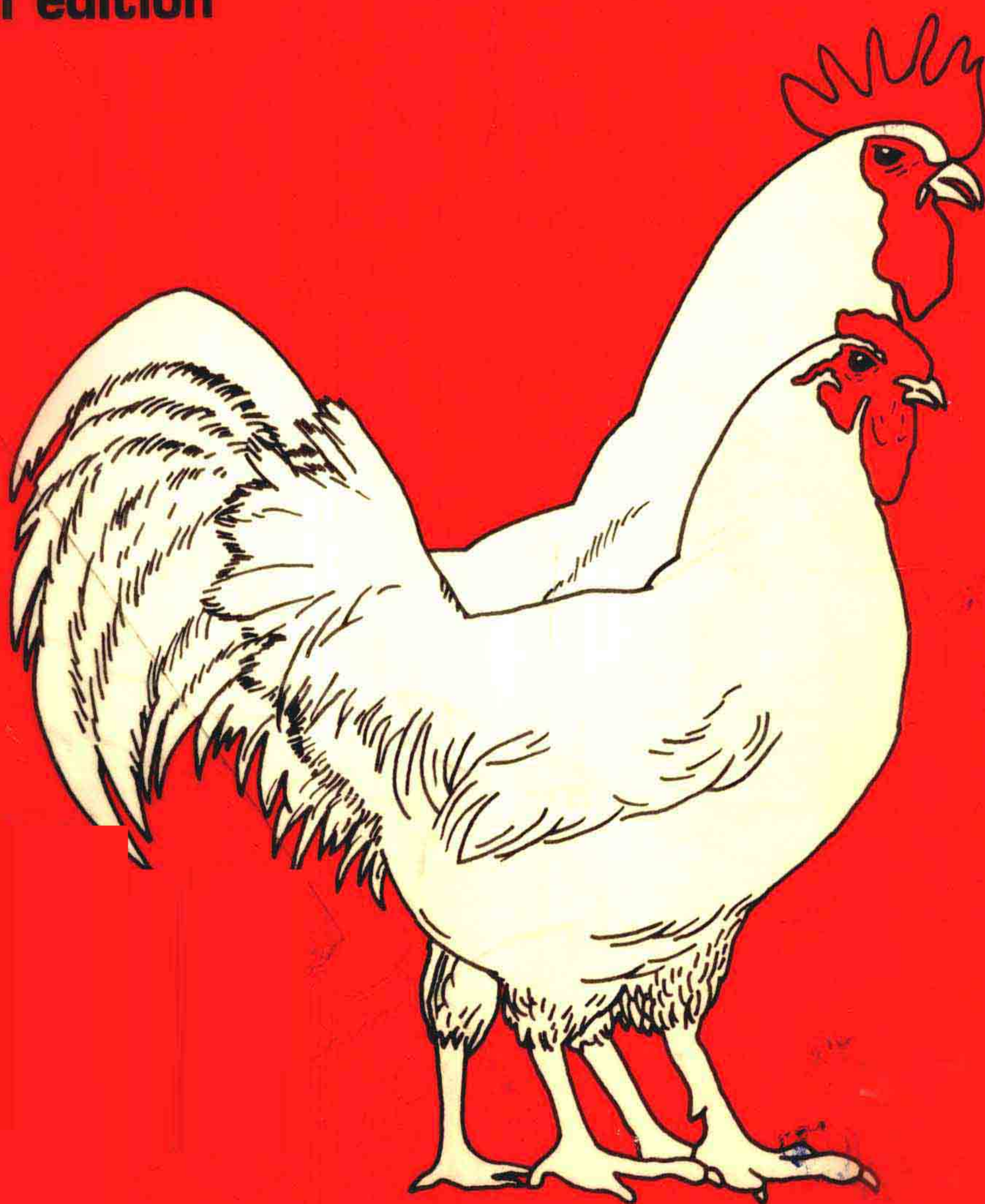


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POULTRY PRODUCTION

thirteenth edition



Poultry Production

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Preface

Poultry Production is a textbook for students interested in an introduction to the science and practice of the production of poultry meat and eggs. The thirteenth edition marks the first time in the history of the text that material on turkeys has been included. This expansion reflects the emergence of turkey production as a major facet of the poultry industry.

The addition of information about turkeys has required the elimination of some material included in previous editions. One of the most obvious changes is the deletion of the section on the business of poultry keeping. This change is appropriate in view of the evolution in industry structure away from independent farm businesses toward large, vertically integrated poultry firms in which profitability is not a simple element of the total farm enterprise.

We have continued to stress fundamental principles in poultry production and have not attempted to provide details of all aspects of poultry production. We hope that the book will provide the reader with an overview of poultry biology, the poultry industry, and the practices needed to ensure the successful operation of a poultry enterprise.

The thirteenth edition of *Poultry Production* reflects the contributions of many individuals. Although the late Dr. Leslie E. Card did not participate in the current edition, his earlier contributions continue to be evident in the organization and subject matter of this edition. Many other individuals and organizations have supplied materials for this revision, and we are grateful for their help.

Ithaca, New York

R.E. AUSTIC, Ph.D.
M.C. NESHEIM, Ph.D.

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Poultry Production

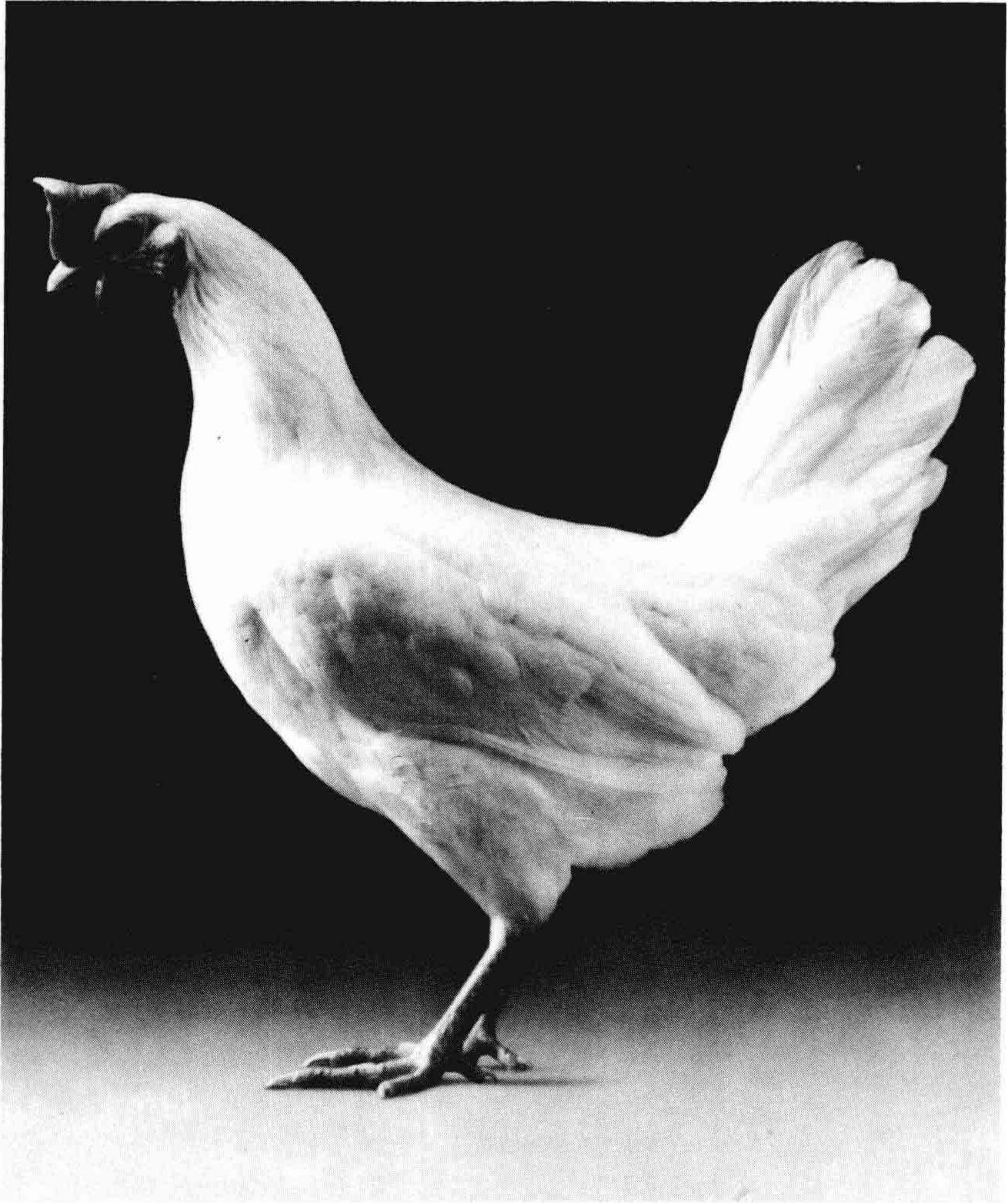


Fig. 1-1. A modern white leghorn layer, the primary egg producer in today's poultry industry. (Courtesy Shaver Poultry Breeding Farms Ltd.)

1 || *The Poultry Industry*

The production of poultry in the United States and generally throughout the world is carried out by a highly specialized industry that has been a leader in the major trends of scale, industrialization, and efficiency that have taken place in agriculture over the past half century. Few other agricultural industries have shifted as rapidly and completely from small scale, nonintensive production units to large, highly specialized intensive units as has the poultry industry. Such changes have caused rapid shifts in geographic distribution, organization, and marketing patterns of poultry production.

The total number of chickens produced in the United States annually amounts to more than 5 billion. Chickens are kept for two separate purposes: the production of poultry meat and the production of table eggs (Figs. 1-1, 1-2). The organization and methods used by these two aspects of the poultry industry are different, and generally commercial table egg production and broiler production are carried out by separate enterprises. The production of turkeys is a rapidly developing sector of the poultry industry. More than 240 million turkeys are produced annually in the United States. The organization of this sector is similar to that of the broiler industry.

The poultry industry in the United States, through the production of eggs, broilers, and turkeys, accounted for 12 billion dollars in gross farm income in 1986.

Chicken Meat Production

Commercial broiler and turkey production accounts for 79% and 17%, respectively, of the poultry meat produced in the United States. This is in marked contrast to the era in poultry production when poultry meat was largely produced from spare cockerels, whose sisters became laying flock replacements, and from hens culled from the laying house. In 1934, when the U.S. Department of Agriculture (USDA) began reporting commercial broilers separately from farm-raised chickens, 4% of total chicken meat was produced as broilers. The growth of the commercial broiler industry has been spectacular, as shown by the data in Table 1-1.

To a considerable extent the modern broiler industry developed by rapid application of technology in several areas of poultry production including breeding, feeding, housing, disease control, and management practices that enabled large concentrations of poultry to be raised in close confinement.

The broiler industry is a highly integrated industry in which most of the steps in the production process are controlled by a single firm. The various components of broiler production are shown in Figure 1-3. A hatchery, breeder flocks, feed mill, processing plant, and a number of contract growers served by technical service staff make up a typical integrated broiler company. Nearly

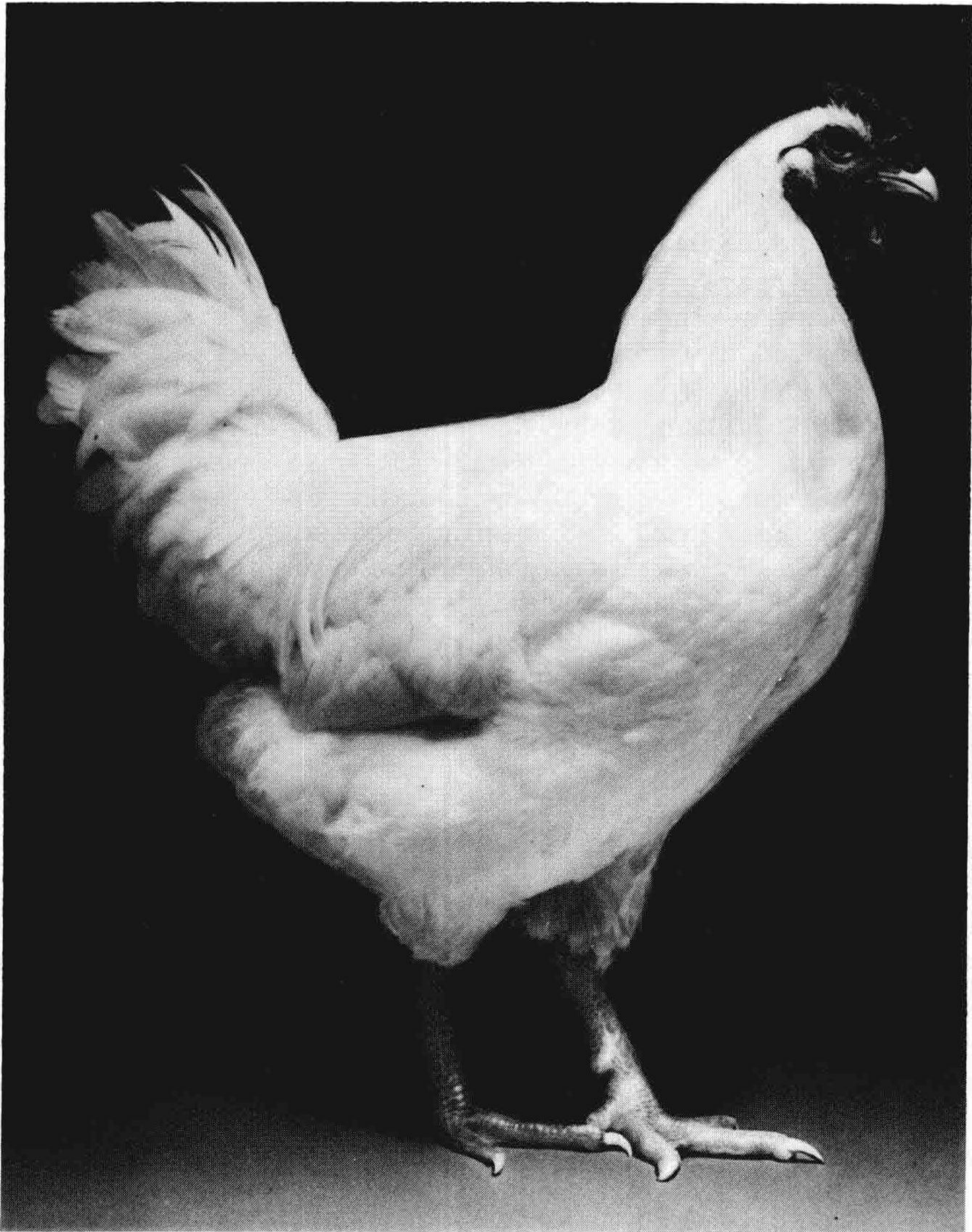


Fig. 1-2. Legend on facing page.

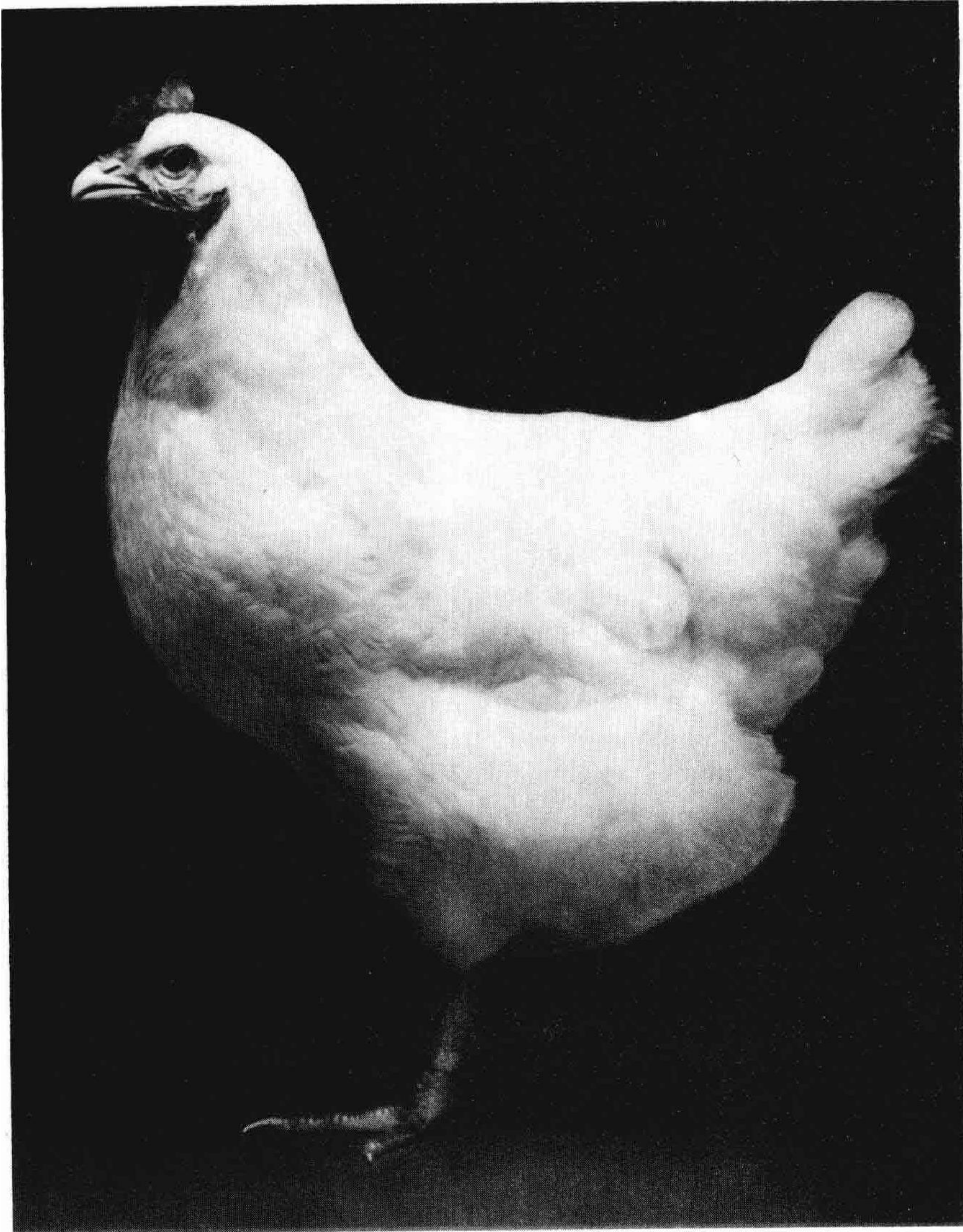


Fig. 1-2. The offspring of broiler breeding stock of this type produce the broilers for today's market. (Courtesy Shaver Poultry Breeding Farms Ltd.)

Table 1-1. Broiler Production in the United States (1934-1987)

Year	Number (millions)	Gross Income (million dollars)
1934	34	19
1940	143	72
1950	631	533
1960	1795	1014
1970	2987	1475
1980	3963	4303
1987	5003	6176

Data from the U.S. Department of Agriculture.

99% of commercial broilers are raised by integrators or by growers under contract to a broiler firm. Many are large production units. Farms producing more than 100,000 broilers account for more than 80 percent of total broiler production.

Broiler production is concentrated in relatively few states, most of which are located in the South. According to recent data, the ten leading states in broiler production (Table 1-2) account for about 84% of the broilers produced in the United States.

Turkey Production

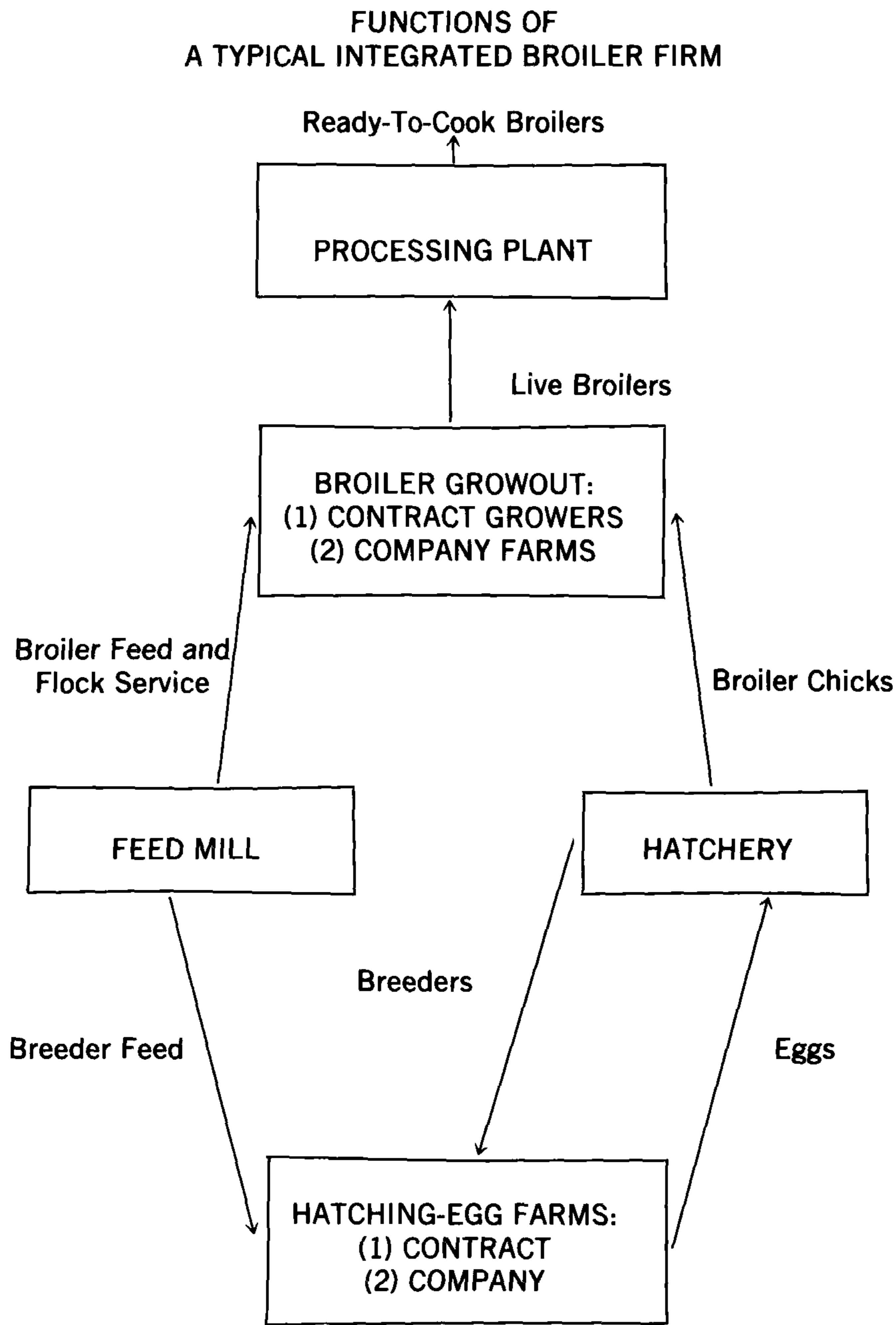
The turkey industry, which was eclipsed by the spectacular growth of the broiler industry, has undergone remarkable growth of its own. Turkey production has nearly doubled in the past two decades and accounts for 17% of all poultry meat produced in the United States (Table 1-3). Increasing in size by several percent per year, the turkey industry is one of the most rapidly growing sectors of the poultry industry (Fig. 1-4).

The production of turkeys was once based on small farm enterprises, located largely in the North Central states and California. The turkey industry has shifted in its geographic distribution under the influence of the same factors that caused the concentration of broiler production in the more southern states. Minnesota continues to be a major site of turkey production. However, North Carolina has recently ranked first in turkey production and several other states

Table 1-2. The Ten Leading States in Broiler Production (1987)

	Broilers (thousands)	Share of U.S. Production (percent)
Arkansas	878,574	17.6
Georgia	733,417	14.6
Alabama	666,538	13.3
North Carolina	477,700	9.5
Mississippi	343,395	6.9
Maryland	264,196	5.3
Texas	259,000	5.2
Delaware	209,818	4.2
California	196,120	3.9
Virginia	154,036	3.1
Ten-state total	4,182,794	83.6
United States total	5,002,934	

Data from the U.S. Department of Agriculture.



USDA

NEG. ERS 8235-77 (7)

Fig. 1-3. Organization of the broiler industry. (Courtesy of the U.S. Department of Agriculture.)

Table 1-3. Turkey Production in the United States (1935-1987)

<i>Year</i>	<i>Number (millions)</i>	<i>Gross Income (million dollars)</i>
1935	20	59
1945	42	245
1955	65	329
1965	106	424
1975	124	793
1985	185	1819
1987	240	1701

Data from the U.S. Department of Agriculture.

in the top ten (Table 1-4) have achieved this status in the past several years. The top ten states accounted for 83% of U.S. turkey production in 1987.

The turkey industry shares many organizational features of the broiler industry, and has become increasingly integrated as owner-integrated and contract production units account for greater than 80% of all production. Another 10% of production is carried out through contract marketing, in which production occurs in response to a contracted arrangement with a buyer.

As in the broiler industry, large firms account for most of the turkey production. According to the U.S. Department of Agriculture, 96 percent of all turkeys sold in 1982 were grown on fewer than one-third of all farms reporting sales of turkeys. More than half of the production was carried out by farms producing more than 100,000 turkeys annually.

Egg Production

Egg production has undergone extensive change in the past four decades. Forty years ago, egg production was centered either in the Corn Belt states where small farm flocks produced most of the table eggs, or near population centers where eggs could be produced to supply large urban markets. During the 1960s and into the 1970s the industry underwent a major geographic redistribution in which the South and Southeast became the areas having the largest population of laying hens.

The West North Central states declined in egg production and the South Atlantic, South Central, and Pacific regions shifted from egg importing regions to egg exporting regions during the last 25 years. The Northeast, East North Central, and Mountain states historically have been, and continue to be, the major importing regions in the U.S.

The shift of egg production toward the South and Southeast probably was caused by the same factors that led to the expansion of broiler and turkey production in these areas: favorable costs for land, labor, and housing (because of the mild climate), favorable feed costs, and lower real estate taxes are among others.

Since 1980, egg production has shifted slightly away from the South with the North Atlantic and North Central states gaining an increasing share of U.S. production.

This shift may indicate that the economic advantages of the South have diminished in the past several years.

The ten leading egg producing states are shown in Table 1-5. In 1955, Iowa

Table 1-4. Ten Leading States in Turkey Production (1987)

	<i>Turkeys (thousands)</i>	<i>Share of U.S. Production (percent)</i>
North Carolina	48,350	20.1
Minnesota	40,500	16.8
California	25,500	10.6
Arkansas	18,000	7.5
Virginia	16,200	6.7
Missouri	15,500	6.4
Indiana	13,000	5.4
Iowa	8,500	3.5
Pennsylvania	8,000	3.3
Wisconsin	5,450	2.3
Ten-state total	199,000	82.6
United States	240,349	

Data from U.S. Department of Agriculture.

was the major egg producing state; but is no longer among the leading states. Only California, Pennsylvania, Indiana, and Texas were in the top ten states in both 1955 and 1985. Total production of eggs in the United States has changed relatively little during the past 30 years, despite an increase in the U.S. population of over 70% during that time (Table 1-6).

The number of farms keeping poultry has declined rapidly during the past 25 years. According to the recent census of agriculture, there are approximately 212,000 farms in the United States with hens of laying age. "Farm" in this context applies from the smallest production units which have flocks of fewer than 100 hens to those having greater than 100,000. Over 95% of U.S. farms have fewer than 3,200 hens while fewer than 1% have 50,000 or more hens. Ninety-seven percent of all laying hens are found on farms with flock sizes of 3,200 or more. Nearly 40% of all hens are owned by large companies that have flocks of greater than 1 million hens.

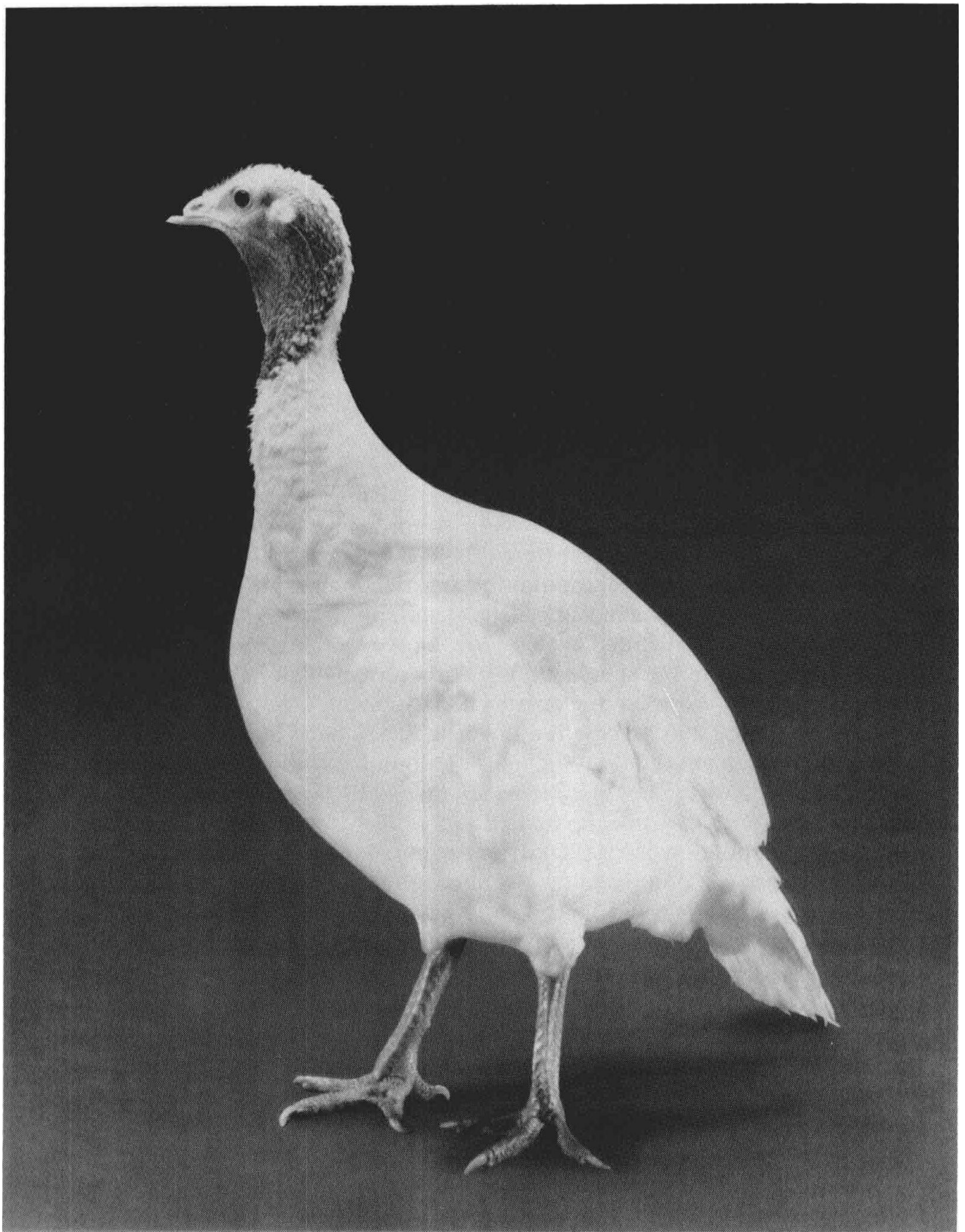
The farm production of eggs is only one component of a multifaceted industry which provides egg products to consumers. The individual components of the egg industry are shown in Figure 1-5.

Increasingly, many functions involved in egg production are being consoli-

Table 1-5. Ten Leading States in the Production of Eggs (1987)

	<i>Average No. Layers During Year</i>	<i>Eggs Produced (millions)</i>	<i>Share of U.S. Output (percent)</i>
California	33,376,000	8,023	11.5
Indiana	22,178,000	5,750	8.3
Pennsylvania	18,266,000	4,853	7.0
Georgia	18,407,000	4,476	6.4
Ohio	16,662,000	4,351	6.3
Arkansas	16,084,000	3,874	5.6
Texas	14,347,000	3,424	4.9
North Carolina	13,886,000	3,251	4.7
Alabama	11,018,000	2,605	3.7
Florida	10,361,000	2,564	3.7
Ten-state total	174,585,000	43,171	62.1
United States	280,475,000	69,492	

Data from U.S. Department of Agriculture.



Hen

Fig. 1-4. Legend on facing page.



Tom

Fig. 1-4. A modern breeder hen and tom used in the commercial production of turkeys. (Courtesy of Hybrid Turkeys, Inc., Kitchener, Ontario, Canada.)

Table 1-6. Egg Production in the United States, (1940-1987)

<i>Year</i>	<i>Average No. Layers During Year</i>	<i>Rate of Laying (no/hen)</i>	<i>Eggs Produced (millions)</i>	<i>Gross Income (thousand dollars)</i>
1940	392,655	134	39,695	582,211
1945	369,430	152	56,221	1,751,381
1950	339,540	174	58,954	1,772,571
1955	309,297	192	59,526	1,954,746
1960	295,284	209	61,602	1,848,389
1965	301,053	218	65,560	1,840,650
1970	312,922	218	68,282	2,223,608
1975	278,101	232	64,626	2,819,275
1980	287,705	242	69,686	3,267,563
1985	276,680	247	68,407	3,252,519
1987	280,482	248	69,492	3,177,043

Data from the U.S. Department of Agriculture.

dated so that they are carried out by an individual integrated firm or by several firms that have entered into contracts to carry out various functions of egg production. The USDA recently estimated that nearly 90% of the eggs produced involve integrated production or some contract arrangement at the production or marketing level. Individual integrated firms also are important in egg production, as more than 37% of commercial egg production is carried out by large-scale integrated operations.

The concentration of the industry has occurred for several reasons. The technology for large-scale production is readily available and quite successful. The declining per capita consumption of eggs has placed considerable economic pressure on the egg industry and has forced changes that have resulted in increased efficiency that can be achieved through changes in scale and industry organization.

The trends of increased concentration and increased scale of poultry production have resulted in considerable increases of labor productivity. The data in Table 1-7 show that in 1940, 145 million hours were spent on farm production of poultry meat and eggs, whereas in 1980, only 23 million hours were spent. This is equivalent to a reduction in labor force employed on a full-time basis from about 70,000 to about 11,000 in spite of the fact that total production of poultry meat and eggs has increased greatly since 1940.

The U.S. Department of Agriculture has estimated that from 1945-1949 to 1976-1980, the labor required to produce 100 eggs decreased from 1.5 to 0.2 hours, and the labor needed to produce 100 pounds of broilers and turkeys decreased from 5.1 hours and 13.1 hours, respectively, to 0.1 and 0.4 hours. The labor efficiency of egg production has increased 7.5 fold, and the labor efficiencies of broiler and turkey production have undergone enormous increases of 51 and 33 fold, respectively.

Production Costs

The costs of producing poultry and eggs are reflected in recent figures used by the U.S. Department of Agriculture statisticians in their attempts to develop mathematical models to predict costs and returns in the poultry industries.