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TURKEY PRODUCTION

Agriculture Handbook No. 393

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TURKEY PRODUCTION

By

Stanley J. Marsden

Agriculture Handbook No. 393

Agricultural Research Service

UNITED STATES DEPARTMENT OF AGRICULTURE

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TURKEY PRODUCTION

BY STANLEY J. MARSDEN, *collaborator*, Animal Science Research Division,
Agricultural Research Service

INTRODUCTION

Turkeys are adaptable to a wide variety of climatic conditions and can be raised successfully almost anywhere in the world if their nutritional requirements are met and protection is provided against diseases, predatory animals, and adverse weather conditions.

Turkey Industry of the United States

Raising turkeys has long been a profitable farming operation in the United States, extending to all major areas of the country. Small farm flocks of turkeys have practically disappeared and have been replaced by larger flocks of from 1,000 to as many as 10,000 birds. Several of these flocks may be found on one farm or ranch, which may produce 50,000 to 100,000 birds per year. Although the majority of turkeys are still raised on range, confinement rearing is increasing rapidly. The turkey industry* [1] has grown from 18,476,000 turkeys raised in 1929, which produced a gross income of $60,027,000, to 116,538,000 raised in 1966, which produced a gross income of $485,725,000. In 1967, about 126,577,000 turkeys were raised but because of lower prices received, produced a smaller gross income of about $459,528,000. In 1968, about 106,419,000 turkeys were raised, which produced a gross income of about $414,629,000. In the long run, further moderate growth of the industry is expected.

Although raising turkeys for market is the largest phase of the industry, the breeding of turkeys, the production of hatching eggs, and the operation of hatcheries and processing plants are large, essential phases.

Practical knowledge of raising turkeys is obviously important to the turkey grower, and to help supply that knowledge is the purpose of this handbook.

National Turkey Improvement Plan*

The National Turkey Improvement Plan, administered by the Agricultural Research Service in cooperation with official State agencies, is designed to improve the quality of turkeys through the administration of regulations relating to breeding and to disease control.

Starting With Turkeys

In contemplating entry into the turkey business, the new grower must consider the economic situation. For example, the margin of profit in producing turkeys for the wholesale market now is relatively narrow so an efficient, fairly large-size operation is necessary if a worthwhile profit is to be realized. The turkey industry of the United States is highly integrated, and a large part of it is financed and controlled by corporations of varying size. Contracting and other integrating arrangements* vary considerably in different areas.

For the new grower, adequate financing and a dependable market for the turkeys are of first importance. Credit may be extended by

[1] Throughout this handbook an asterisk indicates some of the subjects about which additional information is available in Federal, State, and commercial publications. CA 44–62, which is a list of these publications, may be obtained free by writing to the Poultry Research Branch, Animal Husbandry Research Division, ARS, Beltsville, Md. 20705. Please include your own ZIP code number when requesting copies.

commercial concerns such as banks, feed manufacturers, insurance companies, cooperatives, and various integrated organizations. Government-sponsored financing by the Farmers Home Administration, the Production Credit Association, and the Federal Land Bank Association may be available. The turkey grower may join a cooperative, affiliate with a commercial organization, or operate his own business. In the last case, an opportunity exists in the production, processing, and marketing of ready-to-cook turkeys. Fresh-frozen and fresh-killed unfrozen birds in home-consumer sizes are in good demand at relatively high prices, especially during the Thanksgiving and Christmas holidays. Turkeys can be home processed without expensive equipment, but labor cost may be high and the requirement of Federal inspection might be difficult to meet. At present (1970), all turkeys marketed interstate must be Federally inspected, but those marketed without crossing State lines need not be inspected if the total number of turkeys does not exceed 5,000.

A turkey flock can be started with hatching eggs, day-old poults, or started poults, all of which should originate, wherever possible, from flocks tested for and rated free from the Arizona and Mycoplasma infections, fowl typhoid, paratyphoid, and pullorum disease. If turkeys beyond the day-old or battery-brooded stage are purchased, the disease history of the flock should be investigated and the stock should be examined for lice, northern fowl mites, and other external parasites when first received. The flock should be isolated and observed for about 3 weeks to detect any signs of diseases or internal parasites. External parasites such as lice and northern fowl mites are easily destroyed, but internal parasites are difficult to identify and eliminate. Birds harboring diseases or internal parasites should not be retained.

Obtaining brooded poults 7 to 8 weeks of age is becoming common in some areas.

BREEDS AND VARIETIES

Seven standard varieties, popularly called breeds, of domesticated turkeys are recognized by the American Poultry Association and described in detail in the American Standard of Perfection.* These seven varieties are Bronze, White Holland, Bourbon Red, Narragansett, Black, Slate, and Beltsville Small White (BSW). Including wild turkeys, there are perhaps a dozen nonstandard varieties, chief of which are the Broad Breasted Bronze (BBB) and the Broad Breasted Large White (BBLW). In 1966 only three varieties were commercially important. Of the 116.5 million turkeys raised that year, about 40 million were estimated to be of BBB breeding; about 60 million were of BBLW breeding; and about 15 million were of BSW breeding. The remaining 1½ million were those of all other varieties, chiefly those called Medium White. It appears likely that the large white strains will continue to increase in numbers and eventually may completely replace the BBB.

All white varieties and strains have white plumage, which frequently contains specks of gray or black pigment. Less frequently, whole feathers or sizeable parts of feathers may be off-colored. Eyes are medium to dark brown; shanks, feet, and beak are white to pinkish white.

Normal mature males of all varieties of turkeys have a conspicuous black beard attached to the skin of the upper breast region. White females occasionally have small beards but beards are rare in females of colored varieties.

White-plumaged turkeys are not albinos and have none of the weaknesses of albinos. They originated as mutations, or sports, in colored flocks and such mutations still occur. Their white color is due to a recessive nonsex-linked or autosomal gene that prevents almost completely the appearance of any pigmentation in the plumage, shanks, feet, and beak. The eyes, however, are not affected, so white turkeys tend to possess the eye color determined by the color pattern factors carried, but suppressed, by the color-inhibiting factor responsible

for white plumage. Since most white strains originated as mutations in Bronze flocks, they have dark-brown eyes and carry the gene for the bronze color pattern, which results in newly hatched poults that are light yellow with all upper surfaces more or less suffused with light brown, heaviest on the head. Any pure-yellow poults that appear would likely carry the gene, or genes, for either black or black-winged bronze, or both, or they could be Royal Palm or some other rare mutant that would, however, develop pigmented feathers in the adult plumage.

White-feathered turkeys have more feathers than colored turkeys and are difficult to dry-pick. However, with modern scald-pick methods, white turkey varieties can be picked as easily as colored varieties and have the advantage that any pinfeathers present are inconspicuous and do not lower the market grade as they do in the colored varieties.

Broad Breasted Bronze

The BBB turkey (figs. 1 and 2 and table 1) originated in England. It was imported into Canada in the late 1920's and then into the United States in about 1935. Within a few years after its introduction to the United States public in 1939, it became the most widely grown of all varieties. It has been used in crossing to produce the BBLW and the BSW.

In color, the BBB resembles the almost-extinct, standardbred Bronze but tends to have buffy-white instead of pure-white feather tips and lacks the brilliant copper-colored bronzing in back, tail, and upper thighs for which the exhibition strains of standardbred Bronze were noted. Its basic plumage color is black, which

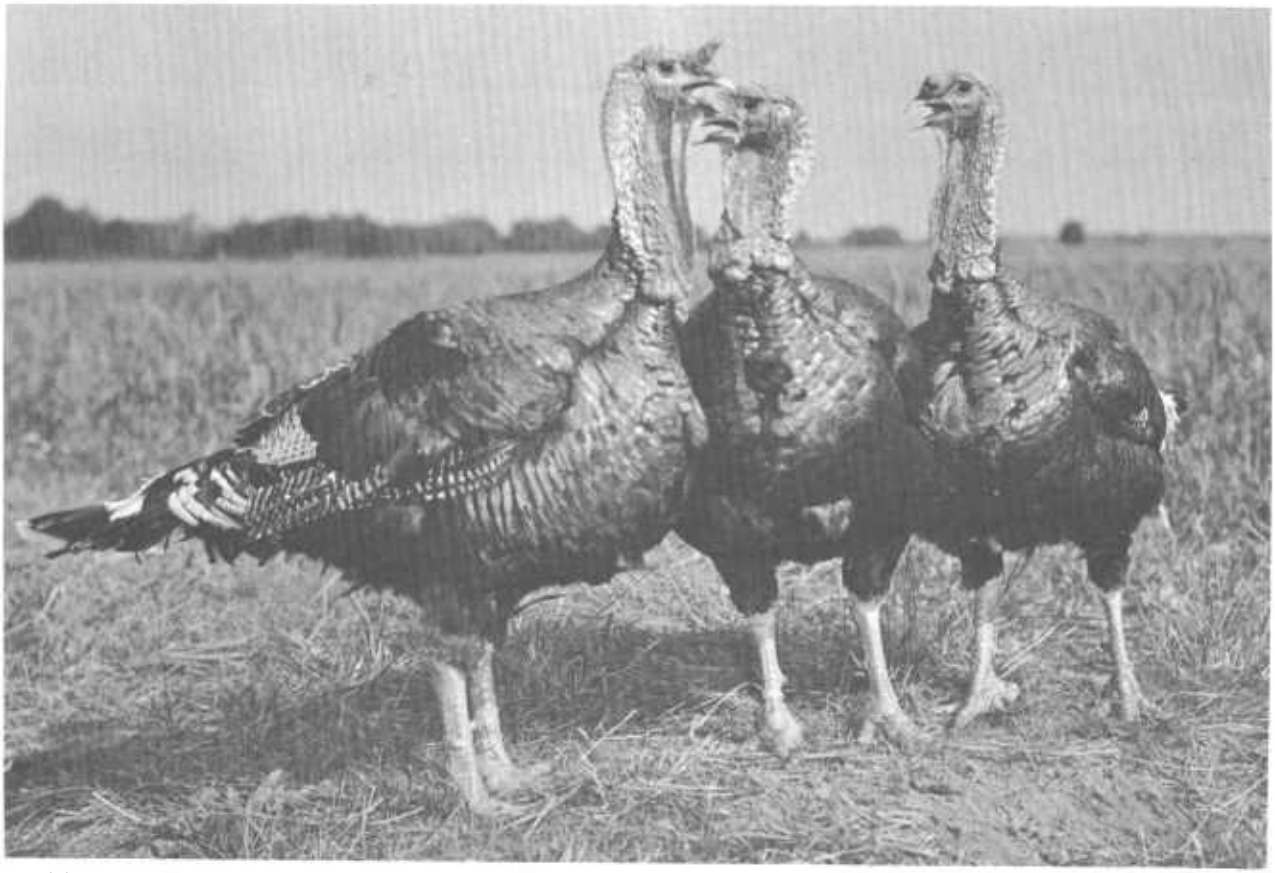

Figure 1.—Broad Breasted Bronze breeding turkey toms. Note strong, straight legs, wide bodies, and upright carriage. (Photo from Washore Turkey Assoc., Oregon City, Oreg. 97045.)

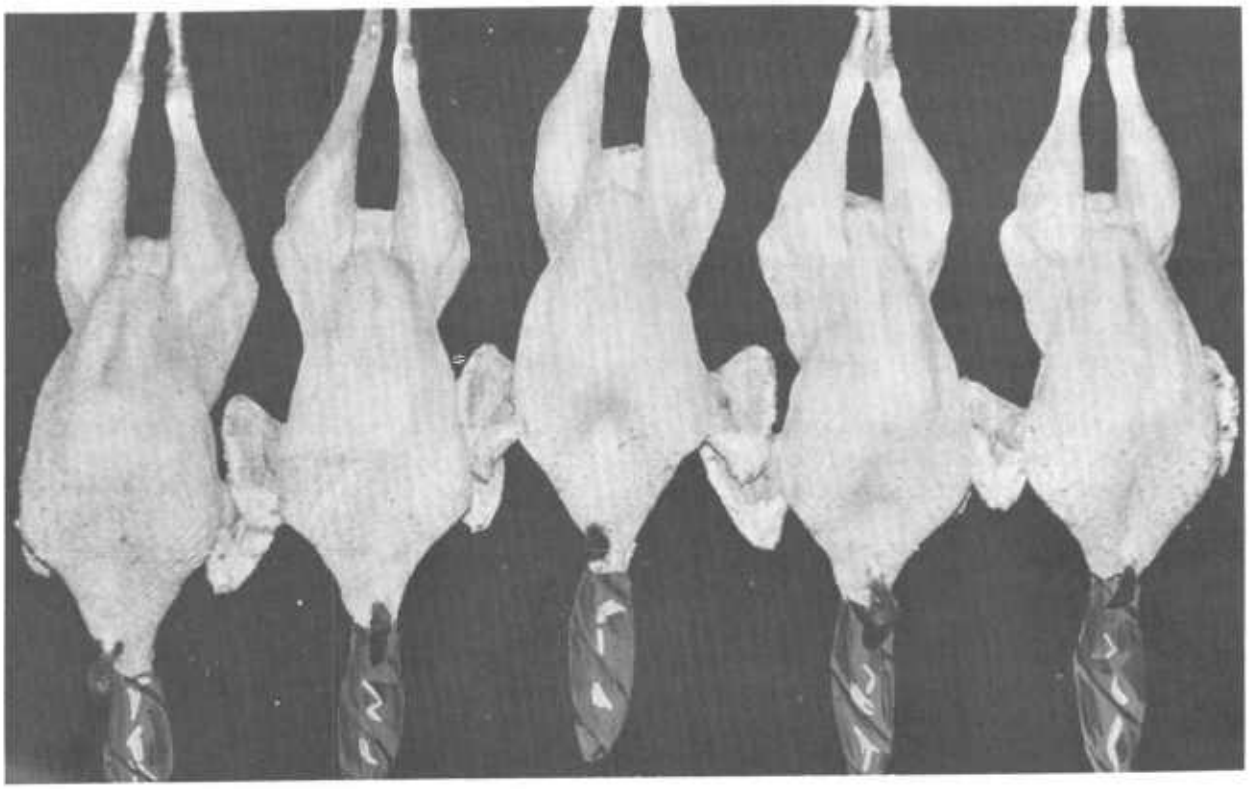

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Figure 2.—**Broad Breasted Bronze breeding turkey toms, New York dressed. Average weigh is 37 pounds at 36 weeks of age.**

results in dark-colored pinfeathers, a disadvantage that contributes to its replacement by the BBLW. Normal Bronze females have white tips on the black breast feathers, which serve as a means of accurately determining the sex as early as 12 weeks of age. Most BBB turkeys are marketed as mature roasters at 23 to 26 weeks, but males sometimes are held to 28 to 30 weeks to meet the demand for extra-large birds.

In reproductive ability, the BBB and the BBLW are generally inferior to the BSW, tending to produce fewer eggs, with lower fertility and hatchability. Reproductive ability varies, however, and in some strains of heavy turkeys it is quite good. Artificial insemination has become standard practice in breeding BBB, BBLW, and other heavy broad-breasted turkeys and is generally required to attain an acceptable level of fertility.

Broad Breasted Large White

The BBLW turkey (table 1) was developed in the early 1950's through pedigree breeding and selection at Cornell University, from crosses of BBB and White Holland. Private breeders soon began to develop other large white strains, mostly through crossbreeding, although a few strains were developed by taking advantage of naturally occurring white mutations in BBB flocks. No overall variety name was proposed and most breeders named their own strains, very few of them using the name White Holland. Selection for large size and broad-breasted conformation has been widely practiced, so most strains of BBLW now equal the BBB in both these respects.

Although most BBLW turkeys are marketed as heavy roasters at 23 to 26 weeks, many are marketed at other ages (table 1). Of the 60 million raised in 1966, about 8 million (13.3

percent) mostly hens, were sold at about 12 weeks, when they make acceptable fryer-roasters. The toms, however, are not well adapted to this use because of their lack of finish and their coarse, large-boned appearance. At 18 to 20 weeks, hens of the BBLW strains fill the need for medium-size roasting turkeys and many are marketed then. Toms sometimes are held to 28 or even 30 weeks to produce extra-large birds for use in further processing. This flexibility as to age at marketing is an important advantage of the Large White.

White turkeys in general appear to tolerate the hot sun better than dark turkeys.

Beltsville Small White*

The BSW turkey (figs. 3 and 4 and table 2) was developed through pedigree breeding and selection by the U.S. Department of Agriculture at the Agricultural Research Center, Beltsville, Md. Between 1941 and 1962, this stock was distributed worldwide. The BSW turkey closely resembles the BBLW in color and body type but is smaller, as indicated in tables 1 and 2. In general, egg production, fertility, and hatchability tend to be higher and broodiness tends to be lower in the BSW than they are in the heavy varieties. Certain American breeders of Beltsville stock have in-

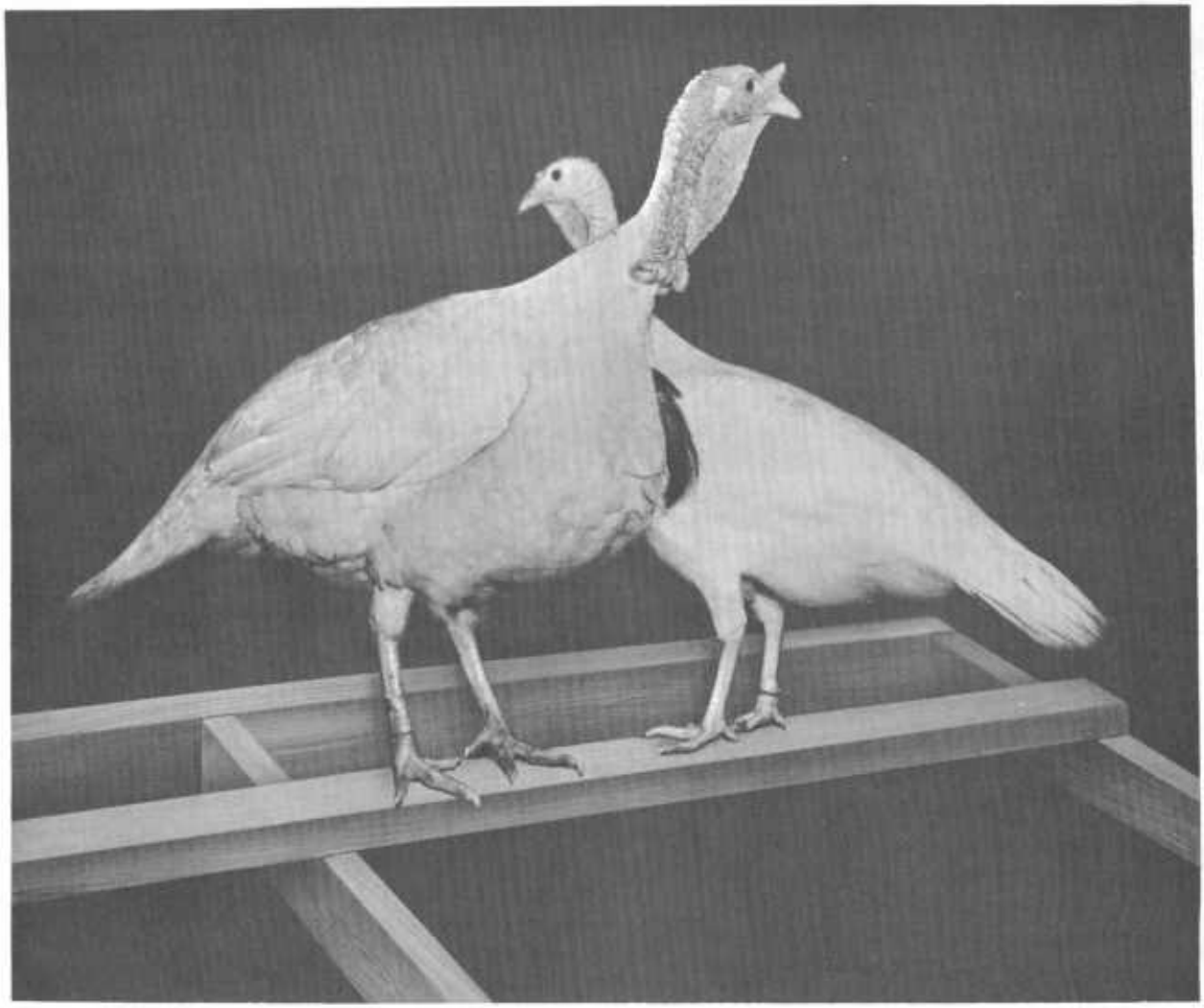

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Figure 3.—**Beltsville Small White breeding turkeys. Male weighs 21 pounds at 34 weeks of age; female, 11½.**

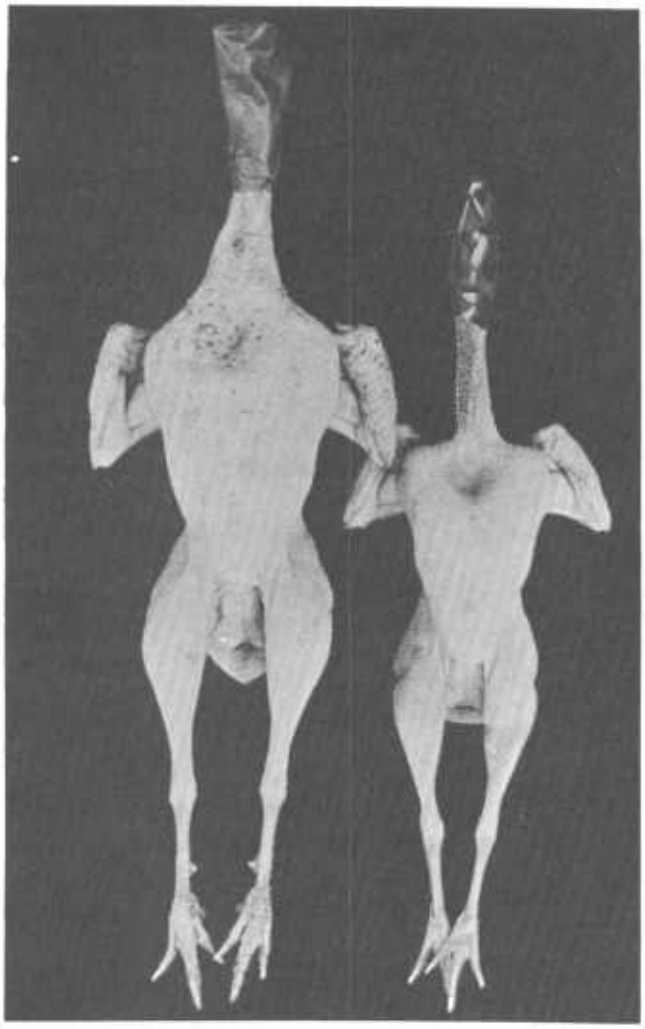

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Figure 4.—Beltsville Small White breeding turkeys, 8 months old, New York dressed: *Left,* Hen, 10½ pounds; *right,* tom, 19 pounds.

creased the weights (table 2), resulting in a turkey better described as medium rather than small, although it is officially classified as a "light breed."

Under favorable growing conditions, including the feeding of nutritionally complete, high-energy diets, both sexes of these light-breed turkeys reach Grade A market condition at 15 to 16 weeks, when most of them (67 percent in 1966, 71 percent in 1967, and 76 percent in 1968) were marketed as fryer-roasters, sometimes called "broilers." If held to 21 to 24 weeks, these birds are high-quality, mature roasters of medium to small size, with the males competing successfully with large-type hens for the mature roaster retail market. At 16 weeks, feed efficiency (pounds of feed per pound of live turkey produced) should average about 2.9 pounds for flocks of mixed sexes under favorable conditions compared with about 2.5 pounds for heavy white turkeys of mixed sexes at 12 weeks. This difference of about 0.4 pound in favor of the large-type fryer-roaster is largely offset by the higher cost, 15 to 20 cents each, for the heavy poults. The extra 3-week production period remains a disadvantage for the small-type bird but the better quality of the product tends to compensate for this.

The BSW and its related strains are no different from other varieties of turkeys in respect to livability, susceptibility to disease, and requirements for feeding and management. Floor space allowances for small-type turkeys may be reduced by about one-fifth of that recommended for large-type turkeys.

GROWTH RATE AND FEED CONSUMPTION

Large- and small-type turkeys that are well managed, fed well-balanced, medium-energy diets, and kept free from diseases, parasites, and other stress factors should increase in weight and eat feed at rates comparable with those shown in tables 1 and 2. Under optimal conditions and with fast-growing strains, the feed required to produce a pound of live turkey can be lower and average weights higher at all ages than the figures shown (see table 1, footnote 1 and table 2, footnote 1). Conversely, slower growing strains, unfavorable environmental factors, and diseases and parasites can lower the growth rate and feed efficiency by similar or greater amounts. Consumption of mash or of grain and mash combined can be reduced by 10 to 15 percent by feeding or allowing access to succulent green feed in large quantities during the growing period, 8 weeks to marketing.

TABLE 1.—*Growth rate and feed consumption of Broad Breasted Bronze (BBB) and Broad Breasted Large White (BBLW) turkeys raised in confinement on medium-energy diets* [1]

Age (weeks)	Toms			Hens			Both sexes in equal numbers		
	Average live weight	Cumulative feed per bird to date	Feed per pound of live bird to date	Average weight live	Cumulative feed per bird to date	Feed per pound of live bird to date	Average live weight	Cumulative feed per bird to date	Feed per pound of live bird to date
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
1/7 (1 day)	0.134	-----	---	0.134	-----	---	0.134	-----	---
1	.29	0.20	0.69	.27	0.18	0.67	.28	0.19	0.68
2	.57	.59	1.04	.53	.53	1.00	.55	.56	1.02
3	1.00	1.19	1.19	.90	1.13	1.26	.95	1.16	1.22
4	1.7	2.1	1.24	1.4	1.8	1.29	1.55	1.95	1.26
6	3.2	4.6	1.44	2.8	4.1	1.46	3.0	4.4	1.45
8	5.1	8.8	1.73	4.4	7.9	1.80	4.8	8.4	1.75
10	7.5	15.6	2.08	6.0	13.2	2.20	6.8	14.4	2.12
12 [2]	10.1	23.7	2.35	7.6	18.2	2.39	8.9	21.0	2.36
13 [2]	11.4	28.0	2.46	8.4	21.0	2.50	9.9	24.5	2.47
14	12.7	32.4	2.55	9.3	24.0	2.58	11.0	28.2	2.56
16	15.4	41.4	2.69	10.9	32.2	2.95	13.2	38.8	2.79
18 [3]	17.9	51.0	2.85	12.3	40.5	3.29	15.1	45.8	3.03
20 [3]	20.3	61.2	3.01	13.6	49.0	3.60	17.0	55.1	3.24
22	22.7	72.5	3.19	14.7	57.7	3.93	18.7	65.1	3.48
23 [4]	23.9	78.5	3.28	15.2	62.2	4.09	19.6	70.4	3.59
24 [4 5]	25.1	85.0	3.39	15.7	67.7	4.31	20.4	76.4	3.75
25 [5]	26.3	91.3	3.47	16.2	73.2	4.52	21.3	82.3	3.86
26 [5]	27.4	97.8	3.57	16.6	77.9	4.69	22.0	87.9	4.00
28 [6]	29.6	118.4	4.00	17.1	88.0	5.14	23.4	103.0	4.40
30 [6]	31.6	134.9	4.27	17.8	96.8	5.44	24.7	116.1	4.70
32	33.0	149.8	4.54	18.6	107.3	5.77	25.8	128.5	5.00
36 [7]	35.0	180.3	5.15	19.5	123.6	6.34	27.3	152.1	5.57

[1] If growing conditions are optimal and high-energy diets are fed, weights about one-sixth higher and feed per pound of turkey about one-tenth lower than those listed may be obtained at all ages with the larger, fast-growing strains of heavy-breed turkeys.

[2] Ages at which BBLW turkeys sometimes are slaughtered as fryer-roasters, or "broilers."

[3] Ages at which BBLW turkey hens sometimes are slaughtered as medium-size roasters.

[4] Ages at which BBB and BBLW turkey hens usually are slaughtered as mature roasters.

[5] Ages at which BBB and BBLW turkey toms usually are slaughtered as mature heavy roasters.

[6] Ages to which heavy-breed turkey toms of all colors sometimes are held to produce extra-heavy birds for further processing.

[7] Age at which all heavy-breed turkeys may be said to attain maximum 1st-year breeding or "standard" weight.

TABLE 2.—*Growth rate and feed consumption of standard Beltsville Small White (BSW) turkeys raised in confinement on medium-energy diets* [1]

Age (weeks)	Toms			Hens			Both sexes in equal numbers		
	Average live weight	Cumulative feed per bird to date	Feed per pound of live bird to date	Average live weight	Cumulative feed per bird to date	Feed per pound of live bird to date	Average live weight	Cumulative feed per bird to date	Feed per pound of live bird to date
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
1/7 (1 day)	0.115	-----	----	0.115	-----	----	0.115	-----	----
1	.22	0.15	0.68	.21	0.15	0.71	.22	0.15	0.68
2	.45	.50	1.11	.40	.45	1.13	.43	.48	1.12
3	.70	1.05	1.50	.60	.92	1.53	.65	.99	1.52
4	1.00	1.95	1.95	.80	1.60	2.00	.90	1.78	1.98
6	1.8	4.1	2.28	1.2	2.8	2.33	1.5	3.5	2.33
8	3.0	7.2	2.40	1.8	4.5	2.50	2.4	5.9	2.46
10	4.4	10.8	2.45	2.7	7.0	2.59	3.6	8.9	2.47
12	6.1	15.6	2.56	3.8	10.2	2.68	5.0	12.9	2.58
14	8.1	21.6	2.67	5.1	14.3	2.80	6.6	18.0	2.73
15 [2]	9.0	24.9	2.77	5.7	16.7	2.93	7.4	20.8	2.81
16 [2]	9.8	28.2	2.88	6.3	19.4	3.08	8.1	23.8	2.94
17	10.6	31.7	2.99	6.8	22.8	3.35	8.7	27.3	3.14
18	11.3	35.3	3.12	7.3	26.2	3.59	9.3	30.8	3.31
20	12.2	42.6	3.49	7.8	31.2	4.00	10.0	36.9	3.69
21 [3]	12.9	46.7	3.62	8.3	34.9	4.20	10.6	40.8	3.85
22 [3]	13.6	50.3	3.70	8.7	38.3	4.40	11.2	44.3	3.96
23 [3]	14.4	54.7	3.80	9.1	41.9	4.60	11.8	48.3	4.09
24 [3]	15.1	60.4	4.00	9.5	45.6	4.80	12.3	53.0	4.31
26	16.6	73.0	4.40	10.0	51.0	5.10	13.3	62.0	4.66
28	18.1	83.3	4.60	10.6	58.7	5.54	14.4	71.0	4.97
30	19.4	93.1	4.80	11.0	64.2	5.84	15.2	78.7	5.18
32	20.2	103.1	5.10	11.3	69.7	6.17	15.8	86.4	5.47
34 [4]	21.0	113.8	5.42	11.5	73.8	6.42	16.3	93.8	5.75
36	21.4	123.0	5.75	11.7	78.4	6.70	16.6	100.7	6.07

[1] If growing conditions are optimal and high-energy diets are fed, weights about one-sixth higher and feed per pound of live turkey about one-tenth lower than those listed may be obtained at all ages with standard BSW turkeys. Weights about one-fifth higher and feed per pound of live turkey about one-eighth lower may be obtained with oversize BSW turkeys and those called Medium White.

[2] Ages at which small- or medium-type turkeys of both sexes usually are slaughtered as fryer-roasters, or "broilers."

[3] Ages at which BSW and medium-size turkeys usually are suitable for slaughter as mature roasters.

[4] Age at which BSW and other small-type turkeys may be said to attain maximum 1st-year breeding or "standard" weight.

BREEDING PRACTICES

Selecting Breeders

Prospective breeding stock (breeders) of both sexes and all types should be hatched about 7 months (30 weeks) before artificial lighting is to be started or 8 months (35 weeks) before egg production is expected. Breeders should be selected when the birds are at or near market age and before any are marketed. At that time, an additional one-fifth more males than would be required should be set aside for final selection at about 7 months.

At the final selection, birds that show defects or do not develop properly can be eliminated. The so-called dimple breast, where the keel bone is slightly sunken into the surrounding breast muscle, is a desirable feature in all broad-breasted turkeys. Dimple-breasted turkeys tend to develop fewer breast blisters and calluses and make very attractive market carcasses.

A walking test is necessary in selecting for strong, straight legs and upright carriage.

Some defects to watch for in selecting breeders are: blindness, crossed beak, crooked neck, crooked or roached back, crooked or curved breastbone, breast calluses and blisters, split wing, pendulous crop, swelled hocks or feet, crooked legs and toes, bowlegs, knock-knees, and decided off-color or off-shape feathers. A guide for selecting breeding stock is available.*

Blood Tests and Vaccinations

As soon after selection as officially allowed, a blood sample should be drawn from each prospective breeding bird. From this sample, depending upon the disease-control programs available, tests can be made for the presence of pullorum disease, fowl typhoid, paratyphoid, infectious sinusitis (*Mycoplasma gallisepticum* infection), and possibly *Arizona* and *Mycoplasma meleagridis* (N-strain PPLO) infections. If necessary to their needs, the birds can be debeaked, wing-clipped, and saddled at the same time they are tested.

After receipt of laboratory reports of the blood tests, unless turkeys must be retested, vaccinations can be started.

The number and kind of vaccinations given should be based upon the requirements set up by the hatching-egg buyer and the advice of competent authorities on disease problems. Some suggestions are given in the section on diseases beginning on page 54. When several vaccinations are given, they should be planned according to competent advice to avoid possible unfavorable interactions. The adjuvant types of vaccines may give longer immunity. In general, preventive vaccinations, usually of the live-virus or killed-bacteria type (bacterins), are given only when the disease in question is present in the area and poses an active threat to the health of the turkeys.

Mating Procedures

Turkeys of either sex seldom are retained after their first breeding season but are marketed when eggs are no longer needed. However, when pedigree breeding is practiced and records are available, hens of proven high breeding value may be retained for a second or third season. Males in high-producing matings likewise are valuable, but males that have passed their first mating season tend to be poor breeders when natural mating is used.

Matings should be made up well in advance of the breeding season and, in naturally mated flocks, sexually active males should be placed with hens when the latter are first placed under stimulatory lighting. It usually is desirable to place the males under stimulatory lighting for about 4 weeks ahead of the hens in order to have those males sexually active when the hens begin to mate.

In single-male natural matings of small-type turkeys, 20 hens to 1 young tom is a good ratio; of medium-type, 18 to 1; and of large-type, 16 to 1. In natural flock matings, ratios of 14 to 1, 12 to 1, and 10 to 1, respectively, are practical. However, a few extra toms, preferably late-hatched or out-of-season, should be separately maintained to replace those that may die or become sick or crippled. To combat

late-season infertility, some breeders maintain a full set of out-of-season toms to replace the older toms about the middle of the breeding season or when late-season infertility becomes noticeable.

Breeding units of 500 to 1,000 turkeys, including males when natural mating is used, are suggested as being practical and manageable. The 500-bird breeding unit may be near optimum. When two or more naturally mated breeding flocks are maintained, they should be separated from each other by at least 10 feet of empty area so the toms will not distract each other. Where separation by an empty area is impracticable, an alternative is to make the dividing fence or partition solid for the first 3½ feet above the ground so the turkeys cannot see those in the adjoining pen.

Saddles

A canvas saddle of proper size for the breed with a free sliding strap at the front end (fig. 5) should be placed on each naturally mated breeder hen to protect her from injury by the tom during natural mating. If saddles are not obtainable, the 8 toenails of each mated tom should be hand clipped almost to, but not into, the bloody core and the stubs smoothed with a coarse file. If an **electric debeaking device is** available for toenail trimming, all four toenails of each foot may be completely removed. Make the cut just outside the outermost toepad. The searing heat prevents serious bleeding and stubs heal rapidly. When the toenails are already short, smoothing with a file usually is sufficient. The spurs of yearling or older males always should be rounded off with a file.

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Figure 5.—**Saddled breeding turkey hen. Numbers are for identification when trapnests are used.**

Where no toms are allowed with the hens, the latter need not be saddled. However, saddles often are used since they give some protection against rain, sleet, snow, and from back injuries sustained during handling. They are also useful in identifying broodiness and other characteristics and are used in trapnesting.

Artificial Insemination

Artificial insemination (AI) has become standard practice in breeding large broad-breasted turkeys. It may be used without natural mating, allowing no males with the hens at any time or it may be used to supplement natural mating, using saddles on the hens. The former method is preferred and is widely used, the first insemination being given when egg production starts, followed 1 week later with a second insemination and after that at 2-week intervals. If and when fertility starts to decline, inseminations may be given at 1-week intervals. However, some breeders prefer a 1-week interval throughout the season.

The plastic straw method, using a clean straw for each hen, is being widely used to prevent the possible spread of infection from hen to hen. The straws, 4 to 5 inches long, are attached to the syringe or inseminating gun. Care must be taken not to injure the oviduct when the straw is inserted.

Two basic procedures are involved in AI of poultry: obtaining semen from the male (milking) (fig. 6) and inseminating the hen (fig. 7). The method described here requires only simple, inexpensive equipment. More detailed information, including the use of thermos-bottle aspirators, semen metering devices, individual-hen plastic straws, and diluents, will be found in other publications.*

The minimal equipment necessary for AI is a receiving container (receiver) and a 1-cubic-centimeter (cc.) or 1-milliliter (ml.) glass or plastic syringe without a needle, graduated in hundredths. The receiver may be any small round-edge glass receptacle not over 2½

inches deep, such as a liqueur glass, a liquor jigger, a very small beaker, an eye cup, a paraffin stoppered funnel (fig. 6) or a short test tube. In the simplest type of operation, semen from one or several males is collected in the receiver, withdrawn into the syringe in single doses, and injected into the hens with the least possible delay. A more efficient method is to milk the semen from each of a dozen or more males for a total of 3 or 4 cc., removing each tom's contribution from the receiver with a thermos-bottle aspirator or a syringe and depositing the contribution in a closed container immersed in water held at about 82° F. (28° C.). The semen is thus protected from contamination, temperature shock, and drying. The pooled semen is then injected into the hens with an automatic "semen gun" or a syringe equipped with a metering device.

Mated toms should be separated from the hens at least 2 days before they are milked. Unmated toms, used regularly, can be milked every 3rd day, thus reducing the number of toms required.

To obtain semen efficiently, promote ejaculation through manual stimulation that causes the male copulatory organ to be partly extruded (fig. 6). The stimulation may be effected by massaging and stroking the abdomen and pushing the tail and tailhead upward towards the head. A male's response has been obtained when the copulatory organ enlarges and partly protrudes from the vent. The operator then takes a deep grip at the rear of the copulatory organ from above the vent with his thumb and forefinger, thus fully extruding the organ, and squeezes out the semen in a short sliding motion downward. The pressure on the rear of the copulatory organ, combined with the short sliding motion, empties the terminal bulbs of the seminiferous tubules and causes the semen to run down the depression between the two parallel teatlike structures of the copulatory organ, where it can be collected in the receiver. If feces or urine appears, brush it away before the semen is collected. With turkey toms, only one ejaculatory response to each manipulation is the rule, but in some cases continued massage and stroking may induce a second. The toms can be massaged as long as semen can be obtained. As an aid in producing clean semen, some operators withhold feed and water from the toms for 8 to 12 hours before milking. However, with proper pressure, expert technicians are able to close off the cloacal opening, which is above the sex organ, to prevent fecal contamination.

Two operators work together to milk the toms. The first operator holds the tom on a padded table or a canvas stand or other comfortable resting place or he may hold the bird loosely by the thighs, supporting its weight on his lap or on his arm. The rear of the bird is toward the second operator, its legs slightly spread so that the abdomen is well exposed. The second operator uses the thumb and fingers of one hand to hold the receiving container and massage the lower abdomen while he pushes the tail upward towards the bird's head with the other hand. When the male responds

59542–B

Figure 6.—**Obtaining semen from male turkey. Male copulatory organ is extruded (turned outward) and squeezed to release semen, which is collected in stoppered funnel.**

to these pressures by starting to extrude his copulatory organ, the second operator forces the organ outward from the vent and milks the semen into the receiver, which he has held in readiness during the massaging.

In another method of milking, the tom may be placed breast down on a 7-inch-wide, 18-inch-high milking stool and held between the knees of the first operator, who uses both hands alternately to massage both sides of the abdomen, starting below the vent and stroking upward toward the tail, which may be pushed upward on the completion of the stroke. The second operator exerts a steady downward pressure on both shanks of the bird and collects the semen. The downward pressure on the shanks, the upward pressure against the tail, and the massaging of both sides of the abdomen combine to effect protrusion of the tom's copulatory organ. When the technique is learned by practicing on toms that respond readily, work with other toms will be easier.

Turkey males may produce from 0.05 to about 0.8 cc. (or ml.) of semen per milking, averaging about 0.25 cc., but an occasional male is found that will not produce any semen. The semen of the turkey is pale cream-colored, fairly thick, and somewhat sticky. It dries so rapidly upon exposure to air that it should be taken up with the syringe as soon as possible after collection and protected from drying and from temperature below or above a range of 77° to 86° F. (25° to 30° C.). As much as 3 or 4 cc. of turkey semen may be accumulated from a dozen or more males in one receptacle, but it should be used within one-half hour after collection.

A trace of blood in the semen should not be regarded very seriously. This may occur occasionally even when the milking is done with extreme gentleness. It is a signal to cease operations on the bird for the day. No permanent harm appears to result from slight bleeding, but males that continue to bleed should not be milked any longer. Thin, watery semen is low in fertilizing ability and should be discarded, along with samples contaminated with feces or chalky-white urine.

The toms used for insemination usually are kept in a group in an isolated pen, but some operators use single-tom cages since it has been reported that caged toms produce more semen than uncaged and that well-trained cooperative males can be milked without removing them from the cages.

AI of hens consists of exposing the orifice of the oviduct and injecting semen directly into it through the funnel-shaped end, which is extruded (turned outward) during natural mating or as result of manual stimulation and pressure (fig. 7). Successful extrusion of the oviduct can be effected only in hens that are in laying condition.

Two operators are needed to artificially inseminate the hen effectively. In one method, the first operator, sitting down, usually is handed the turkey hen with her head toward him and with the breast of the bird resting on his lap. He then extrudes the oviduct by exerting pressure on the abdomen of the hen and by forcing the tail upward towards her

59541–B

Figure 7.—**Starting insemination of turkey hen. Syringe without needle is inserted about 1½ inches into extruded (turned outward) oviduct.**

head. Considerable pressure may be needed to extrude the oviduct properly, but less pressure will suffice if it is applied quickly rather than slowly. In another method, the first operator, standing, holds the hen between his legs and extrudes the oviduct.

In either method when the funnel-shaped orifice of the oviduct can be plainly seen on the hen's left side of the vent, the second operator inserts the syringe containing the semen as far as it will slide easily—about 1½ inches. At this time the pressure on the abdomen is brought to an end and a light pushing pressure is maintained on the syringe which, following the retraction of the oviduct, will slide farther into the hen, another one-half inch, which is highly desirable. The desired amount of undiluted semen, usually 0.025 cc. is then injected by pressing on the plunger. Not all calibrations on the syringe can be read when it is in place for injection because one-half or more of the syringe is out of sight. To remedy this, either withdraw only one semen dose into the syringe at one time or make marks indicating the amounts of semen to be used on the dry plunger with a sharp lead pencil or indelible ink. However, the best method is to use a metering device or a semen gun.

Excellent fertility has been obtained in turkey hens with as little as 0.01 cc. of undiluted semen, which can be used when semen is scarce; or the semen can be diluted 1:1 with isotonic salt solution (8.5 grams of plain sodium chloride, or table salt, per liter of sterile distilled water) and the usual amount, 0.025 cc., of the diluted semen injected very promptly. If the diluted semen is not to be used immediately, a special diluent should be used. Commercial diluents allowing a 3 to 1 dilution are available.

Hens that become fertile by adequate natural or artificial insemination usually will retain their fertility quite well for 2 to 3 weeks, and some viable embryos may be produced as long as 41 days after insemination. A turkey hen may fail to become fertile as the result of a single insemination because of the presence in the oviduct of an egg about to be laid. To minimize this, inseminate turkey hens in late afternoon or evening. Starting at dusk and working into the night may be the best time since the birds are easier to handle in darkness, and very few hard-shell eggs will be present in the oviduct. However, field data suggest that fertility level is not significantly affected by the time of day of insemination.

For catching hens and uncaged toms for artificial insemination, a lighted room that can be darkened is very useful. (See "Handling Turkeys.")

Pedigree Breeding

A relatively simple but effective plan for breeding turkeys for broad-breasted conformation combined with good reproductive ability is the rotational system. It can be practiced with either multiple-male or, preferably, single-male matings. At least 8, but preferably 10 to 20, breeding pens should be maintained and at the outset should be set up to provide as much divergence in blood lines as possible; that is, no two matings should be alike so far as relationship of the tom and hens is concerned. Where relationships are not known, random selection is necessary. The hens in these pens should be trapnested, the eggs marked according to hen number and hatched separately, and the resulting poults individually banded to preserve their identity and make family selection possible.

A minimum of 10 poults, but preferably 20, should be raised from each breeding hen with satisfactory breeding-pen performance; none need be raised from hens with unsatisfactory performance. When they reach market age, the best males and females from the 10 or more poults raised from the best dams in each pen are selected for the next season's breeding. The new females usually are returned to the pen from which they originated. The new males, however, are moved over one or two pens each season. For example, females out of Pen 1 would remain in Pen 1, but the males out of Pen 1 would go into Pen 3 for the next season's breeding. Pen 2 males go to Pen 4 and so on, completing the cycle until males from the next to last pen go into Pen 1 and those from the last pen into Pen 2. This procedure can be repeated indefinitely without building up a high percentage of inbreeding. Sometimes

the progeny from a pen must be discarded because of poor results, disease, accident, or some other cause. Then a new pen for the next year usually would be made up either from the other pens or from outside stock.

Reserve toms, about three full or half brothers of the selected male (or males) in each breeding pen, should be retained for substitution when necessary because of disease, injury, or poor performance. These reserve males can be maintained separately or utilized in flock matings.

The basis for selection of each year's young breeding birds is primarily the dam's reproductive performance and the market quality of her offspring. From trapnest and incubation records, based on a breeding season of 16 to 22 weeks, the breeding hens are rated according to performance, which includes egg production, fertility, and hatchability, including only normal poults. All progeny from dams that have poor performance records should be discarded either at hatching time or later, and none, regardless of individual quality, should be retained for breeding.

The 10 to 20 wingbanded progeny from each breeding hen that has a good performance record should be raised to market age of about 24 weeks, using the same age each year. At that time each bird is graded on desirable physical characteristics.* All physically qualified progeny from dams with satisfactory breeding records are retained for final selection at about 30 weeks. At the final selection, the finest progeny from the best qualified dams are selected as breeders.

Trapnesting

Trapnesting provides information on a hen's egg-laying ability and makes individual pedigreeing possible. One trapnest should be provided for each two hens. With this many nests, three visits a day by the attendant are sufficient. During the period before the beginning of egg production, the hens should have free access to the trapnests. They must be watched carefully to see that they do not lay their eggs outside the nests. Secluded places in the house or yard should be eliminated. A satisfactory type of trapnest is illustrated in figure 8. The turkey enters at the front through the trapdoor, which closes authomatically when she is inside. The door at the top of the coop is opened to release her from the nest. Plans for trapnests and nests with tip-ups (gates) are available.*

The use of numbered saddles instead of legbands makes trapnesting considerably easier because less handling of the hen is required. The hen's number is marked on the saddle in 1¼-inch-high figures with a rubber stamp (one for each digit) and indelible waterproof ink (fig. 5). The number should be placed along the lower rear edge on both sides and in the middle, and all the large wing feathers of both wings should be clipped so the numbers can be read. Numbers also may be placed on the center, the rear center, and the underside rear center so that the numbers still may be read if the rear of the saddle curls up. All numbers should be readable from the rear.

Strain and Variety Crossing

Strain crossing is the crossing of different strains of the same turkey variety. It is sometimes a desirable method to use for the commercial production of poults because it prevents inbreeding and may in some cases produce a certain amount of hybrid vigor, or heterosis. The large-scale breeder can use the principle of strain crossing by developing a female line selected with emphasis on high reproductive ability and a relatively unrelated male line selected for the desired size and conformation characteristics. The two lines are then crossed to produce commercial "hybrid" poults to be raised only for market purposes. Both lines should be carefully selected and retained in pure form each season as the foundation stock for the continuation of the strain crossing project.

Variety crossing is the crossing of two different turkey varieties and in itself offers little advantage because hybrid vigor does not always result and the offspring tend to vary considerably in their physical characteristics. Three-way crossing using three varieties or two strains of one variety and one strain of

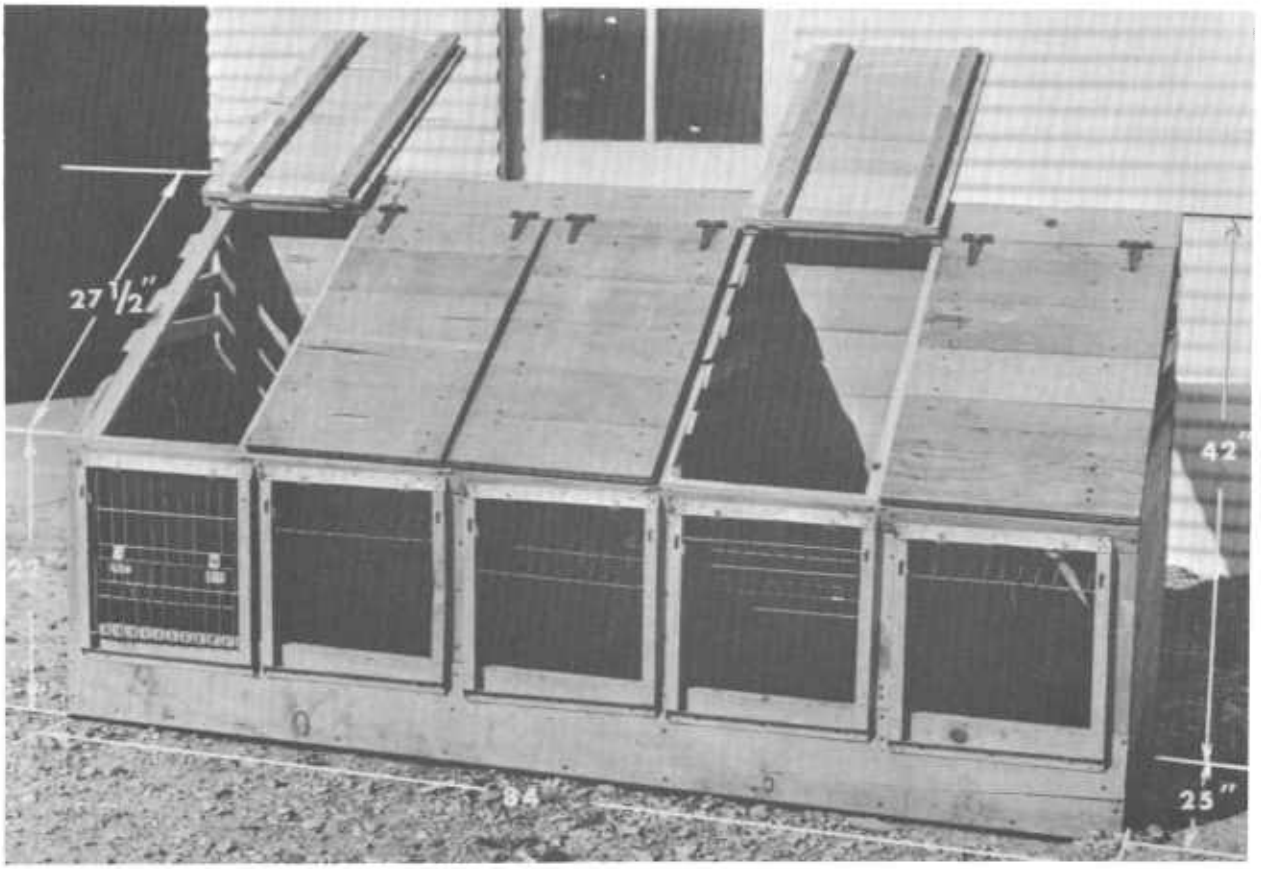

Figure 8.—**Battery of turkey nests. Each nest can be equipped with trapnest fronts, as shown, or with a tip-up front (semitrapnest; see fig. 9). (Photo from Colorado State University.)**

a second variety offers some advantages but may be too involved to be practicable and the variability of the offspring remains a disadvantage.

Out-of-Season Breeding

In most areas of the northern hemisphere, turkeys hatched between about September 1 and April 1 can be considered out-of-season birds that become physically mature during the period of naturally increasing light days or while daylight is decreasing, but the weather is warm, over about 65° F. (18.3° C), and the light day is 11 hours or longer. Such out-of-season hens become refractive to light stimulation and will not lay well or very long when given a lengthened light day.

To obtain high egg production, the out-of-season hens, but not the toms, should be preconditioned by placing them under light restriction starting at 20 to 22 weeks of age and continuing to about 30 weeks. During restriction, allow 6 to 9 hours of natural light or artificial light of 1 to 2 foot-candles (11 to 22 lux) at bird height per 24-hour day. During the remaining 15 to 18 hours, confine the hens in almost complete darkness, not over 0.1 foot-candle, in which white birds can barely be seen and newspaper headlines barely read (brownout). The temperature inside the building at bird height should not be allowed to go above 85° F. (29.4° C.) Forced ventilation and insulation combined should solve the problem in most situations. High-ceiling buildings such as barns help to combat heat but are difficult to darken. If the building is opened up during the lighted period, for example, 10 a.m. to 6 p.m., some relief from the daytime heat will be obtained.

Out-of-season *toms* may be grown to physical maturity under natural light conditions if the light days are 13 hours or longer. If the natural daylength, sunrise to sunset, is shorter than that, lengthen it to 13 to 15 hours with artificial light starting at 26 weeks of age or older and allowing about 4 weeks to bring the toms into sexual maturity by the time they are needed for breeding.

Out-of-season breeding stock should be fed and managed in the same manner as normal-season birds and the intensities of light used should be the same. Failure to obtain efficient out-of-season production usually stems from (1) starting the light-restriction period too late—after production starts—or (2) allowing too much light during the brownout hours of the restriction period.

Second-Season Breeding

A satisfactory second round of egg production during the off-season usually can be obtained from normal-season breeding hens of all varieties by putting them on a 6- to 9-hour light day, as already outlined, as soon as egg production is no longer needed. The reduction in the length of the light day will cause egg production to cease and a molt to start. From 12 to 15 weeks are required for the hens to complete the molt and regain the weight lost during the previous production period. After the hens complete the molt and regain their lost weight, put them on the regular 14- to 15-hour stimulatory lighting program with full feeding of a complete breeder diet. Feed during the short-day molting period can be the regular breeder diet full fed in the usual manner. Egg production during the second production period should be about 75 percent of the first.

The males used for second-season breeding should be young, out-of-season birds hatched the previous winter, but if necessary, the original males may be used. If they have already molted or are molting when the hens go on reduced light, the year-old males can remain on natural daylight. If they have not started to molt, they should be given the reduced-light treatment along with the hens. In either case it would be advisable to put the molted males on stimulatory light for about 4 weeks before the hens are lighted to be sure they are producing semen when it is needed. Hens selected for the second season should be examined carefully to eliminate injured and sick birds and, if records are available, the poor layers and those persistently broody.

BREEDER MANAGEMENT AND HOUSING*

Management on Limited Range

Access to fenced range is especially desirable where natural mating is used, but the soil must be free from diseases and parasites and the turkeys must be protected from natural enemies and bad weather. The use of unprotected, unlimited range is impracticable.

Select sandy soil with good natural drainage and a good sod cover but with no brush piles or thick vegetation of any kind. A good arrangement consists of a permanent predator-proof shelter connected with two or three permanent yards, each yard supplying about 150 square feet of range per bird. The birds use each yard for a week at a time, the other yard or yards remaining vacant. Feeders and waterers are inside the shelter; nests may be either inside or outside, or both places. Outside nests are arranged somewhat differently in the two or three yards. The alternation of yards helps in sanitation, maintenance of forage, and discouragement of broodiness. The breeder turkeys roost inside the building on the litter or on low roosts, which are preferred. During the part of the year when the breeder yards are not used, they should be kept free from all turkeys and other poultry; but the building, if thoroughly cleaned, could be used for rearing young birds in confinement without access to the soil. The type of building used would depend somewhat on climatic conditions.

Housing on Limited Range

Where winters are mild and prolonged rains are rare, housing is not necessary, but the birds should have roosts and shade. However, minimum shelter consisting mainly of low roosts under a roof is highly recommended. In all situations the breeder area should be well fenced (see p. 19) and if necessary, other measures should be taken to provide protection against predatory animals. The shelter can be pole type or conventional with the sills bolted to a concrete foundation. It should be located on well-drained ground and have a flood-proof floor providing about 4 square feet per bird. The feeders, waterers, nests, and a broody pen can be placed under the roof. The turkeys can roost on the litter or on low roosts under the roof, which are preferred.

Where winters are cold, in areas north of about the 38th parallel in North America, reasonably good housing should be provided. A permanent, single-wall, gable-roof, 30- to 40-foot-wide breeder house can be positioned to face in an easterly or southeasterly direction, assuming that prevailing winds are from the west. Pole-type construction is widely used. The north and south ends can be solid except for drive-through doors. The west side can be solid except for turkey doors and an almost full-length, small-bird-proof, wire-covered opening about 3 feet high placed directly under the overhanging 6-foot-high eaves. This opening should be closable. Down-sliding glass window sashes, solid top-hinged panels, or roll-down, heavy, clear-plastic curtains can be used, usually outside the wire screen. Panels or plastic curtains can be winch operated. The east side can be of wire and framing only, or in very severe climates it can be made like the west side. The littered floor can be of smoothly packed earth or concrete or asphalt about 3 inches thick placed on a smooth, level, earthen base graded up to prevent flooding. Concrete or asphalt floors are preferred. Air movement should be provided by small-bird-screened roof ventilators or by a full-length, 1-foot-high, small-bird-screened opening at the peak of the roof, the opening faced away from the prevailing winds (figs. 26 and 27, p. 51).

Electricity usually is installed for lighting and water warming.

To provide access to the yards, install turkey doors at ground level. If these doors are not more than about 30 inches high, the entry of wild birds will be minimized. To provide passage for the attendant, use the Dutch door arrangement or add special full-length doors, one opening into each yard. A building along the lines suggested can also be used for housing growing turkeys that have access to yards, or it can be used for housing breeding or growing turkeys that are completely confined.

Wire Screening

Wire screening to cover openings that start 3½ feet or more above the ground can be of ¾ by ¾ inch, 17-gage hardware cloth to exclude wild birds and other intruders. Other suitable screening wires are ¾-inch hexagonal mesh, 19-gage netting, and ½- by ½-inch, 19-gage hardware cloth. One- by 1½-inch or 1- by 2-inch, 14-gage welded wire and 1-inch-mesh chicken wire sometimes are used to screen poultry houses, but they do not completely exclude house sparrows and other small birds. For openings at or near ground level, the screen should be made of 14-gage or heavier wire securely fastened to exclude dogs.

Partitions

Partitions should be installed in the house and the yards to provide room for breeding units of the desired size. For example, an inside area of 2,000 square feet would house a breeding unit of 500 birds that had access to a yard or porch.

Litter

Some materials suitable for breeder-house litter are soft-wood planer shavings, wheat straw, shredded cane, and peat moss. Various other materials can be used, among them oat straw, beardless barley straw, and soybean straw, but they are less desirable. Peanut hulls and crushed corncobs make good litter but unless they are quickly and thoroughly dried, they may carry dangerous molds. Bearded bar-

ley and other straws containing sharp particles are not recommended because they may cause mechanical sinusitis. Litter should first be about 4 inches deep then built up as needed to provide good floor covering and prevent excessive dust and buildup of droppings. The litter should be removed at the end of the season and, where possible, the whole inside of the building washed down with water under pressure, dried thoroughly, and allowed to remain vacant for at least 1 month. Disinfection of the house after cleaning may be indicated if disease has been present, but thorough washdown, and drying out followed by depopulation usually are sufficient.

Nests

Nests with tip-up fronts, or semitrapnests, one for each four or five hens, are recommended (fig. 9). They can be made of wood* or of more durable welded iron or heavy plastic. The tip-ups, or gates, must be carefully constructed and balanced or equipped with springs so the tip-up closes behind a hen when she enters and remains closed until she leaves. As she

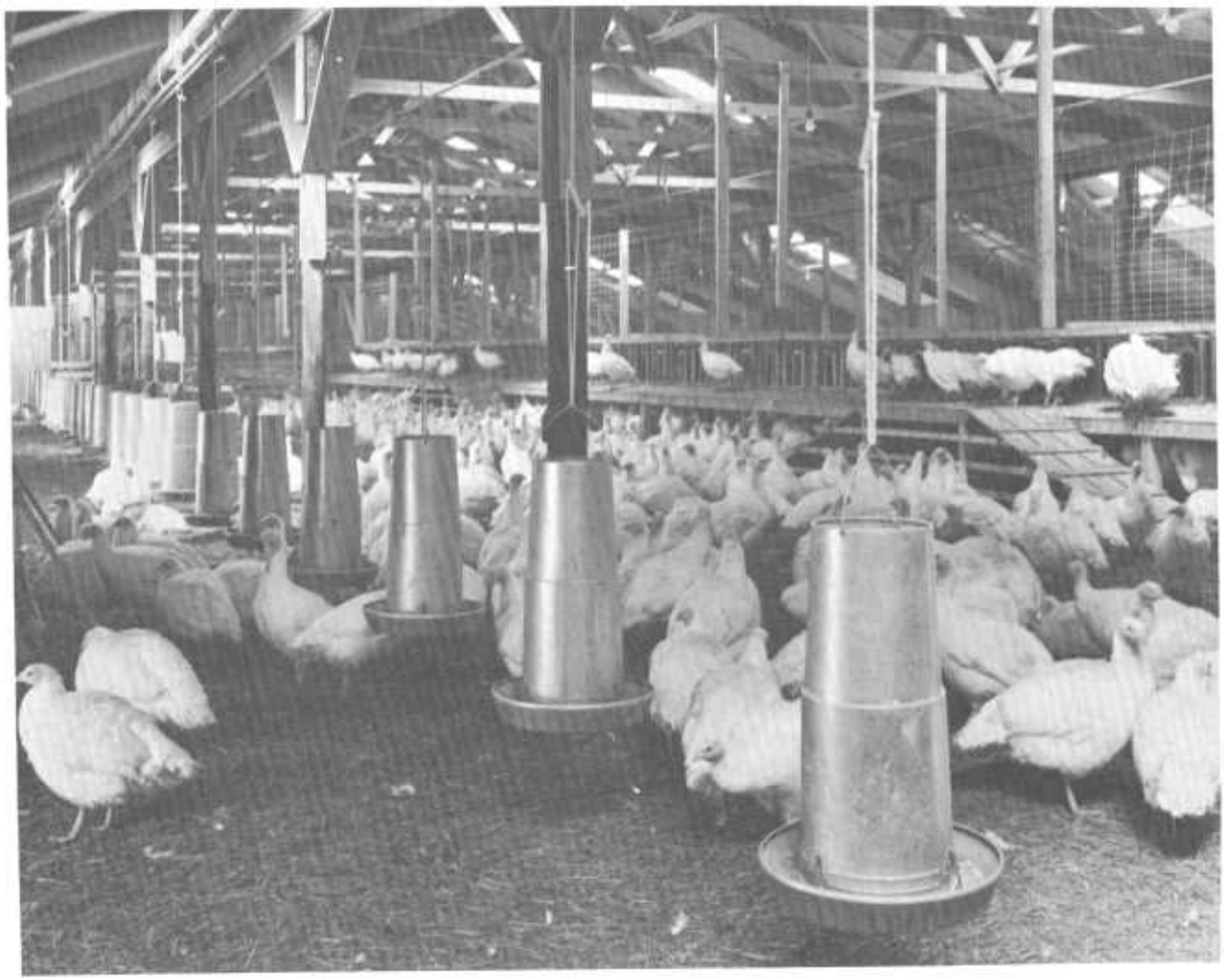

Figure 9.—**Interior of confinement breeder house with hanging feeders adjustable for height and double-deck nests with tip-up fronts. Feeders are suspended from moving track and are filled mechanically at one end of building. (Photo from Canada Department of Agriculture, Ottawa, Ontario.)**

leaves, the tip-up is automatically reset so another hen may enter. Well-ventilated nest compartments for the tip-up nests can be in battery form, each nest 14 to 16 inches wide by 24 inches deep by 24 inches high with a footboard about 5 inches high. For convenience in egg gathering, nest batteries with floorboards can be raised 3 or 4 inches above the floor level and lined up in a single row near the side of the house or in a double row, with an alley between, near the center of the house. Single-decking is preferred but nest batteries can be double-deck if the top deck is equipped with walk-up ramps and a walkway about 2 feet wide (fig. 9). Broody hens and eggs are best removed from a hinged door in the rear, or if the batteries are single-deck, the top of the nest. Figure 8 illustrates a nest battery that can be equipped with either tip-ups or trapnest fronts.

Nests of all types should be installed and made operational well in advance of egg production; otherwise, the hens may be slow in learning to use them.

If neither tip-up nests nor trapnests are used, nest batteries can be the open-manger type, about 2 feet wide by 8 or 10 feet long with 1-foot sideboards, each battery accommodating 50 to 60 hens. A single partition in the middle is desirable. On dry soil or a solid floor, nests can be bottomless but should be placed on top of a strip of smooth-surface asphalt roofing or other resilient water-proof material under which a smoothed, thin layer of any available litter is placed. This arrangement provides a desirable cushioning and protection from dampness. If the nests are outside, add an overhanging roof; and if ground flooding is a problem, add a raised wooden floor.

Roofed nesting houses 4 or 5 feet high are satisfactory for outside use, a 6- by 8-foot unit accomodating about 150 hens. The houses should be placed on a dry location or equipped with a raised wooden floor covered with a resilient bottom as suggested in the previous paragraph.

For nesting litter, a variety of materials is satisfactory—hay, straw, shredded cane, shavings, rice hulls, and pea gravel. Use only a moderate amount of nesting litter so eggs can be readily found. Thick litter will cover up the eggs and make them hard to find.

Fences and Roosts

A tightly stretched, heavy-gage poultry fence, 6 feet high and placed close to the ground with all depressions plugged, will confine turkeys of all ages and protect them from dogs, foxes, and coyotes. Fencing 5 feet high is reasonably effective but these animals sometimes can climb and lightweight turkeys can fly over it.

Housed breeders usually are not given roosts but breeders roosting in the open should have them. A suggested roosting arrangement for all types and ages of turkeys is a portable framework topped with 2 by 4's laid flat, all placed on the same level, the upper surfaces 8 to 12 inches above the ground or floor and 24 inches apart center to center.

Shade

Shade for breeders is necessary where temperatures are likely to be above 100° F. (37.8° C). In extreme heat, higher than about 110° F. (43° C.), sprinklers may be needed in addition to shade.

Control of Broodiness

Broodiness occurs in all strains of turkeys but is less common in some strains, notably the BSW. The condition is difficult to identify in turkeys, but it is practicable to assume that all hens found on the nest around sundown or in the early morning near sunrise are broody. Once or twice each week, drive them into a broody pen or yard and keep them there about 5 days. The broody pen, if inside, should be well lighted. It should contain water and the regular breeder feed but no nests or dark corners. If the hens are saddled, one or more active males may be added. Slat, wire, or gravel floors are preferred in the broody pens but lightly littered floors are satisfactory.

Providing roosts, rotating the range areas weekly, and chasing the hens off the nests at every egg gathering may help to discourage broodiness.

Breeding in Confinement

Breeding in complete confinement on littered floors (fig. 9) is practicable under most conditions. Labor cost is lower, better management is possible, and disease control is easier. Confinement is preferred when the available range is unsuitable or contaminated, or when predatory animals and unfavorable weather are serious problems.

Buildings and equipment suitable for rearing young stock also are suitable for breeding stock and vice versa, but breeding stock requires relatively more floor space. Where natural mating is used, the optimum floor space per bird in the mated flock may be about 11 square feet for the large breeds and 9 for the smaller breeds. Where only hens are housed, the optimum floor space per hen may be about 6 square feet for large breeds and 5 for small breeds if: (1) The hens are debeaked; (2) they are artifically inseminated and no males are allowed with them; and (3) ample ventilation, preferably mechanical, is provided.

Debeaking is recommended for all confined breeders. If not previously debeaked, the birds can be debeaked at the time of selection, blood testing, or vaccination.

The lighting schedule for confined breeders can be one of those suggested for breeding stock allowed outdoors. (See p. 23.)

In mild climates the main feature of the confinement breeder house can be gable roof with wide, overhanging eaves about 6 feet above the floor (fig. 26, p. 51). All four sides are enclosed with strong, small-mesh wire but with enough boarding to provide stability. A concrete or asphalt floor is best, but if a dirt floor is used, it should be smooth, hard packed, and well graded up to prevent flooding. Insulation and forced ventilation are not needed but roof ventilation should be provided. Partitions about 6 feet high, either solid or solid 3 feet up from the floor, should be installed to divide the flock into breeding units of 500 to 1,000 birds. All plywood used in turkey buildings and equipment should be of the exterior marine water-proof types.

For year-round or early-season production in areas with cold winters, the confinement breeder house can be a single-wall wooden building with closable windows as described on page 17. However, some operators prefer a controlled environment in which the building is insulated, vapor sealed, mechanically ventilated, heated to about 50° F. (10° C.) in cold weather, and air-conditioned in hot weather to a livable 60° to 65° F. (15.5° to 18° C.) Under these controlled conditions, floor space could be reduced to about 4½ square feet per large-type hen, 3½ per small-type hen.

Confined breeders are fed and, in general, managed the same way as breeders on range. Special attention should be given to the diet, which must be nutritionally complete and well balanced.

Breeder Batteries

Accurate egg records and egg identification can be obtained through the use of breeder batteries instead of trapnests. The hens are held in individual batteries especially designed for turkeys. Insemination is artificial. Turkey breeding males can be held in individual batteries about 2 feet square and 2½ feet high. It has been reported that caged males can produce up to 30 percent more semen than males maintained in groups on litter. Battery breeding has been found useful in research work but its value in practical operations has not been established. It appears to work best with small or medium-size hens.

A battery unit 22 inches (55 cm.) wide, 20 inches (50 cm.) deep, and 22 inches (55 cm.) high will hold two medium-size turkey hens. The wire floor can be sloped upwards about 2.7 inches (7 cm.) from front to rear. For one large hen the dimensions can be 16 inches (40 cm.) wide, 24 inches (60 cm.) deep, and 24 inches (60 cm.) high; for one small or medium-size hen, 2 inches (5 cm.) less each way; for three large hens, 32 inches (80 cm.) wide, 24 inches (60 cm). deep, and 24 inches (60 cm.) high. The two- or three-hen batteries appear to work well but individual egg pedigrees cannot be obtained.

FEEDING BREEDING STOCK*

All breeding turkeys, males and females, should be given free access to a nutritionally complete breeder diet starting about a month before eggs are expected. Before that time they can be fed all they will eat of the same growing diets as those fed to market stock. Restricting the feed of prospective breeding hens is not recommended. An example of a complete all-mash ration is Breeder Diet No. 1, as follows:

Ingredient:	*Percent*	*Pounds per ton*
Yellow corn, medium grind	34.9	698
Wheat middlings, standard	20	400
Heavy oats or milo, pulverized	15	300
Dehydrated alfalfa meal, 17 percent protein.[1]	8	160
Soybean meal, solvent, 44 percent protein.	5	100
Fishmeal, 60 percent protein	6	120
Delactosed dried whey[2]	2.5	50
Distillers dried product (70 percent solubles, 30 percent grains).	2.5	50
Ground oystershell or limestone	2.5	50
Steamed bonemeal or dicalcium phosphate.	3	60
Finely ground salt (sodium chloride), plain or iodized.	.25	5
Vitamin-trace mineral mix[3]	.35	7
Total	100	2,000

[1] 6 percent alfalfa leaf meal or dried cereal grass and a 2-percent increase in corn may be substituted for the 8 percent alfalfa.

[2] Dried brewer's yeast or plain dried whey may be substituted pound for pound.

[3] A premixed product with approximately the following composition per pound:

Vitamin A		
U.S. Pharmacopoeia (U.S.P.) units		1,000,000
Vitamin D_3		
International Chick Units (ICU)		300,000
Vitamin E	milligrams	4,000
Vitamin K	do	400
Riboflavin	micrograms	800,000
Niacin	milligrams	4,000
d-pantothenic acid	do	2,400
Choline chloride	do	40,000
Vitamin B_{12}	micrograms	2,000
Butylated hydroxytoluene (BHT).	milligrams	22,680
Manganese (Mn)	percent	2.4
Zince (Zn)	do	1.1
Iodine (I)	do	.048
Iron (Fe)	do	.8
Copper (Cu)	do	.08
Cobalt (Co)	do	.008

Breeder Diet No. 1 contains about 16.5 percent protein, 2.3 percent calcium, and 1 percent total phosphorus. Supply water and insoluble grit free choice. If a disease preventive is needed, 50 to 100 grams of furazolidone or a tetracycline antibiotic can be added per ton of feed. Granulated oystershell may be fed free choice but usually the added calcium is neither necessary nor desirable.

If it is not practicable to obtain a complete feed, a simplified one can be substituted, but the birds must be given continual access to direct sunshine and succulent, palatable green feed. An example of a simplified all-mash ration is Breeder Diet No. 2, as follows:

Ingredient:	*Percent*	*Pounds per ton*
Yellow corn, medium grind[1]	30	600
Wheat middlings, standard	30	600
Heavy oats, pulverized	12	240
Meat scrap, 50 to 55 percent protein.	7	140
Fishmeal	7	140
Dehydrated alfalfa meal, 17 percent protein.[2]	10	200
Ground oystershell or limestone	2.5	50
Steamed bonemeal or dicalcium phosphate.	1	20
Finely ground salt (sodium chloride), iodized preferred.	.5	10
Total	100	2,000

[1] Good-quality grain sorghum may be substituted pound for pound.

[2] 7.5 percent dried grass or alfalfa leaf meal and a 2.5-percent increase in corn may be substituted.

This mash contains about 19 percent protein, 2.3 percent calcium, and 1 percent total phosphorus. Clean water and free access to growing green feed and direct sunshine must be provided. If direct sunshine tends to be restricted, add vitamin D as fish oil or as a dry product to provide about 900 International Chick Units (I.C.U.) per pound of diet. Granulated oystershell may be offered free choice with this diet but usually is not needed.

All-mash diets are preferred but breeder diets of mash and grain or concentrate and grain are satisfactory if the grain is fed in the proportions recommended by the formulator of the mash or the concentrate, which may be either pelleted or fed in loose form. Pelleting may help to reduce wastage caused by wind and billing out by the turkeys.

Feed consumption of breeding turkeys amounts to about 0.03 pound per day per pound of average live weight at the time the first eggs are laid. On this basis, feed consumption of breeding turkeys is as follows:

Size of turkey:	Feed consumed by 1 hen *Pound per day*	Feed consumed by 1 tom *Pound per day*
Large	0.60	1.00
Medium	.45	.75
Small	.35	.65

Gravel or commercial insoluble grit and clean water should be available to the birds. No feed should be placed on the ground. Outdoor feeders and waterers should be moved frequently or placed on a grill to avoid unsanitary conditions.

PRODUCTION AND CARE OF EGGS

Egg Production

The number of eggs per hen produced in a season depends on the breeding as well as on climatic conditions and management, including the use of artificial light. Without artificial light in the northern tier of States, well-matured young turkey hens of the better laying strains should average about 40 eggs to June 1, and hens in their second laying season about 30 eggs, provided broodiness is discouraged promptly. In the middle States, these well-matured young turkey hens should lay about 50 eggs to June 1, and in the southern tier of States, about 60 eggs. With adequate artificial light starting December 1, these hens should average about 100 eggs to the following June 1, or 160 to October 1. The poorer laying strains usually average only about 75 percent as many eggs as the better strains. Young hens come into 40-percent production 20 to 30 days (average 25) after stimulatory lighting starts.

Egg Characteristics

Except after a long laying period, typical turkey eggs vary in general overall color from light to medium dark brown and are well sprinkled with medium- to dark-brown spots superimposed on a light, yellowish-brown (ecru) ground color. The shell normally is strong, with the shell membranes very tough and the yolk quite firm but enclosed by a weak vitelline membrane. In shape the eggs are noticeably pointed at one end (fig. 10).

As the egg-laying season progresses and production is heavy, shell texture may deteriorate and the shell usually becomes lighter, sometimes almost white, with inconspicuous spotting or none at all. Although these changes usually can be considered normal, the occurrence of many light-colored, thin shells sug-

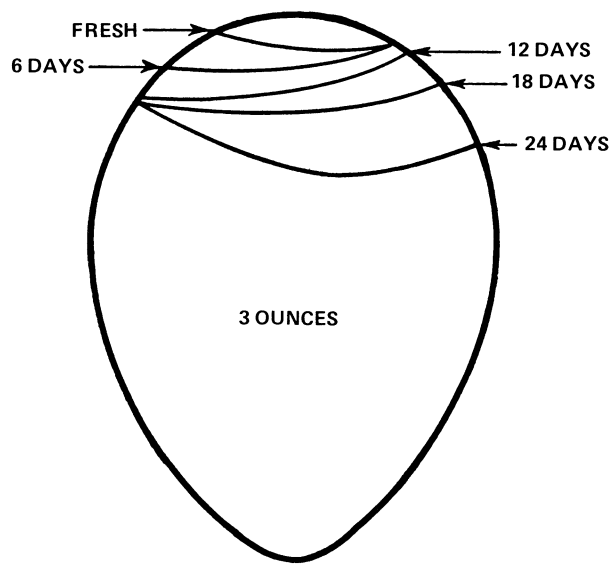

Figure 10.—Diagram showing proper size of air cell in egg after 6, 12, 18, and 24 days of incubation at 60-percent relative humidity.

gests disease involvement. In this case an investigation is in order and the abnormal eggs should not be used for hatching.

Normal turkey eggs not needed for hatching can be used as human food for they are as palatable and nutritious as chicken eggs. They sometimes are broken and the contents frozen.

First-year eggs of the large broad-breasted bronze or white varieties weigh about 38 ounces per dozen, or 3.167 ounces (90 grams) each; those of the medium-size standard varieties, 36 ounces per dozen, or 3 ounces (85 grams) each; and those of the standard Beltsville Small White, about 32 ounces per dozen, or 2.667 ounces (75.6 grams) each. Yearling hens lay eggs averaging about 7 percent heavier than those of the same hens in the first laying season. Lumpy shells are not uncommon and if the shell itself is not weak or thin, the lumps do not affect hatchability. If young hens are well matured, 34 to 35 weeks or older when laying starts, their first eggs are almost as large as they will be at any time during their first laying season. However, if brought into production while physically immature, turkey hens lay only a few small eggs, which increase in size quite slowly and never become normal in size.

Egg Gathering and Storage

Turkey hatching eggs should be gathered three times daily. Sometimes more frequent gathering is essential to avoid breakage, dirtying, and freezing. After the eggs are gathered, they should be held at room temperature, 75° to 85° F. (24° to 29° C.), for about 24 hours or at least overnight, then stored at 55° to 60° F. (13° to 16° C.) until they are set. At 28° F. (−2.2° C.) eggs begin to freeze, and then are useless for hatching. During storage, eggs can be cased with large ends up or trayed lying on their sides. Egg cases may be stood partly on end, sloped at a 45° angle. Reversing the cases end for end once or twice daily during storage turns the eggs. This turning is advisable if eggs are to be stored longer than 1 week. Relative humidity of the air in the storage facility is not too important but extremes under 40- and over 80-percent relative humidity should be avoided. Ventilation is needed in the egg-holding quarters if mold growth is seen on the eggs.

Turkey hatching eggs should not be held over 1 week, but if storage conditions are favorable and the eggs are turned daily, hatchability will be retained quite well for 2 weeks and fairly well for as long as 3 weeks.

Dirty eggs usually show lowered hatchability and may transmit disease. To keep eggs clean, use well-designed and well-placed nests, preferably with tip-up fronts, and clean litter; gather eggs frequently; and keep turkeys out of mud. Eggs badly soiled should be discarded. Eggs moderately or lightly soiled can be machine washed or hand washed by soaking in *warm* water, 105° F. (40.5° C.), for about 10 minutes, sponging off the dirt, rinsing the eggs in clean water, and allowing them to dry without rubbing. The warm water should contain about 200 parts per million of an acceptable quarternary ammonium disinfectant. Fumigating clean or cleaned eggs with formaldehyde gas* is the best method of sanitizing eggs where this is required for disease control.

Cracked eggs, if clean, sometimes can be hatched if the cracked place is covered with collodion or a proprietary preparation containing it. However, the danger of infection is great so it is inadvisable to incubate cracked eggs.

Exploding Eggs

Eggs infected with *Pseudomonas* bacteria may become rotten and explode during incubation, contaminating the incubator with foul-smelling material and necessitating thorough cleaning and fumigation. In hot, wet weather, eggs laid in muddy soil or contaminated with it sometimes pick up the widespread infection, apparently absorbing it through the shell. To prevent this infection, produce eggs uncontaminated with soil. Washing and fumigating contaminated eggs (see above) immediately after gathering may help, but it is advisable to discard all soil-dirtied eggs laid in hot, wet weather.

Artificial Lighting

Egg production can be controlled by the proper use of artificial light. Spring- and sum-

mer-hatched hens of all varieties require no special light treatment during the growing season, but they should be 30 to 32 weeks of age at the time they are given stimulatory light of 13 to 15 hours daily. Toms 26 or more weeks of age should be given stimulatory light 3 or 4 weeks ahead of the hens with which they are to be mated. To obtain a 14-hour light day, turn the lights on abruptly 14 hours before the local hour of sunset and leave them on each day until natural light takes over, or later in the morning, 9 or 10 a.m., for convenience in checking for malfunctions. Starting the lights at 2:45 a.m. in mid-December in the area of 40° north latitude provides a light day of about 14 hours at the start. If the same starting hour is retained until late June, the daylength gradually increases to a maximum of about 17 hours because of the later occurring sunsets. If eggs are desired after July 1, a light day equal to the maximum obtained in late June should be maintained by starting the lights earlier as the summer days grow shorter. A satisfactory alternative plan, well adapted to confined breeding stock, is to turn the lights on at 5:30 a.m. and off at 7:30 p.m. every day. This produces a reasonably uniform 14-hour day throughout the season.

Regularity in lighting is essential. An ordinary alarm clock rigged with a simple switch may be used to turn on the electric lamps but they must be turned off by hand and the clock reset each evening. A time switch can be used to turn lights on and off automatically. Ordinary incandescent white electric light is the most practical. Gasoline and gasmantle lanterns also are satisfactory, but must be handled with care to prevent fire.

The intensity of artificial light supplied can range from 0.6 to 40.0 foot-candles at bird height. The practical optimum is between 2 and 5 foot-candles. An intensity of 2½ to 3 foot-candles can be obtained from clean 75-watt incandescent light bulbs without reflectors or 60-watt bulbs with reflectors placed 6 feet above the roosting birds' backs, 10 feet apart, and 5 feet from the sides of the building or roosting area. Reflectors are not necessary, but if they are used, the wattage can be reduced by about 20 percent as noted above. Aluminum pie pans make satisfactory reflectors, but they should not touch the base of the bulbs, which should be cleaned occasionally.

Light the roosting, watering, and feeding areas at about the same intensity at bird height. If these areas are not lighted, the birds should be confined to the lighted roosting area until natural daylight takes over. An alternative is to use red light or low-intensity white light, either of which will keep the birds on the roosts until natural daylight prevails. For red light, use 25-watt bulbs installed 3½ feet apart and 3½ feet above the roosting birds' backs. For low-intensity white light of about 0.6 foot-candle, use 15-watt bulbs installed 10 feet apart and 6 feet above the roosting birds' backs. Low-intensity lighting is about as effective as high-intensity lighting provided the length of the light day is 14 to 15 hours.

Unhoused turkeys on roosts can be lighted successfully, but the wiring and fixtures should be waterproof and the lamps, 6 feet above the birds' backs, should be fixed firmly in and protected by an inverted trough or similar device, which may be painted on the underside with aluminum paint to act as a reflector. Unstabilized reflectors are not satisfactory in outdoor installations. Floodlamps or quartz-light lamps encircling the roosting area are satisfactory. There is little danger of overlighting, but light is wasted if the intensity exceeds 5 foot-candles at bird height.

ARTIFICIAL INCUBATION

Incubator Operation

Modern incubators (fig. 11) are very efficient hatching machines if properly operated. In general, recommendations of the manufacturer should be followed.

Temperature requirements for the incubation of turkey eggs are the same as those for chicken eggs; but with natural-draft (flat-type) incubators in which the thermometer is suspended from the top of the machine or sits on a stand, a change in the position of the

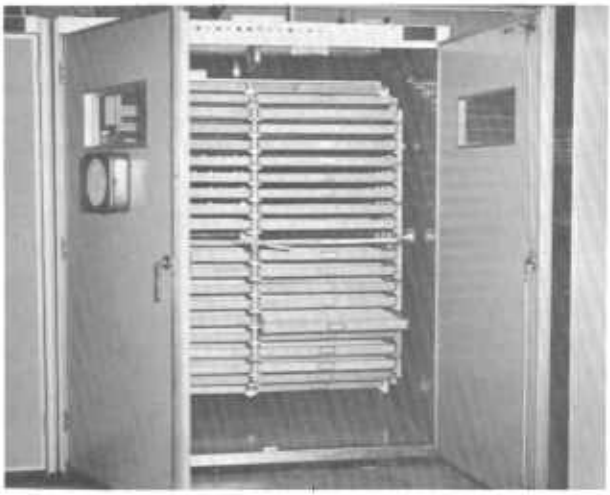

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Figure 11.—**Modern incubator. Drum is reversed automatically every 3 hours to turn eggs. Humidity indicator and temperature recording device are in door at left.**

thermometer must be made because of the greater size of the turkey eggs. With incubators in which the thermometer lies on top of the eggs and in forced-draft machines, no adjustment is necessary and the incubators can be operated according to temperature directions for hatching either turkey or chicken eggs.

The proper position of the thermometer for hatching turkey eggs usually is indicated in the directions furnished by the manufacturer. When such directions are not furnished, adjust the position of the thermometer so that the bottom of the bulb is 1⅞ inches (4.8 cm.) above the floor of the egg tray. In this position, the thermometer should read 100.5° F. (38.0° C.) for the first week; 101.5° (38.6° C.) the second; 102.5° (39.2° C.) the third; and 103° (39.4° C.) the last. An alternative is to maintain a temperature of 102° (39° C.) throughout the hatch. At no time should the temperature exceed 103° (39.4° C.). Be sure the egg trays in natural-draft incubators do not sag because sagging trays cause harmful variations in temperature.

Forced-draft incubators usually are run at a uniform temperature of about 99.5° F. (37.5° C.) but temperatures may vary slightly in different types of incubators.

Humidity requirements are met when the weight loss due to removal of moisture during incubation, based on the weight of eggs just before they are set, ranges within the following limits:

Days of incubation: *Number*	Weight loss: Acceptable range *Percent*	Weight loss: Ideal *Percent*
6	2 to 3	2.5
12	4 to 6	5.0
18	7 to 9	7.5
24	9 to 12	10.0

The ideal weight loss produces air cells of about the size shown in figure 10.

When moisture is needed in the incubator, as it usually is, can be provided by a humidifying device, by putting pans of water in the incubator, or by placing burlap wicks in pans already there. When less moisture is needed, water pans can be removed or the ventilation increased.

Modern forced-draft incubators are equipped with a humidifier that supplies water and regulates the humidity of the air in the machine. Relative humidity is indicated by the difference between the wet- and dry-bulb readings. At a dry-bulb temperature of 99.5° F. (37.5° C.), a wet-bulb reading of 87.5° (30.8° C.) shows a difference of 12° (6.7° C.). This figure indicates a relative humidity of about 62 percent, which is satisfactory for large turkey eggs during the first 21 to 25 days of incubation or until they are transferred to the hatching facilities. At a dry-bulb temperature of 99.5° (37.5° C.), a wet-bulb reading of 88.5° (31.4° C.) shows a difference of 11° (6.1° C.). This figure indicates a relative humidity of 66 percent, which is preferred for small turkey eggs although good hatches can be obtained with a wet-bulb reading as low as 86° F. (30° C.). During the hatching period (after the eggs are transferred to the hatching facilities at 21 to 25 days), a relative humidity of about 70 percent is desirable. With a dry-bulb temperature of 97° F. (36.1° C.) in the hatcher, the wet-bulb reading should be about 88° F. (31° C.); with a dry-bulb temperature of 99.5° F. (37.5° C.), the wet-bulb reading should be about 90° F. (32.2° C.).

Eggs should be turned at least three and preferably five to eight times daily, usually

every 3 hours, day and night, during the incubation period until the eggs are transferred to the hatching facilities. Turning after transfer is not recommended. Turkey eggs may be transferred any time between the 21st and early the 25th day of incubation, counting the day after that on which the eggs were set as the first day. However, if transfer is made late the 25th day, an occasional small-type poult will have hatched in the setting trays.

Incubators should be kept in a ventilated basement or an insulated, aboveground, ventilated room. Where room ventilation is inadequate, fresh air should be conducted directly into the incubator air intakes or close to them. Uniform room temperature of about 70° F. (21.1° C.), a fairly high relative humidity ranging between 49 and 60 percent, and good ventilation are desirable features in an incubator room.

Incubation at elevations over 3,500 feet above sea level presents some difficulties because the thin air does not provide enough oxygen for the developing embryo. This deficiency can be corrected by adding oxygen as suggested by the Colorado Experiment Station.*

After the 23d or 24th day of incubation, any glass-covered opening that exists in the hatching chamber should be darkened and should be kept dark until hatching is completed so that the poults do not crowd to the light. If incubation has been normal, hatching will be completed after 28 days of incubation for large-type turkeys and after 27¼ days for small-type turkeys. As soon as hatching is completed, the poults, which should weigh about 67 percent of the egg weight before incubation, should be removed and placed in the brooding quarters with feed and water available.

If the poults are to be shipped, they should be put in poult boxes and shipped as soon as possible. If they are held in the incubator or in a battery, the temperature should be 95° to 99° F. (35° to 37.5° C.) and the poults should have a rough surface, such as 0.4 inch (No. 2½) mesh hardware cloth, to stand on. A slippery surface, such as that provided by smooth paper, may cause leg injury.

Testing Incubated Eggs

Testing the eggs by candling to remove those that are infertile or contain dead embryos gives valuable information and eliminates waste of space caused by incubating unhatchable eggs. Under commercial conditions, the eggs are usually candled only at the time they are transferred to the hatching trays after 21 to 24, sometimes 25, days of incubation. At this time, all clear eggs and those showing development not up to normal are removed from the incubator trays while those with normally developing embryos are transferred to the hatching trays.

To candle eggs, pass them before a small spot or narrow slit of strong, white light in a darkened room. When candled after 21 to 25 days in the incubator, infertile eggs may appear relatively clear with a well-defined yolk or they may have an irregularly outlined yolk with one or more poorly defined dark spots that cannot be identified as blood vessels, embryos, or parts of an embryo. These dark spots in infertile eggs may be caused by parthenogenetic growth, by foreign infection, or by decomposition of the egg contents during the relatively long period of time the eggs are held at incubation temperature.

Eggs with dead embryos (dead germs) contain recognizable blood vessels, a blood ring, or an undersized embryo or part of one but never show a regularly outlined yolk.

Eggs containing normal live embryos will have a reddish appearance, development will be advanced according to that which is normal for the age at the time of candling, the embryo will be free floating, and the reddish spider-webbed condition caused by normally functioning blood vessels will be observed.

The method just described for candling at transfer time only is, at best, inaccurate for determining true fertility but is considered to be a practical compromise. Fertility can be determined accurately by candling on the 6th to 10th day of incubation, and then breaking and examining the contents of doubtful-appearing eggs. At this time all eggs that appear clear with free-floating, regularly outlined yolks free

from irregularities or dark spots may be counted as infertile and need not be examined further. Candled eggs that show decided irregularity of the yolk or contain dark spots, blood, or undersized embryos should be broken out in a shallow pan of water and examined carefully. Dead-germ eggs always are addled (albumen and yolk mixed) and the embryonic development is roughly circular, with a blood ring or part of one and usually an easily recognized embryo.

Parthenogenetic development and foreign infection sometimes are found in incubated eggs and such eggs should be counted with the infertiles. Parthenogenetic growth may or may not addle the egg, but it always consists of an irregularly outlined mat of whitish tissue. Rarely, there may also be some blood or, still more rarely, an undersized parthenogenetic embryo or part of one. Foreign infection may cause mottling of the yolk, which usually retains its shape and does not mix with the white.

Shipping Containers for Poults

Shipping day-old poults in four-section cardboard poult or chick boxes with an excelsior pad for the poults to stand on is satisfactory even for long distances, but poults are injured by being kept from feed and water for more than about 24 hours after hatching. Ventilation in the boxes should be adjusted according to the temperatures expected to be encountered during shipping, with more ventilation allowed for high temperatures. Boxes should be stacked to allow free circulation of air during transit.

ARTIFICIAL BROODING OF POULTS

Starting the Poults

Place the poults in the brooding quarters and give them feed and water within 24 hours after hatching, the sooner the better. Poults may be started on covered or uncovered litter (see "Litter for Brooding" and "Litter Management"); on asphalt roofing (not tar paper); on wire or slat floors (see "Wire Floors for Brooder Houses" and "Slat Floors for Brooder Houses"); or in batteries (see p. 34).

To start the poults on covered litter, put down about 2 inches of suitable litter material distributed evenly over the brooder house floor. On top of this litter, under the hover and 1½ to 3 feet beyond it, place a layer of strong, rough-surface paper and *enclose it by a brooder ring, or poult guard* (fig. 12). After 5 or 6 days, remove the paper and allow the poults on the litter, which should be deepened to about 4 inches after another week.

To start a brood of 250 poults on asphalt roofing, place a layer of the thick, waterproof roofing directly on the brooder house floor to cover an area about 9 feet in diameter, including the hover. The roofing helps to insulate the poults from the floor, an especially important consideration if the floor tends to be damp or cold. Then sprinkle a thin layer of sharp, clay-free sand or fine gravel on top of the roofing. The poults can remain on this surface for up to 3 weeks, after which the roofing can be taken up for possible re-use or it can be kept there but covered with litter. It is not necessary to use sand on top of the roofing, but it is desirable. If sand is not used, add litter on top of the roofing as well as on all of the brooder house floor when the poults are 5 to 7 days old.

Litter for Brooding

For starting poults on uncovered litter, nonsplinty softwood shavings is one of the few suitable materials generally available. Bright, clean, wheat straw sometimes can be used, but it must be free from chaff and all other small particles. However, with these and most other litter materials, it is safer either to confine the poults on a bare rough surface or sand-covered surface for 5 or 6 days as suggested above or start them in batteries for 5 to 10 days. There is a fairly wide choice of litter to use *after the first few days*, including shavings, wheat and beardless barley straw, peat moss, shredded cane, rice hulls, processed flax straw, and cedar tow. Peanut hulls, crushed corncobs, and shredded corn stover make good litter, but they may contain harmful molds unless they

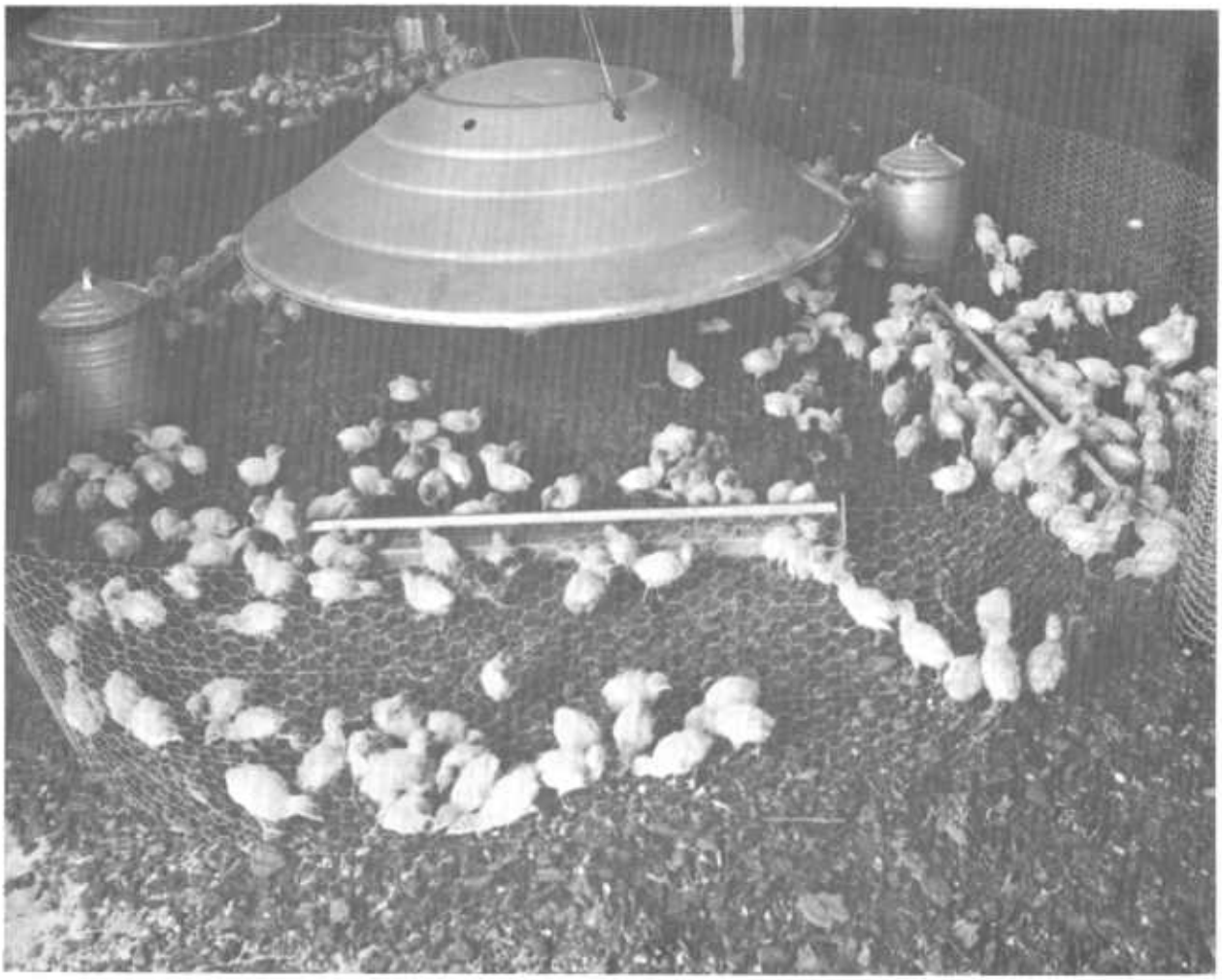

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Figure 12.—**Turkey poults on litter under a nonvented propane gas hover brooder after 5 days in starting battery. Note wire poult guard.**

are promptly and thoroughly dried. There are other satisfactory litter materials, but selection should be based on reliable recommendations and guaranteed freedom from molds. Among litter materials not recommended for brooder-house use are splinty shavings, sawdust, oat hulls, cottonseed hulls, dried beet pulp, and the straws of rye, oats, and bearded barley.

The **brooder ring, or poult guard** (fig. 12), should be 16 to 18 inches high and can be made of ½- to ¾-inch-mesh lightweight hardware cloth or ¾- to 1-inch-mesh lightweight chicken wire; the ¾-inch mesh is preferred. Heavy corrugated paper or lightweight aluminum roll sheeting sometimes is used as a poult guard in cold weather in large, open brooder houses to shield the poults from cold drafts. If paper is used, it usually needs to be supported by the wire ring or other stiff material. The poult guard usually encircles the hover 1½ to 3 feet out from it. After a week it can be removed or it can be enlarged and retained for a second week, which often is desirable.

Litter Management

To provide good litter, first put down about 2 inches of loose litter and then add to it at intervals frequent enough to provide a dry,

clean, resilient walking surface. With good ventilation and a liberal supply of litter, the brooding environment usually remains favorable. However, if wet or caked droppings accumulate, top them with clean litter or, better, remove them and replace with clean litter. Turning the litter occasionally is helpful. To promote sanitation, feeders and waterers can be moved frequently or placed on wire- or slat-covered platforms after the poults are about 3 weeks old. Platforms can be about 3 by 8 feet, made of 1- by 6-inch boards on edge, supported at 18-inch intervals, and topped with 1- by 2-inch, 12- to 14-gage welded wire or, better, with wooden slats 1- to 1¾ inches wide and spaced 1¼ inches apart. Litter usually need not be changed during the brooding, rearing, or breeding seasons; but it should be removed at the end of each of these seasons. Used poultry litter has good fertilizing value, especially if composted before use on cropland.

Feeders and Waterers During Brooding

Small trough-type metal feeders or wooden feeders made of plaster laths (fig. 13) are placed like spokes in a wheel, part under the hover and part outside it, but within the brooder ring. Supply one 3-foot-long trough feeder for each 40 poults, which is about 2 linear inches of feeding space per poult. Heap the troughs with mash at first to encourage eating. In addition, some operators put a little mash in a few paper plates or egg flats the first day or two and place some colored glass marbles on the feed to attract the poults. After a week or so, use larger size feeders (fig. 13) but retain about 2 inches of linear feeder space per poult during the remainder of the brooding period, after which it can be reduced to 1 linear inch.

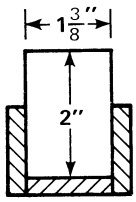
To provide good watering facilities during brooding, start with one circular 1- to 2-gallon glass or metal baby-poult-size waterer for each 50 poults. Select a waterer with a narrow drinking space, not over 1¼ inches wide and 1¼ inches deep. An alternative is to start with one baby-poult-size automatic water trough 4 feet long for each 80 poults. Place the waterers around the edge of the hover and put a few glass marbles in each one. As an extra precaution, some growers add one quart-size waterer per 50 poults for the first 2 days. After about 2 weeks, replace the round poult-size waterers with larger waterers that provide a water depth of about 1½ inches and about one-half linear inch of watering space per bird. In making this change, move the small waterers gradually nearer the larger ones to insure that the poults will freely use the new facilities when the old ones are removed. Young poults deprived of water for 24 hours or longer may suffer heavy mortality if they suddenly engorge themselves with water. (See "Water Glut.")

Waterers should be washed and rinsed, not just emptied, every day. Disinfection usually is not needed but if necessary, the quaternary ammonium or chlorine types are preferred.

Requirements for Brooding

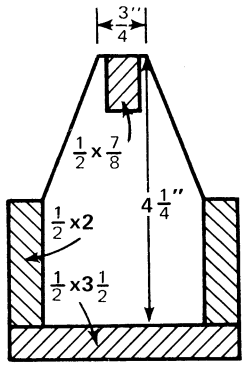
TEMPERATURE.—Young poults will not live and grow unless they are kept warm and dry. For at least the first 2 weeks the temperature 3 inches above the floor at the edge of the hover should be 95° F. (35° C.) for dark poults and about 100° F. (37.8° C.) for white. Unless the weather becomes hot, the temperature regulator in the brooder need not be changed during the brooding period. Temperature near the floor of the room outside the brooding area should be 70° F. (21° C.) or a little higher and should be maintained at about that level, using auxiliary room heat if the brooders do not supply enough.

VENTILATION.—Ventilation during brooding always is important, but is exceptionally so when heat is supplied by open-flame brooders that are not vented to carry off the smoke. Trouble from respiratory diseases is invited when the air in the brooder house is low in oxygen and contaminated with exhaust gases from the brooder stoves. Engineer-approved air outlets in the peak of a gable roof or near the top of a shed roof combined with adjustable window intakes usually provide sufficient ventilation, but a well-designed system of fans and intakes* is preferable, especially where open-



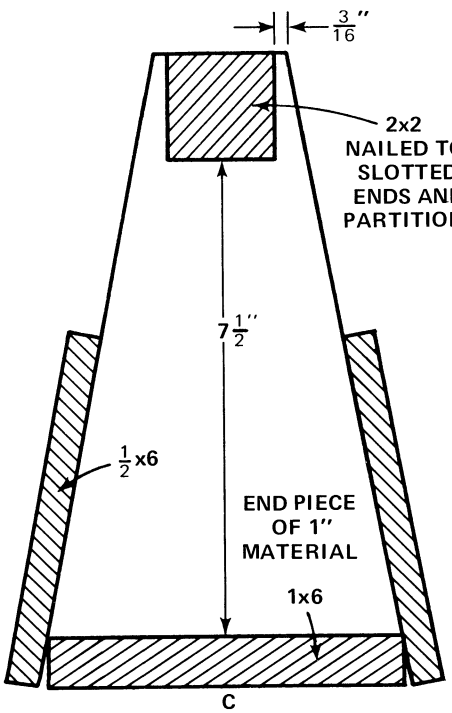
A

MAXIMUM PRACTICAL LENGTH, 3 FT.
ALL MATERIALS ARE PLASTER LATH
OR SIMILAR SAWED LUMBER



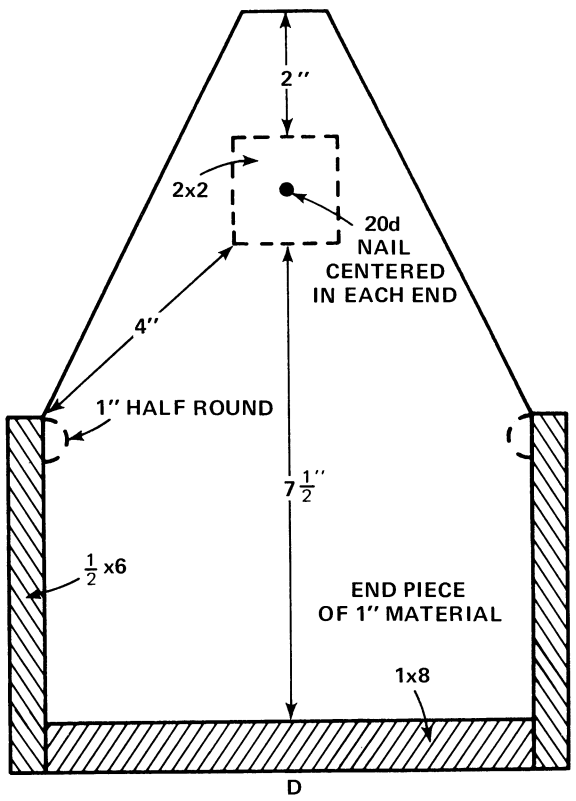
B

MAY BE ANY LENGTH IF PARTITIONS
ARE INSTALLED EVERY 3 FT.



C

MAY BE ANY LENGTH IF PARTITIONS
ARE INSTALLED EVERY 4-5 FT.



D

MAXIMUM PRACTICAL LENGTH, 4 FT.

1"

Figure 13.—End elevations of trough feeders for turkey poults: *A*, Lath feeder for 1st week; *B*, feeder for 2d to 4th weeks; *C* and *D*, feeders for 5th to 8th or 12th weeks.

flame brooders are used and minimum floor space per bird is provided.

LIGHTING.—For the first 2 weeks of brooding in all types of houses, the room should be well lighted day and night at 10 to 15 foot-candles at poult level; and, if practicable, a small 7½- to 15-watt light bulb should be installed under the hover. In windowed houses after 2 weeks, only dim lights at one-half foot-candle would be needed at night, none in the daytime. In windowless houses after about 2 weeks, the intensity of the light can be reduced gradually to about 1 foot-candle during the 16-hour day and one-half foot-candle during the 8-hour night. The dim lights at night may help to discourage piling and stampeding.

CORNERS.—In individual brooding rooms or small brooder houses, corners should be rounded with small-mesh (¾″ or less) wire to prevent or reduce losses from piling, which may be caused by fright, drafts, or too-low floor temperature, or during catching.

ROOSTS.—Roosts seldom are used in modern turkey brooding operations, but they may help to prevent stampedes and piling at night. Roosts used during brooding do not contribute to breast blister trouble later on. If brooder-house temperature is 70° F. (21° C.) or higher at floor level, turkeys will start roosting as early as 3 weeks of age and nearly all will be on the roosts at 5 weeks. For the brooder house, roosts of the stepladder type are practical, allowing about 3 lineal inches per bird. They may be made of 1½- to 2-inch-round poles, 2 by 2's or 2 by 3's, the lowest one about 12 inches above the floor, each succeeding roost 2 to 4 inches higher. The roosting units can be either removable or hinged so that they can be raised up out of the way. The roosts should be placed near the windows. Poults will not take to the roosts readily if the roosts are placed in a dark part of the house.

Size of Units and Floor Space

Although brooding units of 300 to 500 poults sometimes are used, it is better practice and less risky to limit the brood to 250. For brooding turkeys to 8 weeks in naturally ventilated houses, allow about 1¼ square feet of floor space in the brooder house for a large-type poult, 1 square foot for a small. In insulated, force-ventilated houses, 0.8 to 1 square foot is sufficient up to 8 weeks but no longer. If porches or yards are used, inside floor space may be reduced by one-third; if they are not used or if they cannot be used because of the weather, the full recommended space should be provided in the brooder house itself. At the start of brooding, in brooders with canopies, about 14 square inches of canopy space are needed for each large-type poult and 12 for each small.

For growing turkeys to fryer-roaster age, 12 to 13 weeks for large-type white turkeys, usually hens only, or 15 to 16 weeks for small- or medium-type turkeys of both sexes, allow 2½ square feet for each bird.

Housing During Brooding

Before constructing a brooder house, check plans based on successful experience. Building plans and prefabricated structures are offered by some commercial concerns and help often can be obtained from State extension or commercial services.* A few suggestions are offered here.

Brooder houses often are used both for brooding and for rearing to market age. Width usually varies from 24 to 40 feet, length from 100 up to 600 feet. Clear-span, rigid-frame, gable-roof houses 40 feet wide and 300 feet long are popular. Location should be on fairly high ground, preferably on top of a low ridge where natural air and water drainage is good. The soil should be graded up, smoothed, and packed down to provide a smooth, raised floor into which no surface water can enter. A concrete or asphalt floor 3 inches thick, level or with a slight downslope from center to sides or rear to front is highly desirable although raised packed-clay floors sometimes are used successfully. The gable roof usually is of metal and not over about 15 feet high at the top. The outside walls can be of tight metal or wooden single-wall construction for use in moderate weather. For cold-weather brooding, insulation of side walls and ceiling is needed, especially if the brooders are of the type that do not provide an abundance of heat. Side- or down-sliding glass windows should be evenly

spaced in front and rear walls at the rate of about 1 square foot of glass to 10 square feet of floor space. Mechanical ventilation is highly desirable in all brooder houses and necessary in those over 40 feet wide. Correct engineering principles should be followed when ventilation systems are installed.

Partitions appear not to be necessary in small houses used for brooding and rearing but some operators prefer to install them at intervals in long houses so that no more than 1,000 to 1,500 turkeys are allowed in one pen. This arrangement is useful in separating the turkeys by age and sex and can help to control stampedes and disease outbreaks. Permanent dividing walls about 6 feet high often are made of wire, but solid metal or boards next to the floor provide better separation. Drive-through doors in ends and partitions allow the use of labor-saving machinery. Removable partitions of solid material 3 to 4 feet high sometimes are used during the first few weeks of brooding.

Electric wiring should be installed for lighting and debeaking, especially if natural light is restricted as it usually is in wide houses. Water should be piped to the building with numerous frost-proof outlets or with provisions for draining if subfreezing weather is expected.

Pole-type breeding and rearing houses* also may be used for moderate-weather brooding by enclosing the open sides and ends with clear plastic, adding electricity, and installing brooders and water supply. After the brooding period, turkeys can be reared to market age in the same building, but some should be removed to allow enough rearing space for the remaining birds.

Wire- or slat-floored sunporches attached to the brooder house have been widely used, but have been largely replaced by brooder houses without porches or outside yards.

Brooder houses as well as breeding and rearing houses should be built to exclude small wild birds and rats as well as larger birds and animals. Some of the requirements are concrete foundations, tight-fitting doors and windows, and all openings covered by ¾-inch-mesh, or smaller, wire.

Wire Floors for Brooder Houses

Wire floors, like slats, make the use of litter unnecessary and they tend to prevent filthborne diseases such as coccidiosis, hexamitiasis, and blackhead. Plenty of heat and good ventilation are essential, but to prevent floor drafts, long stretches of unobstructed open space underneath should be broken up by solid wood or metal partitions about every 20 feet. The wire floor may be: (1) Galvanized welded-wire floor sections about 3 feet square and 6 inches high, the top of 1- by 2-inch-mesh, 12-gage wire; or (2) wire-covered wooden sections about 3 by 8 feet, made of 1- by 6-inch boards well braced, supported at 18-inch intervals, and surfaced with 1- by 2-inch, 12-gage wire. These sections should be spaced about 1¼ inches apart and supported with the bottom surfaces about 2 inches above the floor. The long axis of the 1- by 2-inch wire should extend from the front to the rear of the house. At the start of brooding, strips of small-mesh wire of the types suggested for battery brooder floors (see p. 35) should be laid over the larger mesh. The area covered should include that under the hover and that normally included in the brooder ring, which should be retained for about 2 weeks. The small-mesh starting wire is retained for about 4 weeks and then is taken up. The poults use the large-mesh wire for the rest of the brooding period when most of them will be roosting if roosts are available. Roosts during the brooding period are especially desirable when wire or slat floors are used.

Slat Floors for Brooder Houses

Removable, 4-feet-square sections composed of plaster lath or narrow, lathlike slats mounted on metal or wooden supports are good brooder house floors. They minimize losses from crowding and piling and help to prevent filthborne diseases. The boards or laths are held in position three-fourths inch apart and supported with their tops about 8 inches above the floor. For the first 2 weeks, however, the slats in the area under the hover and within the brooder rings should be covered with 0.4-inch-mesh, 21-gage hardware cloth, or heavy

paper or asphalt roofing, topped with a thin layer of sand. Poults can be raised to fryer-roaster age on the slats. If the space is used for rearing, the laths or slats would then be replaced by litter after 8 to 16 weeks.

Types of Brooders

Nonvented propane radiant gas hover brooders (fig. 12), which have no smoke-exhaust or chimney pipes, are the most widely used of the various types available. They are portable, economical to operate, durable, reliable if burners are kept adjusted and clean, and not affected by power failures. Good ventilation in the brooder house, which always is important, is especially so with these brooders. Mechanical ventilation is highly desirable. For use in very cold weather, it may be necessary to supply supplementary heat such as that provided by vented gas or fuel-oil space heaters.

Catalytic gas hover brooders are a new development claimed to be completely fireproof and very efficient. With these brooders, ventilation of the brooder house would still be extremely important.

Vented gas hover brooders have smoke-exhaust pipes, provide ample heat, and do not contaminate the air of the house. They are very desirable, especially for cold-weather brooding, but are more expensive in first cost and installation and are not always available.

Gas infra-red brooders in general are somewhat similar to electric infra-red brooders but supply more heat.

Continuous hot-water brooding systems that are properly designed and installed are well adapted to cold-weather brooding. They are safe, dependable, and durable, and provide a margin of safety in case of heat interruptions. Their chief disadvantage is the high cost of installation which, however, may be offset by lower operational costs. Great care should be exercised to select equipment that has proved satisfactory and to install it according to correct engineering principles.

A few general remarks are made regarding hot-water brooding systems. Water for circulation is heated to 160° to 190° F. by a boiler which may be fueled by gas, oil, wood, or coal. For a brooder house 28 to 32 feet wide, a hot-water brooding system can consist of three 1½-inch (inside diameter) pipes carrying water from the heater and three returning it, alternately, about 6 inches apart center to center, 12 to 14 inches above the floor, and in the center of the house or about 6 feet out from the rear walls. A strong covering such as asphalt roofing or plastic material can be placed on top of the pipes to form hovers.

A poult guard is placed under and outside of the pipes to confine each brooding unit of poults for about the first 2 weeks. The poult guards are placed at proper intervals along the pipes to allow the right amount of brooder-house floor space for starting each unit of poults. If a chicken-wire fence about 5 feet high is placed on top of the pipes to keep turkeys off them, the house can be used for rearing the poults to market age. This also applies if a removable, sectional, flat plywood or board platform without sideboards is installed on top of the pipes for the full length of them. On this platform could be placed a covering of sand or the regular litter.

The pipes should be properly painted to provide efficient radiation. The system can be designed for gravity circulation or for circulation by electric pumps. In any case, the pipes should be provided with outlets to facilitate draining when necessary.

Infra-red electric heat lamp brooding devices are satisfactory for brooding poults in warm weather, but they do not supply sufficient heat in cold weather. If these devices are used in cold weather, supplementary heat must be supplied. They have the advantage of low initial cost, but are more expensive to operate than electric hover brooders. Like other electric brooders, they provide no reserve of heat.

From two to four 250- to 375-watt infra-red heat lamps, preferably of the hard-glass type, should be set in a baffle board suspended so that the bottoms of the lamps are 18 or 19 inches above the litter or floor at the start of brooding. Raise the lamps 2 inches each week to a maximum of 2 feet.

The lamp assembly must be securely hung

with chains and surrounded with a metal frame to keep these very hot lamps away from the litter if they should fall.

Feeding and watering facilities should be at least 4 feet away from the lighted bulbs to prevent possible vitamin destruction in the feed and cracking of the bulbs if water is shaken upon them. One bulb never should be used alone for if it should burn out during the night, the poults would chill. Not over 50 poults should be allowed for each infrared lamp. A wafer thermostat is desirable when three or more lamps are used. Such thermostats usually are set to cut off all but one or two bulbs when the temperature first begins to rise and the rest of the bulbs if the heat gets too high. Some other source of heat must be supplied to the poults immediately if current is interrupted.

In warm weather, where the source of electric power is reliable and reasonable in cost, **electric hover brooders** as the sole source of heat are satisfactory. In moderate to cold weather, auxiliary heat must be supplied and the size of the brood should not exceed 200 poults.

Coal- and wood-burning colony brooder stoves provide abundant heat and, if properly constructed with 4- or 5-inch-diameter smoke pipes, are dependable and efficient; however, they are little used and now are largely unavailable. Some disadvantages are the labor required to operate them, the lack of flexibility in the heat supply during warm weather, and the danger of fire when flammable litter is used. Either wire floors or nonflammable litter such as sand or a mineral litter on a nonflammable floor or floor covering immediately surrounding the stove are needed to provide protection against fire from escaped coals.

Air-blast, oil-burning stoves supply an abundant, flexible heat supply. They usually are built to burn kerosene, although some will burn distillate. Many stoves can be connected to the same oil supply. Some disadvantages are higher fuel costs, danger of fire, and danger of gas formation if the stove is carelessly operated or poorly constructed. As with coal-burning stoves, either wire floors or nonflammable litter on a nonflammable floor surrounding the brooder are needed to provide protection against fire. The selection of a well-constructed stove with a 4- or 5-inch-diameter smoke pipe for disposing of gases formed during combustion is most important. In multiple-unit houses equipped with coal or oil-burning brooders, 24-hour attention is a practical necessity.

Forced hot-air brooding systems provide an economical and safe type of heat for brooding but supply no heat reserve. Thus, stoppages, in cold weather, even for short periods, can be disastrous (fig. 14). Reliable electric power is required, and in low-humidity areas it may be desirable to humidify the air. A satisfactory type of hot-air brooding system uses ducts and hovers, which can be raised up out of the way when not in use. Fresh air is heated by a furnace and circulated through the system by fans. To conserve heat, part of the air can be filtered and recirculated. A minimum of labor is required, the litter is always dry, and the air is not polluted.

Many operators use **battery brooders** (fig. 15) for starting poults for 5 to 14 days or a little longer, then transfer them to floor-brooding quarters. The started poults have learned

Figure 14.—**Thermostatically controlled hot-air brooding system. Heat is furnished by furnace and is circulated through brooding units by fans. (Photo from Turkey World, Mt. Morris, Ill. 61054.)**

Figure 15.—Battery brooder with electrically heated hover sections in center. (Photo from Petersime Incubator Co., Gettysburg, Ohio 45328.)

to eat and drink and do not require special litter or special floor arrangements under the hover. However, be sure they find the new water supply promptly.

Special poult batteries should be used, but if chick batteries are used, you may need to adjust the feeding grills to accommodate the larger heads of the turkey poults. To use battery brooders, you will need a very well-lighted and fan-ventilated room, heated to about 70° F. (21° C.), with about 60-percent relative humidity.

Where feed and water troughs do not extend into the battery, a shallow pan of feed and a fruit-jar waterer should be placed inside each battery section at the start of brooding, to encourage early feed and water consumption. Glass marbles in feed and water help to attract the young poults' attention.

Ample headroom, preferably 12 inches (except under the hover), and battery floor space of about 25 square inches per bird should be provided for each poult held up to 1 week of age, 36 inches for each held to 3 weeks.

The vertical wires of the sides of the battery should be 1⅜ inches apart.

For the battery floor, the best material probably is 20- to 21-gage, 0.4- by 0.4-inch-mesh (No. 2½) hardware cloth. One-third-inch-mesh (No. 3) wire is satisfactory but will clog with droppings if it is used for more than a week. One-half-inch-mesh wire is satisfactory for large-type (heavy-breed) poults if it is made of heavy, 16-gage wire. However, if lightweight wire is used in ½-inch mesh, it may cause leg injuries and loss of wingbands, which become caught in it and are pulled out.

Battery operations are highly specialized and the requirements are most exacting. However, where battery operation is efficient, growth is rapid and mortality tends to be low. Battery manufacturers' instructions should be followed carefully. Batteries are widely used by hatcherymen and poult dealers for the production of started poults and for holding poults before delivery.

Small-capacity electric hover brooders are well adapted to brooding small groups of poults in a warm environment. Small electric brooders may be improvised by placing two ordinary electric light bulbs in a wooden or cardboard box, which should be well ventilated and provided with a cloth or plastic curtain opening onto a warm exercise and feeding area.

Feather brooders can also be used; but these, except in warm weather, require some sort of auxiliary heat in connection with the feather boards, which contain tufts of turkey feathers closely spaced, against which the poults can hover.

Oil-lamp brooders are of little value and are dangerous.

Debeaking

Debeaking poults at 3 to 5 weeks of age to prevent cannibalism is done routinely by many growers. It is recommended for turkeys that are to be raised in confinement. Turkeys to be ranged should not be debeaked unless picking or serious fighting occurs. In that case, debeaking can be done at any age. Use an electric cutting and cauterizing device, applying pressure with a red-hot iron bar, to cut off the outer part of the upper beak at a point halfway between nostril and tip (figs. 16 and 17) for confined birds, less for ranged. In lieu of this, sharp, heavy shears or dog-toenail clippers can be used, but without heat there may be some danger from infection and bleeding.

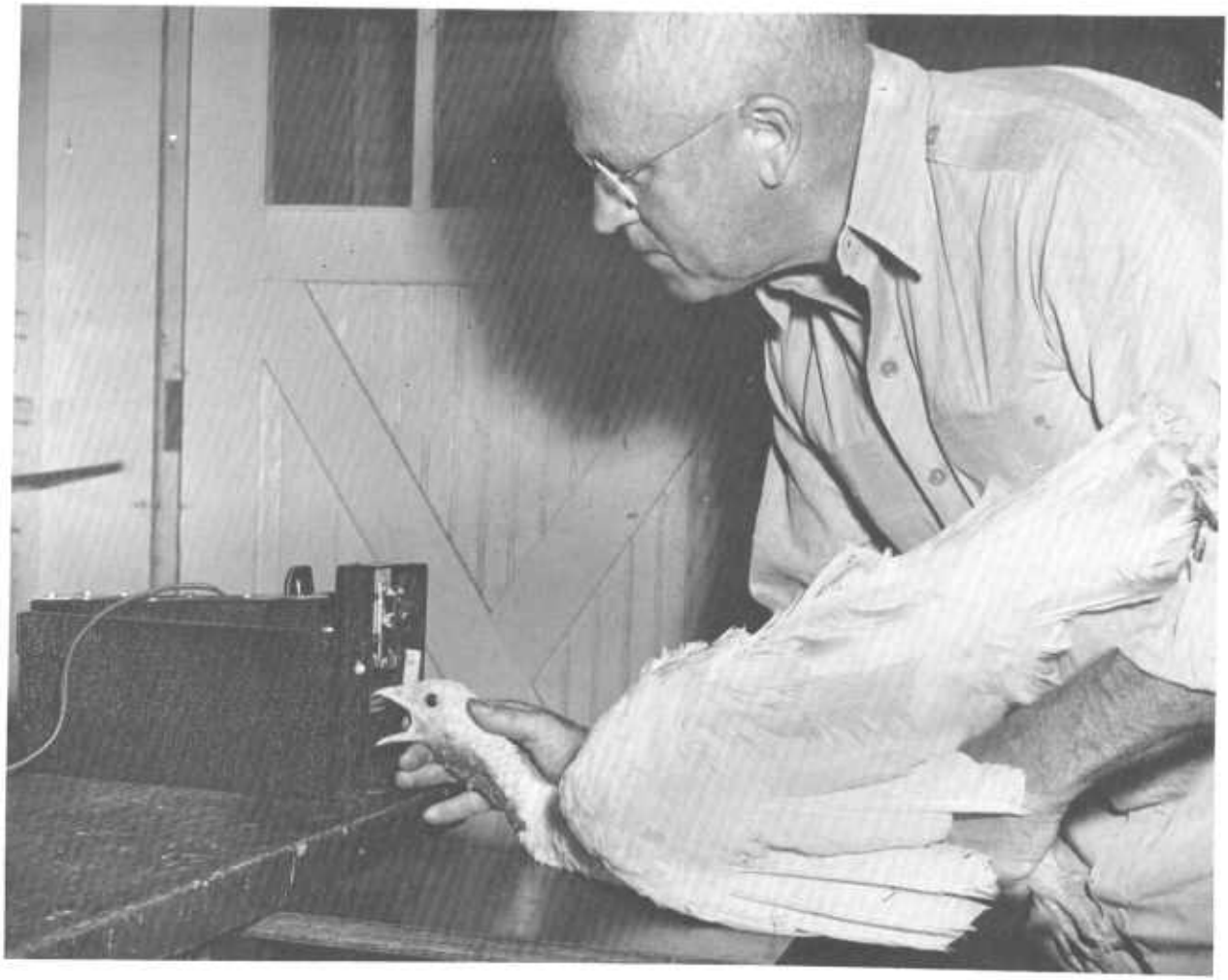


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Figure 16.—Debeaking turkey with electric cutting and cauterizing device.

82233-B

Figure 17.—Debeaked and desnooded Beltsville Small White breeder turkey hen.

Desnooding

Desnooding—removing the snood, or dewbill, (the tubular fleshly appendage on top of the head near the front)—helps to prevent head injuries from picking or fighting and may reduce the spread of erysipelas should this disease get started in the flock. At the day-old age, the snood can be removed by thumbnail and finger pressure. Up to the age of about 3 weeks, it can be cut off close to the head with sharp, pointed scissors.

Wing Clipping and Notching

Wing feathers can be clipped with sharp, heavy shears, with hedge clippers, or with a

sharp hatchet and chopping block. With small- or medium-type turkeys, when flying must be prevented, it is good practice to clip the flight feathers of one wing of both hens and toms at the time they are put on range and again at about 16 weeks of age. If kept for breeding, the hens should be clipped again at market age. Large, broad-breasted turkeys of either sex seldom need treatment to prevent flying but it sometimes is helpful to clip the feathers of one wing of young females when they are put on range. If kept for breeding, toms of all types should never have the feathers of one wing clipped after the age of 16 weeks because this throws them off balance, which makes roosting and natural mating difficult. If clipping of toms is necessary, lightly clip the flight feathers of *both wings*. Turkeys confined to buildings usually require no flight-prevention treatment.

For permanent flight-prevention treatment, almost all of the end segment of one wing (which bears the large flight feathers and the small pinion feathers) can be cut off at hatching time or up to 10 days of age with sharp, strong shears or an electric beak cutter. Make the cut just a little way out from the last articulation of the wing bones in order not to damage the joint itself. Flight also can be permanently prevented by *wing notching* at the age of 5 to 8 weeks. The tendon that crosses the center of the outermost wing joint is severed with a vertical red-hot steel bar on the electric debeaking device. *However, both wing cutting and wing notching handicap the birds and often result in lowered market grades, hence are not recommended for market turkeys nor for birds to be used in natural matings.*

Toe Clipping

Clipping the toes of each foot of day-old poults is becoming common among turkey growers to prevent scratched and torn backs, which are an important cause of downgrading of market turkeys. Clipping is best done at the hatchery with 5-inch surgical shears, removing the tip of the toe just to the inside of the outermost toepad, including all of the toenail. Clipping with an electric cauterizing device will prevent bleeding but is much slower. It is preferred for clipping older turkeys. Usually the inside and center toe of each foot is clipped, for which a charge of one-half cent per poult sometimes is made. It has not been determined if it pays to clip three or all four toes of each foot.

Separating the Sexes

The sex of day-old poults may be determined by examining the vent.* The procedure is the same as with chicks, and as with chicks, both study and practice are required to obtain accuracy and speed. Commercially sexed poults are available at many hatcheries.

Where accurately sexed day-old poults are available at reasonable cost, raising toms and hens separately is practicable. Advantages are: (1) Injuries to the hens due to treading in the later growth stages are eliminated; (2) hens can be marketed at an earlier age than the toms without loss of grade due to injuries occurring when the sexes are separated during the loading operation; (3) there appears to be less fighting and competition among the toms when hens are not present; and (4) sex-separated flocks sometimes can be fed more efficiently, using the complete feeding plan.*

In mixed-sex flocks, treading by the toms is likely to occur in the later growth stages of early-hatched flocks but is unlikely to be noticeable in flocks hatched later than about April 15 in the central and northern areas of the United States.

Handling Turkeys

Turkeys of all ages can be easily driven from place to place with the aid of light poles or sticks several feet long. With a pole in each hand, one person is able to control a good-size flock. However, if turkeys are able to fly well, driving is less satisfactory because they may take to the air if frightened. Driving entails much less labor than crating and hauling and, if distances are not too great, is easier on the birds. A cloth tied to the end of each driving stick facilitates control of the flock. Dogs can be used for driving turkeys but they must be well trained and gentle and the turkeys must be accustomed to them.

For catching turkeys, a darkened room is ideal. In the dark or in semidarkness, turkeys can be picked up by both legs without confusion or injury. For this reason, market turkeys sometimes are loaded at night. However, a low-cost catching room, 15 by 20 feet or larger, could be built into each confinement or semiconfinement house, perhaps in or near the center. The catching room should be closable against outside light and equipped with electric lights. The turkeys are driven into the lighted catching room and then the lights are turned off. The littered catching room can be part of the regular floor space when not used for catching. The room also might be used for catching ranged turkeys that can be driven to it.

Portable catching chutes, preferably with a conveyor, can be used for catching and loading ranged turkeys. Chutes should be of open-wire construction with wide wings to funnel the birds into the opening. To get the turkeys used to the chute, park it in the turkey area a few days before the birds are to be caught.

Metal hooks of one-fourth-inch round iron for weighing turkeys can be made up in several sizes. For small turkeys, the hook at a point three-eighths inch above the inside loop is three-eighths inch wide; for mature hens and partly grown toms, one-half inch wide; and for large toms five-eighths inch wide. The legs are placed in the hook with one shank ahead of the other, the front side first (fig. 18). If hooks are the right size and the birds' legs properly placed in them, the legs will not be injured. However, mature heavy turkeys should not be left hanging for more than 3 or 4 minutes and it is better to pick up turkeys by both legs in a dark room rather than catch them with a hook.

To make a catching hook, extend the shank of the weighing hook to about 36 inches long and bend the upper end of the shank into a loop to fit the hand, or insert it into a wooden handle.

67025–B

Figure 18.—**Hook made of ¼-inch round iron, for catching and weighing turkeys.**

FEEDING YOUNG TURKEYS*

Poults should be fed and watered as soon as possible after they hatch and as soon as they are put into the brooder house. The first feed may be starting mash or crushed pellets (granules), which should be placed in small feeders and in small heaps on cardboard box covers, clean boards, pie plates, or cup flats underneath and close to the hover for the first day or two. Many small lath-type feeders are needed. (See p. 29.) These feeders should at first be heaped with loose mash or granules and, to attract the poults' attention, colored glass marbles or rolled oats (oatmeal) can be placed on the feed and in the water. The start-

ing feed and water should be kept continuously before the poults for the first 8 weeks. Pelleted mash can be fed after the first 4 weeks, but poults do not take well to it as their first feed. Liquid milk is not recommended for poults, but cottage cheese is a good supplement and is useful in teaching poults to eat.

Although finely chopped, tender green feed guards against nutritional deficiencies and helps to encourage poults to eat, feeding it usually is impracticable because of labor costs and difficulty in obtaining suitable types of green feed. Most turkey growers prefer to feed a nutritionally complete starting mash. However, when green feed is fed, use tender alfalfa, clover, onion tops, white Dutch clover, young tender grass, or green grain sprouts, all chopped into ¼-inch lengths and fed once or twice daily. Wilted green feeds never should be allowed to remain before the poults. When nutritionally complete diets cannot be obtained, green feed should be supplied.

Force Feeding

Poults that have been denied feed and water for more than about 36 hours after hatching do not readily learn to eat and drink. These poults may be saved by force feeding. Make a thin mixture of regular starting mash and water. Take the small end of a 25-cubic centimeter glass laboratory pipette in the mouth and by suction fill the pipette with the mixture. Open the poult's mouth, insert the large end of the pipette down the poult's gullet *below the entrance to the windpipe,* then force out enough of the food to fill the crop comfortably. A good-size eye dropper with the constricted tip removed also can be used. One such feeding usually is enough but two or three may be needed where dehydration is severe. Instead of the mash-water mixture, plain sweet milk, buttermilk, diluted evaporated milk, or a dried skim milk-water mixture can be used in force feeding.

Starting Diets

Starting diets (starters) to be fed during the first 8 weeks of the poults' lives can be purchased ready-mixed; they can be home- or custom-mixed according to recommended formulas;* or a concentrate can be purchased and mixed with ingredients such as ground corn and soybean meal according to manufacturers' directions. Starting Diet No. 1 is an example of a ration suitable for feeding turkey poults intended for any purpose, in any environment. It is an all-mash, complete, high-energy feed, needing no supplements except water and is capable of producing a high rate of growth. The composition of starting diet No. 1 is as follows:

Ingredient:	*Percent*	*Pounds per ton*
Ground yellow corn	40	800
Soybean meal, dehulled, 50 percent protein.	40	800
Dehydrated alfalfa meal, 17 percent protein.[1]	3	60
Fishmeal, 60 percent protein	6	120
Delactosed dried whey[2]	2.500	50
Distillery by-product (70 percent distiller's dried solubles, 30 percent distiller's dried grains).	2.500	50
D-L methionine, 98 percent pure.	.125	2.5
Vegetable, animal, or animal-and-vegetable fat, stabilized.	2	40
Finely ground salt (sodium chloride), plain or iodized.	.250	5
Ground limestone	.650	13
Dicalcium phosphate or steamed bonemeal.	2.6	52
Vitamin-trace mineral mix for turkey starting and growing diets.[3]	.35	7
Antibiotic supplement (25 grams of chlortetracycline, oxytetracycline, or bacitracin per pound).	.025	.5
Total	100	2,000

[1] Dehydrated alfalfa leaf meal or cereal grass can be substituted pound for pound.

[2] Dried brewer's yeast or plain dried whey can be substituted pound for pound.

[3] A premixed product with approximately the following composition per pound:

Vitamin A	
U.S. Pharmacopoeia (U.S.P.) units	1,000,000
Vitamin D_3	
International Chick Units (I.C.U.)	300,000
Vitamin E milligrams	1,200
Vitamin K do	350
Riboflavin micrograms	600,000
Niacin milligrams	8,000

(*Footnote continued at bottom of next page.*)

This mash contains about 29 percent protein, 1.5 percent calcium, and 1.1 percent total phosphorus. If coccidiosis seems likely to occur, add a recommended coccidiostat at the preventive level. Supply water free choice. Insoluble grit may be provided if desired.

Starting Diet No. 2 is an all-mash, complete, medium-energy feed and can be used where it is impracticable to obtain or use methionine, fat, distillery byproduct, and a vitamin-trace mineral supplement. Reasonably good but not maximum early growth rate can be obtained with this diet. The composition of Starting Diet No. 2 is as follows:

Ingredient:	*Percent*	*Pounds per ton*
Ground yellow corn or grain sorghum.	22	440
Wheat middlings, standard	30	600
Meat scrap, 55 percent protein	15	300
Fishmeal, menhaden, 60 percent protein.	10	200
Dried whey, delactosed or plain	2.45	49
Soybean oil meal, 44 percent protein.	10	200
Alfalfa meal, dehydrated, 17 percent protein.[1]	10	200
Finely ground salt, iodized or plain.	.25	5
A & D feeding oil (600–D–2250A).	.25	5
Antibiotic supplement, 25 grams of wide-spectrum antibiotic per pound.	.05	1
Total	100	2,000

[1] Alfalfa leaf meal or dried cereal grass can be substituted pound for pound.

This mash contains about 28 percent protein, 2 percent calcium, and 1.4 percent total phosphorus. A coccidiostat should be added if coccidiosis seems likely to occur.

Folic acid	do	800
d-pantothenic acid	do	1,000
Choline chloride	do	60,000
Vitamin B_{12}	micrograms	1,200
Butylated hydroxytoluene (BHT).	milligrams	22,680
Manganese (Mn)	percent	2.4
Zinc (Zn)	do	2.2
Iodine (I)	do	.048
Iron (Fe)	do	.8
Copper (Cu)	do	.08
Cobalt (Co)	do	.008
Bacitracin (or aureomycin or terramycin).	grams	.8

Baby poult feeds (prestarters) are recommended for the first 3 weeks by some nutritionists. These feeds contain 30 to 33 percent protein, increased allowances of vitamins, and a fairly high level of antibiotic. Prestarters* are followed by the regular starter. Growers who find it difficult to obtain fast early growth with low mortality may wish to feed a prestarter.

When only ground feeds are supplied, the need for *insoluble grit* during brooding has not been proved. However, it has been suggested that gizzard development and function may be enhanced by supplying grit to young turkeys. For this purpose, coarse sand or fine gravel may be offered in a small feeder after the poults have learned to eat mash. Although gravel stones make the best grit and never are eaten to excess, commercial chick-size insoluble grit such as quartz or granite can be added to the starting diet at the 1-percent level or sprinkled lightly on top of the mash once a week during the first 4 weeks of life. However, commercial grit should not be fed free choice to very young turkeys since it may be eaten to excess instead of the feed. If sand or gravel is used on the floor of the brooder house, additional grit need not be fed until the birds are 4 weeks old, when larger grit, up to pea size, is indicated. Soluble grit such as limestone or marble should not be used at any time because it may upset the mineral balance of the feed. After 8 weeks, turkey-size insoluble grit, up to 0.6 inch in diameter, should be supplied to all turkeys.

Growing Diets*

Growing diets (growers) are fed to poults from 8 weeks of age to maturity. These diets may consist of mash only or pellets only, or they may include either loose or pelleted mash plus whole or cracked grain, sometimes referred to as scratch grain. Pelleted mashes usually must be purchased; loose mashes can be purchased or can be home- or custom-mixed. A commercial concentrate can be purchased and combined with ground grain or with soybean meal and ground corn in proportions recommended by the manufacturer and accord-

ing to the age and sex of the birds. Special methods of fattening (finishing) are unnecessary because the birds are fed all the regular growing feed they will eat up to the time of marketing.

Turkeys intended to be marketed as fryer-roasters, or turkey broilers, should be fed a complete, high-energy diet such as Starting Diet No. 1 for about 8 weeks, followed by a complete grower such as Growing Diet No. 1. This grower can be fed alone or free choice with heavy oats to the age of 15 to 16 weeks for small-type turkeys or 12 or 13 weeks for heavy white turkeys. Dark-colored turkeys should not be marketed as fryer-roasters.

Growing Diet No. 1 is a mash-and-grain, nutritionally complete feed suitable for turkeys grown on range or in total confinement. The composition of Growing Diet No. 1 is as follows:

Ingredient:	*Percent*	*Pounds per ton*
Ground yellow corn [1]	56	1,120
Alfalfa meal, dehydrated, 17 percent protein.[2]	10	200
Soybean meal, solvent, 44 percent protein.[3]	20	400
Meat scrap, 55 percent protein [4]	5	100
Fishmeal, menhaden, 60 percent protein.[5]	3.775	75.5
Steamed bonemeal or dicalcium phosphate.	3	60
Ground limestone or oystershell	1.2	24
Vitamin-trace mineral mix [6]	.5	10
Antibiotic supplement (25 grams of chlortetracycline, oxytetracycline, or bacitracin per pound).	.025	.5
Finely ground salt, plain or iodized.	.5	10
Total	100	2,000

[1] Ground sorghum grain, white corn, or wheat can be substituted pound for pound.

[2] Alfalfa leaf meal or dried cereal grass can be substituted pound for pound.

[3] Soybean meal (or soybean oil meal) is the processed bean minus the oil, not ground soybeans, which are not recommended. Corn gluten meal, hempseed oil meal, degossypolized cottonseed meal, dehulled sunflower seed meal, sesame meal, safflower seed meal, peanut meal, or dehulled soybean meal (50 percent protein) can be substituted pound for pound.

[4] Poultry byproduct meal or 50 percent protein meat-and-bone meal can be substituted pound for pound.

[5] Any good-quality fishmeal can be substituted.

Supply insoluble grit, water, scratch grain, and the mash, all free choice. The mash contains about 21 percent protein, 2 percent calcium, and 1 percent total phosphorus.

Growing Diets No. 2 and No. 3 are mash-and-grain simplified feeds for turkeys having continual access to succulent green feed and direct sunshine. These two are low-cost growing diets designed to make fullest use of pasture, *which must be provided.*

The composition of Growing Diet No. 2 is as follows:

Ingredient:	*Percent*	*Pounds per ton*
Ground yellow corn [1]	50	1,000
Wheat middlings	30	600
Meat scrap, 50 percent protein	19	380
Finely ground salt, plain or iodized.	1	20
Total	100	2,000

[1] Other ground grains except wheat can be substituted for up to 100 percent of the ground corn in Diet No. 2 and No. 3. If used in the mash, the heavy-hulled grains such as barley and oats should be finely ground or pulverized; if fed whole as scratch grain, they should not also be used in the mash.

Supply insoluble grit, water, succulent green feed, grain, and the mash, all free choice. The mash contains about 20 percent protein, 1.9 percent calcium, and 1.3 percent total phosphorus.

The composition of Growing Diet No. 3 is as follows:

Ingredient:	*Percent*	*Pounds per ton*
Ground yellow corn [1]	30	600
Wheat middlings	30	600
Soybean meal solvent, 44 percent protein.	30	600
Steamed bonemeal or dicalcium phosphate.	6	120
Ground oystershell or limestone	3	60
Finely ground salt, plain or iodized.	1	20
Total	100	2,000

[1] See footnote 1 under Growing Diet No. 1.

Supply insoluble grit, water, succulent green feed, grain, and the mash, all free choice. The mash contains about 21 percent protein, 2.9 percent calcium, and 1.3 percent total phosphorus.

[6] See footnote 3, Starting Diet No. 1, page 39, for composition of the mix.

All three growing diets are intended to be fed free choice with one or two grains, preferably different from those in the mash. Suitable grains would include heavy oats, barley, spelt, emmer, hog millet (proso), and all sorghum grains except the brown-seeded, eastern-grown sorghums or those shrunken by drought. The scratch grain or grains may be offered in separate feeders or feeder compartments. Whole-grain corn is not eaten liberally by turkeys younger than 16 weeks of age, hence corn should not be fed in the scratch-grain part of the diet before then unless it is cracked and cleaned (freed of meal). A popular feeding program calls for oats free choice as the only scratch grain from 9 to 16 weeks, after which whole yellow corn is added to the free-choice offering. As the turkeys grow older, they eat more grain and less mash thus adjusting the protein intake to their needs. Rye, buckwheat, wheat screenings, and rice are satisfactory feeds for turkeys over 8 weeks of age but should not constitute more than about 20 percent of the total diet.

Yellow corn tends to produce light-yellow skin in the turkey whereas most of the other grains, including white corn, produce almost-white skin. If fed in moderation, wheat usually produces white skin; but if fed in large quantities along with abundant green feed, some wheat varieties produce decidedly yellow skin in birds carried to a high degree of finish.

The mash formulas suggested are only a few of many possible combinations of ingredients.* *Commercial concentrates* containing 20 to 30 percent protein are available and are widely fed along with grain free choice or mixed with ground grain in specified amounts. Growing mashes may be made up of other combinations of grains, grain by-products, protein feeds, and vitamin supplements; the exact composition depends partly on cost and availability of ingredients.

Free-choice feeding of loose or pelleted mash and one or more grains as suggested above is a practical method of feeding growing turkeys. Keep the mash and grain in separate but adjacent feeders or feeder compartments and allow the birds free access to both.

Because turkeys use all the common grains efficiently, the choice of which to feed the turkeys can depend largely upon cost and availability. When comparing prices, remember that oats, common barley, emmer, spelt, rough or paddy rice, buckwheat, and proso, because of their higher fiber content, are worth only 80 to 85 percent as much per hundred pounds as corn, wheat, rye, hulless barley, brown rice, and the sorghum grains.

"Complete" Feeding Program*

Research has shown that turkeys can be grown at a maximum rate with early maturity, improved finish, and high feed efficiency by feeding them nutritionally complete, all-mash, high-energy diets, graduated in the quality and quantity of protein and other nutrients according to age and sex of the birds. This has been called the "complete" feeding program and usually involves sexing the day-old birds, rearing the sexes separately, and changing the all-mash feed every 4 to 8 weeks. Although yields can be maximum, such a program for the average turkey farmer is likely to be more expensive and more difficult to administer than the mash-grain free-choice method just described. The complete program is best adapted to large-scale operations where facilities are available for supplying the various feeds at the right times to birds of the right age and sex. In utilizing a complete feeding program, follow carefully the directions of the feed manufacturer or the formulator. Some programs involve grinding and mixing the ingredients, for which grinder-mixer mills are available.

General Suggestions on Feeding

Feed and water should be kept before turkeys constantly from hatching to market age and, if turkeys are kept for breeding, during the season before egg laying as well as during the breeding season. Put all feed in feeders, never on the ground. Changes from starting to growing mashes or changes in the growing mashes can be made quickly without using special methods, but changes in watering methods for young birds under 5 weeks old should be made carefully to prevent damage from water glut (see p. 65). During the last 6 weeks before

turkeys are marketed, they should not be moved or subjected to radical changes in management or feeding because this may slow down the finishing process.

Vitamin D, which prevents rickets, is necessary in starting diets and desirable in all diets; but as a rule it is not necessary in growing and breeder feeds provided the birds have access to direct sunshine. Where direct sunshine is restricted or absent, add dry Vitamin D, the preferred source, to the diet in quantity sufficient to provide about 1,500 chick units of vitamin D per pound of mash that is fed free choice with grain or about 900 units per pound of all-mash diets.

Fishmeal, though an excellent protein supplement, may impart an undesirable fishy flavor to turkey meat. Therefore, in growing and finishing diets, assuming that no other fish products are in the feed, fishmeal of good quality should be limited to that amount that on the basis of its oil content would not provide over 0.3 percent oil in the total diet. As a rule of thumb, in growing and finishing diets, a typical fishmeal containing 8 percent oil should be limited to about 3½ percent of all-mash mixes and 5 percent of mashes fed with grain.

Fish oils and poor-quality fishmeals should be avoided in all turkey diets since they are a prolific source of fishy flavor. However, if it is necessary to use fish oil to supply vitamin A or vitamin D, or both, use a concentrated product and limit it to about 0.15 percent of total feed consumed; also, limit fishmeal to that amount that would provide not over 0.15 percent additional oil.

Turkeys can be pastured in grain stubble fields to salvage waste grain or they may be used to harvest fields of ripe proso (hog millet) or the grain sorghums. Combined with a simplified growing mash and good pasture, feed costs thus can be reduced to a significant degree.

Feeders and Waterers

Wooden trough feeders for turkeys up to 8 or 12 weeks of age are shown in figure 13. Metal feeders of similar dimensions generally are available. For turkeys to 8 weeks of age, allow 2 linear inches of feeding space, counting both sides of trough feeders, per bird. For older turkeys, including breeding stock, allow 1 linear inch of feeding space per bird.

Trough-type feeders are relatively inexpensive and are easy to construct, but they require more frequent filling and more labor to operate. The feeder shown in figures 19 and 20 can be used inside or, if precipitation is light, outside. It prevents roosting and can be tightly closed if desired. This feeder can be made any desired length, but partitions patterned after the end piece should be installed every 4 feet to support the reels, which are secured on center by 20-penny nails or ⅜-inch round iron held in place with metal clips. The covers may be omitted if closure of the feeder is not required. The reels may also be made of round wood or metal about 2¼ inches in diameter.

The feeder shown in figures 21 and 22 is designed for outside use. Maximum practical length is about 8 feet.

Large-capacity, square wooden or round metal hopper-type feeders* holding one-half ton or more of feed (fig. 23) are more efficient than trough-type feeders and allow the use of mechanized feed-handling equipment. Feed is dumped or augured in at the top and is emptied by the birds from the relatively shallow trough at the bottom.

For outside use, feeders should have a waterproof and windproof cover and a rain guard, and be placed on skids for easy moving and for bringing the smoothed lip of the feeder to the proper height (fig. 24).

Round metal feeders with roll-down edges

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Figure 19.—Trough feeder for turkeys over 8 weeks old.

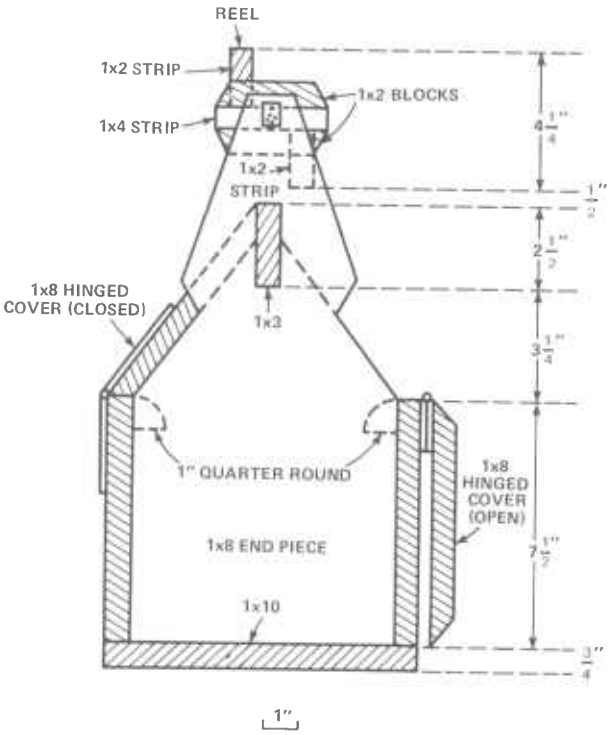

Figure 20.—End elevation of trough feeder shown in figure 19.

holding about 50 pounds of feed and adjustable for height above the litter can be used inside (fig. 9). They can be suspended from a moving track and filled automatically from one position.

Mechanical feeders such as that shown in figure 25 are important labor savers for the large-scale operator. On this farm is a feed-processing center, which grinds and mixes the feed according to the age and sex groupings of the turkeys and delivers it to the desired feeding station.

To reduce waste of feed by turkeys billing it out, feeders should be supported at the proper height. In general, the lips of all feeders should be about the height of the average birds' backs above the adjacent walking surface. This amounts to about 8 inches for 8-week-old birds and increased to about 15 inches for mature hens and mixed flocks and 18 to 22 inches for tom flocks. Filling trough-type feeders only to about three-fourths capacity will reduce waste from wind and billing. Pelleted feed is less subject to waste than loose mash.

All outside feeders should be moved often enough to prevent excessive accumulations of droppings near them. Inside feeders should also be moved, or the litter around them removed or renewed when necessary to provide sanitary conditions.

On range (pasture) water may be provided in heavy-gage eave troughing or in 14-gage galvanized steel troughs with smoothed edges, supported by wooden or metal framing. The troughs can be approximately 3½ inches wide at the bottom, 5 inches wide at the top, and 4 inches deep. The troughs are connected to a supply of water under pressure. Control can be by continuous slow flow into a drain or by shielded float valves. Efficient automatic waterers with control valves can be purchased. Galvanized washtubs, 20- to 30-quart trash cans, or 12- to 16-quart water pails can be used, but the pails should be set in a wooden rack to prevent overturning. Waterers of all types should be placed on top of wire-or slat-covered platforms or at least on sloping ground to prevent puddles from forming when control valves fail and equipment is washed and rinsed. Plastic hose is useful in distributing the water from frostproof hydrants or other sources. Waterers should be moved as needed to promote sanitation.

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Figure 21.—Covered outdoor feeder for turkeys over 8 weeks old.

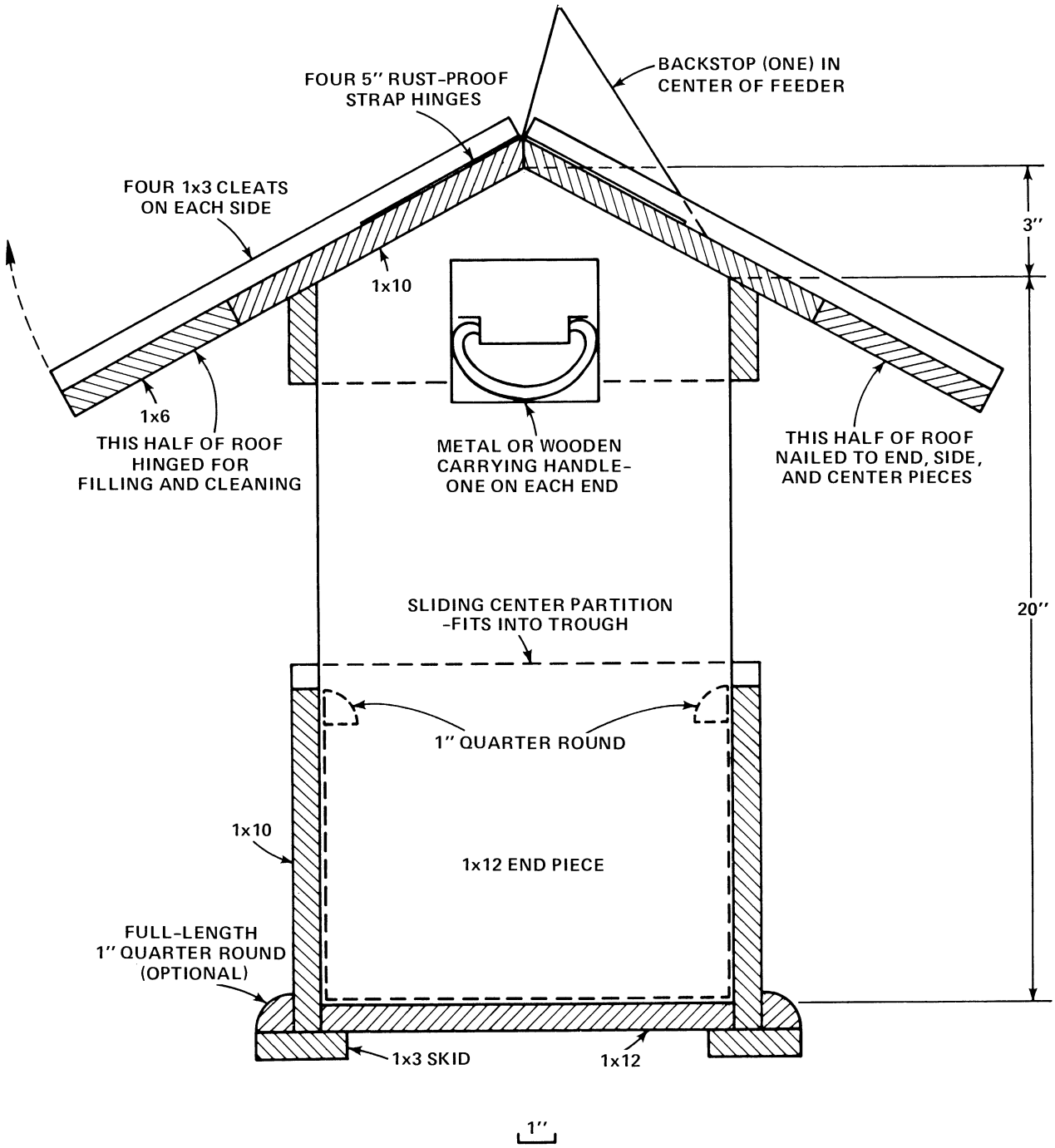

Figure 22.—End elevation of covered outdoor feeder shown in figure 21.

Figure 23.—Large-capacity, portable, hopper-type feeder with rain guard for turkeys over 8 weeks old. (Photo from Colorado State University.)

In confinement, level troughs with float-valve control can be attached to one side of the house, outside, or inside with a water deflector.

No feeders should be placed farther away than about 20 feet from the waterers. The lips of both should be adjusted to the level of the standing birds' backs. Provide about one-half linear inch of watering space per bird at all ages and maintain a depth of about 2 inches for turkeys over 5 weeks old. All waterers should be washed and rinsed daily.

Water for turkeys should be free from contamination by animal and plant life, hence water from natural sources such as streams or ponds generally should not be used unless it is equivalent in purity to that acceptable for human drinking water.

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Figure 24.—Turkeys on well-shaded range. Note large-capacity, covered trough feeders built on skids.

N-41070

Figure 25.—Farmer inspecting automatic feed trough conveyer.

RANGE REARING

Feed costs can be minimized by rearing turkeys on range (pasture) (fig. 24), especially if low-cost, simplified diets such as Growing Diet No. 2 or No. 3 are fed along with locally grown grains. Direct sunshine and green feed obtained from the range, even though that feed may be mediocre, usually will adequately supplement a simplified growing diet containing proper amounts of proteins and minerals. However, losses from soilborne diseases, insects, predatory animals, thievery, and adverse weather conditions sometimes render range rearing unprofitable. On account of this, confinement rearing on litter, which tends to minimize these losses, is replacing range rearing and should be considered where protective range management is impracticable or losses are excessive.

Portable range shelters,* providing about 1½ square feet of floor space per bird, preferably with roosts or with floors of 1- by 3-inch wooden slats placed 1½ inches apart, are recommended for birds likely to be exposed to adverse weather conditions during their first month on range. In any case, close supervision is always needed during the first few days the turkeys are on range.

Under normal conditions after June 1, with-

out range shelters, turkey poults can be moved to the range from the brooder house when they are about 8 weeks old. However if rain, strong winds, or either cold or extremely hot weather are present or predicted, delay the move until the weather is favorable. With adequate range shelters, which are recommended, the poults can be moved safely when they are 7 to 8 weeks old unless exceptionally severe weather is encountered.

Moving part of the flock to range at intervals of a day or two, preferably in the morning, helps to get the birds used to range conditions without losses. If distances are short, the turkeys can be driven to range, otherwise they should be hauled in well-ventilated coops or truck bodies. Mechanical loaders are available for moving turkeys 8 weeks or older.

Minnesota Plan

The Minnesota Plan is a method of range rearing that is usually effective in preventing soilborne diseases and parasites without medication. The plan involves moving the turkeys and their equipment to an adjacent clean location once every 7 to 14 days, more frequently in wet weather. The birds usually stay fairly close to their feed and water and will bed down there.

Although no fencing is required where the available range area is ample, it is safer to enclose with portable fencing enough rangeland to supply green feed for each 1- to 2-week period. Sheep or hog fencing 4 or 5 feet high will confine heavy-breed turkeys quite well, but heavy-gage poultry wire 6 feet high will provide better protection from predatory animals and will largely prevent the turkeys from flying out of the enclosure. The heavy wire sometimes is fastened at the top only, with the galvanized steel posts on the inside of the fence to provide protection from piling if the birds crowd into the fence.

If the range is on a slope, start at the lower side and move the birds and equipment uphill. Use each range only once every 2 to 4 years so that diseases do not build up. The turkey droppings fertilize the land, which is cropped in the intervening years.

About 1 acre of good pasture is required each year for each 250 turkeys raised. Range units of about 2,500 turkeys, the maximum 4,000, are suggested for this type of management.

One modification of the Minnesota Plan provides for moving the birds and their equipment less frequently than every 1 to 2 weeks. Another modification is to move the turkey feeders and waterers every week or two in a wide circle around a permanent, predator-proof, usually roostless shelter, driving the birds into that shelter at night. They will follow the feed and water and thus be ranged on relatively clean ground with good pasture conditions. Under favorable soil and climatic conditions and when clean land is used each year, results are satisfactory. However, if soilborne disease occurs, either preventive medication or a change in management, or both, would be indicated.

A combination of confinement and range rearing involves a permanent shelter, such as a pole barn about 40 feet wide, and 2 fenced range lots, one on each side of the building. Each range lot should supply about one acre of pasture for each 250 turkeys. The two range lots would then be alternated yearly; one is rested or cropped while the other is used for range by the turkeys. The roostless, littered building in which the turkeys are shut at night provides shade, a safe bedding area, and protection from predatory animals and adverse weather. Feeders and waterers should be placed inside the building. The building should provide about 2½ square feet of floor space for each bird when free access to range is available. This method of rearing is practical only where the soil is sandy, very well drained, and clean. If the range should become contaminated with disease or otherwise unfit for turkeys, preventive medication could be used or the building could be converted to confinement rearing, but with more floor space provided for each bird. Dim night lights inside the house providing about one-fourth foot-candle at floor level might help to prevent stampeding.

Range Rotation

A 4-year range rotation works well where other farming operations are combined with

turkey raising. The turkeys are grown the 1st year on a range seeded that same year or the previous year to a suitable range crop. Corn could follow the turkeys the 2d year; then wheat or some other grain, or perhaps corn again the 3d year; and finally some other suitable crop such as soybeans, grass, clover, or alfalfa the 4th year, going back to turkeys the 5th year.

A suitable 3-year range rotation would be turkeys, corn, small grain, and back to turkeys, planting the range to the desired forage crop after the grain harvest the 3d year or in the early spring of the 4th. In such a range rotation, the turkeys fertilize the land, and crop yields are high during the intervening years.

Where permanent pasture is available, it can be used alternately by cattle and turkeys, the latter using any given area 1 year in 3. Because of the possibility of erysipelas infection, keep turkeys from all contact with sheep or swine.

Shade

Turkeys can be raised successfully without shade in low-humidity areas where temperatures do not exceed about 104° F. (40° C.). In high-humidity areas, the maximum tolerable temperature is probably about 90° F. (32° C.) without shade. As an emergency measure, turkeys can be sprinkled with water or cooled with foggers. Since most areas of the United States are subject to periods of abnormally high temperatures, shade of some sort for growing and breeding turkeys must be provided at the rate of about 2½ square feet for each bird. Trees, bushes (if not too dense), strip plantings of corn, sunflowers, or other tall leafy crops, all provide good shade. Artificial shade can be provided by range shelters or by a framework of poles or sawed lumber topped with slabwood, sheet metal, or fence wire and coarse roughage of some sort. Shades should be positioned north and south and should be at least 5 feet above the ground.

Range Crops

The crop grown on the turkey range will depend on the climate, soil, and range management. Many turkey ranges are permanently seeded, others are part of a crop rotation plan. As part of a 3- or 4-year crop rotation, legume or grass pasture and annual range crops such as soybeans, rape, kudzu, kale, sunflowers, reed canarygrass, and sudangrass have been used successfully. The last three provide both green feed and shade and sometimes are sown in strips between areas of other range crops. Combinations of two or more annual crops to provide ample green feed throughout the season sometimes are used.

For permanent range, alfalfa, ladino clover, bluegrass, bromegrass, and orchardgrass are popular. Other satisfactory pasture plants are lespedeza sericea, white Dutch clover, and various perennial grasses. Mixtures of some of these plants often are desirable, the choice depending upon local soil and climate. Where alfalfa grows well, it is an excellent pasture crop. In sections where ladino clover grows well, where the soil is fairly well watered, ladino clover recently has become popular. Bluegrass is one of the best pasture plants for turkeys in areas receiving sufficient summer moisture to keep it growing. Crops not suited to turkey range are sweetclovers and common lespedeza because they are unpalatable to turkeys.

Protection Against Predators

Predatory wild animals and free-ranging dogs can, and often do, cause heavy losses among ranged turkeys by direct attack or by causing stampedes. Double-strand electric fences effectively protect turkeys against most nonflying predators. Tightly stretched heavy-gage poultry fencing 6 feet high effectively protects them against dogs, coyotes, and foxes. To help prevent these animals from crawling under the fence, place the fence close to the ground, add a strand of barbed wire at the bottom, and plug all sizeable depressions under the fence. Steel wolf traps placed in strategic locations also effectively control roving animals but must be used with great care to avoid trapping desirable animals, including turkeys and humans. Well-trained watchdogs are good protection. They can be tethered near the roosting

areas or allowed to range over them. Brush piles and thick vegetation should be eliminated from turkey ranges.

A rotating electric light beam or electric lamps about 30 feet apart in a double row and completely surrounding the roosting quarters have been used to protect the turkeys and help prevent stampedes. Ringing the roosting area with cannonball oil flares 30 feet apart is quite effective. However, a continuous guard or confinement of the turkeys to a safe place during the night and early morning hours may be required for protection against predators and thieves.

Great horned owls and certain large hawks sometimes cause appreciable losses among turkeys roosting in the open. These predatory birds may be trapped by placing a steel trap on top of a tall pole or dead tree.

Protection Against Weather

In northern areas where late-fall storms are likely, turkey growers should plan to market their unsheltered ranged turkeys no later than November 1. Late-hatched birds or those retained for breeding should be given at least minimum housing—windbreak and a roof. Portable range shelters* can be drawn together to form a long roosting shelter. Snow fences strategically placed protect the turkeys from drifting snow. Littered, roostless shelters can provide all-season protection for young stock and housing for breeding stock.

CONFINEMENT REARING

Rearing turkeys in houses on litter (confinement rearing) without access to ouside yards or porches is a relatively new development, which has been widely adopted in all areas where turkeys are raised in commercial quantities. Its chief advantages, compared with range rearing, are: (1) Excellent protection against losses caused by thievery, dogs, wild animals, adverse weather conditions, and soil-borne diseases, parasites, and insects; (2) lower land costs; (3) lower labor costs if automatic feeding and watering equipment is used; and (4) better control of operations. Disadvantages are: (1) Higher housing and equipment costs; (2) more risk from respiratory diseases and cannibalism; and (3) more danger from overcrowding. The advantages and the disadvantages listed do not always apply because of the variations in management in both methods of rearing, but in general, the advantages of confinement rearing outweigh the disadvantages. Confined turkeys must be fed diets that are nutritionally complete.

For large-type tom turkeys reared to market age in naturally ventilated, noninsulated buildings and not debeaked, the optimum floor-space allowance might be about 10 square feet each; for hens, about 7 square feet; and for mixed flocks, about 8½ square feet. However, more practical allowances are about 5½ square feet for large-type toms, 3½ for hens, and 4½ for mixed flocks. For small-type turkeys, these allowances can be one-fifth less. With these practical floor-space allowances, the turkeys must be debeaked and the building must be well ventilated to lower the risk of respiratory infections and prevent overheating in hot weather. In well-insulated, force-ventilated, air-cooled or air-conditioned houses, the practical allowances probably can be further reduced by about one-fifth.

The litter, usually softwood shavings or wheat straw, must be kept dry and reasonably clean by adding to it frequently and, if necessary, removing prominent accumulations of droppings and wet litter that may contribute to the development of blisters, leg trouble, and fungus diseases. (See "Litter" under "Breeder Management and Housing.")

Pole-type rearing houses (figs. 26 and 27) are widely used for turkeys. A popular size is 40 by 300 feet but many houses are wider and longer. Strong wire or solid partitions about 5 feet high, either suspended from the tresses or made removable, sometimes are used to divide the flock into units no larger than 1,000 to 1,500 birds each. This arrangement is helpful in sex and age separation and can help to reduce or prevent losses from crowding, stampeding, and disease. All houses should

Figure 26.—Pole-type, 40- by 300-foot, semiconfinement rearing shelter with a 20-foot concrete porch (apron) along south side. Capacity of unit, including porch, is about 3,700 heavy-breed turkeys. Note full-length roof ventilator. (Photo from Turkey World, Mt. Morris, Ill. 61054.)

Figure 27.—Pole-type house for turkeys with full-length ventilation opening in roof facing away from prevailing winds. Plans may be obtained from Colorado State University, Fort Collins, Colo. 80521. (Photo from Colorado State University.)

be strongly built to withstand weather hazards such as high winds and snow. Rearing houses need not be well lighted because turkeys over about 8 weeks old tend to grow faster and more efficiently in dim light of ½ to 1 foot-candle. Suggestions on housing for breeding stock generally are applicable to buildings used for confinement rearing. Plans for confinement rearing and brooder houses for turkeys can be obtained.*

Stone Yards

The capacity of confinement houses can be increased by adding an outside yard evenly covered with 12 to 15 inches of washed stones, varying in diameter from 2 to about 4 inches with fine particles removed (fig. 28). The yard should be well drained and surrounded by strong, tightly stretched, 6-foot fencing. About 5½ square feet of yard space, plus 3 square feet in the house should be provided for each large-type turkey in mixed flocks, allowing the birds continuous access to the stone yard. The stones do not cause breast blisters or foot trouble and normally would not need to be cleaned, stirred, treated, or replaced for 15 years or longer. The turkeys benefit from the direct sunshine, exercise, and fresh air when they are in the yards. Feeders and waterers should be inside the littered shelter, which should be built to exclude wild birds and predatory animals.

Rearing Porches

The capacity of confinement houses can also be increased by adding a slightly sloping concrete or blacktop porch (apron) (fig. 26). About 2 square feet of porch space plus 3 square feet of floor space in the house should be provided for each large-type turkey in mixed flocks. The porch should be surrounded by strong 6-foot fencing and can be used with or without litter. A house 40 by 300 with a porch 30 by 300 feet would hold about 4,000 large-type turkeys of mixed sexes to market age provided the birds are debeaked. With this type of management, periodic cleaning or relittering of the porch may be necessary. Feeders and waterers should be inside the shelter, which should be built to exclude wild birds and predatory animals. For use in extremely hot weather, sprinklers can be installed above the porch.

Figure 28.—Small-scale rearing unit with cobblestone yard and shelter in which the turkeys eat, drink, and roost. 14073-A

DISTINGUISHING CHARACTERISTICS OF MALES AND FEMALES

Behavioral Characteristics

Turkey males frequently strut at the day-old stage and from then on indulge in this characteristic male behavior to a greater or lesser extent throughout life. Failure to strut is a sign of off-condition. Young females rarely strut, but old hens, apparently afflicted with ovarian disorders, have been observed to strut and to attempt to mate with other hens.

Anatomical Characteristics

When first hatched, poults are covered with soft down and have about 16 short, stubby quill feathers on each wing, but no easily visible tail feathers until they are 3 weeks of age. By 2 months of age, both males and females are reasonably well feathered. All turkeys are quick feathering and rarely develop bare backs.

When the turkeys are about 5 weeks of age, prominent fleshy protuberances called caruncles begin to appear on the head of the male. When the males are 7 weeks of age, the caruncles begin to extend down the neck and the single throat wattle, inconspicuous at hatching, has become fairly prominent in both sexes. This process has been termed "shooting the red" and is a natural development of no particular significance.

On top of the head, near the base of the beak of both males and females, a fleshy protuberance, very small at hatching, develops into what is called the tubular leader, dewbill, or snood. On males the snood becomes relatively large, plump, and elastic, whereas on females it is relatively small, thin, and nonelastic.

The beard, a tuft of hairlike feathers, appears on the breast of males between 3 and 4 months of age. It is about 12 inches long in wild turkeys, but usually not more than 6 inches long in domestic (fig. 3). Most females are beardless but a few have small beards, usually not more than 1 inch long. The hock joints of males are much broader, heavier, and more flattened in front than those of females. The head of the males is coarser and broader and the headgear tends to be a brighter red than that of the females. The head, snood, throat wattle, and the unfeathered upper part of the neck of mature males are red, changeable to white overlaid with bright blue; the blue is most intense on the face. Females and immature males show only traces of the blue color.

There also are color differences in the breast feathers of males and females of most colored varieties so that sex may be determined when the adult feathers appear at the age of about 12 weeks. The adult breast feathers of the male Bronze poults are bronze-black; whereas those of the females are bronze-black with narrow white edging. Narragansett poults show similar sex differences in the color of breast plumage. Breast feathers of wild turkey females have iodine-colored tips, whereas those of males have black tips. Breast feathers of Bourbon Red and Buff females are white tipped, whereas those of the males are black tipped.

MARKING TURKEYS

A permanent method of marking turkeys often is needed to separate birds of different ages and breeding. Day-old poults can be marked easily by punching a hole in the webs between the toes or slitting these webs with a sharp pair of shears. If toe punching is used, the plug of flesh produced by the punch must be removed completely, otherwise the hole may grow shut. Fifteen different combinations of punch marks or slits are possible if both webs of both feet are used.

Wingbanding is the best method of marking and is necessary in pedigree breeding. Unless a permanent seal is officially required, the double-clinch type of aluminum band one-fourth inch wide is preferred because such bands may be removed easily if they must be replaced or their location changed. Wingbands usually are inserted directly into the wing at hatching time, using a small, thin, sharp knife blade, or better, a small thin-blade, botanical scapel to make the hole a little longer than the band is wide and

placed exactly three-thirty-seconds of an inch back from the edge of the web and midway between the first and third joint of the wing. Only by very careful placement of the slit, as directed, can band trouble be avoided.

The double-clinch type of wingband has an overall length of 2½ inches and measures about three-fourths of an inch in diameter inside measurement when molded to circular form. When placed directly into the wing at hatching time, the wingband must be flattened so that the center parts touch each other. This prevents the band from slipping around the wing tip and causing deformity. When the bird is 4 to 6 weeks old, the bands must be opened up to allow for wing growth, leaving the band roughly elliptical.

Molded rectangular wingbands usually are about 1 inch long inside measurement and, to prevent slipping around the wing tip, should be pressed together at the center when put on the day-old poult, then opened up to full depth later on.

Metal legbands are a practical means of marking breeding birds. (fig. 18). Bands should be of strong aluminum. They are manufactured in several sizes.

DISEASE PREVENTION*

Although effective drugs now are available for the prevention and treatment of certain turkey diseases, emphasis should be placed on prevention through management. Some management practices that may help to prevent the introduction and spread of diseases and parasites in turkeys are discussed in the following paragraphs.

Obtain stock only from sources tested for and rated free from Arizona infections, fowl typhoid, Mycoplasma infections, paratyphoid, pullorum disease, and any other diseases for which testing of breeding stock is being conducted.

For turkey range, *select naturally well-drained, clean, sandy soil,* which means soil free from contamination by poultry, hogs, or sheep. Allow 1 acre of range for each 250 turkeys raised each year. Move the growing turkeys and their equipment to an adjacent clean area every week or two throughout the rearing season, more often in warm, wet weather, and use the same area only 1 year in 2 or 3. Do not allow turkeys access to ponds, streams, poorly drained areas, weed patches, roadways, or other people's property.

Separate turkeys from chickens and other poultry at all times; separate old from young turkeys; do not mix young turkeys of widely different ages; isolate turkeys from all kinds of livestock except horses and cattle. Separation or isolation means not only complete physical separation but also the prevention of cross contamination through droppings, equipment, transportation, air currents, and the clothing of caretakers.

Control rodents and flies. Screen all buildings against wild birds, which seldom enter open turkey doors that are at floor level and not over 2½ feet high. Check the flocks regularly for lice and northern fowl mites and for damage by chiggers and ticks.

Select visitors carefully and keep them out of all poultry houses and range areas. If they do enter, require them to first step into a shallow pan of strong disinfectant. Try to prevent all farm personnel from visiting other farms where dangerous infections may exist. If such visits are made, the shoes should be disinfected or washed when the visit is concluded and all outer clothing worn there should be cleansed before it is worn on the home premises.

Ventilate the brooder house well and allow the recommended amount of floor space per bird. Limit brooding units to 250 poults each.

Provide good ventilation in confinement rearing quarters and do not overcrowd the birds. Allow the recommended amount of floor space per bird.

Feed and water the birds from equipment that cannot be contaminated by droppings and keep the areas around feeders and waterers dry and clean at all times by moving, by frequent cleaning, or by using wire-covered or slatted platforms or grills.

Avoid extremely dusty or wet conditions on range or in confinement.

Do not allow off-the-farm trucks on the range or in the buildings. Trucks used for hauling live turkeys to processing plants are a special problem because, by the nature of their use, they can easily become mechanical carriers of disease. The entire truck, including the tires, should be thoroughly cleaned, washed down, and disinfected at the processing plant after each use. The turkey grower should limit, as far as practicable, the movements of live-turkey trucks on his farm.

Make a daily check for sick, injured, or dead birds. Isolate the sick and injured. Autopsy the dead birds and those that appear near death to check for external and internal disorders and disabilities. Use professional diagnostic services promptly, as suggested later, if conditions suggest disease.

Get rid of dead birds by incineration, deep burial, or disposal pit. NOTE: Some States require poultry producers to have incineration facilities or a disposal pit.

Disinfecting and Cleaning

In general, there is little to be gained in disease prevention by routinely applying disinfectant solutions to poultry buildings, soil, and equipment. However, when infectious disease occurs, the use of a disinfectant may be indicated as suggested in this handbook, recommended by competent authority, or required by regulations. For example, it sometimes is recommended or required that hatching eggs be fumigated with formaldehyde or dipped in an antibiotic or a quaternary ammonium solution to aid in the control of certain egg-transmitted diseases. When infectious diseases occur, fumigate at frequent intervals the battery brooding rooms, incubators, egg rooms, and all egg and poult equipment that can be tightly closed or placed in a tightly closed room. After thorough cleaning, use formaldehyde gas according to directions of the manufacturer.

All turkey-occupied buildings should be cleaned thoroughly after each brooding, growing, and breeding period. To clean buildings that have solid floors of waterproof material, remove the birds and all the litter, scraping off all accumulations of dirt and droppings. Then wash down the house, including all built-in fixtures, with water under pressure. Start with the ceiling or the underside of the roof and remove all dust and dirt, washing it down the drain or out the doors. Wash, rinse, and drain the watering equipment. Scrape the feeders clean of all loose dirt and spoiled or dirty feed. Where practicable, expose all parts of the portable equipment to direct sunshine for several hours. After the cleaning, open up the house to the fresh air and sunshine and leave it vacant for at least 30, preferably 90, days.

In buildings with dirt floors or where water under pressure is not available, take the removable equipment outside and wash or dry-clean it and then allow it to remain in the sunshine for at least 3 days. Sweep down, blow out, or remove by vacuum as much dust and cobwebs as possible, preferably with a portable steam-cleaning unit with a detergent. Then clean out all litter and dirt. If infectious disease has been a problem, spray the cleaned house, including the dirt floors, thoroughly with a cresylic disinfectant recommended and approved by the U.S. Department of Agriculture or with some other recommended product. Finally, open up the house and leave it vacant for at least 30, preferably 90, days.

Disinfectants

For general use in poultry buildings, the **saponated cresol disinfectants** are effective and relatively inexpensive but they leave a persistent disagreeable odor and are irritating to the skin and eyes. They should not be used on or in feeders, waterers, or any equipment concerned with human food or poultry feed. A list of cresylic disinfectants permitted for official use is available from the Animal Health Division, USDA, Federal Center Building, Hyattsville, Md. 20782.

The **quaternary ammonium** compounds are considered to be good disinfectants if used according to directions and *not* in soapy solutions or on surfaces containing residues of soap or detergents. In the recommended solutions, they are odorless, effective, and rela-

tively nonirritating to eyes and skin. They are recommended for disinfecting eggs, clothing, instruments, glassware, utensils, and metals. They can be used on the human skin if all soap and detergent residues are first removed.

Chlorine disinfectants such as sodium hypochlorite, calcium hypochlorite, and the chlorinated triazinetriones are powerful disinfectants and effective deodorants and bleaches when used as directed on clean surfaces. They are useful in disinfecting *cleaned* equipment and housing and can be used as antiseptics in drinking water where this is prescribed. Solutions providing 1,000 parts per million of available chlorine are necessary to provide strong disinfecting action. Calcium hypochlorite containing 70 percent available chlorine is widely used. Because of irritation of the eyes and air passages, chlorine disinfectants should not be used in closed rooms containing people or animals. The free chlorine generated also is destructive to fabrics, leather, and metals, so chlorine disinfectants must be used with care.

Formaldehyde, a gas, is sold as formalin, a 40 percent water solution, or as paraformaldehyde, a powder that liberates formaldehyde when heated. Formaldehyde is an excellent disinfectant but its use is limited to disinfecting relatively airtight rooms and equipment, utensils, and clothing that can be placed in them. It does not injure equipment or utensils but is irritating to the skin and eyes. As a rule, fumigation of poultry buildings is not effective because they cannot be made airtight.

Direct sunshine has value as a disinfectant for use where it can be applied directly to clean equipment, fabrics, and utensils but it is not dependable for general use.

Depopulation, although not classed as a disinfectant, helps to combat disease because most bacteria and viruses are unable to live for long periods of time outside the body of the host. To aid in eliminating these diseases from buildings, depopulation for at least 30, preferably 90, days, combined with cleanliness, dryness, good air circulation, and sunshine is helpful. However, some protozoan and fungus diseases do not die out readily and are resistant to disinfectants. These diseases are best combatted by such control measures as **range rotation, sanitation,** especially around feeders and waterers, **elimination of carrier birds,** and **treatment with drugs.**

Miscellaneous disinfectants such as **lye, carbolic acid,** (phenol), **sodium orthophenylphenate** (Dowicide A), **Beta-Propiolactone** (BPL), **pine oil disinfectant, sulphuric acid, ethylene oxide, heat from a fire gun, very hot water, steam, quicklime, potassium permanganate, copper sulphate** (bluestone), **iodine preparations,** and **mercuric chloride** (corrosive sublimate), all have value as disinfectants and some have special uses but none are especially recommended as aids in turkey sanitation.

The common **detergents** are efficient cleansers and have considerable disinfecting action, especially if applied in hot water, about 167° F. (75° C.), 1 pound to 40 gallons.

COMBATING A DISEASE OUTBREAK

One of the first signs of an impending disease outbreak often is a lowering of feed consumption. Birds may be nervous or they may appear droopy and listless. Coughing and sneezing indicate respiratory infections; abnormal droppings suggest intestinal disorders. Young poults may crowd together and seem to be cold even though plenty of heat is available. However, external symptoms seldom can be used to diagnose diseases; post-mortem examinations and laboratory tests usually are necessary.

Defensive Measures

When sick or crippled birds are detected in ranged turkeys, move them to isolation quarters and, if practicable, move the healthy birds to a clean range area and continue to move them twice a week. Remove all sick birds that may appear. If isolation quarters are not avail-

able, the sick birds can be left where they were at the time the healthy birds were moved. If the birds are confined, isolate the sick birds and add clean litter frequently to both the confined and the isolation quarters. Keep the sick birds isolated from the healthy.

Keep all turkeys on the regular feed and water and keep waterers clean by daily washing and rinsing. Do not *medicate* until a diagnosis is obtained, then follow directions promptly and carefully.

Do not drench the birds, litter, range soil, or equipment with disinfectants. Do not put *disinfectants* in the drinking water unless so directed by competent authority. *Fumigation* is valuable but only in places that can be tightly closed such as incubators and egg rooms, seldom in poultry houses. Litter and soil cannot be freed from infection through fumigation or disinfection. However, thorough cleaning followed by disinfection of the building, exposure to direct sunshine, and depopulation of the turkey premises for at least 30, preferably 90, days is helpful.

Obtaining a Diagnosis

As soon as all the obviously affected birds are removed from the flock, carry or send by private transportation about five live, very sick (moribund) birds to a local poultry disease diagnostic laboratory or a poultry-oriented veterinarian for diagnosis and recommendations on treatment or control. Freshly dead birds may be taken if moribund birds are not available. Transport the dead birds in sealed bags, preferably plastic, and the live birds in closed crates or boxes from which manure or feathers are not likely to escape. Do not attempt to transport sick or dead birds by common carrier. All bags, boxes, or other containers that have been in contact with such turkeys should be burned.

Accompany the shipment with written information on symptoms, the number of sick and dead birds observed, the medications and vaccinations that may have been used, the source and size of the affected flock, the management (whether range or confinement), the feeds and litter used, and other pertinent data such as name, address, and telephone number of owner or caretaker.

Post-Mortem Examinations

If diagnostic facilities are not available within transportable distance, the turkey grower should promptly perform a post-mortem examination (autopsy) of five or more of the freshly dead or very sick birds and record the observations. Before the autopsy, however, the grower should first examine a normal, healthy bird to aid him in recognizing abnormal conditions.

To conduct autopsies, use a good-size, sharp-pointed knife, a bone cutter or autopsy shears, and a small scissors for opening the digestive tract. Set up a metal-top table or other smooth, easily cleaned surface close to water and sewage facilities. Provide newspapers for wrapping and a disinfecting solution for the equipment. If the bird to be examined is alive, kill it by dislocating the neck, by a sharp blow at the top rear of the head, or by drowning (holding the head under water will do it) so that blood will not be spilled. To avoid possible infection, use rubber gloves in handling and examining obviously diseased birds.

First examine the dead bird externally, starting with the head and mouth. A swollen darkened snood may be caused by injury or possibly by **erysipelas** or **cholera.** An opaque retina (clouded eye) suggests **Arizona infection.** Wartlike nodules on the head and sometimes cheesy cankers in the mouth indicate **fowl pox;** swollen sinuses around the eyes indicate **sinusitis;** a lump in the throat and drooling indicate a **curled-back tongue,** which may be caused by eating finely ground feed.

Examine the wings, back, keel, and legs for **broken** or **abnormal bones.** Look for **skin damage, breast blisters,** and **abscesses** and for the sizeable yellow or brown **lice** and the tiny black **northern fowl** or **feather mites** in the area around the vent.

The crop may be **pendulous** with liquid or semiliquid contents, it may be **impacted** with solid material, or its contents may feel soft and

mushy. The last may indicate (1) **a fungus infection (mycosis),** which appears as a yellowish-white curdlike mass if the crop is slit open or (2) **cropworm** (*Capillaria*) **infestation,** which appears as whitish thickened masses of tissue in the crop walls, in which the threadlike worms ½ to 3 inches long can be seen if the mass is carefully examined.

Breeding birds of both sexes may have (1) scabby eyelids **(keratoconjunctivitis,** or **blepharitis)** or (2) a foul-smelling vent, or **vent gleet.** In this case destroy the bird promptly and check the flock for more infected birds. Breeding hens may have a **prolapsed** and **inflamed oviduct.**

For the internal examination, place the dead bird on its back, make a crosswise cut through the abdominal skin at the rear of the breastbone and then a foward cut through all the ribs on each side, and finally break back the breastbone exposing the abdominal organs, lungs, and air sacs.

Upon examining the viscera, the observer will be able to accurately identify only a few obvious findings such as the following. A massive hemorrhage in the abdominal cavity without other abnormalities would reliably indicate **aortic rupture.** The intestines ballooned and filled with dark-colored bloody material would identify the disease as **hemorrhagic enteritis.** Yellowish ulcers showing on the enlarged blind pouches (ceca) of the intestine combined with yellowish lumps or sizable whitish sunken spots in the liver would reliably indicate **blackhead. Penetrations** and **impactions** anywhere in the digestive tract are easily seen and the cause usually is obvious. **Accumulations of whole eggs or their yolks** occasionally occur in breeder hens indicating a malfunction usually unrelated to disease. **Inflammation of the lining of the abdominal cavity, with purulent adhesions (peritonitis),** usually is the result of injury or a malfunction of the abdominal organs. When the external appearance and the internal organs of dead poults under 5 weeks of age appear normal and the birds are in good flesh, **smothering, injury,** or **water glut** may be suspected. Small, dehydrated poults a few days old showing no lesions anywhere usually are **starve-outs** resulting from failure of the poults to eat and drink.

The following findings are suggestive but not necessarily reliable indicators of certain diseases.

Yellowish spots on lungs or air sacs **(airsacculitis)** usually accompanied by lesions (whitish deposits, reddish inflammation, cheesy abscesses, hemorrhages) on or in the abdominal organs suggest infections due to one of several disease-producing organisms such as the *Mycoplasma* bacteria, *Escherichia coli,* and the virus causing **ornithosis.** (See Airsacculitis, Coliform Infections, Sinusitis, and Ornithosis.) Accurate diagnosis depends upon laboratory tests, but *Mycoplasma meleagridis* is a likely culprit. If the air-sac spots appear greenish, the lungs have a furry down, and the air sacs are covered with a yellow exudate, the disease is likely to be **aspergillosis,** caused by the fungus *Aspergillus fumigatus,* which also may cause blindness and cheesy deposits in mouth and windpipe.

Fowl cholera is suggested by a salmon-colored, friable liver with whitish pin-point spots, an enlarged heart with a whitish-yellow exudate, fluid in the lungs, and sometimes yellow cheesy accumulations in the air sacs. Feces are yellow to yellow-green and there is a characteristic fetid odor in the body cavity. The snood may be swollen as in erysipelas. These findings in turkeys over 10 weeks old, combined with sudden death, strongly indicate cholera.

Fowl typhoid is suggested by mahogany-streaked, sometimes greenish-yellow enlarged liver; necrotic areas in the heart; grayish lungs; enteritis; and a mottled, greatly enlarged spleen in poults 6 to 20 weeks old (usually in the older birds). (See Salmonellosis and Arizona Infections.) Turkeys sometimes die rather quickly from typhoid but not so suddenly as from cholera.

Soft swellings of the hock joint and feet suggest **synovitis.** In addition, the liver usually is enlarged and darkened, the feces are sulfur colored as in blackhead, and there may be a large abscess next to the breastbone.

Bluecomb in small poults is suggested by emaciation with dark, dried-out flesh combined with bulbous small intestines, their contents watery, fetid, and gaseous. In older poults and mature turkeys, similar lesions occur; in addi-

tion, the pancreas may have small chalky areas. (The pancreas is the two- or three-lobed slender gland attached to a fold of the small intestine next to the gizzard.)

Erysipelas is suggested by an enlarged friable liver, bloody areas in breast muscles, purplish blotches in the skin over the breast, inflamed intestine (enteritis), and an enlarged mottled spleen, combined with a swollen, purplish-red snood in turkeys, mostly males, over 3 months old. Handle infected birds with care because this disease is transmittable to man.

Coccidiosis is suggested when any part of intestines of turkeys under about 8 weeks old is inflamed and thickened and contains a milky fluid and the ceca (the two blind pouches of the intestine) have small whitish ulcers.

Roundworms and **tapeworms** are easily seen if the intestines are slit open with a knife or scissors.

Hexamitiasis is suggested in turkeys under about 10 weeks old if the flesh of the breast is dehydrated and reddened and the small intestines are bulbous and filled with a thick mucus or with a thin, foamy, yellowish mucus, which is fairly characteristic. This disease is easily confused with bluecomb but a laboratory examination will determine if the causal organism *Hexamita meleagridis* is present.

After the post mortem the operator should first dispose of all the turkey material as suggested previously and then thoroughly wash the equipment, his hands, and his arms with soap and water or a detergent. The common detergents are good cleansing agents and have considerable antiseptic value, especially if applied hot at 167° F. (75° C.) or more. A cresylic disinfectant can be used on the equipment after cleaning is completed.

COMMON DISEASES AND DISORDERS*

This discussion of turkey diseases and disorders, parasites, and disabilities is not complete but is intended to cover briefly most of the conditions likely to affect turkeys. As noted previously, professional assistance should be obtained in diagnosing diseases and in planning control methods, especially those involving the use of drugs and vaccines. In conjunction with the following descriptive material on turkey diseases, the reader should refer to the previous discussion of post-mortem findings.

Effective drug treatments for some turkey diseases now are available. Drugs can be administered to groups of turkeys in drinking water or feed, or administered individually, usually by hypodermic injection, but their use should be based on the directions of the manufacturer or a qualified veterinarian. The selection of drugs must be limited to those permitted for such use by State or Federal authorities, including the Food and Drug Administration.

Airsacculitis

Airsacculitis is not a specific disease; it is a condition where deposits of yellowish exudate are found on the air sacs and sometimes on the lungs. These deposits, if extensive, result in condemnations because of septicemia-toxemia when the birds are inspected after slaughter. Airsacculitis can be caused by nine or more different bacteria, fungi, and viruses. Among these are the organisms causing cholera, sinusitis, synovitis, N-strain infections, coliform infections, aspergillosis, and ornithosis.

A very small bacterium, *Mycoplasma meleagridis*, or N-strain PPLO, appears to be an important cause of airsacculitis, which is widespread in turkey breeding flocks in some areas. Transmission is through eggs and through the semen of the male. Hatching eggs can largely, but not completely, be freed of infection by dipping *warm* eggs for 20 minutes in a *cold* solution of the antibiotic tylosin, which also may be used as a treatment in the drinking water. It is possible to identify noncarrier males through tests and then mate them with females from dipped eggs to produce stock free from the disease. No drugs are presently (1970) available to prevent or control airsacculitis caused by *Mycoplasma meleagridis*.

Aortic Rupture

Aortic rupture, or dissecting aneurism, can cause sudden death of male turkeys in good

condition, usually those 10 to 16 weeks of age or older. It seems to be associated with high blood pressure and possibly with an inherited weakness or a deficiency of copper in the diet. It can be produced by feeding sweetpea seeds to the turkeys. The body cavity of the affected bird is filled with blood and no other visceral abnormalities are noted except the ruptured artery, often the posterior aorta near the kidneys. Aortic rupture can be prevented by feeding the tranquilizing drug reserpine continuously at a low level as directed by the manufacturer.

Arizona Infections (Paracolon)

(See "Salmonellosis and Arizona Infections.")

Blackhead (Histomoniasis or Enterohepatitis)

The widespread, destructive disease blackhead is caused by the protozoan *Histomonas meleagridis,* which can affect turkeys of all ages, but especially those 8 to 16 weeks old. Symptoms are droopiness, often with lowered head and wings (fig. 29); watery, yellow-colored droppings; and sometimes darkened head parts. When autopsied, yellowish lumps, or more characteristically, roundish, yellowish or whitish, slightly sunken spots are found in the liver, usually combined with ulcers in one or both of the swollen ceca (the two blind pouches of the intestine). In a few cases, only the cecal lesions are seen. Brooding on wire or slats appears to be effective in preventing blackhead as well as coccidiosis and hexamitiasis in the brooder house. Likewise, blackhead usually does not affect unmedicated turkeys over 8 weeks old that are reared in complete confinement on clean litter or on clean range if turkeys are moved every week or two. However, if the infection occurs or seems likely to occur, it would be advisable to feed one of the several available blackhead-static drugs. These drugs can be fed to young stock continuously at the preventive level until a week before marketing and to breeding stock also.

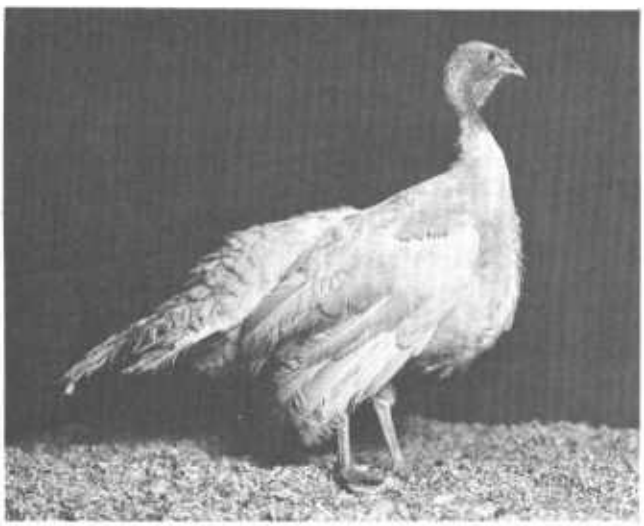

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***Figure* 29.—Blackhead-infected turkey male, 16 weeks old.**

Bluecomb

The highly contagious disease bluecomb, also called transmissible enteritis and mud fever, affects the intestinal tract of turkeys of all ages, including breeding stock. Bluecomb may occur suddenly in young poults, which appear dehydrated, are droopy, and have a gaseous, watery diarrhea. Mortality may range from 5 to 50 percent, sometimes as high as 100 percent of affected flocks. Survivors of an attack are immune but remain carriers; hence they should not be retained for breeding nor allowed to mix with uninfected stock. Bluecomb tends to be sporadic; it may appear suddenly, then disappear.

There is no preventive treatment for bluecomb other than good management, but losses sometimes can be reduced by supplying extra heat and an antibiotic such as neomycin, penicillin, or streptomycin in the drinking water, along with molasses (1 pint per 5 gallons of water for one day) followed by a broad-spectrum antibiotic in the feed. In breeding stock, death losses may not be severe, but morbidity may be high and egg production and body weight are greatly reduced. The cause of bluecomb in unknown but a virus or a *Vibrio* bacterium is suspected.

Bluecomb is not believed to be egg transmitted, but because it is a contagious disease, affected groups should be isolated. Adverse weather conditions when turkeys become wet and chilled seem to increase the chances of an

outbreak. Wild birds and other poultry, which may carry bluecomb, should be kept completely out of contact with turkeys. Depopulation for at least 30 days is an essential part of a control program. Strict isolation of the brooding facilities from older turkeys and wild birds is essential in preventing outbreaks.

Bumblefoot

Hard bumblefoot is a firm swelling in the center of the foot, usually with a horny core. Soft bumblefoot is soft-centered abscesses with purulent-appearing edges on the soles of the feet, particularly the toes. Severe bumblefoot can cause lameness, retardation of growth, and, indirectly, reduction in market grade. Male turkeys raised on hard floors with roosts are most susceptible to hard bumblefoot, and male and female turkeys raised on muddy, dirty range or litter sometimes develop soft bumblefoot. To prevent the disorder, eliminate roosts and raise the turkeys on deep, dry litter or on clean dry, range. Treatment is useless.

Candidiasis

(See "Fungus Infections (Mycoses).")

Cholera

Fowl cholera, a destructive disease caused by the bacterium *Pasteurella multocida,* can cause sudden death of turkeys, usually those over 10 weeks old. There may be a yellow to green diarrhea, a nasal discharge, a pinkish skin or a swollen snood. The abdominal organs are seriously affected, including pin-point spots on the liver, which have some diagnostic value.

The infection may be introduced on equipment, feed sacks, or turkey crates, or by carriers such as houseflies and wild birds. It seems to be triggered by exposure of the birds to stressful conditions such as bad weather, overcrowding, and sudden changes in feeding or watering methods. It is not believed to be egg transmitted.

Preventive measures against cholera are: Provide good sanitation, clean range, and complete segregation of adult and young birds; break all contact with wild birds and all other poultry; retain for breeding no turkeys from infected flocks; do not overcrowd; and avoid stresses, especially in bad weather. Oil adjuvant 4-isolate preventive vaccines are quite effective and are preferred to other types. Vaccines can be used in problem areas, employing two subcutaneous injections at 6 to 8 and at 12 to 16 weeks of age. Treatment of affected flocks with a sulfa drug such as sulfaquinoxaline in the water for young birds or chlortetracycline in the feed of young or old stock may be helpful in controlling mortality.

Coccidiosis

Coccidiosis, which can be caused by any one of three species of *Eimeria* (spore-forming protozoans), affects poults 3 to 8 weeks old. The poults usually continue to eat, but they huddle and cheep, with drooping wings and ruffled feathers and a watery diarrhea sometimes slightly tinged with blood. The small or large intestines usually are inflamed, thickened, dilated, and whitish due to a milky-white exudate. The ceca may contain yellowish-brown fecal material and the cecal walls may be abscessed or hemorrhagic.

Treatment of affected poults is not very effective but sulfaquinoxaline or sulfamethazne in water or feed may reduce losses.

Coccidiosis is easily prevented by including a drug such as amprolium or sulfaquinoxaline in the starting feed. This procedure is routinely applied in situations where the disease is present on the premises. Brooding on wire or slat floors usually prevents coccidiosis.

Coliform Infections (Colibacillosis)

The bacterium *Escherichia coli* is responsible for most coliform infections which can be acute and cause sudden death of turkeys in good condition. Upon post mortem, there may be yellowish cheesy material in the air sacs and on the heart and liver. The spleen is greatly enlarged and hemorrhagic. There may be navel infection, small hemorrhages on the heart, and small white spots on the enlarged liver. Intestinal contents may be greenish and there may be yellowish fecal material around the vent.

A coliform infection usually occurs as a secondary infection to the diseases caused by

the Mycoplasma organisms, but it also can occur by itself. Some strains of the bacterium are pathogenic, others are not. Infected poults are usually from a few days to 2 to 3 weeks old but older poults up to market age are also susceptible. Breeding hens may be carriers of *E. coli* bacteria and the disease may be transmitted in the egg or on the egg surface. The pullorum-typhoid tube test may help to identify breeding hens that are carriers. Laboratory tests are necessary for diagnosis because the post-mortem findings are easily confused with those of cholera, erysipelas, and typhoid.

Preventive measures against coliform infections are: (1) Fumigating the hatching eggs after cleaning the slightly dirty ones and discarding those that are very dirty; (2) starting the poults in a clean environment; (3) excluding wild birds and rodents; and (4) avoiding contaminated feed and equipment. Medication of affected poults is not too effective, but neomycin or erythromycin in feed or water or the day-old hypodermic injection of antibiotics may reduce losses.

Erysipelas

Erysipelas caused by the swine erysipelas organism usually affects turkeys 4 to 7 months old. To prevent it, keep turkeys from all contact with sheep and swine and with land used by these animals. Early debeaking and desnooding of turkeys may help to prevent the spread of this disease. Turkeys can be vaccinated against erysipelas and infected birds can be treated effectively with penicillin or a bacterin, or both. Vaccination is not indicated unless erysipelas is present in the area. For an accurate diagnosis, laboratory tests are required and qualified assistance usually is needed in planning prevention and treatment programs. (See "Post-Mortem Examinations.")

Fowl Pox

Fowl pox is a widespread virus disease causing wartlike nodules on the head of turkeys and yellowish white cankers in the throat, usually on turkeys more than about 12 weeks old. The infection is probably carried by mosquitoes, wild birds, visitors, animals, used feed sacks, and other turkeys. Preventive measures are suggested by the carriers listed.

There is no effective treatment for fowl pox, but it can be prevented by vaccinating young birds with fowl pox vaccine (a live-virus product) when they are 4 to 10 weeks old. In some warm-winter areas, it is advisable to revaccinate breeding stock 6 months after the first vaccination. Unless the disease is present in the area, vaccination would not be necessary.

Fowl Typhoid

(See "Salmonellosis and Arizona Infections.")

Fungus Infections (Mycoses)

Turkeys of all ages are susceptible to fungus infections such as candidiasis (mycosis of the crop, moniliasis, or thrush) and aspergillosis, which affects the respiratory tract. Sources of infection may be high-moisture corn; warm, damp litter, especially sawdust; dirty hatching eggs; poorly drained soil; and continually warm and damp areas, especially those near feeders and waterers. The causes listed suggest methods of prevention. In the absence of effective preventive measures, calcium propionate or an antifungal antibiotic such as Mycostatin in the feed may be helpful in reducing losses from candidiasis but there is no effective treatment for aspergillosis. The medication should be administered according to directions at the first sign of the disease, before it becomes well established. Changing or covering up infective litter or moving the turkeys to clean ground along with removing affected birds from the flock sometimes helps to clear up fungal infections. The antibacterial antibiotics (penicillin, bacitracin and the tetracyclines) never should be used in the treatment of fungus diseases.

Hemorrhagic Enteritis

Hemorrhagic enteritis can occur in turkeys from 3 weeks to 6 months old, but is more common in the older birds. The entire intestinal tract is ballooned and filled with dark-colored bloody material. Mortality may be heavy but it can be largely prevented if, at

the first sign of the disease, the turkeys are injected intramuscularly with 0.5 cc. of antiserum prepared from turkeys recovered from the disease. The cause may be a combination of an unidentified virus with bacteria. Suggestions for treatment and preparation of the antiserum may be obtained from the Extension Service of Virginia Polytechnic Institute, Blacksburg, Va. 24061. When requesting information, please include your own ZIP code.

Hexamitiasis

Hexamitiasis is caused by the protozoan *Hexamita meleagridis* and affects young poults up to 10 weeks old. The birds at first appear nervous; they huddle and require more heat than is normally supplied. Later on they become listless. There is a watery, foamy, yellow-colored diarrhea. A rapid weight loss occurs even though feed consumption tends to be normal. The small intestine nearest the gizzard is inflamed, bulbous, and filled with a foamy mucus. Breast muscles are dehydrated and reddish. Accurate diagnosis is difficult and must depend on identifying the causative organism. So far, drugs have not been very effective in controlling this disease, but nithiazide at the therapeutic level in the drinking water may help to reduce losses when an outbreak occurs. Brooding on wire or slat floors may be the best preventive, but a low level of nithiazide in the feed may also have some preventive value for poults brooded on litter. Sanitation, housefly control, and complete separation of young from old broods and young from old turkeys are desirable management practices.

Myclopasma Infections

(See "Airsacculitis," "Sinusitis," and "Synovitis.")

Ornithosis

Ornithosis, primarily a respiratory disease of birds, does not often affect turkeys; but it can cause serious losses and is dangerous because it is transmittible to human beings, sometimes with fatal results. In humans, the disease is called psitticosis or parrot fever. Breeding stock and young turkeys over 4 months old can be affected, the first symptoms being coughing and sneezing. There may be yellow droppings and a mild swelling of the sinuses of the head. On autopsy, there are no characterisitic lesions but pus may be found in the air sacs and lungs and around the heart and other visceral organs. The spleen may be enlarged. The causative virus can be transmitted *on* the egg but apparently not *in* it and can be identified only by laboratory tests. Because wild birds often carry the disease, they should be excluded from the turkey quarters.

Because of the hazard to human health, any suspected outbreak of ornithosis should be verified by laboratory tests of blood and tissues. Anyone handling ornithosis-affected birds should use rubber gloves, avoid prolonged exposure, and wash and disinfect his clothing and all exposed body areas. The organism can be killed by fumigation.

The antibiotics chlortetracycline and oxytetracycline at 400 grams per ton of feed for 2 to 4 weeks are quite effective in treating affected turkeys, but a withdrawal period of 1 week before marketing is necessary.

Paratyphoid

(See "Salmonellosis and Arizona Infections.")

Poisoning

Poisoning, which is difficult to diagnose from symptoms and autopsy findings, can be caused by the birds' eating or drinking toxic materials such as decomposed animals, maggots, poisoned insects, poisoned insect bait, orchard sprays, disinfectants, and seed grain treated with a fungicide. Excess amounts of copper sulfate (bluestone) and sodium bicarbonate (baking soda) and parts of poisonous plants also may cause poisoning. Among the poisonous plants are the leaves of certain lupines and milkweeds, the young shoots of potatoes and oleander, and the seeds of the showy crotalaria, the coffeeweed, sesbania, the locoweeds, and drought-damaged hegari sorghum. Nitrite poisoning can develop from their eating drought-stricken sudangrass and possibly other forage plants.

If used as directed, ordinary weed killers apparently are not toxic to turkeys.

In poisoned turkeys, inflamation of the intestines (enteritis) usually is found, sometimes along with flabby heart, kidney lesions, liver necrosis, excessive bile, muscular incoordination, and convulsions. Examination of crop and gizzard contents may give a clue. Poisoning is not common in turkeys but it is more likely to occur in ranged birds than in confined.

Pullorum Disease

(See "Salmonellosis and Arizona Infections.")

Salmonellosis and Arizona Infections

Arizona infections (paracolon), fowl typhoid, paratyphoid, and pullorum disease are very destructive diseases caused by related bacteria of the family Enterobactariaceae. Arizona bacteria are not in the salmonella group but they are closely related and produce disease in a similar manner. All these bacteria can be transmitted in or on the eggs or spread by contact with infected chickens, turkeys, and possibly other birds or animals.

Arizona infections, paratyphoid, and pullorum disease occur primarily in poults from a few days to 1 month old. Fowl typhoid usually occurs in poults from 6 to 20 weeks old. Survivors of these four diseases become carriers, which can be identified by blood testing. Generalized visceral lesions are commonly found in poults affected by these four diseases but they are of little help in diagnosis. However, Arizona infection is strongly indicated by clouded eyes.

Salmonellosis caused by fowl typhoid and pullorum disease organisms have been practically eliminated from turkeys in the United States by blood testing prospective breeding stock under the National Turkey Improvement Plan. Control of Arizona infections and paratyphoid is more difficult but flocks intended for breeding can be blood tested for these diseases. If any infection is found, the whole flock must be eliminated from the breeding program. None of the young stock from flocks having a history of these diseases should ever be retained for breeding. All direct or indirect contact with chickens and wild birds should be avoided and infected stock should not be introduced into a flock.

Antibiotics can be injected subcutaneously into the upper neck of 1- to 3-day-old poults as a preventive where Arizona infection or paratyphoid is anticipated. The new antibiotic spectinomycin shows considerable promise here. The injection, often done at the hatchery, may help to prevent mortality and morbidity but does not eliminate the infection. At present (1970) the injection practice has not been properly evaluated. As a treatment of infected poults, furazolidone may be put in the feed for 2 to 3 weeks at the rate of 200 grams per ton. The sulfa drugs and broad-spectrum antibiotics also are quite effective in water or feed.

On-the-farm formaldehyde fumigation of clean eggs and the elimination of dirty eggs are preventive measures sometimes required by hatcheries having trouble with these diseases.

Sinusitis

Infectious sinusitis is caused by a very small bacterium, *Mycoplasma gallisepticum*, which is egg transmitted. Sinusitis is a cause of swellhead and sometimes of air-sac infection. Turkeys of all ages can be affected and recovered birds remain carriers. Breeding stock can be tested with serum plate antigen. If any reactors are found, the whole flock should be eliminated from the breeding program. The best preventive is to use poults from stock tested for and found free from the disease. Swollen sinuses can be treated by withdrawing the exudate with a large 15- or 16-gage hypodermic needle and injecting the emptied sinus with 1 cubic centimeter of a fresh 4-percent solution of silver nitrate. The antibiotics chlortetracycline and oxytetracycline at high levels in the feed have been reported as moderately effective as a flock treatment of poults up to 1 month old.

Mechanical sinusitis can be caused by foreign bodies such as the awns (beards) of common barley, the broken hulls of coarsely ground barley and oats, and other sharp-pointed objects. For this reason, barley, oats, and other heavy-hulled grains should be fed whole or finely ground in a hammer mill, never cracked, rolled, or coarsely ground unless they are soaked before feeding.

Synovitis

The infectious bacterial disease called synovitis or infectious arthritis often is caused by *Staphylococcus* organisms, less often by *Mycoplasma synoviae,* which also causes airsacculitis. In synovitis, the feet and hocks swell and there usually are lesions in the abdominal organs, including enteritis and an enlarged, darkened liver. The swellings are soft and hot and do not contain a core. There may be an abscess next to the breastbone. Suggestions for preventing bumblefoot may help to prevent synovitis. The antibiotic Tylan seems to be effective as a treatment when injected into each affected poult.

Trichomoniasis of the Upper Digestive Tract

The soilborne disease trichomoniasis caused by the protozoan *Trichomonas gallinae* is rare in well-managed turkey flocks. It can be transmitted by pigeons and wild doves and is associated with unsanitary conditions such as polluted stagnant water, poorly drained range, spoiled feed, moldy litter, and accumulations of wet droppings around feeders and waterers. Turkeys over 4 months old are most susceptible. Infected birds often walk in an upright position. Whitish ulcers or nodules are found in the mouth, esophagus, crop, and proventriculus (the small glandular enlargement of the esophagus where it enters the gizzard).

Preventive measures are suggested by the causes listed. Treatment of diseased birds is not very effective although copper sulfate (bluestone) in a 1:2,000 solution may be helpful when used in place of regular drinking water for 3 or 4 days, then again a few days later. The drug metronidazole given orally at 60 milligrams per kilogram of body weight for 5 consecutive days has shown promise as a treatment of infected birds of several species.

Typhoid (Fowl)

(See "Salmonellosis and Arizona Infection.")

Water Glut

Young poults, especially those 1 to 3 weeks old, are susceptible to the disorder water glut which may occur when very young poults fail to drink, or are deprived of, water for 24 to 48 hours. When water consumption is restored, there may be a mild to violent reaction, varying from a depressed growth rate with little or no mortality to a sudden high mortality. Slightly affected poults may show no outward symptoms but those seriously affected develop a unsteady gait and may go into convulsions. Prevention consists of keeping drinking water continuously available and being certain that the poults are drinking without interruption. Changes in the waterers should be made gradually. No cure has been found once a deprival period has occurred. Poults 2 to 3 weeks old seem most susceptible and those older than about 5 weeks appear not to be susceptible to damage from water glut.

MISCELLANEOUS DISEASES AND DISORDERS

The following diseases and disorders are uncommon in turkeys but can cause serious losses.

Avian influenza, a relatively new virus respiratory disease affecting both young and old turkeys, resembles Newcastle disease and Mycoplasma infections and can be identified only by laboratory tests. In breeding stock it can cause lowered egg production, abnormal eggs, and a decline in fertility and hatchability. In young stock near market age it can cause coughing, sinusitis, a nasal discharge, and a foamy exudate on the air sacs. Treatment with tetracycline antibiotics may help to reduce losses.

A new disease of turkeys called **degenerative myopathy** recently was described by the Oregon Experiment Station. The inner large breast muscle *Pectoralis profundus* degenerates and becomes discolored, usually greenish. Outwardly the only sign of the disorder is a conspicuous dent in the musculature of one or both sides of the breast. There is no external discoloration but when the skin and the outer breast muscle are cut away, the degerated, off-colored inner muscle is seen. Mostly breeding hens, not the toms, are affected but hens as young as 22 weeks sometimes show the begin-

ning of the deformity. The cause has not been determined but it seems likely that heredity is involved; hence it is suggested that all breeding stock be carefully examined. If the defect is found, all stock in which it appears should be eliminated from breeding programs. Market birds in which the deformity is detected are condemned.

Dietary diseases result from deficiencies of minerals or vitamins and will not occur if nutritionally adequate diets are fed. When complete diets cannot be obtained, free access to growing green feed should be supplied to turkeys of all ages. Fresh green feed will help to provide most of the required vitamins and some of the minerals.

Leucocytozoan infection, a protozoan malaria-like disease, is transmitted by black flies (turkey gnats) of the genus *Simulium* from carrier breeding birds to young birds 1 to 5 months old. If either the adult carriers or the gnats are eliminated, the young stock cannot be infected. A microscopic examination of a stained blood smear from all breeding turkeys will identify the carrier birds, which then can be eliminated from the breeding flocks.

Muscle degeneration in breeding toms, usually occurring after stimulatory lighting is applied, results in **neck paralysis** or, less commonly, **leg paralysis.** Affected birds given nursing care, sometimes including force feeding, usually recover after a few days. The cause is unknown.

Newcastle disease, a virus respiratory infection, may affect both young and adult turkeys but it is not common. Turkey growers should take every precaution to avoid its introduction, which usually comes from infected chicken flocks. Where Newcastle disease has occurred in turkeys or seems likely to occur, the breeding stock can be vaccinated against it, otherwise vaccination is not recommended.

Omphalitis, a destructive putrid infection around the navel of baby poults, appears to originate as a result of poor hatchery sanitation. Proper fumigation of incubators should eliminate it. The cause may be a virus or a Staphylococcus bacterium.

Peanut-meal (Turkey X) disease recently caused losses in turkeys in Great Britain. It was caused by a poison produced by the fungus *Aspergillus flavus,* which contaminated the peanut meal used in feeding.

Round heart disease is a relatively new ailment of chickens and turkeys occurring mainly in male birds 1 to 4 weeks old but sometimes persisting to market age. The heart is enlarged, rounded, and flabby; there is some straw-colored ascites or dropsy; and the liver may be yellowish. The cause is unknown but a virus or heredity, or both, may be involved. The disease often appears under stress conditions. Effective treatment has not been devised. To prevent round heart disease, avoid affected stock and provide plenty of heat during brooding.

Tuberculosis, a bacterial disease, is uncommon in turkeys, but can occur in adult birds where it causes yellowish-white, hard nodules on the visceral organs. The tuberculin test can be used to identify most of the affected birds. Complete separation from chickens and a clean environment are essential preventive measures.

The disorder **waterbelly** (ascites) resembles round heart disease and, like it, appears in very young poults. There is an accumulation of fluid in the abdominal cavity and the lungs, the heart is enlarged, and the liver may be yellowish. The usual, but not necessarily the only, cause is a level of common salt in the diet that exceeds about 1.25 percent. Because there may be other causes, the composition of the diet and management items should be checked carefully.

Vent gleet (see the discussion of external autopsy findings, p. 58) may occur by itself or in connection with internal candidiasis.

PARASITES

Infestations with internal parasites such as **cecal worms** (heterakids), **cropworms** (*Capillaria*), **flukes** (trematodes), **gapeworms** (*Syngamus*), **roundworms** (ascarids), and **tapeworms** (cestodes) are preventable by using only uncontaminated, well-drained range and pure drinking water. Confined turkeys seldom acquire these parasites if houseflies are controlled,

wild birds are completely excluded, and normal sanitary precautions are taken. Medications to expel these parasites tend to be only partly successful and not indicated except where a massive infestation of the large roundworm (*Ascaridia dissimilis*) is found. Combination "wormers" are not recommended for turkeys.

External parasites such as **biting lice** (*Mallophaga*), the **northern feather** or **fowl mite** (*Ornithonyssus sylviarum*), and the **tropical feather mite** (*Ornithonyssus bursa*) may be transmitted to turkeys from wild birds, from chickens, and from contaminated equipment such as market crates. These parasites can be controlled completely by shaking 4 or 5 percent malathion dust onto the *skin* of the bird (not just into the feathers) above and below the vent, on the thighs, and on the back. One fairly liberal application is often sufficient, but a second application 3 weeks later may be needed. It is not necessary to treat the environment to rid turkeys of lice and the northern feather mites. Heavy infestation with these parasites may cause infertility in breeding stock and the scabs on the skin may cause downgrading in market stock.

The bites of the large (one-third-inch) **blue-bug** (*Argas persicus*) or **poultry tick** can cause inflammation and abscesses of the skin of turkeys and result in the downgrading of market stock. **Mosquitoes** sometimes attack turkeys, particularly those roosting in the open. Mosquito bites can cause loss of blood and swelled heads and necks, and can transmit fowl pox and avian malaria. Range turkeys roosting under shelter or turkeys reared in confinement seldom are damaged by mosquitoes, ticks, or mites.

The **turkey chigger** (*Neoschongastia americana*) is an orange-red mite that lives in heavy soil, especially soil that cracks. It is becoming a serious pest in the Southern and Midwestern States as far north as southern Minnesota. Infestations may persist for many years. The mites crawl onto the turkeys and bore into the skin and flesh of the birds in groups, causing roundish, highly inflamed lesions, sometimes 1 inch or more in diameter. Upon inspection, market turkeys containing these lesions are downgraded. Turkey chiggers are rarely found on sandy soil and do not affect confined turkeys unless access to the soil is allowed. Chemical control does not seem practical although the mites can be controlled by spraying the range soil with malathion every 5 days. The dosage of malathion can be 25 pounds of 4 percent dust, 20 pounds of 5 percent dust, or 1 to 1½ pints of 5 pounds per gallon emulsifiable concentrate in water to cover 1 acre. About 6 weeks are required for chigger lesions to heal after the mites have been removed.

Chiggers that affect humans apparently do not attack turkeys to a significant degree.

DEFORMITIES, INJURIES, AND VICES

Abnormal Feathering

Rough, broken, or weakened feathers accompanied, in young, dark-feathered poults, by achroma (a bar of white across the wing) can be caused by a deficiency of the amino acid lysine. Poults need about 1.5 percent lysine in their starting diet. Achroma itself seldom is a serious disorder but its presence indicates protein imbalance, which is likely to result in subnormal growth. Deficiency of other nutritive factors such as vitamin D, biotin, and zinc may cause rough, broken feathers without achroma.

The feathers of breeding males usually become rough and broken by rubbing against equipment and picking by the hens. This condition, appearing mostly in birds confined to buildings or small yards, seldom causes trouble. Breeder hens tend to lose or wear down their breast and body feathers during the producing season. Debeaking will prevent serious feather picking.

A number of abnormalities involving feathers, most of them genetic mutations, or sports, have appeared in turkeys. Among them are wiry, permanently twisted quill feathers, hen-colored breast feathers in toms, and almost complete lack of feathers (nakedness). Birds having such undesirable characteristics and, where possible, the families that produced them should be eliminated from breeding flocks.

Blueback

Blueback is a permanent, dark discoloration of the skin of the back and sometimes the sides and breast of turkeys with dark plumage but not turkeys with white plumage. Blueback may be caused by a rare recessive hereditary factor or, more likely, by damage to the developing feathers by picking or treading, combined with the action of direct sunshine. Blueback causes downgrading when the birds are marketed. In young stock, blueback will not occur if feather picking and mating are prevented unless the hereditary factor is involved. In naturally mated breeding stock, blueback is difficult to prevent although the use of saddles on the hens reduces it considerably.

Breast Blisters and Calluses

Breast blisters and calluses are much more common in toms than in hens and are less common in dimple-breasted birds than in those without the dimple. (See p. 9.) They are believed to be caused by continuous irritation of the skin that covers the breastbone. They can cause serious losses due to downgrading under Federal inspection. Turkeys reared in confinement on dry litter without roosts usually have fewer blisters and calluses than those reared on range, with or without roosts. Ranged turkeys over about 12 weeks of age should roost on litter or on smooth, well-drained ground free from plant burrs, sharp stones, and other rough material. If roosts must be used, they should be of the type described on page 19.

Bruises of the Skin and Flesh

Fresh bruises tend to be reddish and are acquired during the handling just before and during loading. Old bruises are dark colored, often greenish, and are acquired on the farm before the loading process. Both types cause downgrading and result from activities such as flying against hard objects, rough handling, stampeding, driving too many birds into the catching pen, and struggling when the bird is caught by one leg. The causes listed suggest methods of prevention.

Cannibalism

Feather picking is a mild form of cannibalism to which turkeys are susceptible, especially during the growing period. It results in unsightly appearance, more trouble from pinfeathers when the birds are marketed, and blueback in varieties with dark plumage. It can develop into flesh picking and becomes serious enough to retard growth rate. As a rule, feather picking reaches serious proportions only in turkeys raised in confinement. It can be prevented or stopped almost completely by debeaking or inserting a specially made turkey bit resembling a 1¼-inch hog ring with blunted ends. Either treatment also prevents effective grazing. The ring hangs between the two jaws and is adjusted with special pliers to fit snugly into the nostrils without penetrating the septum between them. This device prevents the beak from being closed completely and thus prevents feather picking.

Management practices that tend to prevent feather picking are: (1) Avoiding overcrowding in confinement rearing quarters; (2) feeding an adequate diet; (3) feeding pelleted rather than loose mash; (4) allowing confined turkeys access to baled legume hay; and (5) not confining turkeys to roosts or other closely restricted quarters, particularly in the early morning.

Head and neck picking, sometimes fatal, may result from fighting among mature or nearly mature males. Introducing strange birds into a flock or mixing strange flocks usually starts the fighting. If the birds are "ringed" or debeaked, injuries are seldom serious.

Pine tar or chick-pick remedies, such as a mixture of 4 ounces of petrolatum, one-fourth ounce of carmine, and one-fourth ounce of aloes, applied to the affected areas offer temporary relief from picking and enable injured birds to recover.

Deformed Back

Severely crooked (hunched) and roached (arched) backs occur infrequently and their causes are unknown. Possible causes are hereditary tendencies and injuries or vitamin deficiencies occurring early in life. Turkeys selec-

ted for breeding should be free from these deformities to prevent possible hereditary transmission of them.

Deformed Beak

Crossbeaks, rare in turkeys, probably are due to a genetic factor. **Ostrichlike beaks,** in which the upper jaw is flattened instead of downcurved, may be caused by injury due to reaching through wire mesh or rubbing beaks on poorly designed feeders or waterers. **Pressure necrosis** of the beaks of young poults appears to be caused by too finely ground, sticky feed that accumulates in the beak and causes infection and deformity. Properly formulated feeds will prevent this deformity.

Deformed Breastbone

Severely crooked breastbones, (fig. 30) rare in broad-breasted turkeys, may be due to grossly inadequate nutrition or possibly a genetic factor. **Deeply dented breastbones,** also rare in broad-breasted turkeys, appear to be caused by poor nutrition or by roosts. Feeding balanced diets and eliminating roosts for turkeys over 12 weeks old usually will prevent the occurrence of significant numbers of these deformed breastbones in all types of turkeys. If roosts are needed, they should be 3½ to 5 inches wide and set 8 to 12 inches above the ground or floor.

Impaction and Penetration of the Digestive Tract

Impaction of crop, proventriculus (glandular stomach), gizzard, and sometimes the intestines may be caused by the liberal eating of dry, bulky feed or litter. Young poults most commonly are impacted, but turkeys of any age may become impacted with a firm mass of relatively dry, fibrous material. Lawn clippings or other hand-fed green feed, if not finely cut or if allowed to wilt before eating, may cause impaction of the digestive tract. Placing day-old poults on unsuitable litter is a common cause of impaction, which may result in starvation and death.

Penetration of crop, proventriculus, or gizzard is caused by eating shiny nails, bits of wire or other metal, or splinters from shavings.

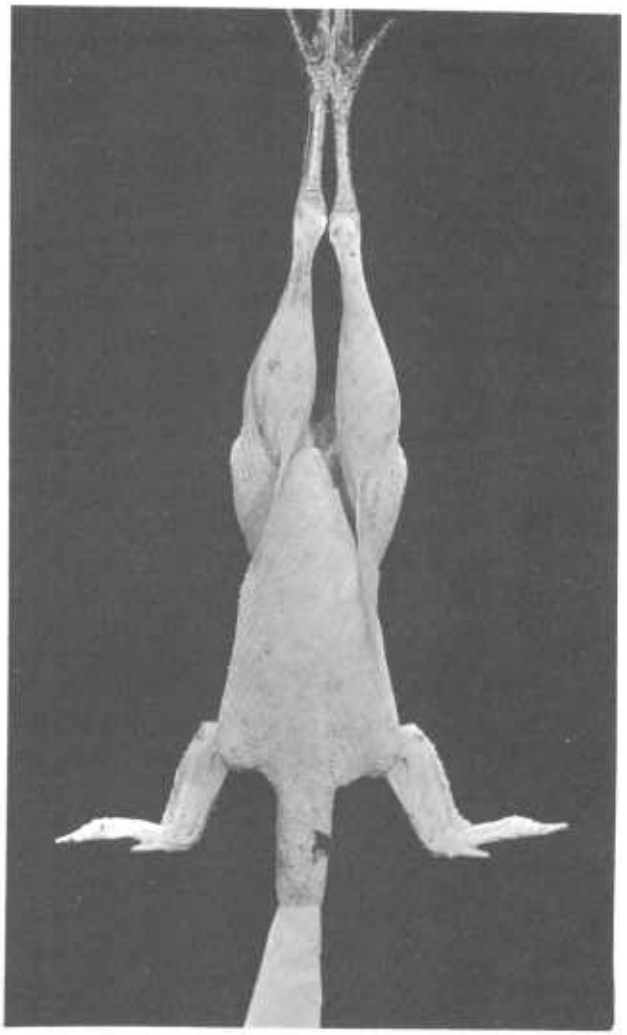

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Figure 30.—Crooked breastbone in Broad Breasted Bronze turkey tom. This deformity is rare in broad-breasted strains.

Penetration of the digestive tract is usually fatal.

There is no practical cure for impaction or penetration; methods of prevention are suggested by the causes listed.

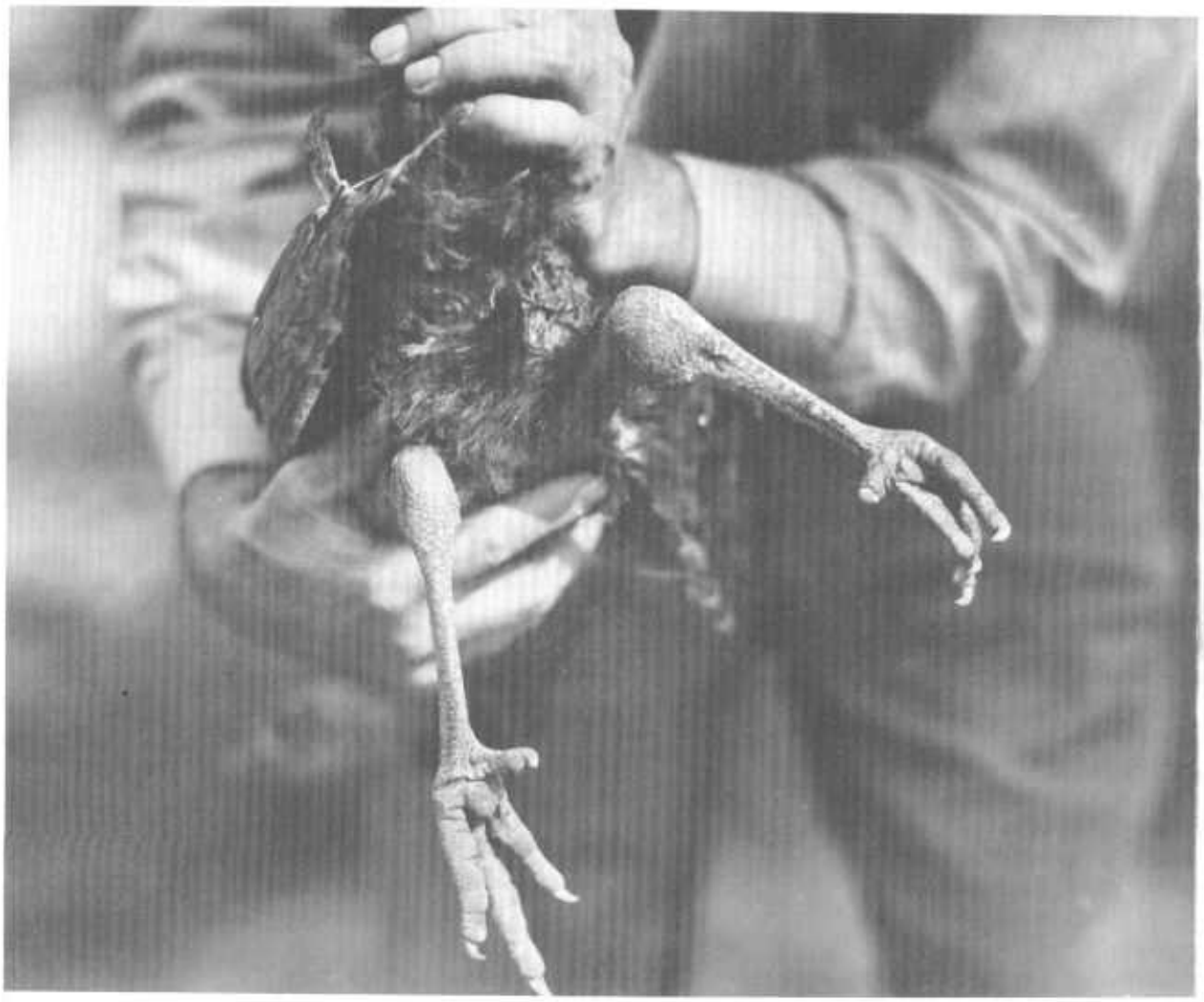
Leg Deformities and Weaknesses

Perosis (slipped tendon) (fig. 31) is a term used to indicate a deformity of one or both legs in which the large tendon at the rear of the hock slips to one side, resulting in a twisted shank. Often the hock is enlarged but is firm and cool, rather than soft and warm to the

touch, as in synovitis. The victim invariably becomes crippled and should be killed because treatment is useless. Perosis can affect turkeys, mostly males, of any age or breed, up to about 30 weeks, after which new cases seldom develop.

The tendency toward perosis appears to be inherited although it can be caused by a nutritional imbalance, the commonest of which is deficiency of manganese in the diet. Deficiency of biotin, niacin, or choline also can cause perosis. Too much phosphorus or calcium may be an indirect cause; hence, bonemeal, limestone, and similar supplements never should be fed free choice or included in the diet in quantities larger than necessary for proper nutrition. To prevent perosis, feed a balanced diet to the turkeys and eliminate susceptible families and strains from the breeding stocks.

Leg weaknesses other than perosis may be caused by deficiency of vitamin D (rickets), vitamin E, and riboflavin or by the disease synovitis. In day-old poults a condition resembling perosis is called **spraddle legs.** This may be due to a genetic factor, faulty incubation, a deficiency in the diet of the breeding stock, or a smooth slippery floor in the hatching trays, shipping boxes, or brooders. Young



59905–B

Figure 31.—Perosis of right leg of young Bronze turkey tom.

poults should be placed on wire, on rough-surfaced paper, or on reasonably thick litter.

Enlarged hock disorder starts as a slight, often imperceptible enlargement of the hock joint at about 2 weeks of age. The enlargement regresses to a normal condition at about 4 weeks, then recurs in a severe form at 14 to 16 weeks, resulting in severe leg weakness, breast blisters, and sore feet. The tendon normally is not slipped but the bird, usually a heavy-type male, becomes crippled and worthless. The cause appears to be nutritional, a deficiency of niacin and vitamin E in the diet. To prevent this disorder, feed a balanced diet and if fish-liver oil is fed, restrict the quantity to 0.25 percent or less.

Crooked toes may be a hereditary defect or they may be caused by injury or by allowing turkeys access to wire- or slat-floored porches in subfreezing weather.

Pendulous Crop

Pendulous crop (fig. 32), sometimes called baggy, sour, or dropped crop, is caused by a weakening of the crop and supporting tissues so that feed and water accumulate in the organ and pass out too slowly or not at all, resulting in a sour, ill-smelling, semiliquid accumulation and a deterioration of the crop lining. In young poults, a mild pendulous condition sometimes occurs but usually corrects itself without treatment. However, seriously affected birds seldom recover. Treatment is useless.

59906–B

Figure 32.—Young turkey tom with pendulous crop.

Some strains or families of turkeys, usually the types that are not broad breasted, seem to possess a genetic weakness that predisposes them to the disorder. When these susceptible birds are exposed to hot weather with consequent heavy consumption of liquids, the deformity develops. Preventive measures include: (1) Selecting strains not carrying the genetic factor; (2) avoiding exposure of turkeys to excessive heat without shade; (3) giving continuous and easy access to cool drinking water; (4) providing ample shade; and (5) feeding no liquid milk.

Pendulous crop should not be confused with crop disorders caused by fungi (mycosis), protozoans (trichomomiasis), and cropworms (capillariasis). In these disorders the crop is only slightly distended and the contents may feel curdled or mushy rather than liquid. In crop impaction the organ is distended with a firm mass of relatively dry material.

Stampeding

Turkeys are subject to fright, especially on moonlit nights. Severe losses from injury, straying, smothering, bruising, broken limbs, and deaths by predatory animals may result from stampedes. To prevent stampeding, avoid disturbances of all kinds around the roosting quarters and provide low-intensity night lighting by a rotating beam or by small light bulbs. Occasional low-flying airplanes may cause serious daytime stampedes in turkeys on range or in yards.

Miscellaneous Deformities

Curled tongue is a deformity in which the tip of the tongue is folded back upon its upper surface causing drooling and a lump in the throat just under the beak. The condition results in lowered feed consumption and reduced growth rate but rarely in death. It appears to be caused by feeding very finely ground dry mash.

Injury to the tongue may follow any attempt to cut off any part, even the tip, of the lower jaw during debeaking, which should be confined to the upper jaw.

Undersized blind eyes (microthalmia) usu-

ally are hereditary, only rarely the result of injury. **Gray, blue,** or **mottled eyes** are associated with certain uncommon but suppressed plumage patterns. They are not caused by disease and are of no practical significance. **Clouded eyes** of normal size may be caused by Arizona infection.

Split wing is a deformity, presumably hereditary, in which the 10 large outer flight, or primary, wing feathers are definitely separated from the more numerous inner large, or secondary, feathers, and protrude in an unslightly manner. Split wing is of no commercial significance but birds with split wing are unslightly and should not be selected for breeding.

MARKETING TURKEYS*

Although about 75 percent of the young turkey crop in North America is marketed from August through December, there is a trend towards lengthening the season by producing fryer-roaster turkeys for marketing at other times of the year. These lightweight birds, consisting for the most part of light-breed white turkeys of both sexes along with some females of the heavy-breed white turkeys, comprised about 14 percent of the total crop, or about 15 million birds in 1968. They are marketed at a fairly even rate throughout the 12-month year.

Most producers market their birds alive through integrated firms, processors, or cooperative organizations. The turkeys are collected and trucked to dressing plants where they are processed for market.

Turkey growers located near centers of population sometimes can sell their turkeys directly to consumers or to retail dealers. These growers usually have their own processing and freezing facilities and some of them have developed profitable gift-package businesses featuring high-quality, frozen, ready-to-cook turkeys that can be shipped long distances in sealed packages containing dry ice—about 1 ounce per pound of turkey. (See "Inspection and Grading.")

When to Market

Under optimum conditions of nutrition and management, all large broad-breasted turkeys, including those with dark plumage, are fully finished and ready to market as mature young roasters at 26 weeks of age for males and 24 weeks for females; small- and medium-type white turkeys of both sexes usually reach market maturity at 22 weeks. However, large-type white males sometimes can be marketed at 24 weeks. Large-type white females can be marketed at 12 to 13 weeks of age as fryer-roosters or at 17 to 20 weeks as light roasters. About 75 percent of the small- and medium-type white turkeys raised are marketed as fryer-roasters at 15 to 16 weeks of age when they average 8 to 9 pounds alive for both sexes combined. At the other extreme, large-type turkey males of all colors sometimes are grown to 28 or 30 weeks of age to produce extra-large, well-finished birds. Because these older birds cost more to produce, to be profitable, they should bring a higher price.

Where growing conditions are suboptimal or where slow-growing strains are used, turkeys may not attain the desired weights and qualities at the ages indicated above.

Selecting for Market

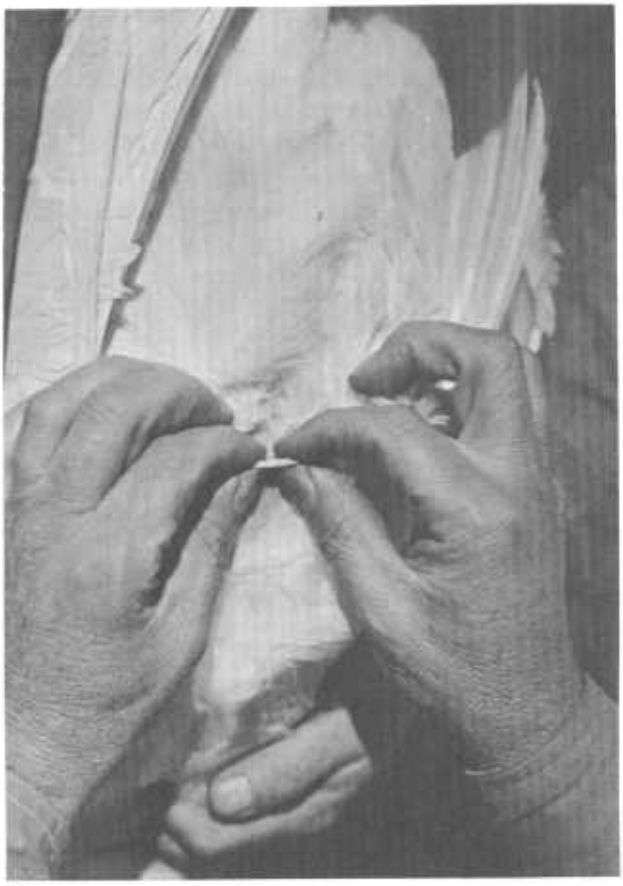
If rearing conditions have been favorable, the inspection of a few representative birds will tell whether or not the flock as a whole is ready for market. Under most conditions it is important to market only birds that are moderately fat and are free of pinfeathers that are dark or too short to be cleanly picked.

To determine market quality, first suspend the bird by the legs and examine the skin at the base of the wings, over the breast, and on the drumsticks for the presence of these dark, short pinfeathers. Such pinfeathers will leave a deposit of dark feather pigments that will lower the market grade. Next, pull a few feathers from the sparsely feathered area of the breast at a point about halfway between the front end of the breastbone and the base of the wing. Take a fold of skin between thumb and fore-

finger of each hand (fig. 33) and examine for thickness and coloration. On a Grade A turkey, the fold of skin in this particular spot (not in the heavily feathered area) will be white or yellowish white and quite thick, the minimum about equal to a fold of average-thickness blotting paper, or 1.75 millimeters (0.07 inch.) Well-fattened birds will have a thick cream-colored skin; under-fattened birds will have a thin, often paper-thin, skin, which is semi-transparent and tends to be reddish.

Preparing for Market

Turkeys that are to be marketed ready to cook and quick frozen, as most are in North America, usually are not fasted on the farm before slaughter but are taken directly off normal feed and water and moved to the processing plant. The delay involved usually provides sufficient fasting time.



76157–B

Figure 33.—**Determining finish (amount of fat) in skin of turkey.**

Where freezing facilities are not available, turkeys can be marketed alive, fresh-killed, ready to cook (chilled but not frozen), ice packed, or, rarely, chilled New York dressed (blood and feathers removed and the head wrapped in parchment or waxed paper) (fig. 2).

Turkeys marketed New York dressed must be fasted on the farm before slaughter. To do this, remove all whole or cracked grain the morning of the day before slaughter, but leave the ground feed before the turkeys until sundown of that day when the ground feed also is removed. If turkeys are kept without feed for more than about 18 hours, they lose too much weight and are likely to eat soil, litter, droppings, or feathers, thus defeating the purpose of fasting. Water is kept before the birds continuously as nearly as possible up to slaughter time.

Defects due to injuries sustained just before killing are common and cause downgrading. Care should be taken not to allow the birds to be bruised or scratched by flying or running against obstructions, or by piling and trampling each other. Toenail clipping, gentle handling, and the use of a catching chute or a catching pen that can be darkened so the birds can be picked up without confusion should reduce the injuries.

White-plumaged turkeys, if subscalded or slack scalded (semiscalded), usually can be cleanly picked at all ages since any imbedded pinfeather stubs are inconspicuous and harmless. However, all protruding pinfeathers must be removed.

Processing

The live turkey is suspended by the legs, the feet held in a steel shackle. The head is held in one hand, the fingers grasping the sides, but not the front, taking care not to compress the jugular veins located in the throat area on the ventral (lower) side of the neck. A strong, deep cut is made across the throat from the outside, close to the head, so that both branches of the jugular vein are cleanly severed at or close to their junction. Before the turkey is

bled, an electric stunner can be used to prevent struggling and relax the muscles that hold the feathers. As soon as breathing stops and bleeding is completed (1½ to 2 minutes), the feathers are loosened, usually by the *subscald method* in which the bird is immersed in agitated water at 140° F. (60° C.) for about 30 seconds. The feathers usually are picked by a rubber-fingered machine that also removes the cuticle or bloom, which is the thin outer layer of the skin. The pinfeathers are removed by hand and the bird is immediately eviscerated, never allowing the skin to dry out.

In one evisceration method, the turkey is suspended in the shackle by the head and both hocks. A crosswise cut is made between the rear end of the keel and the vent, which has been loosened by a circular cut around it. The intestines are loosened carefully and left hanging outside the body but still attached to it for inspection. The lungs and the oil gland at the base of the tailhead are removed. The kidneys usually are left in although most consumers prefer their removal. The head is cut off and the neck is severed at its junction with the body. The entire neck skin is slit along its *upper* surface and peeled back to the lower side of the body where it remains attached, later to be folded up over the neck opening. The crop, gullet, and windpipe are loosened, cut off close to the body, and removed. The gall bladder is carefully removed from the liver; the heart is trimmed; and the gizzard is split lengthwise through the thick muscle and the horny lining and contents of the gizzard are peeled out. The beard is snipped off close to the skin, and the shanks are removed by cutting down through the flat, forward surface of the hock joint. If desired, the bony tendons in the drumsticks of turkeys over about 16 weeks of age can be removed, but only in part, with a tendon puller before the shanks are cut off.

The eviscerated carcass is washed inside and out and the parchment-wrapped giblets and neck are placed inside the body cavity. The bird is then trussed by forcing the legs under the strip of abdominal skin between the crosswise cut and the opening where the vent was removed.

The trussed eviscerated carcass then is chilled in ice water or ice slush to an internal temperature of 35° to 39° F. (1.7° to 4.0° C.). To prevent toughness, young fryer-roaster turkeys of both sexes should be chilled for 12 to 24 hours; young roaster hens, 8 to 10 hours; and young roaster toms, 4 to 6 hours. For maximum tenderness, the longer chilling times mentioned are preferred. After chilling, the carcass is drained, a plastic wrap is applied, the air in it is exhausted by vacuum, and the wrapper is sealed. The bird is then ready for freezing or for marketing fresh killed, unfrozen.

If the *slack-scald* (*semiscald*) method of loosening feathers is used, the dressing procedure is similar to that of the subscald method, but the preferred scalding temperature is 126° F. (52° C.) and the time of immersion in agitated water is about 50 seconds. Slack-scalded turkeys can be picked mechanically, but the skin almost always is damaged so that immediate airtight wrapping or ice packing is necessary. If an undamaged skin is required, slack-scalded turkeys must be picked by hand and usually should be singed by exposing them lightly to a hot, smokeless flame.

Dry picking is little used today but is useful in situations where scald-picking facilities are not available or practical. However, immature turkeys of all types and all white turkeys are difficult to dry pick. Mature, dark-colored turkeys are best adapted to dry picking. The live bird is suspended by the legs in a steel shackle or by a strong cord, the end of which is passed through a hole in the center of a block of wood about 2 inches square. The cord is wrapped once or twice around the shanks and the block is tucked in snugly against the shank. The bird's head is held as suggested on page 73 but with the mouth held open with one finger. Into the mouth, insert a sharp, stiff knife with a very narrow blade about 4 inches long and make one or two slanting cuts well back in the *upper* surface of the throat to sever the jugular veins. As soon as profuse bleeding is established, thrust the knife backward, at an angle corresponding roughly with that of the upper beak, through the groove in the roof of the mouth and into the rear lobe of the brain at the back of the skull. Rotate the point of the

knife slightly to destroy enough brain tissue to cause loosening of the feathers. When the correct "stick" is obtained, the bird usually gives a characteristic squawk, the tail feathers are spread widely and all the feathers are loosened to permit easy picking by hand. An electric shocker or stunner can also be used to release the feathers.

After sticking or electrical shocking, continue to hold the bird's head and attach a hooked, weighted blood cup to the lower jaw. Do not lock the bird's wings or attempt to restrain its struggles. The operator can reach up under the bird, retaining hold of the head but allowing free movement of the wings. For large birds, blood cups should weigh 7 to 9 pounds; for small and medium-size birds, 4 to 6 pounds. An effect similar to sticking or shocking, but not quite so effective, can be obtained by dealing the bird a sharp but not killing blow with a stout club on the rear bulge of the skull.

After sticking and bleeding the bird, start the picking by first removing the large tail feathers, then the large wing feathers, then the bulk of the contour feathers, starting with the drumsticks and leaving the neck and adjacent breast feathers until last. After this rough picking of all sections, complete the picking with the aid of a rounded, dull-blade, pinning knife. Use a twisting motion to help loosen the large tail and wing feathers; use brisk movements against the grain to pull contour feathers in small clusters. The skin never should be rubbed to remove feathers but singeing after pinfeather removal is desirable.

Dry-picked turkeys usually are chilled by exposing them promptly to a free circulation of cold air at 30° to 39° F. (−1.1° to 4.0° C.) for 8 to 24 hours to lower the internal temperature to about 35° (1.7° C.). If cold air is not available, chilling can be done in ice water. Internal temperature is taken by inserting a thermometer well into the vent.

Inspection*

Inspection refers to the examination of birds for indications of disease or other conditions that might make them unfit for human consumption. The Poultry Products Inspection Act, which became fully effective in 1959, required all ready-to-cook poultry and poultry products moving in interstate or foreign commerce to be federally inspected at no direct cost to the owners. New York-dressed poultry cannot move in interstate commerce unless it is shipped from one official plant to another for evisceration or is intended for the "Kosher" trade. In both cases this poultry is exempt from the Act. In 1968, the Act was amended to provide free Federal inspection for poultry and poultry products in *intrastate* commerce. The States have a specified time to develop inspection systems with the assistance of the Federal Government. If they do not provide an inspection system within this time, the intrastate plants (those that do not ship across State lines) also must come under Federal inspection. Persons exempt from all provisions of the Act are those slaughtering not more than 250 turkeys raised on their own farm and those producing for "Kosher" trade. Those who process or slaughter from 250 to 5,000 turkeys per year for intrastate marketing would be required to meet certain provisions that may be prescribed by the Secretary of Agriculture, but would not be required to have their birds federally inspected.

Ante-mortem inspection of poultry is required before it enters the processing plant. This inspection is essentially a spot check of each lot of birds, not of each individual bird.

Post-mortem inspection of each bird should take place at the time the abdominal cavity is opened and the visceral organs are removed.

Grading

Grading consists of identifying individual birds according to class, quality, and weight. Final grading of ready-to-cook poultry should be after the birds are eviscerated and cooled and before they are packaged, frozen, or further processed, but not while they are still warm.

The U.S. Department of Agriculture standards of quality that have been established for ready-to-cook poultry are A, B and C. These grades are based on conformation, fat covering, and degree of freedom from skin tears, skin blemishes, and pinfeathers. The

U.S. Grade mark can be used only when the birds have been officially graded under the voluntary U.S. Department of Agriculture grading program.*

The Grade A turkey is well fleshed, well covered with fat all over the body, well dressed, well bled, and practically free from skin tears, discolorations, pinfeathers, and calluses and blisters containing pus or blood. There are no broken or severely crooked bones. The carcass is clean, attractive, and wholesome.

The Grade B turkey may be slightly lacking in meatiness and fat or may have a few scattered pinfeathers or discolorations of the skin. There may be a broken bone or the bird may be slightly misshapen, but the carcass must be clean and wholesome.

The Grade C turkey may be poorly fleshed on breast and legs, with little or no fat. It may have a prominent breastbone and the leg, wing, or breastbone may be misshapen, or bones may be broken. There may be any number of skin cuts, discolorations, or tears of the skin and a scattering of pinfeathers. However, the body must be free from protruding pinfeathers, the flesh must be substantially intact, and the carcass must be clean and free from indications of decomposition.

Packaging Processed Turkeys

All containers and packaging materials used for processed turkeys should be new and strong enough to carry the birds in good condition. The containers should be made of odorless materials that will not contaminate the product.

At the time of packaging, ready-to-cook turkeys should be clean and drained free of water and ice to avoid seepage of unsightly bloody water into the ice or packing materials.

When ready-to-cook turkeys are marketed fresh killed (chilled but not frozen), they usually are individually wrapped in plastic bags and shipped refrigerated or ice packed in boxes, barrels, or drums with parchment-paper liners.

Whole, ready-to-cook turkeys generally are packaged individually in bags made of a plastic film that is relatively transparent and tough and impermeable to moisture and air. If turkeys are marketed frozen, the air should first be removed by vacuum and the wrapper then sealed.

Freezing and Storing

Following adequate chilling, the tightly wrapped, processed turkeys should be quick frozen and stored at an even temperature of −10° F. (−23.5° C.) or lower. Chilled birds can be quick frozen by placing them on racks and exposing them to circulating air at −20° F. (−29° C.) or lower until frozen solid, which should require not more than 90 minutes.

Frozen turkeys of excellent market quality can be produced by proper processing, chilling, packaging, quick freezing and storing, and the quality can be maintained for at least 1 year.

Turkey Meat Products

Most turkeys are marketed whole, eviscerated, and frozen. A relatively small number are marketed whole, fresh killed, and unfrozen. These fresh-killed birds usually bring premium prices but they are perishable and should be kept refrigerated at about 35° F. (1.7° C.).

Further processing of turkeys* is a relatively new development utilizing mostly large toms to produce turkey rolls, roasts, breasts, pot-pies, turkey parts, dinners, canned boned turkey, turkey soups, baby foods, steaks, patties, fillets, croquettes, sticks, cooked sliced meat, turkey with noodles, fricassee, and a la king. Ready-to-eat smoked turkey is a speciality product utilizing mostly large hens. Turkey rolls are prepared by boning the bird and wrapping the meat tightly in the skin. Rolls are of various sizes and contain an all-light meat, all-dark meat, or mixed meat. (Fig. 34.)

Most turkeys marketed whole are Grade A. To the greatest extent possible, grades B and C and low-priced parts are utilized in further processing.

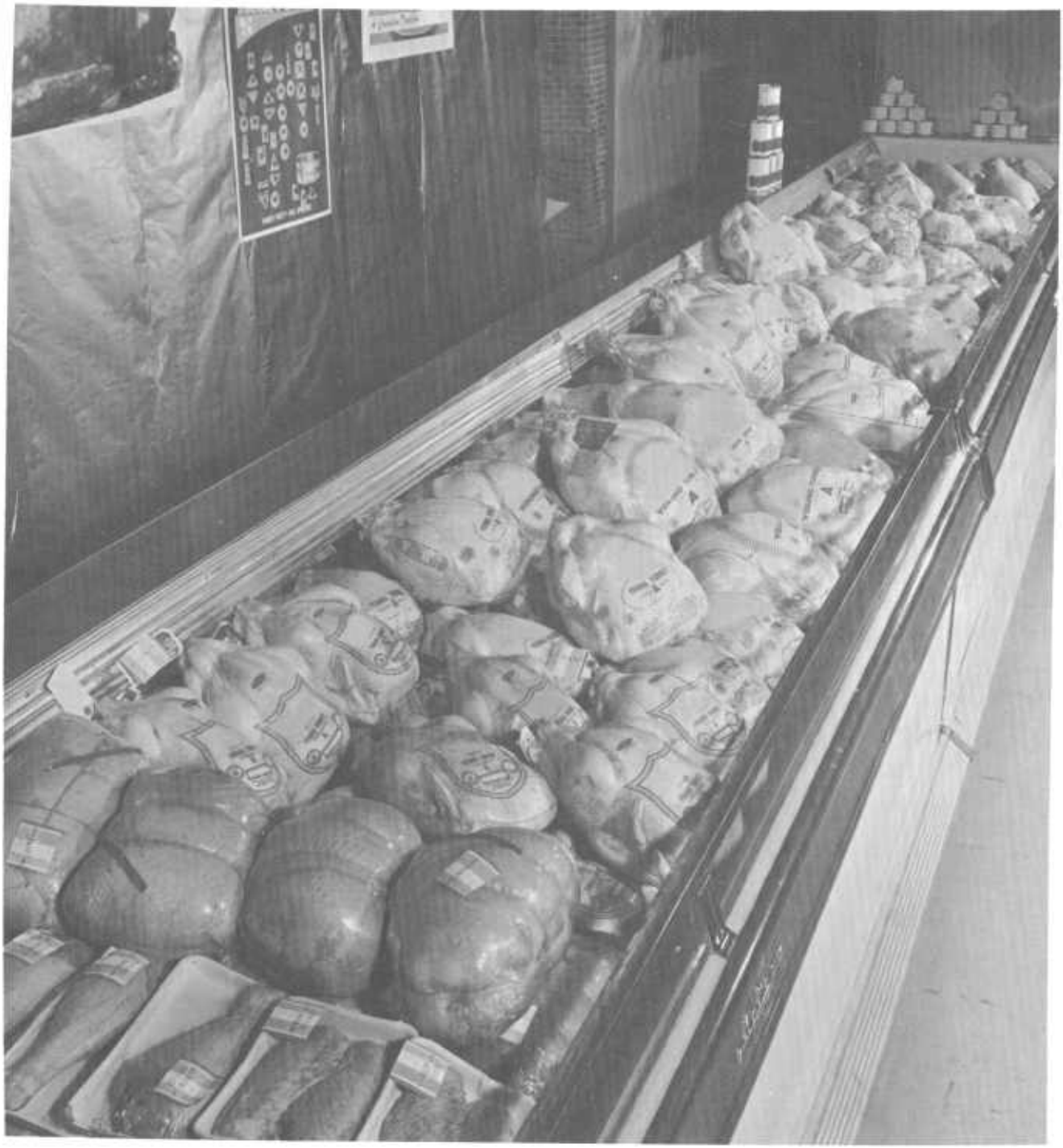


Figure 34.—Retail display of turkey meat products. *Top to bottom:* Canned turkey, large whole turkeys, medium-size whole turkeys, turkey rolls, turkey parts. (Photo from Canada Department of Agriculture.)

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