

Animal Research—A Look at the Future

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Thanks to efforts of the many researchers and extension specialists who have provided livestock producers with the latest information, livestock production in the United States has become highly productive and efficient. The ability of U.S. farmers and ranches to provide consumers with plentiful quantities of highly nutritious food at a low cost is a success story that many other countries are currently attempting to duplicate. This miracle of success had its beginnings with the act of Congress that established the Land Grant colleges. This far-sighted legislation laid the framework for a research and education system that provided the necessary ingredients for the development of the present day animal industry.

Improvements in Productivity and Efficiency

Table 1. Productivity Gains in Livestock Production.^a

Animal Item	1925	1950	1975	Attainable Production ^b
Laying hens				
Egg/hen/yr	112	174	232	260
Feed/dozen eggs, lb	8.0	5.8	4.2	3.8
Broiler chickens				
Age at market, weeks	15.0	12.0	7.5	7.0
Weight at market, lb	2.8	3.1	3.8	4.2
Feed/lb gain, lb	4.0	3.3	2.1	2.0
Turkeys				
Age at market, weeks	34	24	19	18
Weight at market, lb	13.0	18.6	18.4	19
Feed/lb gain, lb	5.5	4.5	3.1	2.8
Dairy				
Milk/breeding female/yr, lb	4,189	5,313	10,500	19,000
Beef				
Live beef/breeding female/yr, lb	220	310	482	900
Swine				
Live pigs/breeding female/yr, lb	1,600	2,430	2,850	4,000
Sheep				
Live lamb/breeding female/yr, lb	60	90	130	240

^aCAST (1980). Foods from animals. Report No. 82.

^bProductivity attainable with reasonable application of technology available in 1987. Values provided by author of the present paper.

Presented in table 1 are data that vividly illustrate improvements in productivity and efficiency that have occurred in livestock production since 1925. During the

period since 1925, egg production per hen has increased 107%, daily gain of broilers has increased from 12 to 33 g and daily gain of turkeys has increased from 25 to 63 g. During the period from 1925 to 1975, feed per unit of poultry production has been cut nearly in half.

Similar improvements in efficiency have occurred in the production of red meat and milk—amounts of these products produced per breeding female more than doubled (except for hogs) during the period from 1925 to 1975.

Also listed in table 1 are levels of production that are attainable using technology available in 1987. These data further illustrate tremendous productivity that is possible because of advances in animal management, nutrition, genetics, reproduction and health.

Reasons for Improved Efficiency and Productivity

Nutrition. Improved nutrition and feeding systems have been major factors in improving livestock productivity. Some of the major nutrition advances are:

- a. discovery of vitamins
- b. knowledge of ruminal nitrogen metabolism
- c. knowledge of mineral requirements
- d. development of accurate energy systems
- e. complete knowledge of feed composition
- f. development of practical feeding systems
- g. knowledge of effects of feed processing
- h. general use of balanced and least cost rations
- i. well trained industry nutritionists
- j. knowledge of amino acid requirements

Genetics. Today's animals have much greater genetic potential for production than those of 50 to 75 years ago. A few of the developments that have led to the genetic improvement of livestock are:

- a. development of quantitative genetic theory
 1. most traits controlled by multiple genes
 2. concept of genetic variance
 3. concept of heritability
- b. development of selection and mating systems
- c. DHI
- d. sire rankings (breeding value)
- e. knowledge of crossbreeding

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Reproduction. No list of advances in livestock production would be complete without consideration of reproduction. Major advances include:

- a. artificial insemination
- b. frozen semen
- c. national breeding organizations
- d. super ovulation and embryo transfer

Management. A large part of the productivity of livestock is due to improvements in animal management.

- a. Improved housing and facilities
- b. record systems and their use
- c. waste management
- d. development of effective vaccines
- e. potent antibiotics
- f. availability of veterinarians
- g. effective anthelmintics
- h. sanitation of livestock and milk handling facilities
- i. control of mastitis
- j. replacement heifer raising programs
- k. environmental control (light, temperature)

Thus, a multitude of factors have helped shape today's animal agriculture and make it a highly efficient system. It would be difficult to determine which of the above items have had the greatest impact on milk production. All of them have been important.

Some Challenges For The Future

Animal agriculture is faced with many challenges; the outcome of these challenges will have a dramatic effect on the future of livestock production.

Diet-health. Consumers are constantly told that animal products contain too much fat, are high in saturated fatty acids, are high in cholesterol and contain too many calories. Animal products are claimed to lead to heart problems, cancer and obesity. As far as its impact on consumers is concerned, the truth may not be of major concern. If people are told frequently that consumption of a given food is a risk to their health and life, they're likely to change their eating habits. Someone once said that a rumor finds its way around the world while a fact is still getting its shoes on. Has this happened in regard to animal foods? Has consumer demand for animal foods weakened because of these claims? Does commodity advertising counter these claims? Will tailor-made animal products increase the demand for foods based on animal products? Answers to these questions will have a major effect on our animal industry.

Over production. Improved technology has resulted in an agricultural production system that is highly productive—given the economic incentive we could produce much more food than currently. In fact, over production frequently results in low prices and economic

stress for U.S. farmers. This author doubts if projected increases in world population will solve the productivity—consumption dilemma in the U.S. Thus, in the near future it is likely that we will continue to have cyclic changes in prices received by farmers.

Animal welfare. The concern by well-meaning, but frequently naive, groups for the well-being of farm animals may result in restrictions that impact on animal productivity. It is possible that legislative regulations will influence our ability to conduct much needed research and may reduce the efficiency of livestock production. The outcome of animal welfare concerns will surely have an impact on animal agriculture.

Energy supply. Fossil fuels are presently in adequate supply. But, how long will this supply last? Coal is apparently abundant, while petroleum reserves are limited. The ability of engineers and farmers to adjust to reduced supplies and increased costs, in the long term, for energy will have a big influence on the ability of the U.S. to maintain its agricultural productivity. If high cost energy results in reduced land in grain crops or to lower yields, diets of farm animals may change from those based largely on grains to diets based on forages. Thus, energy supply alone may result in greatly reduced productivity of animals and to changes in dominant species.

Chemicals in food. Chemicals and drugs are used in the production of both crops and livestock and are added to processed food for a variety of reasons. Many people have expressed concern over the use of antibiotics, growth promotants, insecticides and a variety of other materials that are introduced to animals through their feed. We are likely to see increased restrictions on the use of antibiotics and growth promotants. Alternative production systems will need to be developed if this occurs, but in any event, the productivity of animals will likely decline.

Water Supply. In the long term, water supply (reduced irrigation) will likely have a limiting effect on crop production. When this occurs, grain production will decline and animal diets will shift to a greater dependence on forages.

Soil conservation. The need to preserve our soil resources for future generations may result in legislation or incentives that limit row crop production on marginal land. Such actions may result in increased cost of grain—another factor that would change diets and productivity of animals.

The Future

Despite the general lack of clarity of crystal balls, the following list is offered as one view of what the future may hold for animal agriculture.

The industry

- a. fewer, larger farms
- b. continued low margins
- c. increased focus on total system analyses
- d. increased use of computers for business and animal management
- e. increased control of drugs
- f. more labor saving robotics
- g. many more consultants
- h. extension—the average farmers consultant

Nutrition

- a. rapid (infield) feed analyses
- b. improved nutrient availability
- c. improved feed efficiencies
- d. predigested feeds to allow feeding of crop residues to nonruminants
- e. increased use of premixes
- f. all feeds analysed
- g. diets formulated to meet requirements—no “safety” factors
- h. super bacteria as feed treatments

Genetics

- a. selection for disease resistance
- b. selection for true improvement in feed efficiency
- c. selection for higher quality animal products
- d. the age of molecular genetics.

Animal products

- a. closer attention to demands of consumers
- b. lower fat content of animal products
- c. eggs with less cholesterol
- d. new animal food products
- e. more fish farming

Reproduction

- a. an exciting field
- b. improved embryo freezing
- c. freezing of sperm from all species
- d. maturation of ova from ovaries
- e. in vitro fertilization
- f. embryo cloning
- g. sexing of embryos
- h. sex management
- i. a few super females
- j. more offspring per female
- k. two lamb crops per year

Animal health

- a. monoclonal antibodies
- b. dip stick detection systems
- c. more effective vaccines
- d. general control of major infectious diseases

Growth

- a. regulation of growth
 - 1. slowed protein turnover
 - 2. small females, offspring regulated for rapid growth
 - 3. nutrients repartitioned from fat to muscle
 - 4. control of muscle cell numbers
 - 5. regulation of an animal’s hormone production

Summary

Animal agriculture has undergone many changes in the last 50 years. We now have an industry with tremendous food-producing capability. Much of this productivity is due to technological advances provided by university and industry scientists. Research techniques that have been developed in the last 5 to 10 years will result in even greater changes in our livestock industry in the next 15 to 20 years.

Condolence

We extend our deepest sympathy to the family of Mr. Harold Case who passed away on Friday, November 4, 1988 age 54. Mr. Case was the general manager of Frontier Printers, Stillwater, Oklahoma where *The Bovine Practitioner* and the *Proceedings* are printed.

Mr. Case was an exceptionally hard working, dedicated and devoted gentleman who “went the extra mile” in the service of his clients. He will be greatly missed by those of us who were privileged to work with him: Editor.