



AGRICULTURAL EXPERIMENT STATION  
UNIVERSITY OF KENTUCKY • COLLEGE OF AGRICULTURE

*The Kentucky  
Agricultural Experiment Station*

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**112<sup>th</sup>**

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**Annual Report**  
1999



College of Agriculture  
University of Kentucky • Lexington, Kentucky 40546



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To His Excellency,  
The Honorable Paul Patton  
Governor of Kentucky

I herewith submit the one hundred and twelfth annual report of the Kentucky Agricultural Experiment Station for the period ending December 31, 1999. 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, 2000



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# Purpose of the Kentucky Agricultural Experiment Station

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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 and rural residents for more than 100 years. The continued advancement of Kentucky agriculture attests to the benefits of applying new knowledge and technology. Much of the research leading to increased quantity and improved quality of Kentucky's agricultural output was performed by the Experiment Station. College researchers also have successfully addressed 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 and natural resource-related 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, food, and natural resources.

This Annual Report lists Experiment Station research projects and publications completed during 1999. A faculty list is also provided.

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

## Statewide Research

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Research activities of the Kentucky Agricultural Experiment Station were conducted at Lexington, Princeton, Quicksand, and Owenton and in counties throughout the state in 1999.

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.

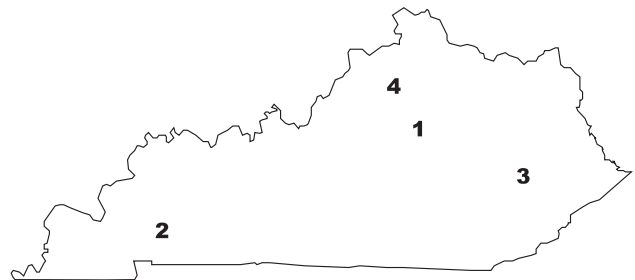
**Campus**—Laboratories and specialized equipment for all research program areas.

**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 Phase I 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 Station** 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.

At the **Eden Shale Farm**, located in Owen County near Owenton, experimental and demonstration studies are conducted on forage crops, tobacco, fruits and vegetables, and beef management.

# Regulatory Services

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The Division of Regulatory Services administers state laws pertaining to the manufacturing, processing, labeling, and marketing of commercial feed, fertilizer, seed, 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 shortcuts in the quality of their products.

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

Ten regulatory inspectors and one auditor cover the state, collecting samples, inspecting facilities, and auditing records. Additionally, a specialty-products inspector checks and samples small-package and specialty feed, fertilizer, and seed products throughout the state.

The Division also offers to growers and homeowners seed testing, soil testing, poultry litter and animal manure testing, and water and nutrient solution analyses for greenhouse production and float-bed systems of seedling production.

## Auditing Program

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*H.S. Spencer*

Audits of sales and fee payments were made on 314 of 546 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; and 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 1999:

|  |                    |
|--|--------------------|
| Feed .....                             | \$720,728          |
| Fertilizer .....                       | 631,360            |
| Milk .....                             | 61,925             |
| Soil testing .....                     | 168,721            |
| Seed tags, testing, and licenses ..... | 363,661            |
| <b>TOTAL .....</b>                     | <b>\$1,946,395</b> |

These cash receivables were substantiated on 2,612 fertilizer tonnage reports, 2,976 feed tonnage reports, 724 seed reports, and 15 milk reports. These reports were checked for accuracy and compared with field audits of the firms submitting them. Additional fees of \$16,920 were found as a result of these audits.

## Milk Regulatory Program

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*C.D. Thompson*

The milk regulatory program administers the Kentucky Creamery License Law and Regulations. The program's primary objective is to ensure the proper payment for milk produced in Kentucky. These payments must be based on a series of accurate weights and tests. The program provides a marketplace environment that is fair and equitable for all individuals and firms involved in the dairy industry. In 1999, the division:

- reviewed and issued licenses to 14 milk buyers, 56 testers, 397 sampler-weighers, and eight raw milk transfer stations.
- analyzed and administered action on 6,757 official samples.
- analyzed 801 samples submitted by licensed testers for comparison purposes.
- conducted 12 producer pay record audits.
- conducted 56 inspections at 15 milk laboratories.
- trained and examined 48 new sampler-weighers and 15 new testers.
- conducted 653 inspections of 225 sampler-weighers.
- conducted 36 inspections of raw milk transfer stations.

## Feed Regulatory Program

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*Eli Miller*

The feed regulatory program provides consumer protection for the purchasers of livestock feed and pet foods, maintains a marketplace environment that promotes fair and equitable competition for the feed industry, and helps ensure the safety and wholesomeness of animal products as human food. In 1999, the program:

- administered actions on 4,839 official samples of commercial feed involving 27,994 official tests to monitor about 3 million tons of commercial mixed feed and feed ingredients distributed in Kentucky.
- administered a cooperative program with the FDA to inspect two feed mills that mix restricted drugs in feed and to inspect seven feed mills for compliance with FDA's national BSE regulation, which prohibits the feeding of certain mammalian proteins to cattle and other ruminants. An additional 63 state inspections were conducted on mills that mix non-MFA drugs in feed to ensure compliance with medicated feed regulations. Fifty-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 900 companies.
- continued implementation of the revised feed labeling requirements for livestock and poultry feeds.



## 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 1999, the program:

- administered actions on 3,856 official and 458 unofficial samples of fertilizer involving 13,361 tests of the approximately one million tons of fertilizer distributed in Kentucky.
- reviewed labels and registered 3,714 products from 543 firms, including 214 who manufactured custom blends of fertilizers.
- conducted two bulk-blend workshops for the fertilizer industry.

## Inspection Program

*F. Herald*

The inspection program aims to achieve industry compliance with the consumer protection laws that the division is charged with administering. Inspectors strategically located throughout the state, each with an assigned area to cover, carry out this responsibility. 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 assistance to clientele in improving their operations to achieve compliance with the laws. In 1999:

- A team of nine inspectors performed 5,205 inspections of the processing, manufacturing, and marketing of feed, fertilizer, and seed. They inspected eight feed mills for compliance with FDA's regulation to prevent the establishment of bovine spongiform encephalopathy (BSE) in the United States. One inspector traveled throughout the state to inspect and sample small-package and specialty feed, fertilizer, and seed products in urban areas. Another inspector covered the state to administer the Creamery License Law.
- Inspectors collected the following numbers of official samples for laboratory verification of appropriate constituents and quality:

|                  |       |
|------------------|-------|
| Feed .....       | 4,839 |
| Fertilizer ..... | 3,856 |
| Seed .....       | 2,981 |
| Milk .....       | 6,757 |

## Seed Regulatory Program

*D.T. Buckingham*

The seed regulatory program assures Kentucky farmers and urban consumers of quality seed and promotes fair and equitable competition among seed dealers and seedsmen. In 1999, the program:

- collected and tested 2,981 official seed samples.
- issued stop-sale orders on 428 official seed samples and 229 violative seed lots at seed dealer and seed processor locations.
- cooperated with the USDA-Seed Branch regarding shipments of seed into Kentucky that were in violation of the Federal Seed Act.
- issued 237 permits to label seed and registered 373 seed dealer locations. Performed inspections and sampling of agricultural, lawn, turf, and garden seeds during 1,854 visits to more than 600 wholesale and retail locations.

## Seed Testing Services

*E.E. Fabrizio*

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 1999, the seed laboratory tested the following number of samples:

|  |              |
|--|--------------|
| Official seed samples (regulatory) ..... | 2,981        |
| Regular seed samples (service) .....     | 3,551        |
| Certified seed samples (service) .....   | 283          |
| Tobacco seed samples (service) .....     | 1,506        |
| <b>TOTAL</b> .....                       | <b>8,321</b> |

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 following fungicide application. The laboratory also provides tests to seedsmen and livestock farmers for the presence of the fungal endophyte in tall fescue seed and live fescue tillers.

## Soil Testing Service

*F.J. Sikora (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. In partnership with the Cooperative Extension Service, it also provides them with lime and fertilizer recommendations based on soil tests. We also offer analyses of poultry litter and animal wastes for farmers and farm advisors, water and nutrient solution analyses to greenhouse operators and float-bed seedling producers, and non-routine soil tests for University of Kentucky researchers.

Samples analyzed in 1999 were:

| Type                           | Number        | % Increase |
|--------------------------------|---------------|------------|
| Agriculture .....              | 32,921        | -4         |
| Home lawn and garden .....     | 6,133         | -1         |
| Strip-mine reclamation .....   | 0             | -100       |
| Commercial horticulture .....  | 610           | 19         |
| Greenhouse .....               | 0             | -100       |
| Research .....                 | 11,775        | -35        |
| Atrazine residue in soil ..... | 65            | -56        |
| Animal waste .....             | 848           | 568        |
| Nutrient solution .....        | 256           | 22         |
| <b>TOTAL</b> .....             | <b>52,608</b> | <b>-12</b> |

# Kentucky Agricultural Experiment Station Projects

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## **Agricultural Economics**

- Agricultural Industrialization and Globalization: Implications for Rural Economies—*S. Goetz, D. Debertin, R. Fleming, A. Pagoulatos*
- Analyzing Impacts of Structure of U.S. Agriculture on Structure of Nonfarm Rural Communities—*D. Debertin, S. Goetz*
- Analyzing the Future International Competitiveness of the U.S. Food Industry—*M.R. Reed, M.A. Marchant, L. Mather*
- Assessment of Trade and Foreign Direct Investment on U.S. Competitiveness in Asian Food Markets—*M.A. Marchant, S.A. Neff*
- Benefits and Costs of Resource Policies Affecting Public and Private Land—*R.A. Fleming*
- Economic and Environmental Impacts of Water-Quality Protection Policies on Kentucky Agriculture—*H. Hall, J.R. Skees*
- Evaluation of Public Policy Alternatives Designed to Help U.S. Cash-Crop Farmers Manage Risk—*J.R. Skees, H. Hall*
- Financing Agriculture and Rural America: Issues of Policy, Structure, and Technical Change—*D. Freshwater*
- Fruit and Vegetable Supply-Chain Management, Innovations, and Competitiveness—*T. Woods*
- Impacts of Trade Agreements and Economic Policies on Southern Agriculture—*M.A. Marchant*
- International Agricultural Market Structures and Institutions—*M.R. Reed*
- Rural Economic Development: Alternatives in the New Competitive Environment—*S. Goetz, D. Freshwater*

## **Agronomy**

- Amount and Quality of Herbage Ingested by Cattle Grazing Tall Fescue Clover Grasslands—*C.T. Dougherty*
- Analysis of mRNA Polyadenylation and Metabolism in Plants—*A.G. Hunt*
- Breeding for Fusarium Head Blight Resistance in Wheat for Kentucky—*D.A. Van Sanford*
- Breeding Grasses for the Transition Zone—*T.D. Phillips*
- Characteristics of a Plant Poly (A) Polymerase—*A.G. Hunt*
- Characterization, Classification, and Use Interpretations of Kentucky Soils—*A.D. Karathanasis*
- Characterization of Phytoalexin and Sterol Biosynthetic Genes in Tobacco—*J. Chappell*
- Classifying Soils for Solute Transport as Affected by Soil Properties and Landscape Position—*E. Perfect*
- Corn Breeding and Genetics: White Endosperm Breeding, Food Quality Inheritance, and Hybrid Performance Tests—*C.G. Poneleit*
- Determining Rates of Several Nutrient Sources for Optimum Crop Production and Soil—*W.O. Thom*
- Early Maturing Soybean Cropping System: Identifying Appropriate Cultivars—*L.J. Grabau*
- Effect of Tillage and Land Use on Physical and Chemical Properties of Kentucky Soils—*G.W. Thomas, R.L. Blevins, J.A. Thompson*
- Evaluation of Burley Tobacco Varieties—*J. Calvert, B. Kennedy*
- Evaluation of Perennial Forage Crop Varieties—*R. Spitaleri*
- Evaluation of Soybean Varieties and Breeding Lines for Use in Kentucky—*T.W. Pfeiffer, C.R. Tutt*
- Forage Crop Genetics and Breeding to Improve Yield and Quality—*N.L. Taylor, T.D. Phillips*
- Herbicide Persistence in Southern Soils: Bioavailable Concentration and Effect on Sensitive Rotational Crops—*W.W. Witt*
- Manipulation and Regulation of Oxylipin Formation in Plant Tissues—*D.F. Hildebrand*
- Mineralogical Controls on Colloid Dispersion and Solid-Phase Speciation of Soil Contaminants—*R.I. Barnhisel, A.D. Karathanasis*

- Microbial Ecology of Nitrate Reduction in Fragipan Soils—*M.S. Coyne*
- Multiplicative (Linear-Bilinear) Models for Genotype X Environment Interaction in Crop Cultivars—*P.L. Cornelius*
- Pest Control Strategies for Grazing Livestock Using Grass-Endophyte Associations—*C.T. Dougherty, F.W. Knapp, L.P. Bush*
- Phenology, Population Dynamics, and Interference: A Basis for Understanding Weed Biology and Ecology—*W.W. Witt*
- Plant Genetic Resource Conservation and Utilization—*N.L. Taylor*
- Predicting Solute Transport Parameters from Pore Characteristics of Kentucky Soils—*E. Perfect*
- Regulation of C6-Aldehyde and Alcohol Formation in Plant Tissues—*D.F. Hildebrand*
- Relationship between Photosynthesis, Assimilate Supply, and the Size of the Reproductive Sink—*D.B. Egli*
- Role of Ammonium-Potassium-Calcium Exchange Interactions in Regulating Nitrification Rates in Soil—*V.P. Evangelou, M.S. Coyne*
- Seed Biology and Technology Investigations—*D.M. TeKrony, D.B. Egli, R. Geneve, A. Downie*
- Significance of Loline Alkaloids in Ecosystems Predominated by Grass/Endophyte Associations—*L.P. Bush*
- Soil and Crop Nitrogen Testing to Improve Nitrogen Management for Burley Tobacco—*R.C. Pearce, J.G. Grove, D.C. Ditsch*
- Somatic Cell Genetics of Crop Plants—*G.B. Collins*
- Species and Crop Management Effects on the Yield and Quality of Round Bale Silage—*M. Collins*
- Studies of and Efforts to Engineer the Metabolism in Plant Trichomes—*G.J. Wagner*
- Understanding Recombination and Modifying Its Frequency in Soybean and Corn—*T.W. Pfeiffer, C.G. Poneleit*

## **Animal Sciences**

- Animal Manure and Waste Utilization Treatment and Nuisance Avoidance for a Sustainable Agriculture—*G.L. Cromwell, J.H. Grove*
- Beef Cattle Grazing: Endophyte-Infected Tall Fescue with Alfalfa and Water Quality in Stream Pastures—*B.T. Larson*
- Breeding to Optimize Maternal Performance and Reproduction of Beef Cows in the Southern Region—*F.A. Thrift, D.K. Aaron*
- Comparison of Forage Finishing Systems, Carcass Traits, and Processing Technologies—*W.G. Moody, W.R. Burris, D.K. Aaron*
- Development of Peptide Blockers to Enhance Cheese Production—*C.L. Hicks*
- Dietary Regulation of Cationic Amino Acid Transporter Protein Expression in Cattle—*J.C. Matthews*
- Effect of Dietary Fiber Type and Amount on Large Intestinal Volatile Fatty Acids and Water Balance in Horses—*L.M. Lawrence*
- Evaluation of Supplemental Chromium on Glucose Tolerance and Performance of Swine—*M.D. Lindemann, G.L. Cromwell*
- Factors Contributing to the Association of 2-Pentyl Pyridine with Soy Proteins—*W.L. Boatright*
- Formation and Treatment of Ovarian Cysts in Dairy Cows—*W.J. Silvia*
- Impact of Level of Preweaning Performance on Subsequent Cow Herd Reproduction—*F.A. Thrift, D.K. Aaron*
- Induction of Puberty Onset in Beef Cattle—*K.K. Schillo*
- Interaction of Structurally Modified Food Proteins in Processed Meat Systems—*Y. Xiong*
- Lipid-Derived Flavors-Odors and Their Association with Food Proteins—*W.L. Boatright, Y. Xiong*
- Mastitis Resistance to Enhance Dairy Food Safety—*R.J. Harmon*
- Metabolic Relationships in Supply of Nutrients for Lactating Cows—*D.L. Harmon*

Microbial Strategies for Improving the Efficiency of Ruminant Production by Enhancing Propionate Metabolism in the Rumen—*K.A. Dawson, H.J. Strobel*

Molasses-Based Strategic Supplementation Program to Enhance Beef Cow Reproductive Performance and Calf Weaning Weight from Endophyte-Infected Tall Fescue Pasture—*D.G. Ely, D.K. Aaron*

Molecular Characterization of Carbohydrate Utilization by Anaerobic Bacteria—*H.J. Strobel, K.A. Dawson*

Nutritional Systems for Swine to Increase Reproductive Efficiency—*M.D. Lindemann*

Organic Chromium and Anionic Salt Supplementation in the Diet of Transition Dairy Cattle—*J.A. Jackson*

Post-Thaw Status of Bovine Spermatozoa: Sperm Qualitative Measurements and Artificial Insemination—*P.M. Zavos*

Regulation of Carbohydrate Digestion and Absorption in the Ruminant Small Intestine—*D.L. Harmon, J.C. Matthews*

Strategies for Improving Ewe Lactational Performance and Predicting Preweaning Growth of Lambs Harvesting the Milk Produced—*D.K. Aaron, D.G. Ely*

### **Biosystems and Agricultural Engineering**

Development and Application of Comprehensive Agricultural Ecosystems Models—*D.R. Edwards, R.C. Warner, J.L. Taraba*

Fiber Optic Sensor Development for Cottage Cheese Processing—*F.A. Payne, C.L. Hicks, R.S. Gates*

Interior Environment and Energy Use in Poultry and Livestock Facilities—*R.S. Gates, D.G. Overhults, L.W. Turner*

Measuring and Predicting Soil Compaction by Machinery—*L.G. Wells, S.A. Shearer, R.I. Barnhisel*

Mechanics of Granular Solids—*I.J. Ross, R.S. Gates, T.C. Bridges*

Precision Agriculture: Development and Assessment of Integrated Practices for Kentucky Producers—*S.A. Shearer*

Precision Farming Technology and Its Economic and Environmental Impacts—*S.A. Shearer*

Residential Air Infiltration and Air Quality—*D.G. Colliver, R.S. Gates, K.T. Priddy*

A Systematic Approach to Enzyme Recovery from Solid State Fermentation—*S.E. Nokes*

Water and Solute Transport in Soils with Perched Water Tables—*S.R. Workman*

### **Entomology**

Biological Control of Selected Arthropod Pests and Weeds—*K.V. Yeargan, B.C. Pass*

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

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

Characterization of Selected Proteins Derived from an Insect Parasitoid—*D.L. Dahlman*

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

Dynamic Soybean Insect Management for Emerging Agricultural Technologies and Variable Environments—*K.V. Yeargan*

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

Evolution of Sex Pheromone Blends—*K.F. Haynes*

Field Evaluation and Implementation of Economic Injury Levels Incorporating Biological Control Agent—*G.C. Brown*

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

Integrated Management of Arthropod Pests of Livestock and Poultry—*S.L. Dobson, J.D. Webb, C.T. Dougherty*

Kentucky's Agricultural Pesticide Impact Assessment Program—*B.C. Pass, M.P. Johnson*

Mating Disruption and the Evolution of Pheromone Communication in Moths—*K.F. Haynes*

Molecular Dissection of Polydnavirus Functional Activities—*B.A. Webb*

Phytochemical and Physiological Effects of Herbivore Feeding Guild Interactions: The Impact of Bud Herbivore on Gypsy Moth Success—*L.K. Rieske-Kinney*

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

Spatial Dynamics of Leafhopper Pests and Their Management on Alfalfa—*B.C. Pass, J.C. Parr*

Structure-Function Relationships in a Polydnavirus Genome—*B.A. Webb, K.S. Shelby*

Systematics and Biodiversity of Biological Control Agents with Special Reference to the Braconidae—*M.J. Sharkey*

### **Forestry**

Conservation, Ecology, and Restoration of Large Mammals in Eastern Kentucky—*D.S. Maehr*

Developing a Digital Photogrammetric Method for Forest Stand Density Estimation—*C.J. Liu*

Economic Assessment of Surface Mine Reclamation Alternatives—*J.M. Ringe, M.H. Pelkki, D.H. Graves*

Effects of Disturbance Corridors (Roads and Hiking Trails) on Invertebrate Macrofauna of Forest Soils on the Cumberland Plateau of Kentucky—*P. Kalisz*

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

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

Roost Selection of Bats in Forests in Eastern Kentucky—*M.J. Lacki*

Sources of Runoff and Sediment Production in Forested Watersheds—*D.L. Brown*

### **Horticulture**

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

Arthropod Repellency and Host-Plant Resistance in *Lycopersicon hirsutum*—*J.C. Snyder*

Botrytis Cinerea Development and Natural Volatile Compounds from Strawberry Fruit—*T.R. Kemp*

Characterizing Drought Resistance and Chemical Thinning of Fruit Crops—*D.D. Archbold*

Controlled Water Table Irrigation for Container Plant Production—*J.W. Buxton*

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

Mechanism and Significance of Post-Translational Modifications in the Large Subunit of Ribulose Biphosphate Carboxylase/Oxygenase—*R.L. Houtz*

Production of Ethylene and its Biosynthetic Precursors as Indicators of Seed Vigor—*R.L. Geneve*

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

### **Landscape Architecture**

Comprehensive Land-Use Planning for Sustainable Rural Development Using Expert Systems—*T.J. Nieman*

### **Nutrition and Food Science**

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

Effect of Dietary Antioxidants on Hepatic NF-kB Activation—*H.P. Glauert*

Effects of Fish Oil and N-3 Fatty Acids on Antioxidant Defense System and Inflammatory Processes—*L.H. Chen*

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

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

Zinc Nutrition and Vascular Endothelial Integrity—*B. Hennig*

## **Plant Pathology**

- Aggressiveness and Pathogenicity Determinants Anthracnose Stalk Rot of Corn—*L.J. Vaillancourt*
- Biological Control and Management of Soilborne Plant Pathogens for Sustainable Crop Production—*J.W. Hendrix*
- Genes of Grass Endophytes Determining Expression of Protective Alkaloids—*H.H. Wilkinson*
- Genetic Analysis of Avirulence/Virulence in *Magnaporthe grisea*, a Pathogen of Rice and Other Grasses—*M.L. Farman*
- Genetic Analysis of Bioprotective Alkaloids Produced by Grass Symbionts—*C.L. Schardl*
- Genetic Determinants of Parasitism and Pathogenicity in *Colletotrichum graminicola*—*L.J. Vaillancourt*
- Host-Pathogen Interactions between *Castanea* Sp. and the Chestnut Blight Fungus—*L. Shain*
- Managing Plant-Parasitic Nematodes in Sustainable Agriculture with Emphasis on Crop Resistance—*D.E. Hershman*
- Mechanisms of Transmission of Plant Viruses that Have a Nonpersistent Vector Relationship—*T.P. Pirone*
- Mechanisms of Virus Particle Disassembly during the Establishment of Plant Virus Infections—*J.G. Shaw*
- Molecular Basis of Disease in a Virus-Infected Plant Pathogenic Fungus—*S.A. Ghabrial*
- Mycovirus-Host Interactions in Diseased Isolates of *Helminthosporium victoriae*—*S.A. Ghabrial*
- National Agricultural Program to Clear Pest Control Agents for Minor Uses—*W.C. Nesmith*
- Vector Specificity in Potyvirus Transmission: Role of the Helper Component—*T.P. Pirone*

## **Rural Sociology**

- Impacts of Structural Change in the Dairy Industry—*L. Garkovich, P. Dyk*
- Rural Low-Income Families: Monitoring Their Well-Being and Functioning in the Context of Welfare Reform—*G. Hansen*
- Rural Restructuring: Causes and Consequences of Globalized Agricultural and Natural Resource Systems—*L. Burmeister*
- Service Sector Penetration and Household Earning Processes: A Comparative Study of Rural Communities—*R. Harris*

## **Veterinary Science**

- Chemotherapeutic Control and Prevalence of Natural Infections of Internal Parasites of Equids—*E.T. Lyons*
- Differential Gene Expression during Early Equine Conceptus Development—*K.J. McDowell*
- Functional Characterization of Immunogenic Proteins of *Leptospira kennewicki*—*J.F. Timoney*
- Identification of the Equine Herpesvirus-1 (EHV-1) Protein Antigens that Elicit Cytotoxic T-Lymphocyte Immune Responses in the Horse—*G.P. Allen*
- Immunologic Management of Lentivirus Infections: EIAV—*C. Issel*
- Melatonin and Seasonal Reproduction in Mares—*B.P. Fitzgerald*
- National Animal Genome Research Program—*E.F. Bailey, E.G. Cothran, K.A. Graves*
- New Therapeutic Approaches to Equine Protozoal Myeloencephalitis (EPM)—*T. Tobin*
- Non-Immune Cellular/Molecular Responses to Influenza Infection of the Horse—*T.M. Chambers*
- Pathogenesis of Equine Infectious Anemia—*C. Issel*

# Publications

All publication dates in this section are 1999 unless otherwise noted.

## Annual Report

*One Hundred and Eleventh Annual Report of the Kentucky Agricultural Experiment Station for 1998*. College of Agriculture, University of Kentucky, C. Oran Little, Director. June.

## Books and Book Chapters

### Agricultural Economics

Casavant, Kenneth L., Craig L. Infanger, and Deborah E. Bridges. *Agricultural Economics and Management*. Prentice-Hall Inc., New Jersey. 409 pp., glossary, and index.

Markley, Deborah, David Barkley, David Freshwater, Ron Shaffer, and Julia Rubin. The current state of the art in rural equity markets in Federal Reserve Bank of Kansas City. pp. 59-70. IN: *Equity for Rural America: From Wall Street to Main Street*. Federal Reserve Bank of Kansas City, Kan.

### Agronomy

Baskin, J.M., C.C. Baskin, and E.W. Chester. The Big Barrens region of Kentucky and Tennessee. pp. 190-205. IN: R.C. Anderson, J.S. Fralish, and J.M. Baskin, eds. *Savannas, Barrens, and Rock Outcrop Plant Communities of North America*. Cambridge University Press, Cambridge.

Baskin, J.M., and C.C. Baskin. Cedar glades of southeastern United States. pp. 206-219. IN: R.C. Anderson, J.S. Fralish, and J.M. Baskin, eds. *Savannas, Barrens, and Rock Outcrop Plant Communities of North America*. Cambridge University Press, Cambridge.

Bush, L.P., W. Hempfling, and H.R. Burton. Biosynthesis of nicotine and related compounds. pp 13-44. IN: J.W. Gorrod and P. Jacob III, eds. *Analytical Determination of Nicotine and Related Compounds and Their Metabolites*. Elsevier.

Coyne, M.S. *Soil Microbiology: An Exploratory Approach* (with teacher supplement). Delmar Publication Inc., Albany, N.Y. 462 pp.

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Karathanasis, A.D., and C.D. Barton. The revival of a failed constructed wetland treating a high Fe load AMD. pp. 167-191. IN: K.S. Sajwan, A.K. Alva, and R.F. Keefer, eds. *Biogeochemistry of Trace Elements in Coal and Coal Compaction By-Products*. Kluwer Academic/Plenum Publishers, New York.

Miller, R.D., and D.J. Fowlkes. Fire-cured tobacco. p. 164. IN: D.L. Davis and M.T. Nielsen, eds. *Tobacco: Production, Chemistry, and Technology*. CORESTA Tobacco Monograph.

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Wagner, G.J. Leaf surface chemistry. p. 292. IN: D.L. Davis and M.T. Nielsen, eds. *Tobacco: Production, Chemistry, and Technology*. CORESTA Tobacco Monograph.

### Animal Sciences

Cantor, A.H., E.A. Decker, and V.P. Collins. Fatty acids in poultry and egg products. pp. 125-151. IN: C.K. Chow, ed. *Fatty Acids in Foods and Their Health Implications*. 2nd ed. Marcel Dekker Inc., New York.

Cantor, A.H., M.L. Straw, M.J. Ford, A.J. Pescatore, and M.K. Dunlap. Effect of feeding organic selenium in diets of laying hens on egg selenium content. pp. 473-476. IN: J.S. Sim, S. Nakai, and W. Guenter, eds. *Egg Nutrition and Biotechnology*. CAB International, Wallingford, United Kingdom.

Dawson, K.A., and J.M. Tricarico. The use of exogenous fibrolytic enzymes to enhance microbial activities in the rumen and the performance of ruminant animals. pp. 303-312. IN: K. Jacques and T.P. Lyons, eds. *Proceedings, 15th Annual Symposium on Biotechnology in the Feed Industry*. Nottingham University Press, Nottingham, United Kingdom.

Hogan, J.S., R.N. Gonzalez, R.J. Harmon, S.C. Nickerson, S.P. Oliver, J.W. Pankey, and K.L. Smith. *Laboratory Handbook on Bovine Mastitis*. National Mastitis Council, Madison, Wis. 222 pp.

Kilberg, M.S., and J.C. Matthews. Amino acid transporters. IN: *Embryonic Encyclopedia of Life Sciences*. Nature Publishing Group, London.

Silvia, W.J. Eicosanoids. pp. 991-1001. IN: E. Knobil and J. Neill, eds. *Encyclopedia of Reproduction*. Volume I. Academic Press Inc., New York.

Wang, B., and Y.L. Xiong. The role of endogenous proteases in gel-weakening of beef heart surimi. Chapter 27, pp. 407-420. IN: Y.L. Xiong, C.-T. Ho, and F. Shahidi, eds. *Quality Attributes of Muscle Foods*. Kluwer Academic/Plenum Publishers, New York.

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Xiong, Y.L. Meat Processing. Chapter 2, pp. 89-145. IN: S. Nakai and H.W. Modler, eds. *Food Proteins: Processing Applications*. VCH, New York.

Xiong, Y.L., F.-Q. Yang, and X.Q. Lou. Chinese meat products. Chapter 7, pp. 201-231. IN: C.Y.W. Ang, K. Liu, and Y.W. Huang, eds., *Asian Foods and Beverages*. Technomic Publishing Co., Lancaster, Penn.

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Xiong, Y.L. Phosphate-mediated water uptake, swelling, and functionality of the myofibril architecture. Chapter 22, pp. 319-334. IN: Y.L. Xiong, C.-T. Ho, and F. Shahidi, eds. *Quality Attributes of Muscle Foods*. Kluwer Academic/Plenum Publishers, New York.

### Biosystems and Agricultural Engineering

Colliver, D.G., T.F. Burks, and R.S. Gates. ASHRAE Design Weather Data Viewer - WDVUE 2.1 (CD-ROM). American Society of Heating, Refrigerating and Air-Conditioning Engineers Inc., Atlanta. ISBN 1-883413-75-3.

Nokes, S.E. Enzyme production using surface culture fermentation. pp. 451-460. IN: T.P. Lyons and K.A. Jacques, eds. *Under the Microscope: Focal Points for the New Millennium*. Proceedings, Alltech's 15th Annual Symposium, *Biotechnology in the Feed Industry*. Nottingham University Press.

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- Fox, C.W., and M.E. Czesak. Evolutionary ecology of progeny size in arthropods. *Annual Review of Entomology* 45:341-369.
- Potter, D.A. Japanese beetle, *Popillia japonica* Newman. CAB International Global Crop Protection Compendium (electronic). Wallingford, United Kingdom.
- Potter, D.A., R.C. Williamson, K.F. Haynes, and A.J. Powell Jr. Cultural control, risk assessment, and environmentally-responsible management of scarab grubs and cutworms in turfgrass. pp. 383-396. IN: J.M. Clark and M.P. Kenna, eds. *Fate and Management of Turfgrass Chemicals*. ACS Symposium Series 743, American Chemical Society, Washington, D.C.

## Forestry

- Stringer, J.W., and L. Loftis, eds. Proceedings, 12th Central Hardwood Forest Conference, February 28-March 2, 1999, Lexington, Kentucky. Gen.Tech. Rep. SRS-24. W.S. Department of Agriculture, Forest Service, Southern Research Station, Asheville, N.C. 293 pp.

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## Plant Pathology

- Ghabrial, S.A., and B.I. Hillman. Partitiviruses - Fungal (*Partitiviridae*). pp. 1147-1151. IN: A. Granoff and R.G. Webster, eds. *Encyclopedia of Virology*. 2nd ed. Vol. 2. Academic Press, San Diego, Calif.
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## Rural Sociology

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- Hansen, Gary L. Gender socialization. pp. 197-198. IN: Charles A. Smith, ed. *The Encyclopedia of Parenting Theory and Research*. Westport, Conn.

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## Patents

### Horticulture

- Houtz, R. U.S. Patent No. 5,908,972 issued on June 1. Isolated Spinach Ribulose-1,5-Bisphosphate Carboxylase/Oxygenase Large Subunit N-Methyltransferase and Method of Inactivating Ribulose-1,5-Bisphosphate Carboxylase/Oxygenase Large Subunit N-Methyltransferase Activity.
- Houtz, R. U.S. Patent No. 5,866,394 issued on February 2. Secondary continuation patent for the tobacco gene under the original pea patent—Cloning and Developmental Expression of Pea Ribulose-1,5 Bisphosphate Carboxylase/Oxygenase Large Subunit N-Methyltransferase.

### Plant Pathology

- Maiti, I.B., and R.J. Shepherd. U.S. Patent No. 5,994,521. Full length transcript (FLt) promoter from figwort mosaic caulimovirus (FMV) and use to express chimeric genes in plant cells.

## Progress Reports

- PR-411: *1998 Alfalfa Report*. R. Spitaleri, J.C. Henning, L.G. Brown, G.D. Lacefield, W.J. Peterson, P.C. Vincelli, and J.C. Parr
- PR-412: *1998 Red Clover Report*. R. Spitaleri, J.C. Henning, N.L. Taylor, G.D. Lacefield, D.C. Ditsch, and R.E. Mundell.
- PR-413: *1998 Tall Fescue Report*. R. Spitaleri, J.C. Henning, T.D. Phillips, G.D. Lacefield, D.C. Ditsch, and E.L. Baker.
- PR-414: *1998 Orchardgrass Report*. R. Spitaleri, J.C. Henning, T.D. Phillips, G.D. Lacefield, D.C. Ditsch, and E.L. Baker.
- PR-415: *Alfalfa Grazing Tolerance Variety Report*. J.C. Henning, R. Spitaleri, G.D. Lacefield, C. Dougherty, G. Davis, and T. Hamilton.
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- PR-418: *1999 Kentucky Small Grain Variety Trials*. C.R. Tutt, C.S. Swanson, B. Mijatovic, and D.A. Van Sanford.
- PR-419: *1998 Kura Clover Report*. N. Taylor, R. Spitaleri, J.C. Henning, G.D. Lacefield, D.C. Ditsch, and R.E. Mundell.
- PR-420: *Kentucky Turfgrass Research 1997-1998*. D.W. Williams.
- PR-421: *1999 Kentucky Hybrid Corn Performance Test*. W.L. Pearce, C.G. Poneleit, and Philip Shine.
- PR-422: *1999 Nursery and Landscape Research Report*. D. Ingram, ed.
- PR-423: *1999 Fruit and Vegetable Crops Research Report*. B. Rowell, ed.
- PR-424: *1999 Kentucky Soybean Performance Test*. E. Lacefield, C.R. Tutt, and T.W. Pfeiffer.
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- PR-426: *1999 Red Clover Report*. R. Spitaleri, J.C. Henning, N.L. Taylor, G.D. Lacefield, D.C. Ditsch, and R.E. Mundell.

## Regulatory Bulletins

- RB-277: *Seed Inspection Report, 1994-1998*. D.T. Buckingham.
- RB-278: *Commercial Feeds in Kentucky, 1998*. C.E. Miller.
- RB-279: *Annual Report: Analyses of Official Fertilizer Samples, July 1998-June 1999*. D.L. Terry.

## Journal Articles

### Agricultural Economics

- Dillon, C.R., D.F. Rutherford, T.C. Keisling, and L.R. Oliver. Economic assessment of irrigated and non-irrigated soybean cropping rotations on a clay soil. *Communications in Soil Science and Plant Analysis* 30, 7, and 8:1165-1182.
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- Pearce, A.D., C.R. Dillon, T.C. Keisling, and C.E. Wilson Jr. Agromomic and economic effects of four tillage practices on salinity damage in rice. *Journal of Production Agriculture* 12(2):169-170; 305-312.
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- Rupasingha, Anil, Timothy R. Wojan, and David Freshwater. Self organization and community-based development initiatives. *Journal of the Community Development Society* 30(1):66-82.
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- Skees, Jerry R., and Barry J. Barnett. Conceptual and practical considerations for sharing catastrophic risks. *Review of Agricultural Economics* 21:424-441.
- Swanson, Louis, and David Freshwater. From New Deal to no deal. *Forum* 14(1):84-89.
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### Agromony

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## Other Research Publications

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# Ph.D. Dissertations

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## **Agronomy**

- Barton, C.D.* Colloid enhanced transport and desorption of contaminants through macropores in Kentucky soils.
- Hamman, B.* A study of factors governing soybean seedling emergence and how they relate to seed quality.
- Koning, G.* Relationship between soybean mosaic virus and Phomopsis spp. infection of soybean seed.
- Wan, J.* Potential functions of a potyvirus-encoded NIA/VPG protein in pathogen-derived resistance and virus replication.

## **Animal Sciences**

- Gang, Liu.* Chemical and functional properties of oxidatively modified food proteins.
- Pierce, James Lewis.* Nutritional assessment of conventional and low phytic acid corn for pigs and chicks.
- Powell, Debra Marie.* Effect of short- and long-term calorie restriction and diet composition on thyroid hormone and the metabolic responses to meal feeding and exercise in horses.
- Richards, Christopher Jay.* Influence of small intestine protein on carbohydrate assimilation and metabolism in beef cattle.
- Verdecchia, C.* Effect of heat treatment on the activity of hydrolyzed whey peptides on culture agglutination.
- Van de Ligt, Christiaan Paulus Antonius.* Assessment of chromium tripicolinate supplementation and dietary energy level, energy source, and protein level on growth and carcass criteria in growing pigs.
- Van de Ligt, Jennifer Lynn Gentry.* Influence of chromium tripicolinate supplementation on porcine immune function during the periparturient, neonatal, and postweaning periods.

## **Biosystems and Agricultural Engineering**

- Zolnier, S.* Dynamic mist propagation methods for poinsettia production.

## **Entomology**

- Komaravalli, Sunila Ranjini.* Search for *Bacillus thuringiensis* isolates to manage stored grain insect pests.
- Tuntibunpakul, Patchanee.* The impact of spiders and ground beetles on the abundance of insect pests and yields in soybean and vegetable agroecosystems.
- Corley, Laura S.* Genetic and developmental constraints and the evolution of facultative parthenogenesis in *Nauphoeta cinerea*.
- Snyder, William.* Intraguild predation and the biological control effectiveness of generalist predators.
- Eliason, Eileen Amber.* Ecology, host plant relationships, and management of the horned oak gall wasp, *Callirhytis cornigera* (Osten Sacken).

## **Horticulture**

- Zhang, X.* Arthropod resistance and 2,3-dihydrofarnesoic acid in hybrids of *Lycopersicon esculentum* x *L. hirsutum*.

## **Rural Sociology**

- Koh, Seung-Han.* Farm succession and inheritance: The social reproduction crisis in South Korean agriculture.
- Wright, Donna Wynne.* Turning over a new leaf: Socio-economic and political transformations in the burley tobacco commodity system.

## **Veterinary Science**

- Behrendt-Adam, C.Y.* Equine uterine endometrial oxytocin: Changes in mRNA abundance during the estrous cycle, early pregnancy, and with exogenous steroids, and oxytocin effects on uterine PGF2a release *in vitro*.
- Simpson, K.S.* Differentially expressed genes during early equine conceptus development: Temporal and spatial expression from day 12 through day 30 of gestation.

# M.S. Theses

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## **Agricultural Economics**

- Demiralay, Aslihan.* An examination of new product development process: A comparative study of hazelnut candy manufacturers.
- Gross, Brad Chaney.* Evaluating cost and returns in burley tobacco production systems.
- Keeton, Kara Kate.* The potential influence of risk management programs on cropping decisions at the extensive margin.
- Liu, Deyu.* Model selection and specification in U.S. dairy product demand analysis.
- Riggins, Seth William.* Freshwater shrimp and the restaurant market channel.

## **Agronomy**

- Caruso, L.V.* Root function and development of float tobacco transplants.
- Etienne, N.* Assessing potential biodegradation of trichloroethene in deep sediments at the Paducah gaseous diffusion plant, Kentucky.
- Ewing, J.* Effects of weed management strategies on winter wheat in Kentucky.
- Hancock, D.R.* The effects of different amounts of stretch film plastic on alfalfa baled silage.
- Maul, J.E.* Characterization of a prenyl alcohol kinase from tobacco.
- Murdock, S.W.* Diclosulam persistence in tilled and no-tilled soybean production systems.
- Pils, Jutta R.V.* Distribution and speciation of trace metals as affected by soil properties in some northern Kentucky soils.

## **Animal Sciences**

- D'Allaird, Jennifer Lynne.* A comparison of low protein diets to a protein adequate diet on nitrogen utilization in the adult dog.
- Parkington, Jennifer.* Storage stability and functionality of beef heart surimi prepared under oxidative and antioxidative conditions.
- Pratt, Shannon.* Acetate clearance during exercise in the horse.
- Rider, Nancy Carolyn.* Vitamin D3 supplementation of cull cows: Effects on longissimus and semitendinosus muscle tenderness.
- Scaletti, Roger William.* Role of dietary copper in enhancing resistance to coliform mastitis.

## **Biosystems and Agricultural Engineering**

- Bushee-Bullock, Elizabeth.* Effects of chemical amendments on gaseous emissions and surface water runoff concentrations from swine manure.
- Coffey, M.* Characterization of a small karst watershed with the swat model.
- Cornilleau, G.* Assessment of the OPUS hydrologic model.
- Fulton, John P.* Evaluation of a mechanized system for reconstructing soil on surface-mined land.
- Hallany, Jihad.* Evaluation of passive dewatering systems for small storms using a large scale laboratory sediment basin.
- Miller-Van Cleave, B.* Analytical methods of simulating lateral subsurface flow with transient boundary conditions.
- Patterson, Jane M.* Modeling the persistence of chlorothalonil on processing tomato foliage.
- Paul, R.M.* The effects of artificial shade on tympanic temperature and production characteristics of grazing beef cows.

## **Entomology**

- Mason, Nicole Rae.* Factors affecting twospotted spider mite populations on winged euonymus.
- Kreuger, Betty.* Biotic and abiotic factors influencing Japanese beetle feeding activity and behavior.
- Jamal, Ehaab Musa.* Chemical cues and orientation behavior of *Hippodamia convergens* larvae during prey location.
- Leathers, Jason Wayne.* The Alabagrus of La Selva, with a key to New World species.

## **Forestry**

- Campbell, Raymond D.* Performance evaluation of satellite real-time DPGS in a hardwood forest.
- Davidson, Wade L.* Soil invertebrates of the Appalachian plateau and the potential effects of atmospheric deposition.
- Kuddes-Fischer, L.M.* Response of understory vegetation and tree regeneration to a single prescribed fire in an oak-pine ecosystem.
- Thomas, William R.* Reclamation of surface mined lands in eastern Kentucky using native high value tree species.
- Washburn, C.S.M.* Tree species effects on soil nutrient availability and the response to fire in an oak-pine forest.

## **Horticulture**

- Collins, K.B.* Efficacy and selectivity of sulfentrazone in nursery production and its persistence in soils.
- Martins, G.* Root pruning method changes plant development and root morphology on seedlings.
- Silvernail, A.F.* Determination of cover crop, tillage, and N fertilization effects on nitrogen sufficiency in watermelon by foliar N, soil N, and chlorophyll meter measurements.

## **Nutrition and Food Science**

- Bundrant, Holly.* The influence of gender and dietary content on binding to the central histaminergic H<sub>1</sub> receptor.
- Thielen, Vidalita.* Effects of long-term ethanol ingestion and thiamin deficiency on antioxidant defense systems in extra-hepatic tissues of rats.

## **Veterinary Science**

- Bair, Heather D.* Studies on the equine cestode *Anoplocephala perfoliata* with emphasis on prevalence.
- Ferguson, Eugene M.* Analysis of equine-specific Mx sequences.
- Flannery, Andrew R.* A study utilizing the DNA sequence variation of the mitochondrial control region to elucidate the domestication pattern of the horse.
- Lang, Doreen G.* The chemical identification of plant toxins in ingesta and forage.
- Raney, Nancy E.* Equine gene mapping using a characterized horse/mouse somatic cell hybrid panel.

# Financial Statement

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## Statement of Current General Fund Income and Expenditures Fiscal Year 1999

### Income

|                                  |                        |
|----------------------------------|------------------------|
| <b>Federal Funds:</b>            |                        |
| Hatch Amended .....              | \$3,941,136.00         |
| Hatch Multistate .....           | 872,025.00             |
| McIntire-Stennis .....           | 418,638.00             |
| Animal Health .....              | 65,538.00              |
| <b>Total Federal Funds .....</b> | <b>\$5,297,337.00</b>  |
| <b>State Funds .....</b>         | <b>23,575,928.00</b>   |
| <b>Total Funds .....</b>         | <b>\$28,873,265.00</b> |

### Expenditures

|                                 | <b>Federal</b>        | <b>State</b>           | <b>Total</b>           |
|---------------------------------|-----------------------|------------------------|------------------------|
| <b>Personal Services</b>        | \$4,407,657.00        | \$14,715,517.00        | \$19,123,174.00        |
| <b>Travel</b>                   | 102,619.00            | 157,005.00             | 259,624.00             |
| <b>Equipment</b>                | 165,985.00            | 1,001,980.00           | 1,167,965.00           |
| <b>Other Operating Expenses</b> | 621,076.00            | 7,701,426.00           | 8,322,502.00           |
| <b>Total Expenditures</b>       | <b>\$5,297,337.00</b> | <b>\$23,575,928.00</b> | <b>\$28,873,265.00</b> |

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