United States Department Of Agriculture
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USDA-ARS Poultry Production & Product Safety Research Unit Fayetteville, Arkansas Website: usdaars.uark.edu

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Working cooperatively with the University of Arkansas Division of Agriculture to further research discovery in poultry science as part of the Center of Excellence for Poultry Science.

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UofA UNIVERSITY OF ARKANSAS DIVISION OF AGRICULTURE

USDA-ARS Poultry Production and Product Safety Research Unit (PPPSRU) Fayetteville, Arkansas

The PPPSRU of the Agricultural Research Service USDA is located within the Center of Excellence for Poultry Science on the University of Arkansas Campus in Fayetteville, Arkansas. The annual budget for this unit is $1.6 million. **This unit employs over 25 scientists, research specialists, students and other personnel.**

Unit Goals include:

- ✔ Finding ways of **reducing air, soil and water pollution** from poultry litter, while increasing it's effectiveness as a fertilizer
- ✔ Developing **alternative approaches to antibiotics** for controlling diseases in poultry, and
- ✔ **Reducing stress and metabolic diseases** in poultry

The scientists in this unit are **internationally recognized** and during the 15 years since this program was established in Fayetteville they have:

- ✔ **Produced** over 400 scientific manuscripts and book chapters
- ✔ **Presented** over 50 international invited talks
- ✔ **Obtained** 13 patents (five pending)
- ✔ **Trained** approximately 40 graduate students and visiting scientists
- ✔ **Received** recognition internationally with multiple awards from scientific societies
- ✔ **Several inventions/discoveries** currently used in animal agriculture

Extramural support of research (a majority with University of Arkansas faculty collaboration) has generated over **$4.4 million dollars in the past five years**.

Some of the important discoveries made by the scientists at Fayetteville include:

Bacteriophage provide an alternative to antibiotics in animal production. Scientists in the Unit are leaders in establishing that bacteriophage (viruses that infect and kill bacteria) can provide an effective alternative to antibiotics in animal production to both prevent and treat animal bacterial diseases. The importance of this work was **recognized by the National Chicken Council's Broiler Research Award, for distinguished research benefiting the broiler industry**. This research is critically important to the animal industry seeking alternatives to antibiotics and has provided an animal model to evaluate the efficacy of bacteriophage in veterinary and human medicine.

Alum additions to poultry litter reduce phosphorus runoff and ammonia emissions. Scientists in the Unit discovered that alum (aluminum sulfate) addition to poultry litter reduces ammonia emissions and phosphorus runoff into the watershed. Birds grown on alum-treated litter weigh more, utilize their feed better, and have lower mortality rates. Additionally, heating costs during winter months are significantly lowered (due to less ventilation required to remove ammonia vapors). This technology was patented and poultry grade alum is being sold under the tradename Al^{+}Clear. In the past year, it is estimated that more than **600 million broilers were produced in the U.S. on alum-treated litter, which will result in less pollution of our nation's air and water**, in addition to facilitating the production of healthier chickens at lower cost. In 2003, the USDA/NRCS developed a Conservation Practice Standard of treating poultry litter with alum.

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Demonstrated the impact of municipal wastewater treatment plants on nutrient sources in streams. Phosphorus pollution in streams located in Arkansas and Oklahoma is often attributed to runoff from fields fertilized with poultry litter. Scientists in the Unit traced high phosphorus levels in the Illinois River back to a municipal wastewater treatment plant, **proving that other sources of phosphorus were causing significant phosphorus pollution of area waterways**. Municipal wastewater treatment plants in Northwest Arkansas later adopted a one part per million limit on phosphorus discharges; partly as a result of this work.

Development of novel probiotics that target human food safety pathogens and improve poultry health (in cooperation with University of Arkansas researchers). These novel probiotic cultures (composed of healthy bacteria) target *Salmonella* and *Campylobacter* in the gastrointestinal system of poultry reducing these pathogens. This discovery was licensed to an Arkansas based start-up company. In the past year, **100 million turkeys and chickens were treated with the probiotic products developed through this partnership** and marketing was initiated internationally in 16 countries.

Photo courtesy of USDA-ARS image gallery

Developed the Arkansas Phosphorus Index. Scientists in the Unit led a team that developed the Arkansas Phosphorus Index from data obtained from hundreds of rainfall simulations conducted with various fertilizer and manure sources. This index is used to determine how much manure can safely be applied to pastures without causing a high risk of phosphorus runoff. **In 2001, Arkansas began using this index to write nutrient management plans for animal feeding operations.** This index provides a sound scientific basis for manure applications which are site specific.

Developed the Protective Rate of Poultry Litter and Commercial Fertilizers and the Protective Rate of Sewage Sludge for the State of Arkansas. The State of Arkansas passed several new laws in 2003 that affected poultry producers. One of these laws states that poultry litter and commercial fertilizers must be applied at the "Protective Rate" in eight watersheds deemed by the state to be nutrient enriched. The Arkansas Soil and Water Conservation Commission requested that scientists from our unit develop what these protective rates should be. A series of rainfall simulation studies were conducted which evaluated nutrient runoff from 17 different fertilizer sources. **Based on these results and predictions made using the Arkansas Phosphorus Index (which was also developed by our unit), the Protective Rates were determined.** This law should greatly improve water quality in Arkansas and other states, such as Oklahoma and Missouri, that have rivers which originate in Arkansas. In 2004, the State of Arkansas requested that scientists from the Unit also develop a protective rate for sewage sludge. Our scientists used methods described above to determine the amount of sludge that could be applied to land without causing serious environmental problems.

Understanding and alleviating stress in poultry production. Unit scientists have shown that stress in the first week of life can affect the disease resistance of adult turkeys and that behavioral stress response measurements of young turkeys can be used to predict adult disease susceptibility. Factors that cause variation in stress response, such as growth rate, sex, and age of parents have been reported. These new tools and methods to study the effects of stress in turkeys **will improve turkey welfare, disease resistance, and the safety of turkey food products**. Improvement of the turkey stress response will lead to a decrease in the usage of antibiotics for turkey production.

Elucidated mechanisms underlying poultry leg problems. Leg weakness that results in lameness and bone breakage is a serious economic problem for the poultry industry that is attributed to poor connective tissue growth and improper bone formation. These problems have caused in excess of **$200 million dollars loss** to the industry, which grows over 8 billion poultry annually. **Unit scientists have contributed significantly to the understanding of this problem and have developed methods to reduce bone weakness**.

Understanding immunity and disease resistance in poultry. Unit scientists devised methods to understand the basics of health and disease by developing cytokine and growth factors assay. Scientists also identified novel biomarkers and cellular components that detect subtle changes in the health of poultry flocks.

For more information about our research programs,
please log on to: **usdaars.uark.edu** or call: **(479) 575-2654**