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# BREEDING

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(Agronomy)



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## FOR YOUR INFORMATION

### ARKANSAS AGRICULTURAL EXPERIMENT STATION

Gerald J. Musick, Director

This year, 1988, the Arkansas Agricultural Experiment Station celebrates a century of service to Arkansas agriculture and to the people of Arkansas.

The theme of our Centennial observance, as illustrated by the special Centennial seal, is Commitment to the People of Arkansas. The problems that have been solved and that remain to be solved through Experiment Station research affect not only farm families, but thousands of non-farm households whose income is derived from an agriculturally-based industry such as food processing. The poultry industry, for example, provides more jobs and generates more revenue today than any other single industry in



the Arkansas economy. A strong agricultural sector undergirded by a strong Agricultural Experiment Station research program is vital to the economy of our state.

The *Commitment to People* theme also recognizes that it is the *people* who conduct Experiment Station research working with the *people* in the Arkansas Cooperative Extension Service who provide vital services to the *people* in agriculture, home economics, forestry and related industries.

As part of our Centennial observance, each issue of *Arkansas Farm Research* during 1988 will include a section of articles providing an overview of research conducted in support of specific Arkansas agricultural enterprises. This issue includes an overview of poultry research programs.

A redesigned cover is being unveiled with the first issue of the Centennial year. The new cover design and the Centennial seal

were created by Elaine Williams, AFR art director. The cover art for each issue will depict the enterprises featured in the Research Overview articles.

Other Centennial activities planned for 1988 include the following.

- A symposium will be held April 12-13 at the University's Center for Continuing Education in Fayetteville.

- A book on the history of the Station is being written by Dr. Stephen Strausberg of the University's history department.

- Centennial gardens consisting of plots of early varieties of cotton, rice and soybeans will be grown at several Experiment Station research units throughout the state.

- A feeding trial to illustrate improvements in animal nutrition will be conducted at the Experiment Station farm in Fayetteville.

- The University Museum in Fayetteville will feature a display on the history of agricultural research.

We are indebted to the Centennial Committee of Ray Barclay (chairman), Dr. C.J. Brown, Dr. Don Voth, Dr. Lloyd Warren and Wallace Williams. They have done an outstanding job of planning these special Centennial events and activities.

## ARKANSAS FARM RESEARCH

is a bimonthly publication of the Arkansas Agricultural Experiment Station, Division of Agriculture, University of Arkansas.

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### Editorial Staff

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**Elaine Williams**, Art Director

**Cover:** A new look for the cover is being unveiled with this first issue in the Experiment Station's Centennial year. The new cover was designed by Elaine Williams, art director. During the Centennial year, the cover of each issue will depict an enterprise undergirded by Experiment Station research, and a special "Research Overview" section in each issue will include articles on major research programs impacting on that enterprise. (Cover illustration by Corrinna Briggs.)

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## Poultry Research Overview

# BREEDING

N.R. Gyles

**P**oultry breeding research at the University of Arkansas and the commercial poultry industry in Arkansas have grown in parallel. During the 1930s, when broilers were marketed live and the Barred Plymouth Rock was the favorite breed, several experiments in crossbreeding for broiler production were conducted at the University. Broiler growers found that mating Barred Plymouth Rock males with New Hampshire females produced broilers with barred plumage that grew faster than the purebred Barred Rock. This was the first general introduction of crossbreeding to produce commercial broilers.

In the forties, the White Wyandotte breed became popular as the male parent for broilers in Northwest Arkansas. Research showed that rapid-feathering Wyandotte males produced superior crossbred broilers with cleaner-looking carcasses. Slow feathering allowed more unsightly "pin feathers" to remain on the carcass of broilers which were marketed in the forties primarily as New York dressed chickens instead of as live birds.

The fifties were a banner decade for poultry breeding. In 1951, the National Chicken-of-Tomorrow Contest—a landmark event in development of the poultry industry—was held at the University of Arkansas. Breeders of meat-type chickens from throughout the United States participated. A Red Cornish male parent line mated to a New Hampshire female parent line won the contest. The winning entry had set the breeding pattern of separate male parent lines and female parent lines that remains in place today.

In 1952, the University, in cooperation with the Arkansas Poultry Improvement Association and the National Poultry Improvement Plan, initiated the Arkansas Random Sample Meat Performance Tests as a sequel to the Chicken-of-Tomorrow contest. At the conclusion of the tests in 1971, the poultry houses were donated to the University and are still used for research. These tests fostered competition among meat-type poultry breeders who all

followed essentially the same strategy to produce a strain-cross broiler. The male parent strain was mostly of the Cornish breed excelling in rapid early growth rate and much fleshing on the breast, drumsticks and thighs, but very poor in egg production. The female parent strain was mostly the White Plymouth Rock breed having adequate early growth rate, good breast fleshing and egg production that was superior to the Cornish male parent strain.

Turkey breeding began to follow the lead of the broiler industry in the fifties. The Beltsville Small White turkey was developed by U.S. Department of Agriculture researchers. A Broad-Breasted Large White turkey developed by an Arkansas breeder became the prototype of large white breeds that replaced the Bronze turkey in commercial production. The Bronze was a domesticated wild turkey—the only animal indigenous to North America used as an important commercial meat product.

In 1959, Arkansas research pointed out that single comb chickens had slightly higher fertility and growth rate than pea comb chickens in the same population. Within a few years, a prominent breeder at a leading institution in the East confirmed this finding and changed the long-standing tradition of using the Cornish type pea comb of the male parent of the broiler to that of a single comb, which is now the industry norm.

A poultry breeding project was begun in 1965 on genetic selection primarily for feed conversion. The conventional procedure was to select for growth rate with no deliberate selection for feed conversion because there is a high positive correlation between growth rate and feed conversion. However, research at the University of Arkansas with turkey toms showed that toms of the same body weight do vary in feed converting ability. Assuming the same for chickens, males with outstanding feed-conversion and growth traits were used as breeders. This resulted in broilers with better feed conversion and an unforeseen associated benefit of reduced abdominal fat.

An on-going project in the poultry genetics program began in 1963 with experiments which indicated that a single pair of genes controlled the number of small tumors caused by inoculation of Rous sarcoma virus on the chorioallantoic membrane surrounding the chick embryo during incubation. Six-week-old chickens were challenged in the wing-web with Rous sarcoma virus. In susceptible chickens the tumor grew and the chickens died an average of 26 days after inoculation. In resistant chickens the tumor grew for awhile, stopped growing, then was reabsorbed with no blemish or scarring of

the tissue. Experiments with all combinations of matings between susceptible, regressor and negative responders showed that a single dominant gene was the probable cause of regression of Rous sarcomas.

In the seventies, crosses between Giant Jungle Fowl and White Leghorns were challenged with Rous sarcoma virus and those that regressed tumors were chosen as breeders. After six generations of selection, a Regressor Line of chicken was developed. Experiments to determine the role of the immune system in regression determined that removal from baby chicks of the thymus and Bursa of Fabricius caused a reduction of about 85 percent in the number of chickens that regressed tumors.

In the seventies, poultry breeders began crossbreeding both the male parents and female parents used in broiler production in order to gain benefits from heterosis particularly for the traits of reproduction and livability. Synthetic dominant white strain cross males were mated to synthetic strain cross females.

In the turkey industry, extreme selection for breast fleshing had produced some double breasted strains complete with a dimple in the middle during the seventies. Turkey breeding has in recent years produced great improvement in growth rate of heavily fleshed turkeys giving large meat-to-bone ratios. White plumaged turkeys mated by artificial insemination have taken over the entire production of turkey meat. Genetic selection for feed converting ability of individual turkey toms is now routine.

Broiler breeding research in the eighties has been aimed at genetic selection procedures to reduce abdominal fat. Studies revealed the surprising fact that adult male parents of broilers have no abdominal fat.

A comparison of 1950 and 1987 industry averages for broiler weight gain and feed efficiency illustrates the progress made through the combined efforts of private industry and public researchers. In 1950, broilers were marketed at 12 weeks of age weighing four pounds live weight with a feed conversion of 3.00 pounds feed per pound of live body weight. In 1987, broilers were marketed at six weeks and four days of age at the same four pounds live weight, and utilized only 1.97 pounds of feed per pound gain in live weight.

Dr. Gyles is a professor in the Department of Animal Sciences.



Gyles