Technical News

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# PRODUCING A QUALITY BROILER: A PRIMARY BREEDER'S PERSPECTIVE

*by Dr. John Hardiman, CVI Vice President of Research and Development*

From a primary breeder's viewpoint, the production of a quality broiler begins with the genetics of the parent breeding stock. Primary breeder companies like Cobb-Vantress specialize in the production and sale of male and female broiler breeder parents both in the United States and around the world. These birds have been selected for constantly improving breeder and broiler performance. The characteristics for which we select our pure line chickens are determined by the needs of the broiler industry. In fact, genetic improvements in broiler performance are made through the processes outlined in ***table 1.***

## IDENTIFYING INDUSTRY NEEDS

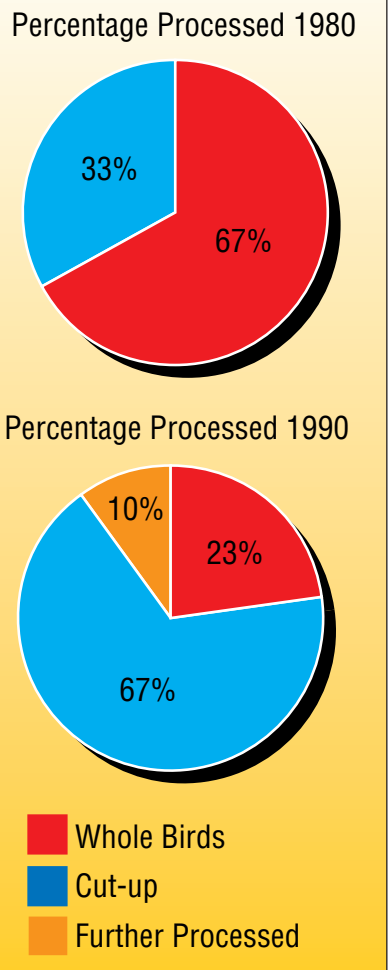
Determining the needs of the poultry industry requires passing information from the customer through the sales or the technical service people, back to the regional managers and company administration. Regional sales and technical conferences in the U.S., Europe, Asia, Africa and South America provide additional feedback to CVI's management.

In addition, our customers' needs are determined by the demands of their local markets. Worldwide, there has been a proportional decline in the number of processed whole birds and an increase in the amount of further processed broilers. Emphasis, therefore, has been switching from total pounds/kilos of meat to percentages of parts, and to percentages of light or dark chicken meat. For example, changes in types of processing are shown between 1980 and 1990 for the U.S. in ***table 2.*** Also, shortage of feed stuffs or the need to import costly feed ingredients can increase the value of feed conversion to a broiler grower. Similarly, shortage of broiler housing or high mortality rates can emphasize growth rate.

**Table 1: THE GENETIC PRODUCTION OF QUALITY BROILERS**

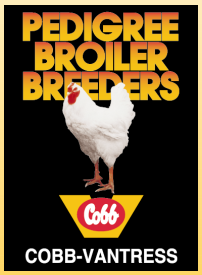
1. Identify industry needs.
2. Define selection traits.
3. Develop a modern pedigree program.
4. Set improvement goals.
5. Evaluate broiler performance.
6. Invest in basic research and research lines.

**Table 2: CHANGES IN TYPES OF BROILER PROCESSING IN THE U.S.**



## Table 3: BROILER SELECTION TRAITS IN PEDIGREE BROILERS

Growth Rate
Feed Conversion
Livability
Ascites Resistance
Heat Resistance
Eviscerated Yield
Part and Meat Yield
Carcass Fat
Leg and Skeletal Strength
Breast Conformation
Degree of Feathering
Feather and Skin Color




## DEFINING SELECTION TRAITS

Selection has traditionally been applied to the selection traits shown in ***table 3.***

These traits include growth rate or body weight at a fixed age, feed conversion, disease and heat resistance (livability), carcass fat, eviscerated yield, meat yield, and causes of condemns and downgrading including crooked legs, TD, crooked keels, breast blisters, degree of feather cover, and possibly black feathers and black pigment. Poultry breeders have been applying selection for these traits by carefully measuring them and then selecting outstanding individual birds from outstanding pedigree families. Unfortunately, not all aspects of broiler performance are heritable and some are so poorly heritable that improvements may take years. Examples include crooked legs and toes, and feather cover. Over time, new traits are added to the list of desirable broiler performance characteristics and recently these have included carcass leanness, deboned meat yields and resistance to ascites.

This list is likely to be expanded to include resistance to specific diseases (LL, Marek's, etc.), supply organ development (heart, lungs, intestines, etc.), additional forms of autosexing chicks, and selection for specific genes related to the major selection traits (growth rate, feed conversion, livability, egg production and yield).

## DEVELOP A MODERN PEDIGREE PROGRAM

Modern pedigree programs include the attributes listed in ***table 4.***

These include a short production pipeline from pedigree pure line to the grandparent level and to the customer, minimum generation intervals to maximize genetic progress per year, fully pedigreeing all lines to permit selection of the best families, computers and electronic scales for recording information, and selection of each line using statistics, breeding value estimation and computer applications such as bar coding, portable PC's and verbal recording. Selection for multiple traits per line requires carefully balanced selection within each pedigree line and strong overall selection pressures at broiler age (only 1% of males and 12% of females kept). Multiple flocks of each pedigree line may be maintained under annual or fast track reproduction schemes. Data collection procedures are rigid and of the highest priority. At Cobb-Vantress, they are accompanied

## Table 4: CHARACTERISTICS OF A MODERN PEDIGREE PROGRAM

- Short production pipeline from pedigree to customer.
- Minimum generation intervals.
- Fully pedigreed lines for family selection.
- Computerized data recording and summaries.
- Adherence to specific pedigree procedures (TQM).
- Multiple annual or fast track pedigree flocks.
- Strong selection pressures.
- Physical isolation and closure of farms.
- Strict biosecurity and company lab facilities.

by Total Quality Management programs. Stock safety is enforced by physical isolation of pedigree farms and by strict biosecurity programs designed to keep non-essential people, the principal carriers of disease, out of each farm. Few breeders risk their business and that of their customers by allowing visitors to their pedigree farms. Most primary breeders have well staffed, sophisticated laboratories equipped to perform all necessary quality control monitoring. Additional benefits are derived from replicating breeding programs and producing grandparent flocks in different countries to permit selection in the local environments.

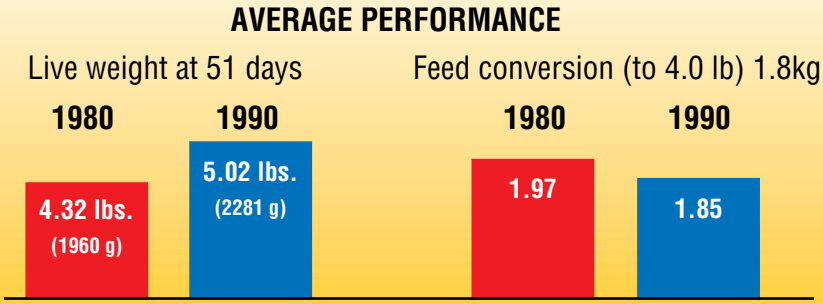
## SET IMPROVEMENT GOALS

In general, the broiler breeder industry has set goals for trait improvement reflecting customer demands and the economics of broiler growing. Typical goals are shown in ***table 5*** and these have been met or exceeded by one or more breeding companies in recent years. Rapid progress has been made in feed conversion, growth rate and meat yields between 1980 and 1990 ***(table 6).*** In fact, ***table 7*** shows CVI's expected changes in average broiler performance between 1990 and 1995 in the U.S. for 4.40 lb (2 kg) straight run broilers. Other broiler traits are often best measured in special research studies. For example, leg strength comparisons to six weeks of age are shown for male broilers in ***figures 1 and 2***. In addition, differences among broiler breeds in eviscerated yield and in part and deboned yields for 1993 are summarized in ***table 8.*** Changes in these latter two traits are the result of selection programs designed to improve skeletal strength and broiler meat yields.

**TABLE 5: FIVE YEAR GENETIC GOALS IN BROILER PERFORMANCE**

| TRAIT | IMPROVEMENT |
|---|---|
| Weight | 0.59 lbs (270 g) |
| Days To Market | - 5 DAYS |
| Feed Conversion | -.05 |
| Eviscerated Yield | +.5% OF LIVE WEIGHT |
| Breast Meat | +1.0% OF LIVE WEIGHT |
| Abdominal Fat | -.3% OF LIVE WEIGHT |
| Livability | +.5% |

**TABLE 6: IMPROVEMENTS IN BROILER GROWTH IN THE U.S.**




*Source: 1990 North Carolina State Universtiy Poultry Extension Survey.*

**TABLE 7: CVI PERFORMANCE FORECAST FOR 49 DAY OLD SR BROILERS**

| | Weight | | | |
|---|---|---|---|---|
| Year | Lbs. | Grams | FCR | Breast Meat (%) |
| 1990 | 4.50 | 2043 | 1.97 | 16.4 |
| 1991 | 4.62 | 2097 | 1.96 | 16.6 |
| 1992 | 4.74 | 2152 | 1.95 | 16.8 |
| 1993 | 4.86 | 2206 | 1.94 | 17.0 |
| 1994 | 4.98 | 2261 | 1.93 | 17.2 |
| 1995 | 5.10 | 2315 | 1.92 | 17.4 |
| or at 44 days | 4.50 | 2043 | 1.87 | 16.9 |

**Figure 1: Lameness in Broiler Males**

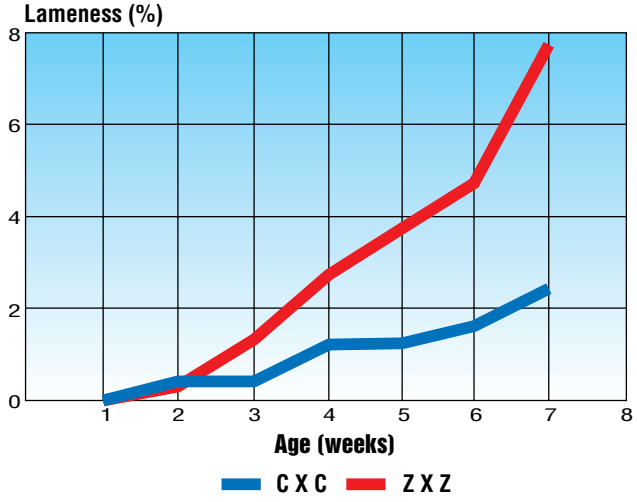
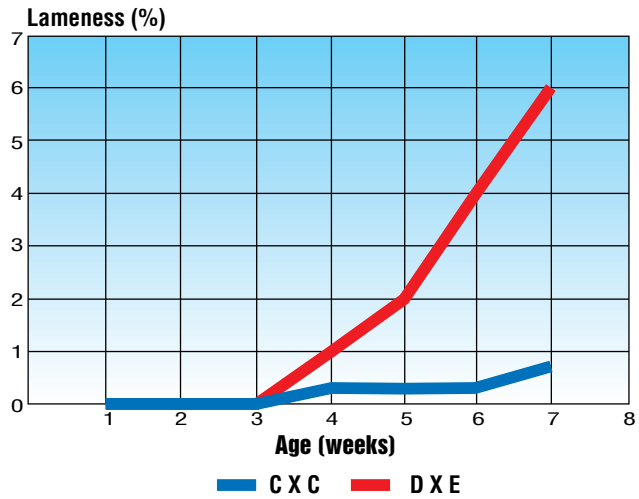



**Figure 2: Lameness in Broiler Males**




## EVALUATE BROILER PERFORMANCE

Broiler data is obtained by one of two methods. First is the collection and analysis of broiler performance by flock or location, and the compilation of these into a database for broiler cross comparisons. Large databases can be valuable for informing both breeder company management and for sales and marketing presentations to customers. Average broiler performance for 1992 for several major broiler breeds are shown in ***table 9.*** The second method is the conducting of small but carefully designed broiler trials. Testing under uniform conditions can identify small differences in broiler cross performance. Often this is the only reliable way of obtaining good information on part and meat yields. ***Table 10*** shows the results from typical broiler yield comparisons conducted in special broiler trial facilities in 1992.

## INVEST IN BASIC RESEARCH AND RESEARCH LINES

Most breeding companies contribute to poultry genetic research

**TABLE 8: DIFFERENCES IN BROILER YIELD AMONG BREEDS**

PERCENTS OF LIVE WEIGHT DEVIATIONS FROM REFERENCE BREED

| Cross | Yield | Breast Meat | Thigh |
|---|---|---|---|
| **Reference** | 68% | 17% | 15% |
| B X B | - .4% | - .5% | 0% |
| A X A | - 1.1% | - 1.6% | 0% |
| D X A | - 1.5% | - 1.8% | - .2% |
| D X G | - 1.5% | - 1.9% | - .1% |
| D X E | - .8% | - 1.5% | - .2% |

**TABLE 9: COBB 1992 U.S. BROILER DATABASE**

BROILERS AT 4.0 LB. (1.8 kg) LIVE WEIGHT

| Cross | Placed | Livability | Feed Conv. | Cond. | Cost$ |
|---|---|---|---|---|---|
| | (Million) | (%) | | (%) | Lb/kg |
| C X C | 7.8 | 96.5 | 1.85 | .60 | .197/.434 |
| B X B | 9.3 | 96.4 | 1.88 | .50 | .198/.436 |

BROILERS AT 4.40 LB. (2.2 kg) LIVE WEIGHT

| Cross | Placed | Livability | Feed Conv. | Cond. | Cost$ |
|---|---|---|---|---|---|
| | (Million) | (%) | | (%) | Lb/kg |
| C X C | 1.0 | 97.6 | 2.06 | .28 | .175/.386 |
| D X A | 4.1 | 97.5 | 2.06 | .24 | .176/.387 |
| D X G | 8.4 | 97.4 | 2.07 | .21 | .176/.387 |

## TABLE 11: BREEDER INVESTMENTS IN RESEARCH

Lymphoid Leukosis Eradication
Disease Resistance Studies
Skeletal and Leg Strength
Live Bird Evaluation of Yield and Fat
Ascites Syndrome and Broiler Growth
Heat Resistance
Skin Strength
A.I. Research
DNA Fingerprinting
Gene Marker Assisted Selection
Transgenic Poultry

through taxes paid to government agencies, contributions to University research programs, and projects with University or industry researchers. In addition, some breeding companies conduct their own basic research. Examples ***(table 11)*** include LL eradication, Marek's disease resistance studies, live challenge studies, blood group analysis, new methods for evaluating live carcass quality, leg strength and skeletal studies, A.I. research, ascites research, DNA fingerprinting and its applications. Of course, some of these ideas can only be tested in new research lines of pedigreed chickens and this requires the breeder to devote 20% or more of his time and profits to research and development of new lines.

### CONCLUSION

In summary, broiler quality is limited by the quality of the broiler breeding parent stock. Primary breeders must be diligent in identifying the characteristics of greatest economic importance, finding methods of selecting for these traits, using modern pedigree procedures, setting progress goals,

## Table 10: CVI BROILER TRIAL

### Average Broiler Performance

| | Age | "A" | C500 x C500 | "C" | "D" |
|---|---|---|---|---|---|
| **Farm Weight** | 48 days | 5.37 lbs. (2438g) | 5.52 lbs. (2506g) | 5.32 lbs. (2415g) | 5.13 lbs. (2329g) |
| **Feed Conversion** | 48 days | 1.87 | 1.89 | 1.89 | 1.89 |

### Processing Results (Dry Yield) at 49 Days of Age

### Average Yields by Broiler Cross

| | % Of | "A" | C500 x C500 | "C" | "D" |
|---|---|---|---|---|---|
| **Plant Weight** | | 5.32 lbs. (2415g) | 5.44 lbs. (2470g) | 5.25 lbs. (2304g) | 5.05 lbs. (2293g) |
| **Eviscerated Weight** | | 3.53 lbs. (1603g) | 3.66 lbs. (1662g) | 3.46 lbs. (1571g) | 3.33 lbs. (1512g) |
| **Front Half** | WOG | 51.65% | 53.00% | 51.75% | 51.60% |
| **Eviscerated Yield** | Live | 66.37% | 67.50% | 65.99% | 65.96% |
| **Breast Meat** | Live | 14.35% | 15.99% | 14.18% | 14.07% |
| **Thighs (Bone In)** | Live | 15.75% | 15.68% | 15.50% | 15.56% |
| **Drumsticks (Bone In)** | Live | 9.91% | 9.70% | 9.79% | 9.84% |
| **Wings** | Live | 8.22% | 8.05% | 8.25% | 8.18% |
| **Fat** | Live | 2.37% | 2.35% | 2.43% | 2.33% |
| **Cage** | Live | 9.44% | 9.31% | 9.38% | 9.47% |
| **Back** | Live | 6.44% | 6.41% | 6.52% | 6.57% |

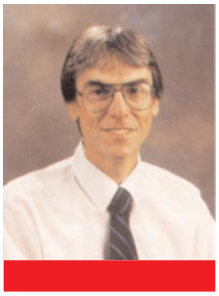
evaluating field broiler performance and investing in research lines. Responsible breeding policies maximize the chances of survival and growth for billions of broilers subjected to the dazzling variety of disease organisms, feed rations, housing types, climates and management schemes of our world poultry industry.

## About the Author:

Dr. John Hardiman, Vice President of Research and Development for Cobb-Vantress since 1986, has been responsible for the development and improvement of CVI products, which include the Cobb 500. He is also responsible for research line programs designed to produce future CVI products and is in charge of CVI's Broiler Evaluation Program.

Dr. Hardiman remains very active in the industry. He is Past President of Poultry Breeders of America, is on the Technical Advisory Committee of the Arkansas Poultry Federation and is an active member of the Poultry Science Association, the American Association of Animal Science and the Council for Agricultural Science and Technology.

Prior to joining CVI in 1986, Dr. Hardiman was the geneticist for Tyson Foods, Inc. and was responsible for both swine and poultry genetics. Dr. Hardiman has participated in numerous CVI seminars both here and abroad.



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