGY

Research efforts in plant pathology have two abiding goals. The first is to continue to improve understandings of the nature of disease in plants; how causal agents initiate disease and how plants naturally resist disease. The second, built upon information gleaned in the first endeavor, is to utilize scientific knowledge to advance disease control strategies that are efficacious and as environmentally benign as practical. Progress continues in both areas.

Plant-Parasite Interactions

Mutations that affect the ability of two potyviruses to cause disease have been identified. A single amino acid change in the coat protein of tobacco vein mottling virus (TVMV) or tobacco etch virus makes either virus incapable of systemically infecting plants. Two amino acid changes in the Vpg gene of TVMV allow that virus to break the resistance of a tobacco cultivar.

The ability of aphids to transmit nonpersistent viruses has long been known to be increased by fasting the aphids and decreased by the presence of oil films on leaf surfaces, but the reasons were not understood. Both effects were found to be correlated with the retention or not of virus particles in the food canal of the stylets; gross uptake of virus is not affected. Reverse transcription-polymerase chain reaction analysis allowed identification of the parts of the RNA genome of tobacco mosaic virus (TMV) particles from which the viral coat protein molecules are released during the first few minutes of the infection of plant cells. The process involves a bi-directional mechanism of disassembly of the rod-shaped virus particles.

Most of the genome of petunia vein clearing virus (PVCV) was cloned, providing evidence that PVCV's tentative classification as a caulimovirus is correct. Of particular interest, the PVCV genome was shown to occur as part of the genetic material of healthy petunia, where it is probably spliced into its host's chromosomal DNA to form a "retro element." Under stress conditions, this element may move from site to site as a mobile genetic element, or transposon. This is the first example known of a plant virus existing as an integral part of its host's genome.

Cloning and sequencing of the 5, 178 base pair double-stranded RNA genome of the *Helminthosporium victoriae* 190S totivirus was completed, representing the first molecular characterization of a totivirus infecting a filamentous plant pathogenic fungus.

A technique was developed for the isolation of a signal(s) for systemic induced resistance (SIR) in tobacco exposed to TMV or *Peronospora tabacina*, the blue mold fungus. The phosphorylation of both membrane-associated and cytoplasmic proteins is correlated with SIR in tobacco. A β-1,3-glucanase, which lysed fungal spores and germ tubes, was characterized from cucumber plants expressing SIR to *Colletotrichum lagenarium*.

Quantitative estimates of the antifungal hydrolases, chitinase and β-1,3-glucanase, were obtained from blight-susceptible American chestnut and blight-resistant Chinese chestnut. Although constitutive levels of these enzymes did not differ significantly between the bark of the two hosts, appreciably higher levels were induced by the wound hormone ethylene in Chinese as opposed to American chestnut.

A key step in alkaloid biosynthesis in *Claviceps purpurea*, the ergot fungus, is catalyzed by dimethylallyltryptophan (DMAT) synthase. Clones of the DMAT synthase gene cDNA were introduced into a yeast expression system. Transformed yeast with the cDNA in the correct orientation relative to a yeast promoter expressed the enzyme activity, whereas those with the cDNA in opposite orientation, or without the cDNA, expressed no significant activity.

Spores of arbuscular mycorrhizal fungi indigenous to soils in a central Kentucky cropping system were about 50% viable. The range was 35 to 60%, regardless of spore population density, time of year, or crop. In the absence of extreme treatment of soil, such as fumigation or steaming, about half of the spores present in surface soil may be considered viable.

Nine confirmed or likely mating populations (biological species) of *Epichloë* were identified, most being associated with individual grass tribes in either North America or Eurasia. Mating tests among stroma-forming and nonstroma-forming strains of the fungus from several fine fescue species indicated a distinct mating population of *Epichloë* from the fescue hosts.

The list of landscape trees reported as hosts for *Xylella fastidiosa*, the primary causal agent of bacterial leaf scorch disease, was expanded to include sugar maple and sweet gum. This disease, which has now progressed from the coastal states to the U.S. interior, is contributing dramatically to decline of mature trees in some urban Kentucky settings.

Fields coming out of the Conservation Reserve Program and intended for soybean production were sampled for the presence of the soybean cyst nematode (SCN). Data indicated that the extended absence of soybeans cannot be presumed to reflect absence of the SCN. The nematode evidently can multiply on appropriate weed hosts, and thus remain a potential pest for new soybean plantings.

Plant-Disease Management

The widespread occurrence of metalaxyl-resistant *P. tabacina* was responsible for a major 1995 epidemic of tobacco blue mold, with estimated losses in excess of $50 million. Moreover, preliminary evidence was established indicating that some fungal strains were metalaxyl-requiring, infecting only metalaxyl-treated plants. Two fungicides have been identified that have high potential to control the metalaxyl-resistant strains.

The minimal unit of a nucleotide sequence motif that is present in the 3'-noncoding region of the RNA of a variant of TVMV that can infect but does not produce a disease in inoculated plants has been identified. Plants infected with the variant virus are temporarily protected from disease when subsequently inoculated with the wild type virus.

Transgenic soybean lines expressing the bean pod mottle virus (BPMV) coat protein gene were produced and evaluated for virus resistance. This research represents the first instance of development of soybean transformed with viral genes conferring disease resistance.

A red clover germplasm with resistance to viruses and powdery mildew was developed and released.

Sclerotinia crown and stem rot can be a destructive disease of alfalfa seeded during the late summer, particularly in no-till seedings. The potential of an integrated management program to reduce disease impact was investigated. Parameters considered included varietal resistance, planting date, harvest at dormancy, mixtures with forage grasses and control of winter annual weeds.

A protocol for estimating potential yield lost as a result of gray leaf spot infection in corn was established. Gray leaf spot is apparently becoming an increasing problem as a result of enhanced inoculum survival in no-till acreage.

An on-going, multi-year project to study the effect of various cropping sequences on soybean cyst nematode (SCN) population densities and associated soybean yields provided some early data. Single seasons of a susceptible variety resulted in 1000-fold increases in SCN populations. After two growing seasons, there was no evidence of a race shift occurring in any rotation involving a resistant variety. Corn reduced SCN populations from planting to harvest in a single season by about one third, less than the more than 50% reduction seen with resistant soybean varieties. Resistant varieties generally resulted in the greatest yields.

Juniper cultivars were evaluated for their reactions to Kabatina tip blight disease. In addition, flowering dogwood cultivars were evaluated for their reactions to powdery mildew, and spot anthracnose. There were significant cultivar differences.

An electronic weather monitor was used in a commercial apple orchard to test the concept that accumulated leaf wetness could be used to establish a threshold for timing fungicide sprays for sooty blotch and flyspeck diseases. Preliminary results suggested that disease symptoms appear at 200 hours (sum of all leaf wetness time periods beginning 10 days after petal fall) and that fungicide sprays need to be applied at 175 hours. In spite of an extremely wet late spring, two fungicide applications were saved. With further experimentatioin, these results could be incorporated into integrated pest management (IPM) protocols for apple growers.

Research Projects

Altering Ergot Alkaloid Biosynthesis by the *Acremonium* Endophyte of Tall Fescue — *C.L. Schardl*

Assessment of *Phytophthora sojae* as a Soybean Pathogen in Kentucky — *D.E. Hershman*

Biological Improvement of Chestnut and Management of the Chestnut Blight Fungus — *L. Shain*

Characterization of Potyvirus Mutants Nonpathogenic to Tobacco — *T.P. Pirone*

Characterization of Viral Genes and Gene Products Which Mediate Aphid Transmission and Cell to Cell Movement — *T.P. Pirone*

Chemical Controls for Tobacco Diseases in Float/Greenhouse Systems — *W.C. Nesmith*

Consequences of the Ten-Year, Conservation Reserve Program on Disease Development in Corn, Soybean and Wheat — *D.E. Hershman*

Cultural Practices for Managing Spring Dead Spot of Bermudagrass — *P.Vincelli*

Defining and Mapping the Genes of Caulimoviruses — *R.J. Shepherd*

Disassembly and Early Gene Expression of RNA Plant Viruses — *J.G. Shaw*

Distribution of Bacterial Leaf Scorch in Kentucky — *J.R. Hartman*

Effect of Cropping Sequence on Soybean Cyst Nematode Reproductive Ability and Soybean Yield — *D.E. Hershman*

Effect of Reduced Tillage on Disease Development in Wheat — *D.E. Hershman*

Epidemiology and Insecticidal Control of Barley Yellow Dwarf Virus in Wheat — *D.E. Hershman*

Evaluation of Disease Management Strategies for Tobacco and Vegetables — *W.C. Nesmith*

Evaluation of Fungicides and Biocontrol Products for Control of Turfgrass Diseases — *P. Vincelli*

Evaluation of Landscape Austrian Pines for Pine Tip Blight Disease and Assessment of Management Strategies — *J.R. Hartman*

Expression of Latent Mechanisms as a Means for Plant Disease Control — *J. Ku*

Forage Legume Viruses: Identification and Genetic Resistance for Improved Productivity — *S.A. Ghabrial*

Genetic and Biochemical Analysis of the Hypersensitive Response in Plants — *S.Y. He*

Genetic and Biochemical Analysis of the Hypersensitive Response in Higher Plants — *S.Y. He*

Host-Pathogen Interactions between *Castanea* sp. and the Chestnut Blight Fungus — *L. Shain*

Identification of Disease Resistant Cultivars of Turfgrasses and Corn — *P. Vincelli*

Integrated Management Program for Sclerotinia Crown and Stem Rot of Alfalfa — *P.Vincelli*

Introduction of *Acremonium* Endophytes into Grasses for Crop Improvement — *M.R. Siegel*

Management of Rhizosphere Dynamics to Control Soilborne Pathogens and Promote Plant Productivity — *J.W. Hendrix*

Modulation of Virus Symptoms and Down Regulation of Gene Expression in Tobacco via Viral Satellite RNA — *S.A. Ghabrial*

National Dogwood Anthracnose Survey — *J.R. Hartman*

Natural and Modified Grass Endophytes as Agents for Biological Protection —*C.L. Schardl*

Pest Predictive Technology for Apple Disease Management — *J.R. Hartman*

Plant-Fungal Endophyte Interactions: Potential for Cultivar Improvement in Species of *Festuca* and *Lolium* — *M.R. Siegel*

Phylogenetics of *Epichloë* Species and Related Grass Mycosymbionts — *C.L. Schardl*

Potyvirus Replication and Pathogenicity —*J.G. Shaw*

Proteinaceous Inhibitors of *Cryphonectria parasitica* in Chestnut Bark — *L. Shain*

The Relationship between Boxwood and Mycorrhizal Fungi — *J.W. Hendrix*

Role of Coat Protein and Helper Component in Aphid Transmission of Potyviruses — *T.P. Pirone*

The Role of Specific Viral Genes and Gene Products in Potyviral Pathogenicity, Host Range and Aphid Transmission — *J.G. Shaw and T.P. Pirone*

Structure and Function of the Viral dsRNAs of the Plant Pathogenic Fungus *Helminthosporium victoriae* — *S.A. Ghabrial*

Transformation of Plant Pathogenic and Plant Mutualistic Fungi — *C.L. Schardl*

Transgenic Resistance to Bean Pod Mottle Virus and Soybean Mosaic Virus in Soybeans — *S.A. Ghabrial*

Urban Tree and Ornamental Plantings Disease Evaluations — *J.R. Hartman*

Viral Satellite RNAs as Riboregulators of Gene Expression in Tobacco — *S.A. Ghabrial*

Wheat Seed Treatment and Foliar Fungicide Screening — *D.E. Hershman*

REGULATORY SERVICES

The Division of Regulatory Services administers state laws pertaining to the manufacturing, processing, labeling, and marketing of commercial feed, fertilizer, seed, tobacco seedlings, and raw milk. Its purpose is to protect farmers and other consumers from poor quality, mislabeled, or misrepresented products and to protect agricultural businesses from unfair competition from those who might take short cuts in the quality of their products.

Feed, fertilizer, seed, and tobacco seedlings are monitored in the manufacturing or retail channels for reasonable and acceptable compliance with state laws through label review, product inspection, and sampling and analyzing of products. Raw milk is monitored during marketing to assure an accurate and equitable exchange between producers and processors and to ensure the integrity of milk from farm to processor.

Ten regulatory inspectors and one auditor travel throughout the state, collecting samples, inspecting facilities, and auditing records. Additionally, three full-time, temporary inspectors cover the state to inspect labels, records, and visual quality of tobacco seedlings in the marketplace.

The Division also offers seed testing, soil testing, and poultry litter and animal manure testing to growers and homeowners. Water and nutrient solution analyses for greenhouse production will be offered in 1996.

Auditing Program

H.S. Spencer

Audits of sales and fee payments were made on 346 of 702 milk, seed, feed, and fertilizer businesses in Kentucky to verify check-off and tonnage fees. Fees assessed to help pay the costs of inspecting, sampling, and analyzing commodities in accordance with Kentucky laws are: fertilizer, 50 cents per ton; feed, 35 cents per ton; seed, 4 to 24 cents per unit. During May, raw milk is assessed a check-off fee of 3 cents per 100 pounds.

Income from fees in 1995:

Feed	$630,607
Fertilizer	587,565
Milk	59,168
Soil testing	159,143
Seed tags, testing and tonnage	293,646
Tobacco seedlings	24,818
TOTAL	$1,754,947

These cash receivables were substantiated on 2,694 fertilizer tonnage reports, 3,108 feed tonnage reports, 804 seed reports, and 18 milk reports. These

reports were checked for accuracy and compared with field audits of the firms submitting them. An additional $4,600 was realized through auditing and correcting inaccurate reports.

Milk Regulatory Program

R.H. Hatton

The milk regulatory program administers the Kentucky Creamery License Law, which establishes regulations for ensuring that dairy farmers are accurately paid for the milk they produce and that the integrity of milk is maintained from the farm to the processor. In 1995 the program:

- Reviewed and issued licenses to 13 milk buyers, 55 testers, 446 sampler-weighers, and 7 raw milk transfer stations.
- Analyzed and administered action on 10,000 official samples and checked 3,000 producer pay records.
- Conducted 68 inspections at 17 milk laboratories.
- Analyzed 1,000 exchange samples from commercial laboratories.
- Trained and examined 72 sampler-weighers and 11 testers.
- Conducted 534 inspections of 246 sampler-weighers.

Feed Regulatory Program

C.E. Miller

The feed regulatory program provides consumer protection for the purchasers of commercial feed, maintains a marketplace environment that promotes fair and equitable competition for the feed industry, and helps ensure the safety and wholesomeness of animal products for human consumption. In 1995 the program:

- Administered actions on 4,381 official samples of commercial feed involving 24,282 official tests to monitor the distribution of about 3 million tons of commercial mixed feed and feed ingredients.
- Administered a cooperative program with FDA on six feed mills that mix restricted drugs in feed. An additional 73 state inspections were conducted on mills that mix non-MFA drugs in feed to ensure compliance with medicated feed regulations. Forty-three mills that mix no drugs were inspected to ensure compliance with labeling, manufacturing, and storage practices.
- Conducted 7,500 label reviews and maintained product registration for about 15,000 products from 875 companies.
- Cooperated with the Association of American Feed Control Officials in conducting the 30th Annual Feed Management Seminar at Shakertown, Kentucky. Thirty-eight professionals from 25 states, Canada, and the FDA attended.

Fertilizer Regulatory Program

D.L. Terry

The Kentucky Fertilizer Law ensures that fertilizers sold in Kentucky are clearly and accurately labeled so that consumers can make informed purchases of fertilizer and be assured of its quality. The law also protects the legitimate fertilizer industry from unfair competition. In 1995 the program:

- Administered actions on 3,804 official and 251 unofficial samples of fertilizer involving 11,333 tests of the 970,000 tons of fertilizer distributed in Kentucky.
- Reviewed labels and registered 3,728 products from 544 firms, including 241 who manufactured custom blends of fertilizers.

Inspection Program

F. Herald

The inspection program aims to achieve industry compliance with the consumer protection laws that the Division is charged with administering. This responsibility is carried out by inspectors strategically located throughout the state, each with an assigned area to cover. They inspect manufacturing plants, processing facilities, storage warehouses, and retail stores; collect official samples of feed, pet food, fertilizer, milk, and seed; review records; and offer advice and assistance to clientele in improving their operations to achieve compliance with the laws. In 1995:

- A team of nine inspectors performed 5,454 inspections of the processing, manufacturing, and marketing of feed, fertilizer, and seed. In addition, three temporary inspectors traveled throughout the state during March, April and May to implement the Tobacco Seedling Law, and one full-time milk inspector covered the state to administer the Creamery License Law.
- Inspectors collected the following official samples for laboratory verification of appropriate constituents and quality:

Feed	4,381
Fertilizer	3,804
Seed	2,887
Milk	10,000

Seed and Tobacco Seedlings Regulatory Program

D.T. Buckingham

The seed regulatory program assures Kentucky farmers of quality seed and tobacco seedlings of known varieties and promotes fair and equitable competition among seed dealers and tobacco seedling distributors. In 1995 the program:

- Collected and tested 2,887 official seed samples.
- Issued stop sale orders on 406 official seed samples and 194 violative seed lots at seed dealer locations.
- Conducted a cooperative program with USDA, AMS on trueness-to-variety testing and on interstate shipments of seed.
- Conducted 215 on-site inspections at tobacco seedling dealer and labeler locations.

Seed Testing Services

E.E. Fabrizius

The seed testing program provides the seed industry and seed growers of Kentucky with competent, reliable, and timely analyses of their seeds for labeling requirements and quality assurance. In 1995 the seed laboratory tested the following number of samples:

Official seed samples	2887
Regular seed samples (service)	4356
Certified seed samples (service)	389
Tobacco seed samples (service)	778
TOTAL	8411

In addition to routine testing for purity, germination, and noxious weed seed, the laboratory offers testing for seed vigor (accelerated aging and cold test), seed moisture, seed size (seed count) and germination with fungicide application. The laboratory also provides tests for the presence of the fungal endophyte present in tall fescue seed and live plant tillers to seedsmen and livestock owners in the state.

Soil Testing Service

V.W. Case (Lexington)
D.L. Kirkland (UKREC, Princeton)

Soil testing provides farmers, homeowners, greenhouse operators, surface mine specialists, and others with scientific information about the fertility status of their soils, and in partnership with the Cooperative Extension Service, pro-

vides them with lime and fertilizer recommendations based on soil tests. The program also offers non-routine, optional soil tests for UK researchers and analyses of poultry litter and animal wastes for farmers and farm advisors. Beginning in 1996, water and nutrient solution analyses for greenhouse production will be offered.

In 1995 the program analyzed the following number of soil samples:

Agriculture	32,650
Home lawn and garden	6,330
Strip-mine reclamation	322
Commercial horticulture	678
Greenhouse	63
Research	8,159
TOTAL	48,202

The Lexington lab also analyzed 87 soil samples for triazine residue.

ROBINSON SUBSTATION

Research and demonstration trials at Quicksand are primarily conducted by the departments of Agronomy, Horticulture and Plant Pathology. Horticulture research consisted of trials with fruit and vegetable cultivars for both commercial and home gardens. Agronomy Department research activities included forage management, no-till corn production, tobacco nitrogen management, and variety trials for sweet sorghum, kenaf and corn. Plant Pathology trials dealt primarily with evaluating cultivar resistance in tobacco, peppers and field corn.

Horticulture

An annual flower cultivar evaluation was conducted as part of a statewide effort to determine which cultivars would produce attractive bloom and foliage for Kentucky's commercial and home landscapes. Sixty-six annual flower cultivars were evaluated as part of this cooperative trial with Lexington and Princeton. This is the third year of annual testing at Quicksand and several cultivars have done very well every year. Recommended annuals include: Melampodium (Show Star), Petunia (Purple Wave), Helianthus (Valentine and Evening Sun), Hypoestes (Splash Pink), and *Cuphea hyssopifolia*.

Twenty-three supersweet (sh_2) sweet corn cultivars were evaluated for commercial yield and ear quality. With approximately 15,500 acres grown annually in Kentucky, sweet corn is one of our largest horticultural crops. Several promising new yellow (Festival, TopNotch, Maxim), white (Snowbird) and bi-color cultivars (Hudson) were identified.

The departments of Horticulture and Plant Pathology conducted a field evaluation of fourteen bell pepper cultivars with different levels of resistance to bacterial leaf spot (BLS). There were significant differences among the resistant bell pepper cultivars in yield, appearance and BLS disease ratings.

Marketable yields under severe disease pressure were highest for Boynton Bell, XR3 Lancelot, SummerSweet 870, and Summer Sweet 880. Among these Boynton Bell and Summer Sweet 870 showed the best fruit shape. Pepper cultivars with resistance to only one or two races of BLS were no better than the susceptible cultivars. That is only pepper cultivars with resistance to races 1, 2 and 3 of BLS were acceptable.

Market demand for fall decorations resulted in an ornamental corn cultivar trial. Kentucky growers need an attractive, highly marketable, large eared (8-12 in.) ornamental corn variety. Currently, Rainbow and Fiesta are recommended for commercial use. Future trials are planned to evaluate other large eared cultivars in hopes of finding some with brighter colors, tighter shucks, better tip fill, and resistance to lodging. Results from this trial and last year's trial have been used to help expand sales of Kentucky's fall ornamental crop acreage by providing a more diverse sales package.

A study involving fall cole crops as scavengers of residual fertilizer nitrogen was conducted to evaluate the use of fall cole crops (*i.e.*, cabbage and/or broccoli) to recover residual fertilizer N following high-value summer annual cash crops such as tobacco and sweet corn. No cabbage yield response to fertilizer N was measured in 1993 or 1995. A cabbage yield response to 50 lb N/A was measured in 1994. Residual N following sweet corn and tobacco was slightly lower in 1994 than 1993 or 1995 indicating that a yield response to fertilizer N could be expected when residual soil NO_3-N levels fell below 20 ppm.

Soil nitrate-N and plant total N uptake were also measured to determine the usefulness of cabbage (compared to winter rye and fallow) to recover residual N and minimize the potential for N loss to the environment. Fall cabbage was found to be as effective as rye in capturing nitrogen that would normally be lost due to leaching. Additional research in 1996 is planned using broccoli as the fall nitrogen scavenger.

Work on field diagnostic tools for estimating nitrogen needs for fresh market tomatoes is also ongoing. Hand held Cardy meters were found to be effective for rapidly measuring fresh petiole sap nitrate levels in fertigated fresh market tomatoes. The Cardy meter was also effective in determining soil nitrate-N levels prior to planting.

Results showed that there was no significant US #1 tomato yield increase due to nitrogen, when an initial soil mineral N test showed 65 lb N/acre available for plant growth. Prior tests have shown that many Kentucky soils contain this or higher levels of nitrogen prior to fertilization. Cardy meter readings throughout the tomato growing season showed that all four N treatments, including the 0 N treatment, were supplying the plants with sufficient or surplus nitrogen.

Work is now underway to determine the correlation between initial soil mineral nitrogen levels and tomato crop nitrogen requirements. The role that residual soil nitrogen plays in determining tomato N response will eventually enable growers to customize their fertilizer nitrogen applications to specific growing sites.

Agronomy

Forty sweet sorghum varieties were grown to evaluate their disease resistance to Maize Dwarf Mosaic Virus (MDM) and other leaf diseases. The MDM transferred from johnsongrass was very severe again this year. The most recently released varieties — Dale, Della, M81E and Theis — are still showing good resistance. Three new varieties from Nebraska were evaluated and two of the three were quite resistant to MDM. A few of the older varieties had some resistance but most of the varieties that are being grown today, such as Sugar Drip, Umbrella, Orange, Justice and Simon, were severely damaged by MDM and would not have produced good juice for cooking off.

Kenaf *(Hibiscus cannabinus* L.), a non-wood fiber producing plant, was evaluated for the effect of row width on yield. Late planting and a bad drought during the middle of the summer kept the kenaf from growing very tall. There was no effect of row width on yield. Kenaf must be planted earlier in May and possibly in 15 inch rows to obtain economical yields.

A study to test the availability of carryover soil N to no-till corn, recovered by winter wheat sown as a cover crop, was concluded. The increased N content of the killed wheat cover crop did not increase N uptake or grain yields of the following no-till corn crop.

Research to determine the importance of the endophytic fungus in tall fescue for survival in a stressful environment continues. This work was established in 1993 on a surface mine site in Breathitt County and on an undisturbed site at the UK Robinson Substation and UK Spindletop Research Farm. A second planting for this study was established in the fall of 1994. Eight tall fescue cultivars or experimental synthetics, with and without the endophyte, are being evaluated for plant stands, insect and disease incidence and dry matter accumulation. A companion study was initiated in 1993 at the same mine site to evaluate a wide range of tall fescue plant materials collected from around the world.

Tall fescue and orchardgrass variety trials established in 1994 at the UK Robinson Substation continue to assist forage producers in eastern Kentucky with the selection of forage species and varieties evaluated under more site-specific growing conditions. A red clover variety trial was also established in the spring at the Substation. This project is managed by the UK Forage Variety Testing Program.

A field study to evaluate alternatives to atrazine containing products for weed control in corn was conducted. Weed control options evaluated were six soil-applied herbicide combinations that contained atrazine and four treatments that did not contain atrazine consisting of soil-applied and postemergence herbicide applications. The four alternative treatments contained herbicide products that have been recently registered by the Environmental Protection Agency for use on corn.

The effectiveness of the treatments evaluated was dependent on the weed species present. In general, annual grass and broadleaf weed control was fair to good with most treatments. However, soil-applied treatments alone did not provide good johnsongrass or honeyvine milkweed control. Best control of these perennial weeds was obtained with the newer postemergence herbicide products. Acceptable weed control could be obtained with treatments that did not contain atrazine, but the treatment cost for these alternatives would be two or three times greater on a per acre basis than treatments containing atrazine.

The Robinson Substation serves as one of three primary sites of nitrogen trials aimed at the development of a soil and/or plant nitrogen test for burley tobacco. The goal of these studies is to enable producers to assess nitrogen availability in the field and make more precise decisions about fertilizer nitrogen application rates on burley tobacco.

Plant Pathology

Several fungicides, including labeled products, materials labeled under emergency conditions, and experimental chemicals, were evaluated for their control of tobacco blue mold in burley tobacco during a 1995 epidemic. Below is a sum-

mary of the data; the findings from this study are being used by many tobacco producing states to support applications for emergency labeling of blue mold controls. The following general conclusions were made based on the data collected:

- Both the metalaxyl-sensitive and metalaxyl-resistant strains of the blue mold fungus were present, with the sensitive population dominating except in metalaxyl treated plots. This was confirmed by laboratory testing of isolates collected on each rating date.
- Acrobat 50, used alone or mixed with Dithane DF, provided a very high level of control (greater than 98% control) all season.
- Aliette performed better in this test than in previous evaluations, especially late in the season after many applications had been made. The performance of Dithane DF was similar to that achieved in previous tests, reducing disease levels by 50 to 90% of those in the untreated control.
- Using Chlorox, a popular local approach, provided only marginal improvement in disease control. Adding Chlorox to Dithane DF did not markedly reduce the efficacy of Dithane.

Research Projects

Annual Flower Cultivar Evaluations — *S. Bale and R.T. Jones*

Bacterial Leaf Spot Resistant Bell Pepper Cultivar Evaluations — *B. Rowell, R.T. Jones and W.C. Nesmith*

Determining Fertilizer Nitrogen Needs for Fresh Market Tomatoes - *R.T. Jones and D.C. Ditsch*

Evaluating Disease Resistance of Sweet Sorghum Varieties — *M.J. Bitzer and M. Morrison*

Evaluating Row Width Effect on Kenaf — *M.J. Bitzer*

Evaluation of Labeled and Experimental Fungicides for Blue Mold Control in Burley Tobacco — *W.C. Nesmith and M. Morrison*

Evaluation of Soil and Crop Diagnostic Tools to Improve Nitrogen Management for Burley Tobacco — *R.C. Pearce and D.C. Ditsch*

Fall Cole Crops as Scavengers of Residual Fertilizer Nitrogen — *D.C. Ditsch, R.T. Jones and R.C. Pearce*

Ornamental Corn Cultivar Evaluations — *R.T. Jones and M. Witt*

Response of No-Till Corn to Carryover Soil N Recovered by a Winter Wheat Cover Crop — *K.L. Wells, D.C. Ditsch and W.O.Thom*

Southeast Region Asian Pear Cultivar Evaluation — *R.T. Jones, J. Strang and J. Brown*

1995 SuperSweet Sweet Corn Cultivar Evaluation — *R.T. Jones and J. Strang*

Tall Fescue Adaptability as Affected by Endophyte Fungus Infection — *T.D. Phillips, D.C. Ditsch, L.M. Lauriault, M. Collins and J.C.Henning*

Tall Fescue, Orchardgrass and Red Clover Variety Trials — *L.M. Lauriault, J.C. Henning and D.C. Ditsch*

Weed Control Options in No-Till Corn with and without Atrazine — *J.D. Green*

RURAL SOCIOLOGY

The Rural Sociology research program is designed to advance the development and understanding of social structure and social processes in the changing rural society. Through an integrated program of research, Extension programs, and instruction, the faculty focus on initiatives which are organized around two major areas: sociology of agriculture and community and human resource development. Within each major area, several substantive areas of specialized activity exist.

Community and Human Resource Development

Social and Economic Factors Affecting Family Well-Being. Rural society's prospects for growth and development ultimately rest with the capacities of people. Human resources refer to the skills, abilities, and understanding required for people to function effectively in families, the work place, organizations, and communities. Specific areas of study are rural health, youth, family dynamics and functioning, leadership development, aging, and the role of service agencies in human resource development.

Findings from a study of women's home-based work indicate that nearly all rural women currently operating a home-based business have also worked outside the home, and nearly half have simultaneously worked outside the home *and* operated a home-based business. The primary reasons for operating home-based businesses are: the flexibility in work time and location of work, the desire to be at home with children, and the independence and satisfaction from being their own boss. This suggests that home-based employment may not always be a "forced choice" due to lack of public job opportunities, but instead is one component of a livelihood strategy for rural families.

Faculty continue working with the Kentucky Kids Count Consortium to produce an annual data book highlighting various indicators of the demographic and socioeconomic status of Kentucky's children and families. Ninety-seven focus groups of families and service care providers have determined social and economic factors influencing family well-being which will be used to guide Kentucky's state plan for family preservation and family support services. Extension programs with youth at risk have been evaluated to explore school and family factors that influence educational achievement and the ability of communities to retain youth.

Labor Markets. Research began on: U.S. government goals in the Uruguay Round negotiations of the General Agreement on Trade and Tariffs and the degree to which these goals were affected; the extent to which changes in U.S. agricultural policy following the Uruguay Round will be responsive to domestic policy concerns or the Uruguay Round accords; the likely impact of compliance with the Uruguay Round agreement on farm structure and communities in the aggregate; and the likely impact of compliance with the Uruguay Round agreement on Kentucky agriculture, farm households, and rural communities.

Initial research findings are that, in the short term, domestic budget deficit problems, rather than Uruguay Round compliance provisions, will be the driving force in changes in U.S. agricultural commodity policy. In the longer term, dismantling of existing agricultural commodity policies to achieve Uruguay Round agreement compliance is likely to have quite variable impacts across commodities and regions and may seriously impact existing linkages between environmental and agricultural policies.

Community Resource and Rural Development. Communities are the settings in which people interact with the larger society to provide basic human services, employment, and solutions for local problems. Within the sphere of rural development policy, the local community is the context for initiation of economic and social development. Research findings have led to policy proposals based upon the concept that programs can gain local legitimacy by sharing policy authority with local citizens. Local rural development efforts would be led by local boards which involve a broad base of local citizens but with federal funding to facilitate implementation of local plans.

Sociology of Agriculture

Trends in Agriculture. As an example of research regarding changing agriculture, findings show that Kentucky's dairy industry is confronting both a changing market place and changing conditions of production. Research results indicate that among Kentucky dairy farmers, one-third feel their financial situation has stayed the same during the last five years, and 30% feel it has gotten worse. Looking toward the future, more than four in ten predict that their financial situation will improve, while one-quarter believe it will get worse. More than half believe that a change in or elimination of milk marketing orders and dairy support programs will have negative effects on their dairy operations. More than half also plan to increase milk production and the number of cows and practice intensive grazing in the next five years. In-depth interviews will be conducted with a sample of dairy farm families to explore details of their perceptions and responses to changes in the dairy industry.

Other research programs are examining the impacts of changes in the international trade system on the structure of agriculture and rural communities, impacts upon Kentucky rural communities from changes in the federal tobacco program and potential decreases in income from tobacco farming, and post-productionist agricultural sector adjustment strategies that emphasize the production of "social goods" such as environmental amenities and landscape preservation in lieu of traditional commodity production objectives.

Intergenerational Changes in Farm Family Perspectives of the Environment. Environmental and natural resource issues are critical components of rural development policy. Program focus is on natural resource utilization and economic development, impacts of natural resource production, and relationships among environment and quality of life. Findings have led to the development of a conceptual framework of how cultural groups transform the nonhuman envi-

ronment symbolically and thereby mesh the social, cultural, and nonhuman environments into structures of symbols and beliefs that are shared among members of the group.

Research Projects

Garrard County Child Care Program Evaluation — *P. Dyk*

Harlan Youth Employability Program Evaluation — *P. Dyk*

Household, Labor Markets, and Human Resource Development in Rural Kentucky — *L. Burmeister*

Intergenerational Changes in Farm Family Perspectives on the Environment — *T. Greider*

Kentucky Kids Count — *L. Garkovich and G. Hansen*

Land Policy Issues in East Asia — *L. Burmeister*

Ohio River Valley Development — *L. Swanson*

Organizational and Structural Changes in the Dairy Industry — *L. Garkovich*

Planning Grant for the Family Preservation and Support Services Act — *P. Dyk and L. Garkovich*

Rural Labor Markets in the Global Economy — *A. Tickamyer*

Rural Policy Mandates and Black Land Grant Research — *R. Harris*

Social and Economic Factors Affecting the Well-Being of Kentucky Rural Families — *P. Dyk*

The Transformation of Agriculture: Resources, Technologies, and Policies — *L. Burmeister*

Women and Persistent Rural Poverty — *R. Harris*

Women, Poverty, and Health in Rural America — *R. Harris*

VETERINARY SCIENCE

The Department of Veterinary Science plays a major role in support of the Commonwealth's animal industry by providing a comprehensive range of research, diagnostic and extension programs for the benefit of Kentucky's horse and livestock industries. All three primary divisions of the department, namely the Maxwell H. Gluck Equine Research Center, the Livestock Disease Diagnostic Center and the Equine Blood Typing and Research Laboratory, continue to gain national and international recognition for the quality of their respective research and service programs.

Maxwell H. Gluck Equine Research Center

Although infectious diseases remains the area of major research emphasis in the Gluck Center, considerable strides have also been made during this past year in establishing the Center as an international leader in the fields of equine immunogenetics, pharmacology and immunoparasitology research. All of these programs have successfully garnered significant extramural funding.

Biomechanics and Locomotion. In spite of a significant loss of faculty from the program during 1995, considerable collaborative research was accomplished with the Department of Animal Sciences on the applicability of electromyographic analysis for the measurement of electrical conduction in skeletal muscle in horses in different exercising states. Studies on the kinematics of head and neck motion in sound and lame horses during various gaits were completed.

Immunogenetics. In collaboration with the faculty in the Equine Blood Typing and Research Laboratory, genetic markers were developed for the creation of an equine gene map and for mapping to synteny groups using somatic cell hybrids. A very successful international workshop was hosted by the Gluck Center on the development of a gene map for the horse, and the immunogenetics program in the Gluck Center was selected to coordinate this initiative for the next five years. Research continues into defining the major histocompatibility genes involved with controlling the immune response in the horse.

Infectious Diseases. The re-emergence of old diseases and emergence of new ones internationally serves to underscore the continued significance of infectious diseases for the horse industry.

As in the last few years, research in **equine herpesvirus 1** has focused on better defining the correlates of protection in the horse to this important viral infection. Virus-specific cytotoxic T-lymphocyte precursors are being investigated for their role in protecting against abortion caused by the virus. This work has helped to improve our understanding of how more effective protection against this ubiquitous virus might be achieved in the horse.

Several significant accomplishments have emerged from the research program on **equine influenza**. Certainly, the most notable has been the finding that strains of equine-2 virus in eastern and western hemispheres have evolved inde-

pendently of one another with some evidence of cross-over. This has led directly to the international adoption of new recommendations for appropriate virus strains representative of each lineage to be included in updated equine influenza vaccines. In collaboration with the equine pharmacology program, the pharmacokinetics of the anti-influenza virus drug, amantadine, has been established for the horse.

Research on **equine infectious anemia virus** has expanded in the area of viral genetics. The genes coding for viral regulatory and structural proteins during viral replication in the horse are being investigated in an attempt to identify the genes related to pathogenicity in certain strains of the virus. Experimental studies with an attenuated strain of EIA virus derived by deletion of the DU gene would suggest that this deletion variant may stimulate immune effector mechanisms which may well aid in conferring protection against virus challenge. There are indications that a PCR-based assay may help in the diagnosis of this infection in horses where there are conflicting serologic test results.

A collaborative research program with the University of California-Davis has established the phylogenetic relationships among a diversity of geographically and temporally disparate strains of **equine arteritis virus**. Studies are continuing into confirming the reliability of the RT-PCR assay for the rapid detection and diagnosis of equine arteritis virus infection. Additional experimental studies are aimed at establishing the pathogenicity of semen isolates of the virus from carrier stallions of different breeds with special reference to their abortifacient potential.

The **rotavirus** vaccine field safety and efficacy trial continued on 9 farms in central Kentucky. The favorable results of this and the previous year's study provided the basis for the granting of a conditional USDA license to the vaccine manufacturers at the beginning of 1996. Ongoing studies into the infectious etiology of foal diarrhea provided evidence for the first time of the occurrence of group B rotavirus infection in horses.

Research on equine **streptococcal** diseases has provided further evidence of the significance of the M-like proteins of *Streptococcus equi* subsp. *equi* in virulence and immunity in the horse. Studies on the functional characterization of the immunogenic proteins of *Leptospiral kennewicki* continue to offer promise in terms of the future development of a vaccine against **leptspirosis** caused by this serovar in horses. Studies on the pathogenesis of equine recurrent uveitis associated with leptospira have indicated that leptospires use ocular immune privilege to survive in the eye and cause a release of sequestered eye antigens that triggers specific immune responses in affected horses.

Parasitology. The efficacy of the orally administered anthelmintic praziquantel against the cecal tapeworm,*Anoplocephala perfoliata*, was confirmed in naturally infected equids. Ongoing studies have revealed over 15 sp. of nematodes in wildlife species found on horse farms in central Kentucky.

In relation to research on equine protozoal myeloencephalitis, the opossum was shown to be the definitive host of *Sarcocystis neurona*, the causal parasite of this disease. An *S. neurona* PCR-specific assay was developed and used to screen

sporocysts from various wildlife species. Sequence comparison of the 18S single-stranded DNA of *S. falcatula* from birds with that of *S. neurona* revealed that the two organisms are virtually identical.

Pharmacology and Experimental Therapeutics. A short course for the Commission Veterinarian/Medical Director was successfully hosted. A total of six metabolites of therapeutic medications have so far been synthesized in support of the program on "No Effect Thresholds" (NETs) for therapeutic medications in racing horses. The pharmacokinetics of amantadine and rimantadine for anti-influenza virus therapy in horses was established.

Reproductive Physiology. Considerable progress has been achieved in furthering our knowledge of how the oviducts, uterus and embryo communicate biochemically with each other in the pregnant mare. Studies involving differential gene expression and molecular cloning of gene products of these tissues continue to improve our understanding of how pregnancy is established and maintained in horses.

Research on the neuroendocrinological control of seasonal breeding in mares has revealed that the environmental cues which normally lead to cessation of the breeding season, though recognized by all mares, may be translated incorrectly in a small proportion resulting in continuation of breeding activity. The possibility that a metabolic cue, energy availability, plays a pivotal role in this phenomenon is under investigation.

Livestock Disease Diagnostic Center

The comprehensive range of service and Extension programs offered by the Livestock Disease Diagnostic Center constitutes a major resource for the state's animal industry. The Diagnostic Center was granted provisional accreditation as a full service laboratory by the American Association of Veterinary Laboratory Diagnosticians for three years effective January 1, 1996. Notwithstanding the increased number of accessions presented for examination, 1995 saw greater research involvement by many of the faculty in the laboratory on a variety of disease problems. The toxicology section was host to a visiting Fulbright Scholar from Albania who carried out a number of studies on pyrrolizidine alkaloid toxicosis in livestock.

Equine Blood Typing and Research Laboratory

A record number of blood samples (27,531) were tested for a record number of breed registries (25) by the Equine Blood Typing and Research Laboratory. Collaboration in the development of a gene map of the horse has been, and will continue to be, an area of major research focus. Studies are in progress to detect genetic markers for traits of economic significance, such as *Epitheliogenesis imperfecta* in certain horse breeds and juvenile cataracts in the Boston Terrier breed, as are population genetic studies of the maintenance and significance of genetic variation in domestic and feral horse populations.

Research Projects

Amantadine/Rimantadine Prophylaxis of Equine Influenza — *T. Tobin*

Antigenic Relatedness of Geographic and Temporally Disparate Isolates of Equine Arteritis Virus as Compared by the Microneutralization Test — *W.H. McCollum*

Application of New Technology for the Diagnosis of Equine Infectious Anemia — *C.J. Issel*

Cell Culture Models for Analysis of Equine Influenza Viral (Host Discrimination) — *T.M. Chambers*

Characterization of Equine Seminal Plasma Proteins — *K.J. McDowell*

Chemotherapeutic Control and Prevalence of Natural Infections of Internal Parasites of Equids — *E.T. Lyons*

Control and Transmission of Internal Parasites of Ruminants — *E.T. Lyons*

Determining the Importance of Coronavirus in Respiratory Infections of Cattle — *M.L. Vickers*

Development of Available Techniques for Immunohistochemical Detection of Viruses in Fixed Tissue and Use of PCR Technology in the Diagnostic Laboratory — *M.L. Vickers*

Development of a Rapid Screening Test for EVA Antibodies — *M.L. Vickers*

Diagnostics for Equine Infectious Anemia — *C.J. Issel*

Effect of Conceptus Age on Transferrin Expression — *K.J. McDowell*

Effect of State of the Estrus Cycle and Pregnancy on Retinol Binding Protein in Equine Endometrium — *K.J. McDowell*

Equine Protozoal Myeloencephalitis: Development of an Antemortem Diagnostic Probe and Epizootiologic Analysis — *D.E. Granstrom*

Equine Protozoal Myeloencephalitis: Isolation and Characterization of the Etiological Agent — *D.E. Granstrom*

Equine Protozoal Myeloencephalitis: Prevention and Control — *D.E. Granstrom*

Equine Respiratory Tract Mucosal Antibody Production in Response to Influenza Infection or Vaccination — *T.M. Chambers*

Field and Efficacy Trial of an Equine Rotavirus Vaccine — *R.M. Dwyer*

A Field Safety and Efficacy Study of an Inactivated Rotavirus Vaccine — *D.G. Powell*

Functional Characterization of Immunogenic Proteins of *Leptospira kennewicki* — *J.F. Timoney*

Gene Map of the Horse — *E.F. Bailey*

Genetic and Mechanistic Analysis of Equine Mx Antiviral Gene — *E.F. Bailey, T.M. Chambers*

Genetic Basis of *Epitheliogenesis imperfecta* in American Saddlebred Horses — *E.G. Cothran*

Genetic Management of Feral Horse Populations on Public Lands — *E.G. Cothran*

Genetic Variation and Genetic Relationships of Populations of Domestic Horses — *E.G. Cothran*

Gonadotropin-Releasing Hormone in Mares: Development of Methods for Measurement and Factors Affecting Secretion during Anestrus — *B.P. Fitzgerald*

Hemagglutinin Antigen of Equine-2 Influenza Virus: Surveillance, and Molecular Characterization of Isolated Virus Strains — *T.M. Chambers*

Identification of the Equine Herpesvirus-1 Proteins and their Respective Subregions that Elicit Cytotoxic T-Lymphocyte Immune Responses in the Horse — *G.P. Allen*

Immune Enhancement of EIAV Replication and Disease — *C.J. Issel*

Immunologic Management of Lentivirus Infections: EIAV — *C.J. Issel*

Immunological Significance of Hypervariable Region of M-Like Protein of *Streptococcus zooepidemicus* — *J.F. Timoney*

In vivo Evaluation of Infectivity, Pathogenicity, and Immunogenicity of Different Novel Candidate Live Equine Influenza Virus Vaccines — *T.M. Chambers*

Inhibin Alpha Subunit: Equine cDNA Sequence and Presence in Equine Tissues — *K.J. McDowell*

Investigation of Equine Infectious Disease Outbreaks in Central Kentucky for Diagnostic Support and Disease Control Consultations — *R.M. Dwyer*

Lyme Disease Seroprevalence among Dogs in Central Kentucky — *R.M. Dwyer*

M-Like Proteins of *Streptococcus equi* Subspecies *equi* in Virulence and Immunity — *J.F. Timoney*

Mapping of the Horse Genome Using Horse-Mouse Somatic Cell Hybrids — *K.T. Graves*

Mapping the Gene for Combined Immunodeficiency in Horses — *E.F. Bailey*

Mechanism of Influenza-Induced Cytopathology in the Respiratory Tract of the Horse — *T.M. Chambers*

Medical Applications of Apoptosis Inhibitors — *C.J. Issel*

Melatonin and Seasonal Reproduction in Mares — *B.P. Fitzgerald*

Molecular Cloning and Expression of Equne Transferrin — *K.J. McDowell*

Musculoskeletal Injuries in Racing Horses — *T. Tobin*

Pathogenesis of Equine Recurrent Uveitis — *J.F. Timoney*

Pathogenesis of Natural Infection of Horses with *Sarcocystis neurona* — *D.E. Granstrom*

Pathogenic Determinants of EIAV — *C.J. Issel*

Population Genetics of Feral Horses — *E.G. Cothran*

Pyrrolizidine Alkaloid Intoxications in Livestock in Albania — *R.A. Smith*

Research in Equine Pharmacology — *T. Tobin*

Study of the Galactokinase Gene in Boston Terriers: Candidate Gene for Juvenile Cataracts — *K.T. Graves*

A Study of the Prevalence and Distribution of Leptospirosis in the Horse Population in Central Kentucky and of the Significance of *Leptospira* as a Cause of Abortion in Mares and a Study of Distribution to Determine Whether Certain Wildlife Species can Serve as Long-Term Reservoirs of the Organism on the Affected Farms — *K.B. Poonacha*

Thresholds and Clearance Times for Medications in Horses — *T. Tobin*

Thresholds and Clearance Times for Therapeutic Medications in Horses — *T. Tobin*

Publications*

Annual Report

One Hundred and Seventh Annual Report of the Kentucky Agricultural Experiment Station, College of Agriculture, University of Kentucky, for 1994. C. Oran Little, Director. June.

Books and Book Chapters

Agricultural Economics

Buzby, Jean C., Jerry R. Skees, and Richard C. Ready. "Using contingent valuation to value food safety: A case study of grapefruit and pesticide residues." IN: Julie A. Caswell, ed., *Valuing Food Safety and Nutrition*. Boulder, CO: Westview Press.

Freshwater, David. "The role of direct aid." IN: *OECD Creating Employment for Rural Development: New Policy Approaches*. Paris, France: OECD.

Reed, Michael and Y. Ning. "Foreign investment strategies by U.S. multinational food firms." IN: *Industrial Organization and Trade in the Food Industries.* Boulder, CO: Westview Press.

Reed, Michael and J. Salvacruz. "Technological progress and international trade: The case of the less developed Asian countries." IN: *Agricultural Competitiveness: Market Forces and Policy Choice*. Dartmouth Press.

Agronomy

Andersen, R.A., C.T. McCracken, Jr., Hamilton-Kemp, T.R. and D.F. Hildebrand."Nitrosation of tobacco alkaloids during storage reduced by antimicrobial (*E*)-2-hexenal vapor." 40:463-472. IN: D. R. Baker, J.G. Fenyes and G.S. Basarab, eds., *Synthesis and Chemistry of Agrochemicals IV*. American Chemical Society, Washington, D.C.

Blevins, R.L. and W.C. Moldenhauer, eds. *Crop Residue Management to Reduce Erosion and Improve Soil Quality — Appalachia and Northeast Regions*. USDA-ARS Conservation Research Report No. 41.

Moldenhauer, W.C., W.D. Kemper, and R.L. Blevins. "Long-term effects of tillage and residue management." pp. 88-102.

Schumacher, T.E., M.J. Lindstrom, M.L. Blecha and R.L. Belvins."Management options for lands concluding their tenure in the Conservation Resource Program." pp. 80-87.

Wells, K.L. and D.B. Beegle. "Nutrient management." pp. 22-30.

Chen, C. and G.M. Cheniae. "High affinity binding of the Ca^{2+} essential for oxygen evolution is dependent on the existence of the Mn-cluster but is independent of the extrinsic proteins." 2:329-332. IN: *Photosynthesis: From Light to Biosphere. Proceedings, Xth International Congress on Photosynthesis.* Dordrecht, The Netherlands: Kluwer Publishers.

Collins, M., and J.K. Moore. "Postharvest processing of forages." pp. 147-161. IN: R. F. Barnes, D.A. Miller, and C.J. Nelson, eds., *Forages: The Science of Grassland Agriculture*, Vol. 2. Ames, IA: Iowa State University Press.

Collins, M. "Hay preservation effects on yield and quality." pp. 67-89. IN: *Post-harvest Physiology and Preservation of Forages.* Crop Science Society of America Special Publication No. 22.

Coyne, M.S. and R.L. Blevins. "Fecal bacteria in surface runoff from poultry-manured fields." pp. 77-87. IN: Kenneth

* All publication dates in this section are 1995, unless otherwise noted.

Steele, ed. *Animal Waste and the Land-Water Interface.* Boca Raton, FL: CRC/ Lewis Press.

Evangelou, V.P. "Pyrite oxidation and its control." IN: Marsha Baker, ed. *Acid Mine Drainage, Surface Chemistry, Molecular Oxidation Mechansisms, Microbial Role, Kinetics, Control, Ameliorates, Limitations, Microencapsulation.* Boca Raton, FL: CRC/ Lewis Press.

Hamilton-Kemp, T.R., C.T. McCracken, Jr., R.A. Andersen and D.F. Hildebrand. "Antimicrobial properties of natural volatile compounds." 40:463-472. IN: D.R. Baker, J.G. Fenyes and G.S. Basarab, eds., *Synthesis and Chemistry of Agrochemicals IV*. American Chemical Society, Washington, D.C.

Henning, J.C., L.M. Lauriault, L.D. Brown, G.D. Lacefield, P.C. Vincelli, and J.C. Parr. "1995 Kentucky Alfalfa Variety Test Report." 41:61-66. IN: J. L. Caddel, ed., *1995 CAIC Variety Tests.*

Hildebrand, D.F., H. Zhuang, T.R. Hamilton-Kemp, and R.A. Andersen. "C_6-aldehyde in plant leaves and preliminary information on the *in vivo* control of their formation." 15:313-335. IN: M. Pessarakli, ed., *Handbook of Crop Physiology*. NY: Marcel Dekker.

Wagner, G.J. "Assessing Cd partitioning in transgenic plants." pp. 1-13. IN: KMA Gartland and M.R. Davey, eds., *Agrobacterium Protocols: Methods in Mol. Biol. Series*. Humana Press Inc.

Woods, S.H., J.E. Woods, and G.B. Collins. "Somatic embryogenesis in bamboo." pp. 2:41-51. IN: S.K. Jain, P.K. Gupta, and R.J. Newton, eds., *Somatic Embryogenesis in Woody Plants*. The Netherlands: Kluwer Press.

Animal Sciences

Ely, Donald G. "Forages for sheep, goats and rabbits." Chapter 22, pp. 313-326. IN: Robert F. Baines, Darrell A. Miller, C. Jerry Nelson, eds. *Forages, Volume II, The Science of Grassland Agriculture* (Fifth Edition). Ames, IA: Iowa State University Press.

Harmon, R.J. "Mastitis and milk quality." pp. 25-39. IN: F. Harding, ed. *Milk Quality*. NY: Chapman and Hall.

Lawrence, L.M. and R.H. Raub. "Nutritional management of the horse." pp. 93-113. IN: C.N. Kobluk, ed. *The Horse: Diseases and Clinical Management.* Philadelphia: W.B. Saunders.

Biosystems and Agricultural Engineering

Murphy, William E. "Geothermal energy." Chapter 29. IN: *1995 ASHRAE Handbook-HVAC Applications.* American Society of Heating, Refrigerating, and Air Conditioning Engineers. Atlanta, GA.

Nokes, S.E. "Evapotranspiration." pp. 91-132. IN: A.D. Ward and W.J. Elliott, eds. *Environmental Hydrology*. Boca Raton, FL: CRC/ Lewis Press.

Entomology

Brandenburg, R.L. and M.G. Villani, eds. *Handbook of Turfgrass Insect Pests.* Entomological Society of America.

Potter, D.A. "Beneficial and innocuous invertebrates in turf." pp. 101-104.

Potter, D.A. "Masked chafers." pp. 70-72.

Horticulture and Landscape Architecture

Baker, D.R., J. Fenyes, and G.S. Basarab, eds. *Synthesis and Chemistry of Agrochemicals IV*. ACS Symposium Series 584. Washington, D.C.: American Chemical Society.

Andersen, R.A., C.T. McCracken, Jr., T.R. Hamilton-Kemp, and D.F. Hildbrand. "Nitrosation of tobacco alkaloids during storage reduced by antimocrobial (E)-2-hexenal vapor." pp. 463-472.

Hamilton-Kemp, T.R., C.T. McCracken, Jr., R.A. Andersen, and D.F. Hildebrand. "Antimicrobial properties of natural volatile compounds." pp. 449-462.

Hildebrand, D.H., H. Zhaung, R.A. Andersen, and T.R. Hamilton-Kemp. "C_6 aldehydes in plant leaves and preliminary information on in vivo control of their formation." pp. 313-335. IN: M. Pessarakli, ed. *Handbook of Plant and Crop Physiolgy*. NY: Marcel Dekker.

Smeda, R. and L.A. Weston. "Weed management for horticultural crops." pp. 553-601. IN: *Handbook of Weed Management*. NY: Marcel Dekker.

Plant Pathology

Murphy, F.A., C.M. Fauquet, D.H.L. Bishop, S.A. Ghabrial, G.P. Martelli, M.A. Mayo and M.D. Summers. *Virus Taxonomy: Sixth Report of The International Committee on Taxonomy of Viruses*. Wien, New York: Springer-Verlag.

Ghabrial, S.A. and K.W. Buck. "Rhizidiovirus."

Ghabrial, S.A., R.F. Bozarth, K.W. Buck, S.Yamashita, G.P. Martelli and R.G. Milne. "Partitiviridae." pp. 253-260.

Ghabrial, S.A., J.A. Bruenn, K.W. Buck, R.B. Wickner, J.L. Patterson, K.D. Stuart, A.L. Wang and C.C. Wang. "Totiviridae." pp. 245-252.

Atreya, C. D., P.L. Atreya, D.W. Thornbury and T.P. Pirone. "Domains in the coat protein and HC-pro protein involved in aphid transmission of a potyvirus". pp. 265-275. IN: D.D. Bills and S.-D. Kung, eds. *Biotechnology and Plant Protection - Viral Pathogenesis and Disease Resistance*. Singapore: World Scientific.

Hendrix, J.W., B.Z. Guo and Z.-Q. An. "Divergence of mycorrhizal fungal communities in crop production systems." pp.131-140. IN: H.P. Collins, G.P. Robertson, and M.J. Klug, eds. *The Significance and Regulation of Soil Biodiversity*. The Netherlands: Kluwer Academic Publishers.

Kuc, J. "Induced systemic resistance: An overview." pp. 169-175. IN: R. Hammerschmidt and J. Kuc, eds. *Induced Resistance to Disease in Plants.* The Netherlands: Kluwer Academic Publishers.

Kuc, J. "Systemic induced resistance as part of integrated plant disease control". pp. 129-136. IN: M. Maka, ed., *Environmental Biotic Factors in Integrated Plant Disease Control*. Pozna, Poland: The Polish Phytopathological Society.

Shain, L. "Stem defense against pathogens." pp. 383-406. IN: B.L. Gartner, ed. *Plant Stems: Physiology and Functional Morphology*. New York: Academic Press.

Ye, X.S., N. Strobel and J. Kuc. "Induced systemic resistance (ISR): Activation of natural defense mechanisms for plant disease control as part of Integrated Pest Management (IPM)." pp. 95-113. IN: R. Reuveni, ed. *Novel Approaches to Integrated Pest Management*. Boca Raton, FL: CRC/Lewis Publishers.

Rural Sociology

Garkovich, L., J. Bokemeier, and B. Foote. *Harvest of Hope: Family Farming/Farming Families.* Lexington: University Press of Kentucky.

Veterinary Science

Timoney, J.F. "Streptococcal infections." pp. 70-75. IN: A.J. Higgins and I.M. Wright, eds. *The Equine Manual.* London, Philadelphia: W.B. Saunders Co.

Tobin, T., G.D. Mundy, S.D. Stanley, R.A. Sams, D.L. Crone, eds. *Testing for Therapeutic Medications, Environmental and Dietary Substances in Racing Horses:* A workshop held at the Maxwell H. Gluck Equine Research Center, University of Kentucky, Lexington, Kentucky August 18-19, 1994. Lexington, KY: Maxwell H. Gluck Equine Research Center.

Patents

Agronomy

Evangelou, V.P. and H. Huang. Oxidation Proof Silicate Surface Coating on Iron Sulfides. U.S. Patent Number 5,494,703.

Biosystems and Agricultural Engineering

Duncan, G.A. and B. Tapp. Tobacco Harvester. U.S. Patent Number 5,400,577.

Horticulture

Complementary DNA Sequence (cDNA) for Ribulose-1, 5 Bisphosphate Carboxylase/Oxygenase (Rubisco) Large Subunit (LS) N-Methyltransferase (Rubisco LSMT). U.S. Patent Application Serial Number 08/341,000.

Subirrigation System and Related Method. U.S. Patent Application Serial Number 08/1442,217.

Progress Reports

372 1994 Kentucky Soybean Performance Test. J.M. Wood, Charles Tutt and Todd Pfeiffer.

373 Correlation and Calibration of the SMP Lime Requirement Test with Direct Titration of Soil Acidity. J.E. Dollarhide, K.L. Wells, and V.W. Case.

374 Some Chemical Characteristics of Twenty-Six Springs in Five Physiographic Regions of Kentucky. G.R. Haszler.

375 1994 Kentucky Vegetable Crop Research.

376 1995 Kentucky Small Grain Variety Trials. C.R. Tutt, C.S. Swanson, D.A. VanSanford and W. L. Pearce.

377 1995 Kentucky Hybrid Corn Performance Test. C.G. Poneleit, K.O. Evans and W. L. Pearce.

378 1995 Orchardgrass Report. J.C. Henning, L.M. Lauriault, T.D. Phillips, G.D. Lacefield, D.C. Ditsch, and E.L. Baker.

379 1995 Red Clover Report. L.M. Lauriault, J.C. Henning, N.L. Taylor, G.D. Lacefield, D.C. Ditsch and R.E. Mundell.

380 1995 Alfalfa Report. J.C. Henning, L.M. Lauriault, L.D. Brown, G.D. Lacefield, P.C. Vincelli and J.C. Parr.

381 1995 Tall Fescue Report. L.M. Lauriault, J.C. Henning, T.D. Phillips, G.D. Lacefield, D.C. Ditsch and E.L. Baker.

382 1995 Timothy Report. L.M. Lauriault, T.D. Phillips, J.C. Henning and E.L. Baker.

383 1995 Kentucky Soybean Performance Tests. J.M. Wood, C. Tutt, T. Pfeiffer.

Regulatory Bulletins

265 Commercial Feeds in Kentucky, 1994. C.E. Miller.

266 Seed Inspection Report, 1990-1994. D.T. Buckingham and E.E. Fabrizius.

267 Analysis of Official Fertilizer Samples, July 1994 - June 1995. D.L. Terry.

Special Reports

95-1 Nursery and Landscape Program: 1995 Research Report.

Scientific Papers/ Other Publications

Agricultural Communications

Weckman, R., D. Witham, G. Quinn. American agricultural communicators in eastern Europe: Observations, opportunities, challenges. pp. 92-94. Proceedings, 92nd Annual Meeting, Southern Association of Agricultural Scientists, Agricultural Communications Section, New Orleans, LA.

Witham, D., R. Weckman, G. Quinn. The divided agricultural communicator: Functioning as both a professional and faculty member. pp. 112-115. Proceedings, 92nd

Annual Meeting, Southern Association of Agricultural Scientists, Agricultural Communications Section, New Orleans, LA.

Agricultural Economics

Barnett, B.J. and J.R. Skees. Region and crop specific models of the demand for a federal crop insurance. Journal of Insurance Issues, Vol. XIX.

Buzby, Jean C., Richard Ready, and Jerry R. Skees. Contingent valuation in food policy analysis: A case study of pesticide residue risk reduction. Journal of Agricultural and Applied Economics, 27(2):613-625.

De La Barra, V., M.A. Marchant and A. Isinika. Stabilization policies and agricultural impacts in developing countries: The case of Bolivia. Journal of Agricultural and Applied Economics, 27(1):184-196.

Freshwater, D. Rural economic development policy and credit programs. Testimony before the U.S. Senate Committee on Agriculture, Nutriton and Forestry, Washington, D.C.

Freshwater, D., T. Baker and M. Boehlje. Farmer Mac: Making public policy for private benefit? Staff Paper 95-12. Department of Agricultural Economics, Purdue University, West Lafayette, IN.

Freshwater, D. and B. Reimer. Socio-economic policies as causal forces for the structure of agriculture. Canadian Journal of Agricultural Economics, 209-222.

Goetz, S.J. Economic, industrial changes driving demand for workforce training. pp. 1-5. IN: Foresight Publication by KY LTPRC, Frankfort, KY.

Goetz, Stephan J. Finance. pp. 42-48. IN: Proceedings, Conference on Education in Kentucky: Current Results, Future Visions. Sponsored by the University of Kentucky/ University of Louisville Joint Center for the Study of Educational Policy, Radisson Hotel, Lexington, KY, February 8.

Goetz, S.J. and D. L. Debertin. School finance reform in: A review of research on the Kentucky Education Reform Act (KERA). Prepared for the University of Kentucky/University of Louisville Joint Center for the Study of Education Policy.

Goetz, S.J. and S.R. Morgan. State-level locational determinants of biotechnology firms. Economic Development Quarterly, 9:174-84.

Goetz, S.J. and R.C. Ready. Modeling economic growth with unpredictable shocks: A state-level application for 1960-90. Journal of Agriculture and Applied Economics, 27:400-8.

Jones, W., D. Freshwater and R. Fiarchuk. Why the structure of agriculture still matters to national governments. Canadian Journal of Agricultural Economics, 232-240.

Karungu, P., M. Reed and D. Allen. Dynamic simulations on overshooting of flexible commodity prices with a modified arbitrage condition. Development Southern Africa, 12:153-66.

Loomis, J., B. Roach, F. Ward and R. Ready. Testing transferability of recreation demand models across regions: A study of corps of engineer reservoirs. Water Resources Research 31, 721-730.

Marchant, M., M. Mawampanga and R. Munirathinam. The North American Trade Agreement: International competitiveness for vegetables. International Advances in Economic Research, 1(2):110-118.

Marchant, M.A. and S.A. Neff. Interaction of United States and European Community dairy policies through the international market. Journal of Dairy Science, 78:1191-98.

Ning, Y. and M. Reed. Locational determinants of U.S. direct foreign investment in food and kindred products. Agribusiness: An International Journal, 11:77-85.

Pagoulatos, A. and M. Blackwell. Equipment replacement in agriculture: The case of the 100-HP tractor with overhauling option. Review of Agricultural Economics.

Ready, R.C. and D. Hu. Statistical approaches to the fat tail problem for dichotomous choice contingent valuation. Land Economics, 71:491-499.

Ready, R.C., J.C. Whitehead, and G.C. Blomquist. Contingent valuation when respondents are ambivalent. Journal of Environmental Economics and Management, 29:181-196.

Riemenschneider, C. and D. Freshwater. Is a revised mandate for the Farm Credit System needed? Agribusiness: An International Journal, 11:1.

(In addition, members of the department published 35 abstracts.)

Agronomy

Avdiushko, S., K.P.C. Croft, G.C. Brown, D.M. Jackson, T.R. Hamilton-Kemp and D.F. Hildebrand. Effect of volatile methyl jasmonate on the oxylipin pathway in tobacco, cucumber, and *Arabidopsis*. Plant Physiology, 109:1227-1230.

Back, K. and J. Chappell. Cloning and bacterial expression of sesquiterpene cyclase from *Hyoscyamus muticus* and its molecular comparison to related terpene cyclases. Journal of Biological Chemistry, 270:7375-7381.

Barrett, M. Metabolism of herbicides by cytochrome P450 in corn. Drug Metabolism and Drug Interactions, 12:299-316.

Brown, G.C., G.L. Prochaska, D.F. Hildebrand, G.L. Nordin and D.M. Jackson. Green leaf volatiles inhibit conidial germination of the entomopathogen *Pandora neoaphidis* (Entomophthorales: Entomophthoraceae). Environmental Entomology, 24:1637-1643.

Chappell, J. Biochemistry and molecular biology of isoprenoid biosynthesis in plants. Annual Review of Plant Physiology, 46:521-47.

Chappell, J. The biochemistry and molecular biology of soprenoid metabolism. Plant Physiology, 107:1-6.

Chen, C., J. Kazimir and G.M. Cheniae. Calcium modulates the photoassembly of photosystem II $(Mn)_4$-clusters by preventing ligation of nonfunctional high-valency states of manganese. Biochemistry, 34:13511-13526.

Chen, G.-X., D.J. Blubaugh, P.H. Homann, J.H. Golbeck and G.M. Cheniae. Superoxide contributes to the rapid inactivation of specific secondary donors of the photosystem II reaction center during photodamage of manganese-depleted photosystem II membranes. Biochemistry, 34:2317-2322.

Collins, M., L.D. Swetnam, G.M. Turner, J.N. Hancock, and S.A. Shearer. Storage method effects on dry matter and quality losses of tall fescue round bales. Journal of Production Agriculture, 8:507-514.

Coyne, M.S., A. Villalba, and R.L. Blevins. Nitrous oxide loss from poultry manure-amended soil after rain. Journal of Environmental Quality, 24:1091-1096.

Coyne, M.S., R.A. Gilfillen, R. Rhodes, and R.L. Blevins. Soil and fecal coliform trapping by grass filter strips. Journal of Soil and Water Conservation, 50:405-408.

Crossa, J., P.L. Cornelius, K. Sayre and I. Ortiz-Monasterio. Using the fusion method to cluster environments without cultivar rank change. Crop Science, 35:54-62.

Cui, M., H.R. Burton, L.P. Bush, T.G. Sutton and S.J. Crafts-Brandner. Effect of Maleic hydrazide application rate and method on composition of burley tobacco. Tobacco Science, 39:9-17.

Darrah, L.L., R.L. Lundquitst, D.R. West, C.G. Poneleit, B.E. Zehr, B.D. Barry, L.D. Maddux, P.R. Martin, K.E. Zeigler, S. Tragrsser, D. Stenberg, A.J. Bockholt, R.W. Elmore, L.W. Rooney, S. Mbuvi, R. Henry, and D. Benson. White food corn: 1995 performance test. ARS-USDA, Univ. of MO, Agric. Exp. Sta., Spec. Rep. 494.

Darrah, L.L., L.W. Rooney, A.J. Bockholt, C.G. Poneleit, B.D. Barry, D.R. West, B.E. Zehr, B.R. Hamaker, R.L. Lundquist, K.

Hudelson, K.E. Ziegler, and S. Tragresser. Yellow food corn: 1995 performance test. ARS-USDA, Univ. of MO, Agric. Exp. Sta., Spec. Rep. 495.

Das Gupta, J., Q. Li, A.B. Thomson, and A.G. Hunt. Characterization of a novel plant polyadenylate polymerase. Plant Science, 110:215-226.

Diehl, K.E., E.W. Stoller and M. Barrett. *In vivo* and *in vitro* inhibition of nicosulfuron metabolism by terbufos metabolites in maize. Pesticide Biochemistry and Physiology, 51:137-149.

Dougherty, C.T., F.W. Knapp, P.B. Burrus, D.C. Willis and P.L. Cornelius. Behavior of grazing cattle exposed to small populations of stable flies (*Stomoxys calcitrans* L.). Applied Animal Behaviour Science, 42:231-248.

Evangelou, V.P. Potential microencapsulation of pyrite by artificial inducement of $FePO_4$ coatings. Journal Environmental Quality, 24:535-542.

Evangelou, V.P. and Y.L. Zhang. A review: Pyrite oxidation mechanisms and acid mine drainage prevention. Critical Review in Environmental Science and Technology. CRC Press, 25:141-199.

Grabau, L.J., and J.G. Graveel. Reinventing the College of Agriculture: A symposium summary. Journal Natural Resources and Life Science Education, 24:190-196.

Grabau, L.J., and P. Wilson. Jumping on thin ice: Values argument writing assignment for a large enrollment plant science class. Journal Natural Resources and Life Sciences Education, 24:185-189.

Grayburn, W.S. and D.F. Hildebrand. Progeny analysis of tobacco that express a mammalian D9 desaturase. Journal American Oil Chemists' Society, 72:317-321.

Grove, J.H., C.S. Stoddard and W.O. Thom. Manure as a source of leached nitrate in tilled and untilled soil. Proceedings, Southern Conservation Tillage Conference for Sustainable Agriculture. pp 77-81.

Guo, Z. and G.J. Wagner. Biosynthesis of cembratrienols in cell-free extracts from trichomes of *Nicotiana tabacum*. Plant Science, 110:1-10.

Guo, Z. and G.J. Wagner. Biosynthesis of labdenediol and sclareol in cell-free extracts from trichomes of *Nicotiana glutinosa*. Planta, 197:627-632.

Hayati, R., D.B. Egli and S.J. Crafts-Brandner. Carbon and nitrogen supply during seed filling and leaf senescence in soybean. Crop Science, 35:1063-1069.

Howell, J.M., M.S. Coyne and P. Cornelius. Fecal bacteria in agricultural waters of the Bluegrass region of Kentucky. Journal of Environmental Quality, 24:241-249.

Hunter, D.E., II, J.P. Murphy and T.D. Phillips. Isozyme variation in *Avena sterilis* L. collected in Turkey. Crop Science, 35:1477-1482.

Jiang, Hongfei and D.B. Egli. Soybean seed number and crop growth rate during flowering. Agronomy Journal, 87:264-267.

Jones, D.S., H. Lin, M.V. Kane, and L.J. Grabau. Reduced imazaquin rates for broadleaf weed control in soybean. Agronomy Journal, 87:498-502.

Karathanasis, A.D., and Y.L. Thompson. Mineralogy of iron precipitates in a constructed acid mine drainage wetland. Soil Science Society America Journal, 59:1773-1781.

Kasu, T., G.C. Brown and D.F. Hildebrand. Formation of lipoxygenase products in *Phaseolus vulgaris* L. leaves as a response to twospotted spider mite (Acari: Tetranychidae) feeding and their effect on spider mite populations. Journal of the Kansas Entomological Society, 68:27-34.

Kennedy, B.S., M.T. Nielsen, and R.F. Severson. Biorationals from *Nicotiana* protect cucumbers against *Colletotrichum lagenarium* (Pass.) Ell. & Halst disease development. Journal Chemistry Ecology, 21:221-231.

Kroumova, A., Z. Xie. and G.J. Wagner. A pathway for synthesis of straight and branched, odd and even length, medium chain fatty acids in plants. Proceedings, National Academy of Science, 91:11437-11441.

Kroumova, A. and G.J. Wagner. Methods for separation of short, medium, and long chain, free fatty acids and for their decarboxylation. Analytical Biochemistry, 225:1-7.

Legg, Paul D. Registration of PY KY 171 and PY KY 160 tobacco germplasm lines with the pale-yellow trait. Crop Science, 35:601.

Legg, Paul D. Registration of IG KY 171 and IG KY 160 tobacco germplasm lines. Crop Science, 35:601.

Li, Q. and A.G. Hunt. A near upstream element in a plant polyadenylation signal consists of more than six bases. Plant Molecular Biology, 28:927-934.

Liu, W., D.F. Hildebrand and G.B. Collins. Auxin-regulated changes of fatty acid content and composition in soybean zygotic embryo cotyledons. Plant Science, 106:31-42.

Lumbanraja, J. and V.P. Evangelou. Adsorption-desorption of potassium and ammonium at low exchange fractional loads of three Kentucky subsoils. Soil Science, 157:269-277.

Ma, Y. Z., C.T. MacKown, and D.A. Van Sanford. Kernel mass and assimilate accumulation of wheat:cultivar responses to 50% spikelet removal at anthesis. Field Crops Research, 42:93-99.

Mauro, A.O., T.W. Pfeiffer and G.B. Collins. Inheritance of soybean susceptibility to *Agrobacterium tumefaciens* and its relationship to transformation. Crop Science, 35:1152-1156.

Mauro, A.O., J.C. Nobrega, T. Pfeiffer and G.B. Collins. Susceptibility of some Brazilian soybean genotypes to *Agrobacterium tumefaciens*. Revista Brasileira de Genetica, 18:417-420.

Miceli, F., S.J. Crafts-Brandner and D.B. Egli. Physical restriction of pod growth alters development of soybean plants. Crop Science, 35:1080-1085.

Mitchell. L.K., and A.D. Karathanasis. Biochemical treatment of metal-chloride enriched wastewater by simulated constructed wetlands. Environmental Geochemistry and Health, 17:5-12.

Nielsen, M.T. and J.C. Chappell. Biotechnology in tobacco improvement: Applications and current status in the industry. Recent Advances in Tobacco Science, 21:134-164.

Perfect, E. and B.D. Kay. Applications of fractals in soil and tillage research: a review. Soil Tillage Research, 36:1-20.

Perfect, E. and B.D. Kay. Brittle fracture of fractal cubic aggregates. Soil Science Society of America Journal, 59:969-974.

Perfect, E., B.D. Kay and A.P. da Silva. Influence of soil properties on the statistical characterization of dry aggregate strength. Soil Science Society of America Journal, 59:532-537.

Pfeiffer, T.W., L.J. Grabau, and J.H. Orf. Early soybean production system: Genotype X environment interaction. Crop Science, 35:108-112.

Polge, N.D. and M. Barrett. Characterization of cytochrome P450 mediated chlorimuron ethyl hydroxylation in maize microsomes. Pesticide Biochemistry and Physiology, 53:193-204.

Rasiah, V., B.D. Kay and E. Perfect. Linear and nonlinear estimates of fractal dimension for soil aggregate fragmentation. Soil Science Society of America Journal, 59:83-87.

Siegel, M.R., C.L. Schardl, and T.D. Phillips. Incidence and compatibility of non-clavicipitaceous fungal endophytes in *Festuca* and *Lolium* grass species. Mycologia, 87:196-202.

Sims, J.L., J.H. Grove, and W.S. Schlotzhauer. Soluble calcium fertilizer ef-

fects on early growth and nutrition of burley tobacco. Journal of Plant Nutrition, 18:911-921.

Taylor, N.L., S.A. Ghabrial, G.A. Pederson, and M.R. McLaughlin. Quantification of yield benefits from incorporation of virus resistant white clover germplasm into grass legume systems. Plant Disease, 79:1057-1061.

Taylor, N.L. Characterization of the United States germplasm collection of zigzag clover (*Trifolium medium* L.). Genetic Resources and Crop Evolution, 42:43-47.

Taylor, N.L. Registration of three genetic marker stocks for red clover: TP-RC, TP-LS, and PT-MC. Crop Science, 35:1241.

Taylor, N.L. and S.A. Ghabrial. Registration of 19-L38-1472, a powdery mildew and virus resistant red clover germplasm. Crop Science, 35:1721.

TeKrony, D.M. and J.L. Hunter. Effect of seed maturation and genotype on seed vigor in maize. Crop Science, 35:857-862.

Trawatha, S.W., D.M. TeKrony and D.F. Hildebrand. Soybean lipoxygenase mutants and seed longevity. Crop Science, 35:862-868.

Trawatha, S.E., D.M. TeKrony and D.F. Hildebrand. Relationship of soybean seed quality to lipoxygenase activity, fatty acid levels and C_6-aldehyde production during storage. Crop Science, 35:1415-1422.

Van Sanford, D.A., and Herry Utomo. Inheritance of tillering in a winter wheat population. Crop Science, 35:1566-1569.

Van Sanford, D.A., W.L. Pearce, C.S. Swanson, C.R. Tutt, L.J. Tomes, and D.E. Hershman. Registration of KY 83C-16-2 wheat germplasm. Crop Science, 35:1719.

Vincelli, P., L.M. Lauriault, and J.C. Henning. Yields of alfalfa varieties selected for *Aphanomyces* resistance in Kentucky. Agronomy Journal, 87:748-752.

Walton, L.R., H.R. Burton, L.D. Swetnam. Effect of mechanization on the physical appearance and chemical composition of burley tobacco. Recent Advances in Tobacco Science, 21:3-38.

Walton, L.R., H.R. Burton, L.D. Swetnam. Field curing burley tobacco from a mechanized harvesting system. Applied Engineering in Agriculture, 11:285-289.

Witt, W.W., J.R. Martin and C.H. Slack. Corn weed management in tall fescue sod. Proceedings, Southern Conservation Tillage Conference for Sustainable Agriculture. pp. 31-33.

Zhu, Q., J. Chappell, S. Hedrick, C.J. Lamb. An accurate *in vitro* transcription system using whole cell extracts from monocots and dicot cell cultures. Plant Journal, 7:1021-1030.

Zhuang, H., D.F. Hildebrand and M.M. Barth. Senescence of broccoli buds is related to changes in lipid peroxidation. Journal of Agricultural and Food Chemistry, 43:2585-2591.

(In addition, members of the department published 95 abstracts.)

Animal Sciences

Appeddu, L.A., D.G. Ely, D.K. Aaron, W.P. Deweese and E. Fink. Supplementing ewe diets with the calcium salts of palm oil fatty acids during lactation. Sheep and Goat Research Journal, 11(3):132-139.

Bauer, M.L., D.L. Harmon, K.R. McLeod and G.B. Huntington. Adaptation to small intestinal starch assimilation and glucose transport in ruminants. Journal of Animal Science, 73:1828-1838.

Bridges, T.C., L.W. Turner, G.L. Cromwell and J.L. Pierce. Modeling the effects of diet formulation on nitrogen and phosphorus excretion in swine waste. Applied Engineering in Agriculture, 11(5):731.

Coffey, R.D. and G.L. Cromwell. The impact of environment and antimicrobial agents on the growth response of early-weaned pigs to spray-dried porcine plasma. Journal of Animal Science, 73:2532-2539.

Cremin, J.D., Jr., K.R. McLeod, D.L. Harmon, A.L. Goetsch, L.D. Borquin and

G.C. Fahey, Jr. Portal and hepatic fluxes in sheep and concentrations in cattle ruminal fluid of 3-(4-hydroxyphenyl)propionic, benzoic, 3-phenylpropionic, and trans-cinnamic acids. Journal of Animal Science, 73:1766-1775.

Cromwell, G.L. Swine nutrition in the 21st century. p. 13. Proceedings, California Animal Nutrition Conference. Fresno, CA.

Cromwell, Gary L. Nutrient management from feed to field. p. 20. Proceedings, World Pork Expo Seminar. Des Moines, IA.

Cromwell, G.L., R.D. Coffey, H.J. Monegue and J.H. Randolph. Efficacy of low activity, microbial phytase in improving the bioavailability of phosphorus in corn-soybean meal diets for pigs. Journal of Animal Science, 73:449-456.

Cromwell, G.L., R.D. Coffey, G.R. Parker, H.J. Monegue and J. H. Randolph. Efficacy of a recombinant-derived phytase in improving the bioavailability of phosphorus in corn-soybean meal diets for pigs. Journal of Animal Science, 73:2000-2008.

Danielsen, K., L. Lawrence, P. Siciliano, D. Powell and K. Thompson. Effect of different diets on weight loss and plasma variables in endurance exercised horses. Equine Veterinary Journal Supplement, 18 (Exercise Physiology):372-377.

Harmon, R.J. and B.E. Langlois. Mastitis due to coagulase-negative *Staphylococcus* species. pp. 56-57. Proceedings, 34th Annual Meeting National Mastitis Council. Arlington, VA.

Harmon, R., T. Clark, S. Trammell, B. Smith, K. Akers, P. Torre, B. Langlois, R. Hemken and E. Decker. Copper status and mastitis in heifers. pp. 94-95. Book II (sec. 6), Proceedings, Third IDF International Mastitis Seminar, National Mastitis Reference Center, Kimron Veterinary Institute. Beit-Dagon, Israel.

Healy, H.P., P.D. Siciliano and L.M. Lawrence. Effect of concentrate form on blood and gastric fluid variables in ponies. Journal of Equine Veterinary Science, 15:423-428.

Krehbiel, C.R., R.A. Britton, D.L. Harmon, T.J. Wester and R.A. Stock. The effects of ruminal acidosis on volatile fatty acid absorption and plasma pancreatic enzyme activities in lambs. Journal of Animal Science, 73:3111-3121.

Kreikemeier, K.K. and D.L. Harmon. Abomasal glucose, corn starch and corn dextrin infusions: Small intestinal disappearance, net glucose absorption and a profile of infused carbohydrate escaping small intestinal digestion. British Journal of Nutrition, 73:763-772.

McLeod, K.R., D.L. Harmon, K.K. Schillo and G.E. Mitchell, Jr. Cysteamine-induced depletion of somatostatin in sheep: Time course of depletion and changes in plasma metabolites, insulin and growth hormone. Journal of Animal Science, 73:77-87.

McLeod, K.R., D.L. Harmon, K.K. Schillo, S.M. Hileman and G.E. Mitchell, Jr. Effects of cysteamine on pulsatile growth hormone release and plasma insulin concentrations in sheep. Comparative Biochemistry and Physiology, 112B:523-533.

Moody, W.G. and Y.L. Xiong. Improvements of sensory attributes of grass grain-fed beef through product formulation and restructuring technology. Meat Focus International, January.

Mooney, K.W. and G.L. Cromwell. Effects of dietary chromium picolinate supplementation on growth, carcass characteristics and accretion rates of carcass tissues in growing-finishing swine. Journal of Animal Science, 73:3351.

Raw, R.E., W.J. Silvia, T.E. Curry, Jr. Effects of progesterone and estradiol on prostaglandin endoperoxide synthase in ovine endometrial tissue. Animal Reproduction Science, 40:17-30.

Russell-Campbell, E. and C.L. Hicks. Effect of bulk starter incubation time on severity of culture agglutination. Journal Cultured Dairy Products, 29(4):2-8. 1994.

Shantha, N.C., L.N. Ram, J. O'Leary, C.L. Hicks and E.A. Decker. Effect of processing and storage on conjugated linoleic acid concentrations in dairy products. Journal of Food Science, 60:695-697.

Siciliano, P.D., L.M. Lawrence, K. Danielsen, D. Powell and K. Thompson. Effect of exercise conditioning and type of exercise on serum creatinine kinase and aspartate amino-transferase activity. Equine Veterinary Journal: Supplement 18 (Exercise Physiology), 248-251.

Strobel, H.J. Growth of the thermophilic bacterium *Clostridium thermocellum* in continuous culture. Current Microbiology, 31:210-214.

Strobel, H.J., F.C. Caldwell and K.A. Dawson. Carbohydrate transport by the anaerobic thermophile *Clostridium thermocellum* LQRI. Applied and Environmental Microbiology, 61:4012-4015.

Thrift, F.A. Teaching a senior-level beef cattle science course utilizing strategically placed, humorous "tid-bits" of information. NACTA Journal, 39:36-37.

Torre, P.M., R.J. Harmon, L.M. Sordillo, G.A. Boissonneault, R.W. Hemken, D.S. Trammell and T.W. Clark. Dietary copper insufficiency alters bovine blood leukocyte function. pp. 150-151. Proceedings, 34th Annual Meeting National Mastitis Council, Arlington, VA.

Torre, P.M., R.J. Harmon, L.M. Sordillo, G.A. Boissonneault, R.W. Hemken, D.S. Trammell and T.W. Clark. Modulation of bovine mononuclear cell proliferation and cytokine production by dietary copper insufficiency. Journal of Nutritional Immunology, 3(4):3-20.

Ustunol, Z. and C.L. Hicks. Use of an enzyme treated, whey based medium. Journal of Dairy Science, 77:1479-1486. 1994.

Walker, J.A. and D.L. Harmon. Influence of ruminal or abomasal starch hydrolysate infusion on pancreatic exocrine secretion and blood glucose and insulin concentration in steers. Journal of Animal Science, 73:3766-3774.

Xiong, Y.L. and E.A. Decker. Alternations in muscle protein functionality by oxidative and antioxidative processes. Journal of Muscle Foods, 6:139-160.

Xiong, Y.L., D.C. Noel and W.G. Moody. Textural and sensory evaluation of salted low-fat beef sausage with added water and gums. 41st Annual Proceedings, International Congress of Meat Science and Technology, 41 (II):439-440.

Xiong, Y.L. and W.G. Moody. Palatability of grass and grass/grain-fed and implanted beef as related to postmortem aging. Meat Focus International, January.

Xiong, Y.L., F. Nicastro and S.P. Blanchard. Functionality of myofibrillar proteins from cattle at different maturities. Proceedings, International Congress of Meat Science and Technology, 41 (II):572-573.

Xiong, Y.L., S. Srinivasan and G. Liu. Functionality of myofibrillar proteins isolated under antioxidative conditions. John E. Kinsella Memorial Symposium on Food Protein and Lipids, American Chemical Society.

(In addition, members of the department published 61 abstracts.)

Biosystems and Agricultural Engingeering

Bridges, T.C., L.W. Turner, G.L. Cromwell, and J.L. Pierce. Modeling the effects of diet formulation on nitrogen and phosphorus production in swine waste. Applied Engineering in Agriculture, 11(5):731-739.

Bridges, T.C., R.S. Gates, K.L. Chao, L.W. Turner and H. Minagawa. Techniques for development of swine performance response surfaces. Transactions, ASAE, 38(5):1505-1511.

Colliver, D.G. Energy requirements of ventilating air. IN: Implementing the Results of Ventilation Research. 1:1-13. Interna-

tional Energy Agency, Air Infiltration and Ventilation Centre, Coventry, Great Britain.

Colliver, D.G. Energy requirements for conditioning ventilating air. Technical Note 48. International Energy Agency, Air Infiltration and Ventilation Centre, Coventry, Great Britain.

Colliver, D.G., H. Zhang, R.S. Gates and K.T. Priddy. Design Data for the 1%, 2.5% and 5% Occurrences of the Dew-Point Temperature, with Mean Coincident Dry-Bulb Temperature. Final Report, Vols 1-3. ASHRAE 754-RP, American Society of Heating, Refrigerating and Air Conditioning Engineers, Atlanta, GA.

Colliver, D.G., H. Zhang, R.S. Gates, and K.T. Priddy. Determination of the 1, 2½, and 5% Occurrences of Extreme Dew-Point Temperatures and Mean Coincident Dry-Bulb Temperatures (RP-754). ASHRAE Transactions, 101(2):265-286.

Duncan, G.A. A post-frame barn for the cable-hoist tobacco housing system. Applied Engineering in Agriculture, ASAE, 11(6):881-885.

Felton, G.K. Temporal variation of soil hydraulic properties on MSW-amended mine soils. Transactions, ASAE, 38(3):775-782.

Felton, G.K. and N.M. Herrera. Design procedure for rockfill dams. Applied Engineering in Agriculture, 11(5):653-657.

Gates, R.S. and D.G. Overhults. Time Integrated Control Variables (TIV) for Summer Heat Stress Relief in Tunnel Ventilated Broiler Housing. Final Report to Research Concepts, Inc. (USDA-SBIR Phase I Grant). Lenexa, KS.

Gates, R.S., L.W. Turner, H.C. Chi and J.L. Usry. Automated weighing of group-housed, growing-finishing swine. Transactions, ASAE, 38(5):1479-1486.

Gates, R.S., H. Zhang, D.G. Colliver and D.G. Overhults. Regional variation in temperature humidity index for poultry housing. Transactions, ASAE, 38(1):197-205.

Horabik, J., M. Molenda, C.V. Schwab and I.J. Ross. Wall and bottom loads in grain bins of different diameters. Bulk Solids Handling, 15(2):215-218.

Horabik, J., M. Molenda and I.J. Ross. Comparison of load distribution in two similar grain bins. Transactions, ASAE, 38(6):1875-1879.

Johnsen, K.E., H.H. Liu, J.H. Dane, L.R. Ahuja and S.R. Workman. Simulating fluctuating water tables and tile drainage with the root zone water quality model and a new model WAFLOWM. Transactions, ASAE, 38(1):75-83.

Lacey, R.E. and Payne, F.A. Ultrasonic velocity in used corn oil as a measure of oil quality. Transactions, ASAE, 37(5):1583-1589, 1994.

Lewis, S.M., B.J. Barfield and D.E. Storm. A methodology for developing probability distributions for rill flow and density. Transactions, ASAE, 37(6):1879-1887, 1994.

Malone, R., R.C. Warner, V.P. Evangelou and J. Wong. Transport of benzene and trichloroethylene through a landfill soil liner mixed with coal slurry. Waste Management and Research, 12:417-428. 1994.

Molenda, M., J. Horabik and I.J. Ross. Dynamic load response in a model bin at the start of grain discharge. Transactions, ASAE, 38(6):1869-1873.

Moore, P.A., Jr., T.C. Daniel, D.R. Edwards and D.M. Miller. Effect of chemical amendments on ammonia volatilization from poultry litter. J. Environ. Qual., 24:293-300.

Mukerji, S., Murphy, W.E., and Tagavi, K. Transient Heat Conduction Around Buried Spirally Coiled Pipes: A Numerical Implementation. Final report to the Electric Power Research Institute on project TR-3024-20.

Murphy, W.E., B.D. Miller and G.K. Felton. Soil drying characteristics around a buried heated pipe. American Society of Mechanical Engineers, Solar Engineering, 1:77-85.

Payne, F.A. Automatic control of coagulum cutting in cheese manufacturing. Applied Engineering in Agriculture, 11(5):691-697.

Saputra, D., F.A. Payne, C.L. Hicks. Analysis of enzymatic hydrolysis of k-Casein in milk using diffuse reflectance of near infrared radiation. Transactions, ASAE, 37(6):1947-1955, 1994.

Schwab, C.V., I.J. Ross, G.M. White and D.G. Colliver. Wheat loads and vertical pressure distribution in a full-scale bin. Part 1 - Filling. Transactions, ASAE, 37(5):1613-1619, 1994.

Stepanek, P.J., A.P. Wilcox and S.A. Shearer. A proposed standard for hydraulic coupler capacity on agricultural tractors. Applied Engineering in Agriculture, 11(1):41-50.

Swetnam, L.D., L.R. Walton and J.H. Casada. Evaluation of a commercial harvesting system for burley tobacco. Tobacco Science, 39:100-104.

Thomasson, J.A., M.P. Mengue and S.A. Shearer. Light scattering on cotton fibers; relating optical properties to quality. Transactions, ASAE, 38(2):367-377.

Thomasson, J.A. and S.A. Shearer. Correlation of NIR data with cotton quality characteristics. Transactions, ASAE, 38(4):1005-1010.

Timmons, M.B., R.S. Gates, R.W. Bottcher, T.A. Carter, J.T. Brake and M.J. Wineland. TIV algorithms for poultry environment control. Journal of Agricultural Engineering Research, 62(4):235-237.

Turner, L.W. Case Study 10: Steers grazing low-endophyte tall fescue with grain supplement. pp. 47-50. In: O.J. Loewer and L.D. Parsch, eds. GRAZE Beef-Forage Simulation Model: Case Studies. Southern Cooperative Series Bulletin 381B, University of Arkansas. Fayetteville, AR.

Turner, L.W. Integrated systems planning and decision support for improved sustainability and environmental quality: A final report prepared for the Southern Region SARE/ACE Program. Final Progress Report for Grant No. AS94-15. Submitted to SARE/ACE Southern Region Program, University of Georgia.

Walton, L.R., H.R. Burton and L.D. Swetnam. Effect of mechanization on the physical appearance and chemical composition of burley tobacco. Recent Advances in Tobacco Science, Volume 21. Symposium Proceedings, 49th Tobacco Chemists' Research Conference, Lexington, KY.

Walton, L.R., H.R. Burton and L.D. Swetnam. Field curing burley tobacco from a mechanized harvesting system. Applied Engineering in Agriculture, 11(2):285-289.

Workman, S.R., A.D. Ward, N.R. Fausey and S.E. Nokes. Atrazine and alachlor dissipation rates from field experiments. Transactions, ASAE, 38(5):1421-1425.

Zhang, H., R.S. Gates and D.G. Colliver. Development and documentation of a psychrometric Turing machine. Department of Biosystems and Agricultural Engineering, University of Kentucky, Paper No. RIS95-10.

(In addition, members of the department published 4 abstracts.)

Entomology

Arne, C.N. and G.L. Nordin. Enhancement of indices of viral infection by simultaneously administering *Helicoverpa zea* and *Autographa californica* nuclear polyhedrosis viruses to larval *Helicoverpa zea* (Boddie). Journal of Invertebrate Pathology, 66:18-24.

Brodie, E.D. III and A.J. Moore. Experimental studies of coral snake mimicry: Do snakes mimic millipedes? Journal of Animal Behavior, 49:534-536.

Brodie, E.D., A.J. Moore, and F.J. Janzen. Visualizing and quantifying natural selection. Tree, 10(8):313-318.

Brown, G.C. and R. Hasibuan. Conidial discharge and transmission efficiency of *Neozygites floridana,* an entomopathogenic fungus infecting two-spotted spider mites

under laboratory conditions. Journal of Invertebrate Pathology, 65:10-16.

Brown, G.C., G.L. Prochaska, D.F. Hildebrand, G.L. Nordin, and D.M. Jackson. Green leaf inhibit conidial germination of the entomopathogen *Pandora neoaphidis* (Entomopthorales: Entomopthoraceae). Environmental Entomology, 24(6):1637-1643.

Burg, J.G., J.E. Cilek, and F.W. Knapp. Variability of glass and filter paper insecticide-treated surfaces used to determine horn fly (Diptera: Muscidae) insecticide resistance. Journal of Economic Entomology, 88(3):654-658.

Cheverud, J.M, and A.J. Moore. Quantitative genetics and the role of the environment provided by relatives in behavioral evolution. Quantitative Genetic Studies of Behavioral Evolution, 67-100. 1994.

Cilek, J.E., D.L. Dahlman, and F.W. Knapp. Possible mechanism of diazinon negative cross-resistance in pyrethroid-resistant horn flies (Diptera: Muscidae). Journal of Economic Entomology, 88(3):520-524.

Cilek, J.E. and F.W. Knapp. Residual activity of three slow-release temephos formulations against *Aedes aegypti* larvae. Journal of the American Mosquito Control Association, 11(3):358-359.

Clark, D.C., D.D. Beshear, and A.J. Moore. Role of familiarity in structuring male-male social interactions in the cockroach *Gromphadorhina portentosa* (Dictyoptera: Blaberidae). Annals of the Entomological Society of America, 88(4):554-561.

Clark, D.C. and A.J. Moore. Aspects of communication during male-male competition in the Madagascar hissing cockroach: Honest signaling of size. Heredity, 75:198-205.

Clark, D.C. and A.J. Moore. Social communication in the Madagascar hissing cockroach: Features of male courtship hisses and a comparison of courtship and antagonistic hisses. Behaviour, 132(5-6):401-417.

Clark, D.C. and A.J. Moore. Variation and repeatability of male agonistic hiss characteristices and their relationship to social rank in *Gromphadorhina portentosa*. Animal Behaviour, 50:719-729.

Crutchfield, B.A. and D.A. Potter. Damage relationships of Japanese beetle and southern masked chafer (Coleoptera: Scarabaeidae) grubs in cool-season turfgrasses. Journal of Economic Entomology, 88(4):1049-1056.

Crutchfield, B.A. and D.A. Potter. Feeding by Japanese beetle and southern masked chafer grubs on lawn weeds. Crop Science, 35(6):1681-1684.

Crutchfield, B.A., D.A. Potter, and A.J. Powell. Irrigation and nitrogen fertilization effects on white grub injury to Kentucky bluegrass and tall fescue turf. Crop Science, 35(4):1122-1126.

Crutchfield, B.A. and D.A. Potter. Tolerance of cool-season turfgrasses to feeding by Japanese beetle and southern masked chafer (*Coleoptera: Scarabaeidae*) grubs. Journal of Economic Entomology, 88(5):1380-1387.

Davidson, A.W. and D.A. Potter. Response of plant-feeding, predatory, and soil-inhabiting invertebrates to *Acremonium* endophyte and nitrogen fertilization in tall fescue turf. Journal of Economic Entomology, 88(2):367-379.

Dougherty, C.T., F.W. Knapp, P.B. Burrus, D.C. Willis, and P.L. Cornelius. Behavior of grazing cattle exposed to small populations of stable flies (*Stomoxys calcitrans* L.). Applied Animal Behaviour Science, 42:231-248.

Dugatkin, L.A., M.S. Alfieri, and A.J. Moore. Can dominance hierarchies be replicated? Form- re-form experiments using the cockroach (*Nauphoeta cinerea)*. Ethology, 97:94-102. 1994.

Dunham, M.L., R.R. Warner, and J.W. Lawson. The dynamics of territory acquisition: A model of two coexisting strategies.

Theoretical Population Biology, 47:347-364.

Fathpour, H. and D.L. Dahlman. Polydnavirus of *Microplitis croceipes* prolongs the larval period and changes hemolymph protein content of the host, *Heliothis virescens*. Archives of Insect Biochemistry and Physiology, 28:33-48.

Gindling, H.L., G.A.Rosenthsal, and D.L. Dahlman. Purification of L-arginine kinase from the tobacco budworm, *Heliothis virescens* [Noctuidae] and its function in L-canavanine detoxification. Insect Biochemistry and Molecular Biology, 25(8):933-938.

Haynes, K.F. and D.A. Potter. Sexual response of a male scarab beetle to larvae suggests a novel evolutionary origin for a pheremone. American Entomologist, 41(3):169-175.

Haynes, K.F. and D.A. Potter. Chemically mediated sexual attraction of male *Cyclocephala lurida* (*Coleoptera: Scarabaeidae*) and other scarabaeid: Beetles to immature stages. Environmental Entomology, 24(5):1302-1306.

Kasu, T., G.C. Brown, and D.F. Hildebrand. Formation of lipoxygenase products in *Phaseolus vulgaris* L. leaves as a response to two-spotted spider mite (Acari: Tetranychidae) feeding and their effect on spider mite populations. Journal of the Kansas Entomological Society, 68(1):27-34.

Loughrin, J.H., D.A. Potter, and T.R. Hamilton-Kemp. Volatile compounds induced by herbivory act as aggregation kairomones for the Japanese beetle *(Popillia japonica Newman)*. Journal of Chemical Ecology, 21(10):1457-1467.

Moore, A.J., N.L. Reagan, and K.F. Haynes. Conditional signaling strategies: Effects of ontogeny, social experience and social status on the pheromonal signal of male cockroaches. Animal Behavior, 50(1):191-202.

Pfannenstiel, R.S., R.E. Hunt, and K.V. Yeargan. Orientation of a hemipteran predator to vibrations produced by feeding caterpillars. Journal of Insect Behavior, 8(l):1-9.

Potter, M.F. and R.T. Bessin. People, pests and poisons: An attitudinal survey. Pest Control Technology, 23(6).

Redmond, C.T. and D.A. Potter. Lack of efficacy of *in vivo*- and putatively *in vitro*-produced *Bacillus popilliae* against field populations of Japanese beetle (Coleoptera: Scarabaeidae) grubs in Kentucky. Journal of Economic Entomology, 88(4):846-854.

Rosenthal, G.A., D.L. Dahlman, P.A. Crooke, S.N. Phuket, and L.S. Trinfonov. Insecticidal properties of some derivatives of L-canavanine. Journal of Agriculture Food and Chemistry, 43:2728-2734.

Spicer, P.G., D.A. Potter, and R.E. McNeil. Resistance of flowering crabapple cultivars to defoliation by the Japanese beetle (Coleoptera: Scarabaeidae). Journal of Economic Entomology, 88(4):979-985.

Susilo, F.X., G.L. Nordin, and G.C. Brown. Age-specific and inter-sexual susceptibility of two-spotted spider mite, *Tetranychus urticae* Koch, to *Neozygites floridana* Weiser and Muma. Journal of the Kansas Entomological Society, 67(3): 293-296.

Susilo, F.X., G.L. Nordin, G.C. Brown, and R. Hasibaun. Comparing epizootic systems using spectral analysis and autoregression: A case study of *Tetranychus-Neozygites* mycosis. Transactions of the Kentucky Academy of Science, 56(3-4):104-108.

Wagner, J.D. Short Communications: Egg sac inhibits filial cannibalism in the wolf spider, *Schizocosa ocreata.* Animal Behavior, 50:555-557.

Willis, D.C., F.W.Knapp, J.A. Boling, and J.G. Burg. Physiological and nutritional responses of steers infested with varying densities of *Amblyomma americanum* (Acari: Ixodidae). Journal of Economic Entomology, 88(6):1679-1683.

Yu, Z., G.L. Nordin, G.C. Brown, and D.M. Jackson. Studies on *Pandora neoaphidis* (Entomophthorales: Entomophthoraceae) infectious to the red morph of tobacco aphid

(Homoptera: Aphididae). Environmental Entomology, 24(4):962-966.

(In addition, members of the department published 44 abstracts.)

Forestry

Adam, M.D., M.J. Lacki, and L.G. Shoemaker. Influence of environmental conditions on flight activity of *Plecotus townsendii virginianus* (Chiroptera: Vespertilionidae). Brimleyana, 21:77-85. 1994.

Arthaud, G.J. and M.H. Pelkki. The impact of product types and prices on optimal stand management. pp. 114-121. Proceedings, Southern Forest Economics Workshop. New Orleans, LA.

Barnes, T.G. A survey comparison of pest control and nuisance wildlife control operators in Kentucky. Proceedings, Eastern Wildlife Damage Control Conference, 6:39-48.

Barnes, T.G. Survey of the nuisance wildlife control industry with notes on their attitudes and opinions. pp. 104-108. IN: R.E. Masters and J.G. Huggins, eds. Proceedings, Twelfth Great Plains Wildlife Damage Control Workshop. Nobel Foundation, Ardmore, OK.

Barnes, T.G., L.A. Madison, J.D. Sole, and M.J. Lacki. An assessment of habitat quality for northern bobwhite in tall fescue-dominated fields. Wildlife Society Bulletin, 23:231-237.

Burford, L.S., and M.J. Lacki. Habitat use by *Corynorhinus townsendii virginianus* in the Daniel Boone National Forest. American Midland Naturalist, 134:340-345.

Lacki, M.J., L.S. Burford and J.O. Whitaker. Food habits of gray bats in Kentucky. Journal of Mammalogy, 76:1256-1259.

Li, T., J. Dong, R.C. Hamelin, R.N. Patel, and D.B. Wagner. Spatial patterns of mitochondrial DNA variation within jack and lodgepole pine populations. Southern Forest Tree Improvement Conference Proceedings, 23:111-118.

Liu, C.J., and D. Brantigan. Using differential GPS for forest traverse survey. Canadian Journal of Forestry Research, 25:1795-1805.

Pelkki, M.H. Database design for electronic data recorders. The Compiler, 13:37-41.

Pelkki, M.H. Optimal timber management for shortleaf pine in the central United States. pp. 139-147. Proceedings, Southern Forest Economics Workshop. New Orleans, LA.

Pelkki, M.H., J.M. Ringe, and D.H. Graves. Revegetation of an abandoned coal washing site. International Journal of Surface Mining, Reclamation and Environment, 9:31-33.

Pelkki, M.H., G.C. Everest, and D.W. Rose. Using accelerated and extended approaches for data planning and design. The Compiler, 13:27-36.

Rose, D.W., J. Borges, and M.H. Pelkki. Forest management planning based on stand-level decisions. Northern Journal of Applied Forestry, 3:133-142.

Stringer, J.W. Fungicide treatment increases sprouting percent and sprout growth from *Paulownia tomentosa.* Tree Planters' Notes, 45:95-100.

Stringer, J.W. Sprouting and growth of *Pauwlonia tomentosa* root cuttings. Tree Planters' Notes, 45:101-103.

Stringer, J.W., D.B. Wagner, S.E. Schlarbaum, and D.B. Houston. An analysis of phenotypic selection in natural stands of northern red oak (*Quercus rubra* L.). Central Hardwood Forest Conference 10:226-237. USA Forest Service General Technical Report NE-148.

Tomlin, J.A., C.D. Nelson, R. Li, R.N. Patel, and D.B. Wagner. A preliminary survey of mitochondrial variation in loblolly, longleaf, slash, and shortleaf pines. Proceedings, Southern Forest Tree Improvement Conference, 23:272.

(In addition, members of the department published 13 abstracts.)

Horticulture and Landscape Architecture

Antonious, G.F. and J.C. Snyder. Pirimiphos-methyl residues and control of greenhouse whitefly (Homoptera: Aleurodidae) on seven vegetables. Journal of Entomological Science, 30:191-201.

Avdiushko, S., K.P.C. Craft, G.C. Brown, D.M. Jackson, T.R. Hamilton-Kemp, and D.F. Hildebrand. Effects of methyl jasmonate on the oxylipin pathway in tobacco, cucumber, and *Arabidopus*. Plant Physiology, 109:1227-1230.

Archbold, D.D. and MacKown, C.T. Seasonal and cropping effects on total and fertilizer nitrogen use in June-bearing and day neutral strawberries. Journal of the American Society for Horticultural Science, 120:403-408.

Barth, M.M., L.A. Weston and H. Zhuang. Influence of clomozone herbicide on postharvest quality of processing squash and pumpkin. Journal of Agricultural and Food Chemistry, 43:2389-2393.

Brown, J.C., R.E. McNiel, and L.A. Weston. Selected peremergence herbicides for weed control in four annual bedding plants. Proceedings, Southern Nurserymen's Association Research Conference, 40:85-88.

Dunwell, W.C. and D.E. Wolfe. Seed storage affects persimmon germination. Proceedings, Southern Nurserymen's Association Research Conference, 40:388-391.

Galletta, G.J., Maas, J.L., Enns, J.M., Draper, A.D., Fiola, J.A., Scheerens, J.C., Archbold, D.D., and Ballington, J.R., Jr. 'Delmarvel' strawberry. HortScience, 30:1099-1103.

Galletta, G.J., Maas, J.L. Enns, J.M., Scott, D.H., Draper, A.D., Fiola, J.A., Scheerens, J.C., and Archbold, D.D. 'Northeaster' strawberry. Advances in Strawberry Research, 14:73-78.

Geneve, R.L. Propagating cuttings, Part IV. How stock-plant age affects root formation of cuttings. American Nurseryman, 181(6):56-61.

Geneve, R.L., J.W. Buxton and M. Stafford. Copper hydroxide is an effective control of root outgrowth in plug-grown marigold seedlings subirrigated by capillary mats. pp. 203-209. Proceedings, Fourth National Symposium on Stand Establishment.

Ingram, D.L., M. Klahr, and E. Diamond. Long-term fertilization study with field-grown nursery crops. Proceedings, Southern Nurserymen's Association Research Conference, 40:155-156.

Klein, R.R., Houtz, R.L. Cloning and developmental expression of pea ribulose-1,5-bisphosphate carboxylase/oxygenase large subunit N-methyltransferase. Plant Molecular Biology, 27:249-261.

Loughrin, J.H., D.A. Potter, and T.R. Hamilton-Kemp. Volatile compounds induced by herbivory act as kairomones for the Japanese beetle (*Popillia japonica* Newman). Journal of Chemical Ecology, 21:1457-1467.

Masiunas, J. B., L.A. Weston, and S.C. Weller. The impact of rye cover crops on weed populations in a tomato cropping system. Weed Science, 43:318-323.

Mwaja, V.N., J.B. Masiunas and L.A. Weston. The effect of fertility on biomass, phytotoxicity, and allelochemical content of cereal rye. Journal of Chemical Ecology, 21:81-96.

Nieman, T.J. and Merkin, Z.R. Wildlife management, surface mining, and regional planning. Growth and Change, 26:405-424.

Scott, J.E., L.A. Weston and R.T. Jones. Clomazone for weed control in transplanted cole crops (*Brassica oleracea*). Weed Science, 43(1):121-128.

Setyowati, N., L.A. Weston, and R.E. McNiel. Evaluation of selected preemergence herbicides in field-grown landscape crops in Kentucky. Journal of Environmental Horticulture, 13:196-202.

Stegelin, F. and R. McNiel. Observations on marketing activities by Kentucky's Nursery industry. Kentucky Nursery News, 25(2):17-22.

Wang, P., Royer, M., and Houtz, R.L. Affinity purification of ribulose-1,5-bisphosphate carboxylase/oxygenase large subunit N-methyltransferase. Protein Expression and Purification, 6:528-536.

(In addition, members of the department published 21 abstracts.)

Nutrition and Food Science

(College of Human Environmental Sciences)

Berberian, I., L.C. Chen, F.R. Robinson, V.L. Tatum, A. Beach, R. Gupta, H.P. Glauert, C.K. Chow and L.W. Robertson. Effect of vitamin A on the hepatic promotion by 3,3',4,4'-tetrachlorobiphenyl and 2,2',4,4',5,5'-hexachlorobiphenyl in rats initiated with diethylnitrosamine. Carcinogenesis, 16:393-398.

Cader, A.A., D.A. Butterfield, B.A. Watkins, B.H. Chung and B. Hennig. Electron spin resonance studies of fatty acid-induced alterations in membrane fluidity in cultured endothelial cells. Int. J. Biochem. Cell Biol., 27:665-673.

Chen, L.H., S. Xi and D.A. Cohen. Liver antioxidant defenses in mice fed ethanol and the Ain-76 diet. Alcohol, 12:453-457.

Clair, J., R. Talwalkar, C.J. Mcclain and B. Hennig. Selective removal of zinc from cell culture media. J. Trace Elem. Exp. Med., 7:143-151.

Espandiari, P., V.A. Thomas, H.P. Glauert, M. O'Brien, D. Noonan, and L.W. Robertson. The herbicide Dicamba (2-methoxy-3,6-dichlorobenzoic acid) is a peroxisome proliferator in rats. Fund. Appl. Toxicology, 26:85-90.

Hennig, B., D.W. Lipke, G.A. Boissonneault and S. Ramasamy. Role of fatty acids and eicosanoids in modulating proteoglycan metabolism in endothelial cells. Prostaglandins Leukot. Essent. Fatty Acids, 53:315-324.

Hennig, B., M. Toborek, G.A. Boissonneault, N.C. Shantha, E.A. Decker and P.R. Oeltgen. Animal and plant fats selectively modulate oxidizability of rabbit LDL and LDL-mediated disruption of endothelial barrier function. Journal of Nutrition, 125:2045-2054.

Hong, J.T., M.W. Wilson and H.P. Glauert. Effect of phenobarbital and the peroxisome proliferator ciprofibrate on -glutamyltranspeptidase activity and leukotriene C4 concentrations in cultured rat hepatocytes. Journal of Biochemisty Toxicology, 10:239-243.

Mcclain, C.J., P. Morris and B. Hennig. Zinc and endothelial function. Nutrition, 11:117-120.

Ramasamy, S., D.W. Lipke, C.J. Mcclain and B. Hennig. Tumor necrosis factor reduces proteoglycan synthesis in cultured endothelial cells. J. Cell. Physiol., 162:119-126.

Ramasamy, S., E. Wang, B. Hennig and A.H. Merrill. Fumonisin B1 alters sphingolipid metabolism and disrupts the barrier function of endothelial cells in culture. Pharmacology, 133:343-348.

Toborek, M., S.W. Barger, M. Mattson, P. Espandiari, L.W. Robertson and B. Hennig. Exposure to polychlorinated biphenyls causes endothelial cell dysfunction. Journal of Biochem. Toxicology, 10:219-226.

Toborek, M., S.W. Barger, M. Mattson, C.J. Mcclain and B. Hennig. Role of glutathione redox cycle in TNF-A-mediated endothelial cell dysfunction. Atherosclerosis, 117:179-188.

Wilson, M.W., L. Travis, C.K. Chow, H.H. Tai, L.W. Robertson and H.P. Glauert. Altered hepatic eicosanoid concentrations in rats treated with the peroxisome proliferators ciprofibrate and perfluorodecanoic acid. Arch. Toxicology, 69:491-497.

Wurzel, H., C.C. Yeh, C. Gairola and C.K. Chow. Oxidative damage and antioxidant status in the lungs and bronchoalveolar lavage fluid of rats exposed to chronic cigarette smoke. Journal of Biochemistry Toxicology, 10:1-7.

(In addition, members of the department published 25 abstracts.)

Plant Pathology

Atreya, P.L., J.J.M. Lopez-Moya, M. Chu, C.D. Atreya and T.P. Pirone. Mutational analysis of the N-terminal amino acids involved in potyvirus transmission by aphids. Journal of General Virology, 76:265-270.

Broglio, E.P. Mutational analysis of cauliflower mosaic virus gene VI: changes in host range, symptoms, and discovery of transactivation-positive, noninfectious mutants. Molecular Plant-Microbe Interactions, 8:755-760.

Calvert, L.A., M.D. Ospina and R.J. Shepherd. Characterization of cassava vein mosaic virus: A distinct plant pararetrovirus. Journal of General Virology, 76:1271-1276.

Chu, M., M. Johnson, D. Thornbury, L. Black and T. Pirone. Nucleotide sequence of a strain of tobacco etch virus that does not cause Tabasco pepper wilt. Virus Genes, 10:283-288.

Dalisay, R.F. and J. Kuc. Persistence of induced resistance and enhanced peroxidase and chitinase activities in cucumber plants. Physiological and Molecular Plant Pathology, 47:315-327.

Dalisay, R.F. and J. Kuc. Persistence of reduced penetration by *Colletotrichum lagenarium* into cucumber leaves with induced systemic resistance and its relation to enhanced peroxidase and chitinase activities. Physiological and Molecular Plant Pathology 47:329-338.

Ducasse, D.A. and R.J. Shepherd. Systemic infection of solanaceous hosts by peanut chlorotic streak caulimovirus is temperature dependent and can be complemented by coinfection with figwort mosaic caulimovirus. Phytopathology, 85:286-291.

Gao, S. and L. Shain. Activity of polygalacturonase produced by *Cryphonectria parasitica* in chestnut bark and its inhibition by extracts from American and Chinese chestnut. Physiological and Molecular Plant Pathology, 46:199-213.

Gao, S. and L. Shain. Effects of osmotic potential on virulent and hypovirulent strains of the chestnut blight fungus. Canadian Journal of Forest Research, 25:1024-1029.

Gao, S.and L. Shain. Effects of water stress on chestnut blight. Canadian Journal of Forest Research, 25:1030-1035.

Hartman, J.R., B.C. Eshenaur and U.E. Jarlfors. Bacterial leaf scorch caused by *Xylella fastidiosa*: A Kentucky survey; a unique pathogen; and bur oak, a new host. Journal of Arboriculture, 21(2):77-82.

Hendrix, J.W. Mycorrhizal fungi as pathogens controlled by soil fumigation. pp. 35-1, 2. Proceedings, 1995 Annual International Research Conference on Methyl Bromide Alternatives and Emissions Reductions. San Diego: Methyl Bromide Alternatives Outreach.

Hendrix, J.W., B.Z. Guo and Z.-Q. An. Divergence of mycorrhizal fungi communities in crop production systems. Plant and Soil, 170:131-140.

Hershman, D.E. and P.R. Bachi. Effect of wheat residue and tillage on *Heterodera glycines* and yield of doublecrop soybean in Kentucky. Plant Disease, 79:631-633.

Hershman, D.E. and D.M. Perkins. Etiology of canola blackleg in Kentucky and seasonal discharge patterns of *Leptosphaeria maculans* ascospores from infested canola fields. Plant Disease, 79:1225-1229.

Hong, Y., K. Levay, J.F. Murphy, P. Klein, J.G. Shaw and A.G. Hunt. The tobacco vein mottling virus-encoded RNA-dependent RNA polymerase interacts with the coat protein and the genome-linked protein in yeast cells. Virology, 214:159-166.

Hu, C.-C. and S.A. Ghabrial. The conserved, hydrophilic and arginine-rich N-terminal domain of cucumovirus coat proteins contributes to their anomalous electrophoretic mobilities in SDS-polyacrylamide gels. Journal of Virological Methods, 55:367-379.

Huang, Q. and J. Kuc. Cutin, cutinase and esterase as related to the induced systemic resistance of cucumber to *Colletotrichum lagenarium*. Physiological and Molecular Plant Pathology, 46:215-226.

Ji, C. and J. Kuc. Purification and characterization of an acidic β-1,3-glucanase from cucumber and its relationship to systemic resistance induced by *Colletotrichum lagenarium* and tobacco mosaic virus. Molecular Plant-Microbe Interactions, 8:899-905.

Kuc, J. Phytoalexins, stress metabolic and disease resistance in plants. Annual Review of Phytopathology, 33:275-297.

Kuc, J. Systemic induced resistance. Aspects of Applied Biology, 42:235-242.

Li, D., K.-R. Chung, D.A. Smith and C.L. Schardl. The *Fusarium solani* gene encoding kievitone hydratase, a secreted enzyme that catalyzes detoxification of a bean phytoalexin. Molecular Plant-Microbe Interactions, 8:388-397.

Lusso, M. and J. Kuc. Evidence for transcription regulation of β-1,3-glucanase as it relates to induced systemic resistance of tobacco to blue mold. Molecular Plant-Microbe Interactions, 8:473-475.

Lusso, M. and J. Kuc. Increased activities of ribonuclease and protease after challenge in tobacco plants with induced systemic resistance. Physiological and Molecular Plant Pathology, 47:419-428.

Mucharromah and J. Kuc. The effect of sterols on the compatibility or incompatibility of potato tuber discs and foliage to *Phytophthora infestans* and *Helminthosporium carbonum* and the induction of resistance by arachidonic acid. Physiological and Molecular Plant Pathology, 47:1-12.

Mucharromah and J. Kuc. The effect of sterols on phytoalexin steroid glycoalkaloid and sterol accumulation in potato tuber discs inoculated with *Phytophthora infestans* or treated with arachidonic acid. Physiological and Molecular Plant Pathology, 47:13-27.

Mushegian, A.R. and R.J. Shepherd. Genetic elements of plant viruses as tools for genetic engineering. Microbiological Reviews, 59:548-578.

Naidu, R.A., C.-C. Hu, R.E. Pennington and S.A. Ghabrial. Differentiation of eastern and western strains of peanut stunt cucumovirus based on satellite RNA support and nucleotide sequence homology. Phytopathology, 85:502-507.

Powell, G., T.P. Pirone and J. Hardie. Potyvirus transmission associated with aphid stylet activities during acquisition from plants or an *in vitro* system. European Journal of Plant Pathology, 101:411-420.

Siegel, M.R., C.L. Schardl and T.D. Phillips. Incidence and compatibility of non-clavicipitaceous fungal endophytes in *Festuca* and *Lolium* grass species. Mycologia, 87:196-202.

Strobel, N.E. and J. Kuc. Chemical and biological inducers of systemic resistance to pathogens protect cucumber and tobacco plants from damage caused by paraquat and cupric chloride. Phytopathology, 85:1306-1310.

Taylor, N.L., S.A. Ghabrial, G.A. Pederson and M.R. McLaughlin. Quantification of yield benefits from incorporation of virus resistant white clover germplasm into the legume-grass system. Plant Disease, 79:1057-1061.

Taylor, N.L. and S.A. Ghabrial. Registration of 19-L38-1472, a powdery mildew and virus resistant red clover germplasm. Crop Science, 35:1721.

Tsai, H.-F., H. Wang, J.C. Gebler, C.D. Poulter and C.L. Schardl. The *Claviceps*

purpurea gene encoding dimethylallyltryptophan synthase, the committed step for ergot alkaloid biosynthesis. Biochemical and Biophysical Research Communications, 216:119-125.

Van Sanford, D.A., W.L. Pearce, C.S. Swanson, C.R. Tutt, L.J. Tomes and D.E. Hershman. Registration of KY 83C-16-2 wheat germplasm. Crop Science, 35:1719-1720.

Vincelli, P., L.M. Lauriault and J. Henning. Yields of alfalfa varieties selected for *Aphanomyces* resistance in Kentucky. Agronomy Journal, 87:748-752.

Vincelli, P., L.M. Lauriault and J. Henning. Effect of Ridomil 2E at seeding on first-year alfalfa yield, 1993-94. Fungicide and Nematicide Tests, 50:212.

Vincelli, P., J.C. Doney, Jr. and A.J. Powell. Effects of fungicides on overall turfgrass quality of creeping bentgrass, 1994. Fungicide and Nematicide Tests, 50:354.

Vincelli, P., J.C. Doney, Jr. and A.J. Powell. Evaluation of fungicides for control of anthracnose/brown patch complex, 1994. Fungicide and Nematicide Tests, 50:355.

Vincelli, P., J.C. Doney, Jr. and A.J. Powell. Evaluation of fungicides for control of brown patch, 1994. Fungicide and Nematicide Tests, 50:379.

Vincelli, P., J.C. Doney, Jr. and A.J. Powell. Evaluation of fungicides for control of dollar spot, 1994. Fungicide and Nematicide Tests, 50:353.

Vincelli, P., J.C. Doney, Jr. and A.J. Powell. Management of spring dead spot of bermudagrass, 1993-94. Biological and Cultural Tests for Control of Plant Diseases, 10:34.

Vincelli, P., J.C. Doney, Jr. and A.J. Powell. Reactions of bentgrasses to dollar spot and brown patch, 1994. Biological and Cultural Tests for Control of Plant Diseases, 10:35.

Vincelli, P., J.C. Doney, Jr. and A.J. Powell. Reactions of bentgrasses to drechslera leaf blight, 1994. Biological and Cultural Tests for Control of Plant Diseases, 10:36.

Vincelli, P. and J.C. Doney, Jr. Yield loss assessment for gray leaf spot using tilt fungicide, 1994. Fungicide and Nematicide Tests, 50:214.

Vincelli, P., L. Lauriault and J. Henning. Differences in crown rust susceptibility among forage-type Kentucky bluegrass varieties, 1994. Biological and Cultural Tests for Control of Plant Diseases, 10:38.

Vincelli, P. and A.J. Powell. Impact of mowing height and nitrogen fertility on brown patch in tall fescue, 1994. Biological and Cultural Tests for Control of Plant Diseases, 10:42.

Vincelli, P. and A.J. Powell. Reaction of Kentucky bluegrass varieties to necrotic ring spot, 1994. Biological and Cultural Tests for Control of Plant Diseases, 10:39.

Ye, X.S., S.A. Avdiushko and J. Kuc. Protein phosphorylation in tobacco plants with systemic resistance induced by tobacco mosaic virus. Physiological and Molecular Plant Pathology, 47:269-283.

(In addition, members of the department published 24 abstracts.)

Rural Sociology

Garkovich, L., and A. Bell. Charting trends in rural sociology: 1986-1995. Rural Sociology, 60:571-584.

Harris, R.P., J. Bridger, C. Sachs, and S. Tallichet. Empowering rural sociology: Exploring and linking alternative paradigms in theory and methodology. Rural Sociology, 60:585-606.

Veterinary Science

Allen, G., M. Yeargan, L.R. Costa, and R. Cross. Major histocompatibility complex class I-restricted cytotoxic T-lymphocyte responses in horses infected with equine herpesvirus 1. Journal of Virology, 69(1):606-612.

Bailey, E. Variation within the antigen binding site of the major histocompatibility complex dra gene of domestic horses. pp. 123-126. IN: Nakajima, H., Plowright, W., Equine Infectious Diseases VII: Proceed-

ings, Seventh International Conference, June 8-11, 1994, Tokyo, Japan. Newmarket (England): R & W Publications.

Bailey, E., K.T. Graves, E.G. Cothran, R. Reid, T.L. Lear and R.B. Ennis. Synteny-mapping horse microsatellite markers using a heterohybridoma panel. Animal Genetics, 26(3):177-180.

Balasuriya, U.B.R., P.J. Timoney, W.H. McCollum and N.J. Maclachlan. Phylogenetic analysis of open reading frame 5 of field isolates of equine arteritis virus and identification of conserved and nonconserved regions in the G(L) envelope glycoprotein. Virology, 214(2):690-697.

Belak, S., A. Ballagi-Pordany, P.J. Timoney, W.H. McCollum, T.V. Little, B. Hyllseth, and B. Klingeborn. Evaluation of a nested PCR assay for the detection of equine arteritis virus infection. pp. 33-38. IN: Nakajima, H., Plowright, W., Equine Infectious Diseases VII: Proceedings, Seventh International Conference, June 8-11, 1994, Tokyo, Japan. Newmarket (England): R & W Publications.

Chambers, T.M. New approaches to control of equine influenza. In: Nakajima, H., Plowright, W., pp. 305-306. IN: Equine Infectious Diseases VII: Proceedings, Seventh International Conference, June 8-11, 1994, Tokyo, Japan. Newmarket (England): R & W Publications.

Chambers, T.M., R.E. Holland and A.C.K. Lai. Equine influenza - Current veterinary perspectives, part 1. Equine Practice, 17(8):19-23.

Chambers, T.M., R.E. Holland and A.C.K. Lai. Equine influenza - Current veterinary perspectives, part 2. Equine Practice, 17(10):26-30.

Chambers, T.M., A.C.K. Lai, K.M. Franklin and D.G. Powell. Recent evolution of the haemagglutinin of equine-2 influenza virus in the USA. pp. 175-180. IN: Nakajima, H., Plowright, W., Equine Infectious Diseases VII: Proceedings, Seventh International Conference, June 8-11, 1994, Tokyo, Japan. Newmarket (England): R & W Publications.

Cook, R.F., S.L. Berger, K.E. Rushlow, J.M. McManus, S.J. Cook, S. Harrold, M.L. Raabe, R.C. Montelaro and C.J. Issel. Enhanced sensitivity to neutralizing antibodies in a variant of equine infectious anemia virus is linked to amino acid substitutions in the surface unit envelope glycoprotein. Journal of Virology, 69(3):1493-1499.

Cook, R.F., S.J. Cook, D.L. Lichtenstein, K.E. Rushlow, J.L. Langemeier, R.C. Montelaro, and C.J. Issel. Direct transmission of equine infectious anaemia virus (EIAV) proviral DNA in ponies: Efficiency of replication *in vivo* of dUTPase+ and dUTPase- infectious molecular clones. pp. 95-103. IN: Nakajima, H., Plowright, W., Equine Infectious Diseases VII: Proceedings, Seventh International Conference, June 8-11, 1994, Tokyo, Japan. Newmarket (England): R & W Publications.

Costa, L.R., C.J. Issel, R.C. Montelaro, S.J. Cook, R.F. Cook, K.E. Rushlow, C. Grund and S.Z-S. Wang. Responses of ponies to challenge with equine infectious anaemia virus following exposure to recombinant gp90 or viral p26 immunogens. pp. 85-94. IN: Nakajima, H., Plowright, W., Equine Infectious Diseases VII: Proceedings, Seventh International Conference, June 8-11, 1994, Tokyo, Japan. Newmarket (England): R & W Publications.

Cothran, E.G. Genetic markers and breed identification in genetic conservation. pp. 291-306. IN: Proceedings, Third Global Conference on Conservation of Domestic Animal Genetic Resources. University Extension Press, University of Saskatchewan.

Donahue, J.M., Patterson, A.A., Gajadhar, J.V., Marteniuk, X.M. Zhou and J.P. Dubey. Identification of opossums *(Didelphis virginiana)* as the putative definitive host of *Sarcocystis neurona*. Journal of Parasitology, 81(6):916-919.

Donahue, J.M., B.J. Smith, K.B. Poonacha, J.K. Donahoe and C.L. Rigsby. Prevalence and serovars of leptospira involved in

equine abortions in central Kentucky during the 1991-1993 foaling seasons. Journal of Veterinary Diagnostic Investigation, 7(1):87-91.

Dwyer, R. Accurate advice for immunocompromised clients. Kentucky Veterinary News, June: 811.

Dwyer, R. Cutting the apron strings: weaning safety for foals and mares. The Horse, 12(7):30-31.

Dwyer, R.M. Disinfecting equine facilities. Revue Scientifique et Technique de L'Office International Des Epizooties, June 1995, 14(2):403-418.

Dwyer, R. A sharp predicament. The Horse, 12(5):38.

Dwyer, R. Vet-client-patient relationship. The Horse, 12(12):78.

Dwyer, R. The veterinary alphabet. The Horse, 12(5):9.

Dwyer, R. Veterinary involvement in human health care education. Kentucky Medical News, 2(4):10.

Fenger, C.K., D.E. Granstrom, J.L. Langemeier, S. Stamper, J.M. Gerber, V, and E. Bailey. Genetics and disease in the horse. Equine Veterinary Journal, 27(6):400-401.

Fitzgerald, B.P. and M.J. Schmidt. Absence of an association between melatonin and reproductive activity in mares during the nonbreeding season. pp. 425-434. IN: Equine Reproduction VI. (Biology of Reproduction. Monograph Series., v. 1). Madison, WI: Society for the Study of Reproduction, Inc.

Gilbert, S., P. Timoney, W. McCollum and D. Deregt. Single-step extraction of viral RNA from semen for reverse transcription-PCR. Focus, 17(1):18-19.

Granstrom, D.E. Recent advances in the laboratory diagnosis of equine parasitic diseases. Veterinary Clinics of North America — Equine Practice, 11(3):437-442.

Granstrom, D.E., J.P. Dubey, R.C. Gill, A.A. Gajadhar, C.K. Fenger, J.M. MacPherson, R.R. Tramontin, O. Alvarez, N.M. Williams, K.B. Poonacha, S.M. Reed, W.V. Bernard and S. Stamper. Equine protozoal myeloencephalitis: biology and epidemiology. pp. 109-111. IN: Nakajima, H., Plowright, W., Equine Infectious Diseases VII: Proceedings, Seventh International Conference, June 8-11, 1994, Tokyo, Japan. Newmarket (England): R & W Publications.

Harkins, J.D., S. Stanley, G.D. Mundy, R.A. Sams, W.E. Woods and T. Tobin. A review of the pharmacology, pharmacokinetics, and regulatory control in the US of local anaesthetics in the horse. Journal of Veterinary Pharmacology and Therapeutics, 18(6):397-406.

Harkins, J.D. and T. Tobin. Racing horses, nitroglycerin and exercise induced pulmonary haemorrhage (EIPH). Equine Veterinary Journal, 27(4):240-241.

Hong, C.B. and J.M. Donahue. *Rhodococcus equi*-associated necrotizing lymphadenitis in a llama. Journal of Comparative Pathology, 113(1):85-88.

Lai, A.C.K. and T.M. Chambers. Rapid protocol for sequencing RNA virus using Delta Taq® version 2.0 DNA polymerase. Biotechniques, 19(5):704.

Lichtenstein, D.L., K.E. Rushlow, R.F. Cook, M.L. Raabe, C.J. Swardson, G.J. Kociba, C.J. Issel, and R.C. Montelaro. Replication *in vitro* and *in vivo* of an equine infectious anemia virus mutant deficient in dUTPase activity. Journal of Virology, 69(5):2881-2888.

Little, T.V., D. Deregt, W.H. McCollum and P.J. Timoney. Evaluation of an immunocytochemical method for rapid detection and identification of equine arteritis virus in natural causes of infection. pp. 27-31. IN: Nakajima, H., Plowright, W., Equine Infectious Diseases VII: Proceedings, Seventh International Conference, June 8-11, 1994, Tokyo, Japan. Newmarket (England): R & W Publications.

Lyons, E.T., D.J. Patterson, J.T. Johns, R.C. Giles, S.C. Tolliver, S.S. Collins and S.

Stamper. Survey for internal parasites in cattle in Kentucky (1993). Veterinary Parasitology, 58(1-2):163-168.

Lyons, E.T., S.C. Tolliver, S. Stamper and B. Snyder. Nematodes found in the opossum *(Didelphis virginiana)* and four other species of mammals in Central Kentucky in 1991. Transactions of the Kentucky Academy of Sciences, 56(3-4):128-133.

Lyons, E.T., T.W. Swerczek, S.C. Tolliver, J.H. Drudge, S. Stamper, D.E. Granstrom and R.E. Holland. Questioning the validity of a drug efficacy study: Reply. Veterinary Medicine, 90(8):728-729.

Lyons, E.T., S.C. Tolliver, S. Stamper, J.H. Drudge, D.E. Granstrom and S.S. Collins. Activity of praziquantel (0.5 mg kg(-1)) against *Anoplocephala perfoliata* (Cestoda) in equids. Veterinary Parasitology, 56(1-3):255-257.

McCollum, W.H., P.J. Timoney and L.A. Tengelsen. Clinical, virological and serological responses of donkeys to intranasal inoculation with the KY-84 strain of equine arteritis virus. Journal of Comparative Pathology, 112(2):207-211.

McDowell, K.J., M.H. Adams and C.B. Baker. Cloning and sequencing equine transferrin complementary deoxyribonucleic acid: synthesis and secretion of transferrin by conceptus membranes. pp. 141-149. IN: Equine Reproduction VI. (Biology of Reproduction. Monograph Series., v. 1). Madison, WI: Society for the Study of Reproduction, Inc.

McDowell, K.J., M.H. Adams, K.M. Franklin and C.B. Baker. Changes in equine endometrial retinol-binding protein RNA during the estrous cycle and early pregnancy and with exogenous steroids. Biology of Reproduction, 52(2):438-443.

Monreal, L., A.J. Villatoro, H. Hooghuis, I. Ros and P.J. Timoney. Clinical features of the 1992 outbreak of equine viral arteritis in Spain. Equine Veterinary Journal, 27(4):301-304.

Moore, B.R., D.E. Granstrom and S.M. Reed. Diagnosis of equine protozoal myeloencephalitis and cervical stenotic myelopathy. Compendium on Continuing Education for the Practicing Veterinarian, 17(3):419-428.

Poonacha, K.B. and J.M. Donahue. Abortion in a mare associated with *Corynebacterium pseudotuberculosis* infection. Journal of Veterinary Diagnostic Investigation, 7(4):563- 564.

Poonacha, K.B., J.M. Donahue, B.J. Smith, R.C. Giles, C.B. Hong, M.B. Petrites-Murphy, T.W. Swerczek and R.R. Tramontin. The role of *Leptospira interrogans* serovar *pomona* type *kennewicki* as a cause of abortion and stillbirth in mares. pp. 113-119. IN: Nakajima, H., Plowright, W., Equine Infectious Diseases VII: Proceedings, Seventh International Conference, June 8-11, 1994, Tokyo, Japan. Newmarket (England): R & W Publications.

Powell, D.G., K.L. Watkins, P.H. Li and K.F. Shortridge. Outbreak of equine influenza among horses in Hong Kong during 1992. Veterinary Record, 136(21):531-536.

Runge, V.M., J.W. Wells and N.M. Williams. Comparison of gadolinium Cy(2)DOTA, a new hepatobiliary agent, and gadolinium HP-DO3A, an extracellular agent, in healthy liver and metastatic disease. Investigative Radiology, 30(2):123-130.

Runge, V.M., J.W. Wells, N.M. Williams, C. Lee, J.F. Timoney and A.B. Young. Detectability of early brain meningitis with magnetic resonance imaging. Investigative Radiology, 30(8):484-495.

Silvia, P.J., S.L. Meyer and B.P. Fitzgerald. Pulsatile gonadotropin secretion determined by frequent sampling from the intercavernous sinus of the mare: Possible modulatory role of progesterone during luteolysis. Biology of Reproduction, 53(2):438-446.

Smith, R.A. Rapid quantitative determination of cyanide in biological fluids from

coyotes killed with a coyote getter. Veterinary and Human Toxicology, 37(6):580-581.

Smith, R.A. and E. Panariti. Intoxication of Albanian cattle after ingestion of *Senecio subalpinus*. Veterinary and Human Toxicology, 37(5):478-479.

Smith, R.A., R.R. Tramontin, K.B. Poonacha and M.B. Petrites-Murphy. Carbofuran (Furadan) poisoning in animals. Canine Practice, 20(2):8-11.

Smith, R.A. and R.R. Tramontin. Cattle poisoning by a mixture of endosulfan, dieldrin, DDT and DDE. Veterinary and Human Toxicology, 37(5):470-471.

Stanley, S.D., R.A. Sams, J.D. Harkins, G.D. Mundy, J. Boyles, W.E. Woods, and T. Tobin. Frequency distribution of post race urine pH from Standardbreds compared with Thoroughbreds: Research and regulatory significance. Equine Veterinary Journal, 27(6):471-473.

Timoney, J.F., A. Umbach, J.E. Boschwitz and J.A. Walker. *Streptococcus equi* subsp. *equi* expresses 2 M-like proteins including a homologue of the variable M-like protective protein of subsp. *zooepidemicus.* pp. 189-193. IN: Nakajima, H., Plowright, W., Equine Infectious Diseases VII: Proceedings, Seventh International Conference, June 8-11, 1994, Tokyo, Japan. Newmarket (England): R & W Publications.

Timoney, J.F., J. Walker, M. Zhou and J.B. Ding. Cloning and sequence analysis of a protective M-like protein gene from *Streptococcus equi* subsp. *zooepidemicus*. Infection and Immunity, 63(4):1440-1445.

Timoney, P.J. Contagious equine metritis. pp. 53-59. IN: 10th International Seminar: Update on Infectious Diseases of Ruminants, Horses and Pigs, October 2-5. Bologna, Italy: Societa Editrice Esculapio.

Timoney, P.J. Contagious equine metritis (Client Information Series). Equine Practice, 17(7):29-32.

Timoney, P.J. Equine influenza: Current significance for the racing industry. pp. 563-568. IN: Michigan Veterinary Conference, January 26-29, Lansing, Michigan. Lansing, MI: Michigan State University. College of Veterinary Medicine and Michigan Veterinary Medical Association.

Timoney, P.J. Equine viral arteritis: A disease of real or perceived significance. pp. 569-575. IN: Michigan Veterinary Conference, January 26-29, Lansing, Michigan. Lansing, MI: Michigan State University. College of Veterinary Medicine and Michigan Veterinary Medical Association.

Timoney, P.J. Equine herpesvirus 1 and 4 infections: Biology, epidemiology and strategies for prevention and control. pp. 576-584. IN: Michigan Veterinary Conference, January 26-29, Lansing, Michigan. Lansing, MI: Michigan State University. College of Veterinary Medicine and Michigan Veterinary Medical Association.

Timoney, P.J. Equine influenza. pp. 43-51. IN: 10th International Seminar: Update on Infectious Diseases of Ruminants, Horses and Pigs, October 2-5. Bologna, Italy: Societa Editrice Esculapio.

Walker, J.A. and J.F. Timoney. Application of the polymerase chain reaction to the study of the molecular basis of M-like protein variation in *Streptococcus equi* subsp. *zooepidemicus.* pp. 195-200. IN: Nakajima, H., Plowright, W., Equine Infectious Diseases VII: Proceedings, Seventh International Conference, June 8-11, 1994, Tokyo, Japan. Newmarket (England): R & W Publications.

Wilson, W.D., E.W. Kanara, M.S. Spensley, D.G. Powell, S. Files, R.R. Steckel. Guidelines for vaccination of horses. Journal of the American Veterinary Medical Association, 207(4):426-431.

(In addition, members of the department published 25 abstracts.)

Ph.D. Dissertations

(Unpublished)

Agricultural Economics

Best, Michael. A nonlinear dynamic modeling approach to the analysis of biotechnological innovations in the U.S. beef cattle industry.

Chambers, Orlando. Strategic trade theory in international agricultural markets: An application to burley tobacco.

Gong, Honguang. Modeling consumer demand for a quality-differentiated product: The Japanese beef market.

Hu, Dayuan. Economic analyses of wind erosion control with off-site environmental effects.

Isinika, Aida C. Assessing the effect of agricultural research expenditures on agricultural productivity in Tanzania.

Kalala, Nkongolo. A study of the effect of the knowledge about food products' health attributes on the consumption of meats and fish in Japan.

Koula, Joseph. Dynamics of cocoa production in Cote d'Ivoire.

Luo, Haiping. Yield forecast, ratemaking, and systematic risk in crop insurance: Three essays.

Agronomy

Handayani, I. Soil carbon and nitrogen pools and transformations after 25 years of no tillage and conventional tillage.

Seta, Ananto K. Water dispersible soil colloids: Their dispersibility, mobility, and role in facilitating transport of herbicides through intact soil columns.

Zhai, Qiang. Nitrogen transformation and availability in organic waste amended prime farmlands following surface mining.

Zhang, Min. Effects of perched water tables above restrictive layers and limestone interfaces on soil environment and genesis.

Animal Sciences

Anderson, C. Acid insoluble ash as a digestion trial marker for determining the effects of varying dietary calcium and phosphorus levels on dry matter, calcium and phosphorus utilization by weanling horses.

Carter, Scott. The nutritional implications associated with the effects of porcine somatotropin and dietary calcium and phosphorus levels on the homeostatic control of calcium, phosphorus and bone metabolism.

Danielsen, K. The effect of dietary fiber level and fiber type on physiological responses to dehydration in the horse.

McLeod, Kyle R. Manipulation of the somatostatin plexus: Influence on growth hormone release and net visceral and hepatic metabolism in sheep.

Mooney, Kenneth. The effects of chromium supplementation on performance, tissue accretion rates and blood metabolites in pigs.

Siciliano, P. Effect of dietary vitamin E supplementation on the integrity of skeletal muscle in the exercising horse.

Walker, J.A. Influence of slaframine, 4-diphenylacetoxy-N-methylpiperidine methiodide and carbohydrate infusion on pancreatic secretion in the bovine.

Entomology

Arne, Christopher. Investigations of simultaneous viral infection by two nuclear polyhedrosis viruses (baculoviridae) on the corn earworm, *Helicoverpa zea* (Boddie).

Pfannensteil, Robert S. Patterns of habitat use by generalist predators in agricultural ecosystems.

Wagner, James D. Prey abundance regulates densities of the wolf spider *Schizocosa ocreata* (Hentz) (Aranea: Lycosidae) by influencing rates of emigration and cannibalism.

Horticulture

Hoffman, Melinda. Weed response to germinating seeds, seedlings, and residue of sorghum (*Sorghum bicolor*) and rye (*Secale cereals*).

Plant Pathology

Chen, Hsien-Jung. Salicylic acid and the regulation of â-1,3-glucanase gene expression in tobacco cell suspension culture.

Cheng, Ji. Characterization of an acidic β-1,3-glucanase from cucumber and the association of β-1,3-glucanases with acquired and nonhost resistance.

Chu, Meihua. Identification of the genetic determinants of tobacco etch virus responsible for the wilting response of tabasco pepper.

Lusso, Marcos F.G. Association of β-1,3-glucanase, ribonuclease and protease with systemic induced resistance of tobacco to fungal and viral pathogens.

Rural Sociology

Collins, T. Tapestry of conflicts: A political economic of education and economic development in Kentucky.

Reeves, J. The role of labor in a changing agricultural structure.

Verburg, J. Exploratory analysis of church pastors in different sized communities.

Veterinary Science

Baker, Clarence Ben. Studies of factors limiting reproductive success in horses and derivation of investigative strategies for identifying their causes.

M.S. Theses

(Unpublished)

Agricultural Economics

Armstrong, Robert C. Manufacturing and related products sector state-level analysis.

Huang, Li. Mixing government and markets for an improved crop insurance program.

Stone, Jeffrey Adam. Credit scoring methods used in agricultural lending: A discussion of theory and issues.

Agronomy

Carter, Timothy P. Evaluation of selected grasses for wildlife afteruses in the reclamation of a coal slurry lagoon in western Kentucky.

Gift, Nancy. The soybean canopy opens: Effects of maturity group on yield, weed germination and harvest interference.

Greenwell, Joseph M. Weed management in no-till, glyphosate resistant soybeans.

Hadad, Robert G. Establishing the genetic control of the frequency of recombination in a *Zea mays* population.

Liu, Dacheng. An index for plant available molybdenum in Kentucky soils.

Saha, H.M. No-tilling corn into hairy vetch: Fertilizer nitrogen substitution without penalty due to delayed planting.

Sorokina Marina N. Imazaquin leaching and degradation in two Kentucky soils.

Stoddard, C. Scott. Corn response and vadose zone water quality as affected by manure, tillage and fertilizer applications.

Animal Sciences

Bobo, Robert. Use of xanthan gum in cottage cheese manufacture.

Brewster-Barnes, T. The effect of feeding after exercise on glucose and glycogen responses in the horse.

Caldwell, F.C. Cellulosic substrate utilization by *Clostridium thermocellum* LQRI.

Gang, L. Gelatin of myofibrillar proteins isolated from chicken red and white muscle under antioxidative conditions.

Samples, Michael. The effect of abomasal casein infusion on post-ruminal starch digestion in steers.

Warren, L. The influence of trimethylglycine on the untrained and trained horse exercising to fatigue.

Biosystems and Agricultural Engineering

Blanton, Christine. Hydraulic conductivity of earthern liners in agricultural waste containment facilities: Evaluation of field construction techniques.

Lochte, Karen R. Effects of milk pH on diffuse reflectance.

Wilcox, Arlyn P. Modeling and predicting heat dissipation requirements for hydraulically driven agricultural machinery.

Entomology

Blank, Kenneth. The efficacy of a bacterial pathogen against mosquitoes.

Hill, Sankie Joe. Bionomics and computer modeling of the red flour beetle, *Tribolium castaneum* (Herbst), on cracked maize.

Mussey, Guy J. Predicting vulnerable stages of landscape insect plant phenological indicators.

Rowe, William Jackson. Foliar qualities affecting Japanese beetle feeding behavior.

Schepers, Eric Jude. Effects of teratocyte secretory product components from *Microplitis croceipes* (Cresson) (Hymenoptera: Braconidae) on the physiology of *Heliothis Virescens* (F.) (Lepidoptera: Noctuidae).

Shanklin, Donna R. The impact of weeds on predation and parasitism of *Ostrinia nubilalis* egg masses and larvae.

Forestry

Lane, J.S., Jr. The effects of endophyte-infected tall fescue on northern bobwhite nutrition and reproduction.

Horticulture

McCracken, Charles. Stimulation and inhibition of fungal growth by volatile compounds of plants.

Veterinary Science

McCoy, Holly K. A study of recombinant major core and transmembrane proteins Rp26 and Rgp45 as immunogens for equine infectious anemia.

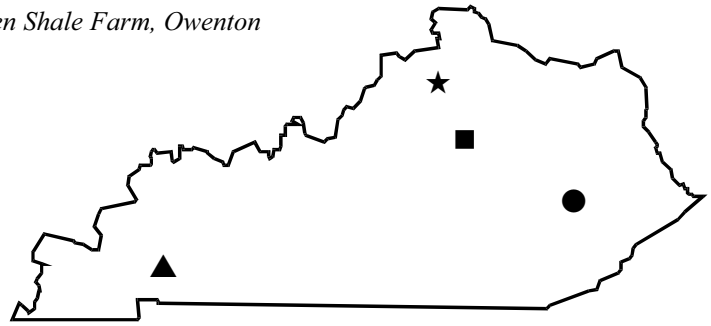
Statewide Research

■ *University of Kentucky, Lexington*

▲ *Research and Education Center and West Kentucky Substation Farm, Princeton*

● *Robinson Substation and Forest, Quicksand*

★ *Eden Shale Farm, Owenton*



Research activities of the Kentucky Agricultural Experiment Station were conducted at Lexington, Princeton, Quicksand and Owenton and in counties throughout the state in 1995.

Efforts are constantly made to ensure that the research studies have application to the problems of all Kentucky farmers and other clientele groups. Locations of the experimental facilities provide conditions representative of most sections of the state.

Campus — Laboratories and specialized equipment for all research program areas.

Coldstream — Maine Chance — Spindletop Farms — Beef and dairy cattle, poultry, horses, sheep and swine, forages and grain crops, tobacco and turf.

South Farm — Fruits and vegetables, ornamentals.

UK Animal Research Center *(Woodford County)* — This farm was purchased in late 1991 as a location for development of state-of-the-art food animal research programs. The farm is in the initial phase of development as a research facility.

At Princeton *(Caldwell county)* the **Research and Education Center** facilities and the **West Kentucky Substation Farm** are devoted to research on grain crops, beef cattle, swine, fruits and vegetables, forages, and tobacco.

At Quicksand *(Breathitt county)* the **Robinson Substation** is the location of research on fruits and vegetables, ornamentals, forages, grain crops, tobacco, and wood utilization. Quicksand is also the headquarters of **Robinson Forest**, which spreads over parts of Breathitt, Perry, and Knott counties and is the site of forestry and watershed management research.

The **Eden Shale Farm**, located in Owen county near Owenton, is where experimental and demonstration studies are conducted on forage crops, tobacco, fruits and vegetables, and beef management.

Financial Statement

Statement of Current General Fund Income and Expenditures Fiscal Year 1995

Income

Federal Funds:	
Hatch Amended	$ 3,765,678.00
Regional Research	787,452.00
McIntire-Stennis	399,353.00
Animal Health	87,698.00
Total Federal Funds	**$5,040,181.00**
Non-Federal Funds	**20,735,548.26**
Total Funds	**$25,775,639.26**

Expenditures

	Federal	Non-Federal	Total
Personal Services	$4,193,506.05	$12,963,282.87	$17,156,788.92
Travel	102,065.26	121,846.90	223,912.16
Equipment	166,405.89	808,940.01	975,345.90
Other Operating Expenses	578,203.80	6,841,388.48	7,419,592.28
Total Expenditures	**$5,040,181.00**	**$20,735,458.26**	**$25,775,639.26**

Staff

University of Kentucky
Board of Trustees 1995

Edward T. Breathitt, Chairperson
Ted Bates
Kay Shropshire Bell
Paul W. Chellgren
Robert N. Clay
Merwin Grayson, Jr.
James F. Hardymon
Robert P. Meriwether
Billy Joe Miles
Elissa M. Plattner
Steven S. Reed
C. Frank Shoop
Marian Moore Sims
Lois Combs Weinberg
Martin Welenken
Billy B. Wilcoxson
Faculty Members: Loys Mather,
Jimmy Jack Miller, & Deborah Powell
Student Member: Shea Chaney

Agricultural Experiment Station
October 1, 1994 — September 30, 1995

Administration
Charles T. Wethington, Jr., President
Elisabeth Zinser, Chancellor
C.O. Little, Dean & Director
H.C. Owen, Treasurer
J.A. Boling, Associate Dean for Research &
Associate Director
A.J. Hiatt, Associate Dean for Administration
J.D. Lawson, Assistant Director for Legal &
Fiscal Affairs
W.O. Peterson, Director of Management
Operations

Departments

Agricultural Communications

Craycraft, C.G., Director
Fehr, R.L., Professor
Weckman, R.D., Assistant Professor
Witham, D.B., Associate Professor

Agricultural Economics

Jones, L.D., Chairman & Professor
Anschel, K.R., Professor
Bobst, B.W., Associate Professor
Brannon, R.H., Professor
Davis, J.T., Professor
Debertin, D.L., Professor
Freshwater, D., Associate Professor
Goetz, S.J., Associate Professor
Hall, H.H., Professor
Marchant, M.A., Assistant Professor
Mather, L.L., Associate Professor
Pagoulatos, A., Professor
Ready, R.C., Assistant Professor
Reed, M.R., Professor
Skees, J.R., Professor

Agronomy

Smith, M.S., Chairman & Professor
Barnhisel, R.I., Professor
Barrett, M., Associate Professor
Blevins, R.L., Professor
Burton, H.R., Associate Professor
Bush, L.P., Professor
Calvert, J.R., Research Specialist
Chappell, J., Associate Professor
Cheniae, G.M., Professor
Collins, G.B., Professor
Collins, M., Professor
Cornelius, P.L., Professor
Coyne, M.S., Assistant Professor
Dinkins, R.D., Research Specialist
Dougherty, C.T., Professor
Egli, D.B., Professor
Evangelou, V.P., Professor
Evans, K.O., Research Specialist
Fanin, F.F., Research Associate
Grabau, L.J., Associate Professor
Grove, J.H., Associate Professor
Hildebrand, D.F., Associate Professor
Hunt, A.G., Associate Professor
Karathanasis, A., Professor
Kennedy, B.S., Research Specialist
Lauriault, L.M., Research Specialist
Legg, P.D., Professor
Nielsen, M.T., Professor
Pearce, R.C., Assistant Professor
Perfect E., Assistant Professor
Pfeiffer, T.W., Professor
Phillips, A.D., Research Specialist
Phillips, T.D., Assistant Professor
Polge, N.D., Research Associate
Poneleit, C.G., Professor
Powell, A.J., Professor
Sims, J.L., Professor
Slack, C.H., Research Specialist
Taylor, N.L., Professor
TeKrony, D.M., Professor
Thom, W.O., Professor
Thomas, G.W., Professor
Tomes, L.J., Research Specialist
Tutt, C.R., Research Specialist
Van Sanford, D.A., Professor
Wagner, G., Professor
Witt, W.W., Professor
Wood, J.M., Research Specialist

Animal Sciences

Kiracofe, G.H., Chairman & Professor
Aaron, D.K., Associate Professor
Boatright, W.L., Assistant Professor
Burris, R., Professor
Button, F.S., Jr., Research Specialist
Campbell, E.R., Research Specialist
Cantor, A.H., Associate Professor
Cromwell, G.L., Professor
Dawson, K.A., Professor
Deweese, W.P., Research Specialist
Edgerton, L.A., Associate Professor
Ely, D.G., Professor
Ford, M.J., Research Specialist

***Adjunct**

Harmon, D.L., Professor
Harmon, R.J., Professor
Hemken, R.W., Professor
Hicks, C.L., Professor
Hightshoe, B., Research Specialist
Huckabay, J.D., Research Specialist
Jackson, J.A., Jr., Associate Professor
Langlois, B.E., Professor
Larson, B.T., Assistant Professor
Lawrence, L.M., Associate Professor
Lindemann, M.D., Associate Professor
Mitchell, G.E., Jr., Professor
Monegue, H.J., Research Specialist
Moody, W.G., Professor
O'Leary, J., Associate Professor
Parker, G.R., Professor
Randolph, J.H., Research Specialist
Schillo, K.K., Associate Professor
Silvia, W.J., Associate Professor
Straw, M.L., Research Specialist
Strobel, H.J., Assistant Professor
Thrift, F.A., Professor
Tidwell, J., Assistant Professor*
Wang, C., Assistant Professor*
Xiong, Y., Associate Professor
Zavos, P.M., Professor

Biosystems and Agricultural Engineering

Walton, L.R., Chairman & Professor
Bridges, T.C., Research Specialist
Colliver, D.G., Associate Professor
Day, G., Research Specialist
Duncan, G.A., Professor
Edwards, D.R., Associate Professor
Gates, R.S., Associate Professor
McNeill, S.G., Research Specialist
Murphy, W.E., Professor
Nokes, S.E., Assistant Professor
Overhults, D.G., Professor
Payne, F.A., Professor
Priddy, K.T., Research Specialist
Ross, I.J., Professor
Shearer, S.A., Associate Professor
Smith, T., Research Specialist
Swetnam, L.D., Research Specialist
Taraba, J.L., Professor
Turner, L.W., Professor
Warner, R.C., Associate Professor
Wells, L.G., Professor
Workman, S.R., Assistant Professor

Entomology

Pass, B.C., Chairman & Professor
Barney, R.J., Assistant Professor*
Brown, G.C., Associate Professor
Burg, J.G., Research Specialist
Collins, J.T., Nursery Inspector
Dahlman, D.L., Professor
Dong, K., Assistant Professor
Freytag, P.H., Professor
Haynes, K., Professor*
Hunt, R., Assistant Professor*
Knapp, F.W., Professor
Moore, A.J., Associate Professor
Nordin, G.L., Professor
Parr, J.C., Research Specialist
Potter, D.A., Professor
Sedlacek, J.D., Assistant Professor*
Webb, B.A., Assistant Professor
Webb, J., Research Specialist
Weston, P.A., Assistant Professor*
Wise, D.H., Professor
Yeargan, K.V., Professor

Forestry

Muller, R.N., Chairman & Associate Professor
Arthur, M.A., Assistant Professor
Kalisz, P.J., Associate Professor
Kimmerer, T.W., Associate Professor
Lacki, M.J., Associate Professor
Liu, C.J., Associate Professor
Overstreet, J.C., Research Specialist
Pelkki, M.H., Assistant Professor
Ringe, J.M., Associate Professor
Stringer, J.W., Research Specialist
Wagner, D.B., Associate Professor

***Adjunct**

Horticulture

Ingram, D.L., Chairman & Professor
Anderson, R.G., Professor
Archbold, D.D., Associate Professor
Brown, G.R., Professor
Buxton, J.W., Associate Professor
Geneve, R.L., Associate Professor
Houtz, R.L., Associate Professor
Kemp, T.R., Professor
Klein, P., Assistant Professor
McNiel, R.E., Professor
Merkin, Z., Research Specialist
Nieman, T.J., Professor
Rowell, A.B., Assistant Professor
Snyder, J.C., Associate Professor
Weston, L.A., Associate Professor
Wolfe, D.E., Research Specialist

Nutrition and Food Science

Mercer, L.P., Chairman & Professor
Barth, M., Assistant Professor
Chen, L.H., Professor
Chow, C.K., Professor
Glauert, H.P., Associate Professor
Hennig, B., Associate Professor

Plant Pathology

Smith, D.A., Chairman & Professor
Ammar, E.D., Research Specialist
Bachi, P.R., Research Specialist
Eshenaur, B.C., Research Specialist
Ghabrial, S.A., Professor
He, S.Y., Assistant Professor
Hendrix, J.W., Professor
Jarlfors, U.E., Research Specialist
Kiernan, J.M., Research Specialist
Kuc, J.A., Professor
Maiti, I.B., Research Specialist
Nuckles, E.M., Research Specialist
Pirone, T.P., Professor
Schardl, C.L., Associate Professor
Shain, L., Professor
Shaw, J.G., Professor
Shepherd, R.J., Professor
Siegel, M.R., Professor
Thornbury, D.W., Biomedical Scientist
Wu, X., Research Specialist

Regulatory Services

Frye, W.W., Director & Professor
Beine, R.L., Laboratory Coordinator
Buckingham, D.T., Seed Regulatory Coordinator
Case, V.W., Soil Testing Coordinator
Coffey, D.S., Insepctor
Cox, B.W., Inspector
Fabrizius, E.E., Seed Testing Coordinator
Flood, J.S., Insepctor
Gibson, G.L., Inspector
Hatton, R., Milk Coordinator
Herald, F., Inspection Coordinator
Johnston, N.T., Inspector
Kirkland, D.L., Soil Testing Specialist
Lichtenberg, D., Lab Specialist
Mason, D.W., Inspector
Miller, E., Feed Coordinator
Prather, T.G., Inspector
Spencer, H.S., Auditor
Terry, D.L., Fertilizer Coordinator & Assistant Director
Thio, A.P., Lab Specialist
Thompson, C.D., Inspector
Troutman, D., Inspector

Robinson Substation

Morrison, M., Superintendent

Rural Sociology

Hougland, J.G., Chairman & Professor
Burmeister, L.L., Associate Professor
Coughenour, C.M., Professor
Dyk, P.A., Assistant Professor
Garkovich, L.E., Professor
Greider, T.R., Assistant Professor
Harris, R.P., Assistant Professor
Maurer, R.C., Associate Chairman & Professor

***Adjunct**

Strang, N.L., Research Specialist
Swanson, L., Professor

Veterinary Science

Timoney, P.J., Chairman & Professor
Adams, M.H., Research Specialist
Allen, G.P., Professor
Bailey, E.F., Professor
Chambers, T.M., Assistant Professor
Cheung, T.K., Research Specialist
Coogle, L.D., Research Specialist
Cook, R.F., Research Specialist
Cothran, E.G., Associate Professor
Davison, L.A., Research Specialist
Donahue, J.M., Professor
Dwyer, R.M., Assistant Professor
Fitzgerald, B.P., Associate Professor
Giles, R.C., Professor
Granstrom, D.E., Associate Professor
Graves, K.A., Assistant Professor
Harrison, L.H., Professor
Henney, P.J., Research Specialist
Hong, C.B., Professor
Issel, C.J., Professor
Leach, D.H., Professor
Leach, R.B., Research Specialist
Lear, T.L., Research Specialist
Lyons, E.T., Professor
McCollum, W.H., Professor
McDowell, K.J., Associate Professor
Newman, D.H., Research Specialist
Petrites-Murphy, M.B., Associate Professor
Poonacha, K.B., Professor
Powell, D.G., Associate Professor
Smith, B.J., Research Specialist
Smith, R.A., Associate Professor
Swerczek, T.W., Professor
Thompson, K.N., Assistant Professor
Timoney, J.F., Professor
Tobin, T., Professor
Tolliver, S.C., Research Specialist
Tramontin, R.R., Associate Professor
Vickers, M.L., Associate Professor
Williams, N.M., Assistant Professor
Woods, W.E., Research Specialist
Wulff-Strobel, C., Research Specialist
Yeargan, M.R., Research Specialist

West Kentucky Substation

Davis, D., Superintendent

***Adjunct**

108th Annual Report 1995

Editor — *Deborah B. Witham*
Department of Agricultural Communications
Designer — *Jeffrey W. Hines*
Department of Agricultural Communications

Look for the College of Agriculture on the World Wide Web at:
http://www.ca.uky.edu/

1.5M - 6-96