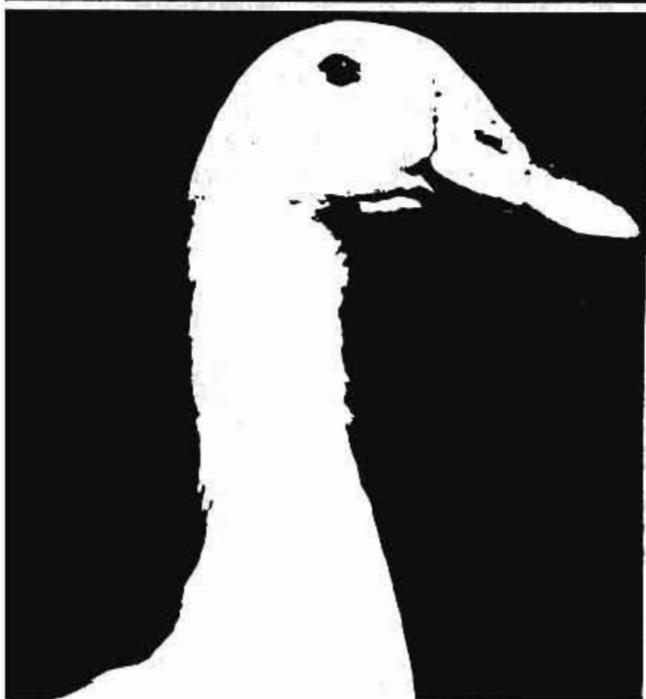
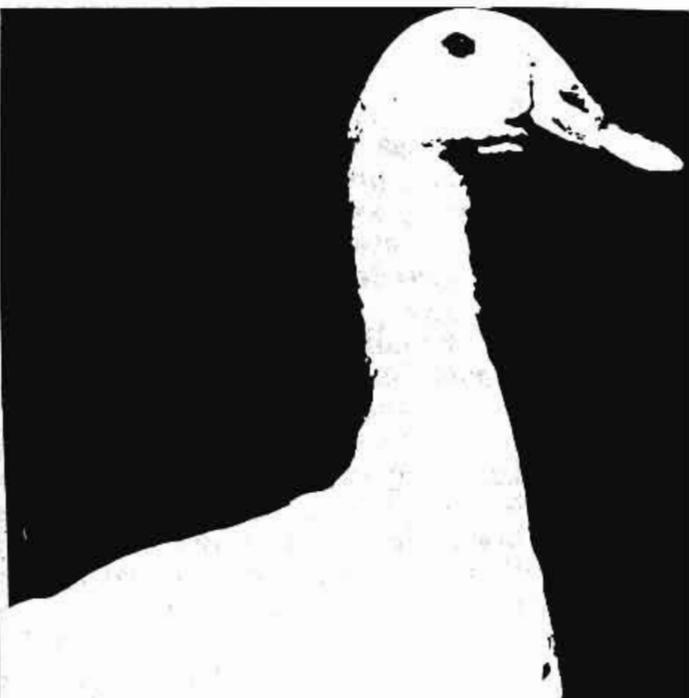
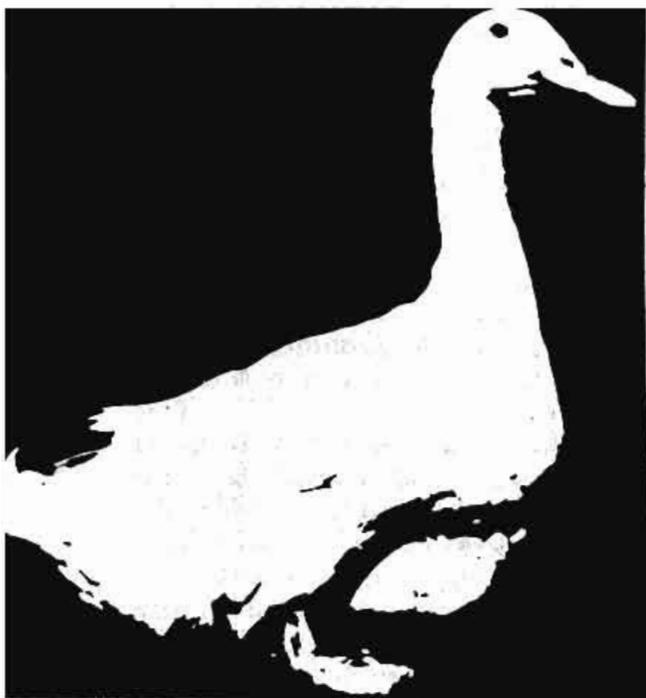


RAISING DUCKS



UNITED STATES
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AGRICULTURE

FARMERS'
BULLETIN
NUMBER 2215

PREPARED BY
SCIENCE AND
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RAISING DUCKS

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The number of ducks raised annually for meat in the United States is in the neighborhood of 10 million. Little change in production has occurred in the past few decades.

Approximately 60 percent of the ducks are raised on Long Island, N.Y. Although climatic conditions on Long Island are ideal for duck production, there is a possibility that major production could shift to areas where feed and labor costs are less, and where real estate values and property taxation are more advantageous to the farmer.

Most meat ducks are marketed as ducklings—ducks 7 to 8 weeks of age. Major producing areas usually have one or more modern processing plants to handle the birds. They are generally sold frozen and ready to cook after thawing. Most

are marketed through supply houses and retail grocery outlets. Farmers who raise limited numbers of ducks usually rely on special retail outlets that sell live or fresh killed ducklings.

Considerable competition exists in the marketing of ducklings. Farmers who raise small numbers should try to develop a special market—a local one if possible. Duckling is generally regarded as a special item to be prepared by the homemaker for holidays or to be served in restaurants. Marketing programs should be developed to service these outlets.

There is little demand for duck eggs in the United States. But small egg-laying flocks could provide a side income for farmers who are able to establish a special retail outlet.

BREEDS

The choice of breeds depends upon the market you are supplying. White Pekin, Aylesbury, and Muscovy ducks are excellent meat producers. Rouen, Cayuga, Swedish, and Call ducks reach weights that make them valuable as meat producers, but poor egg production, and to some extent colored plumage, make them unsatisfactory for mass commercial production.

Khaki Campbells and Indian Runners are excellent egg-laying breeds. Where special duck egg markets exist, the choice of either of these breeds would be wise.

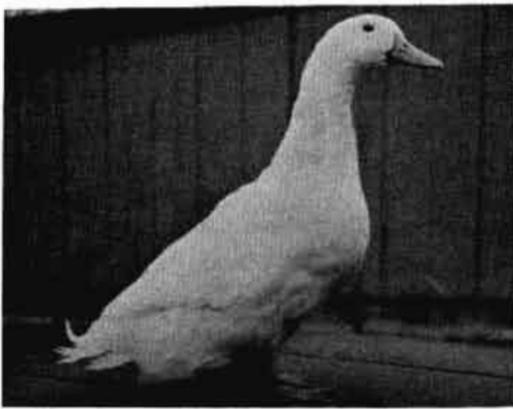
Meat Breeds

White Pekin

The commercial duck industry in the United States relies solely on the White Pekin (fig. 1). White Pekins are ideally suited for meat production. They produce excellent quality meat, and they reach market weight (7 pounds) in 8 weeks.

The breed originated in China and was introduced into the United States in the late 1870's. White Pekins are large white-feathered birds. They have orange-yellow

¹ Current edition reviewed by H. Graham Purchase, NPS, Poultry, Livestock and Veterinary Sciences, Beltsville Agricultural Research Center—West, Beltsville, Md. 20705.



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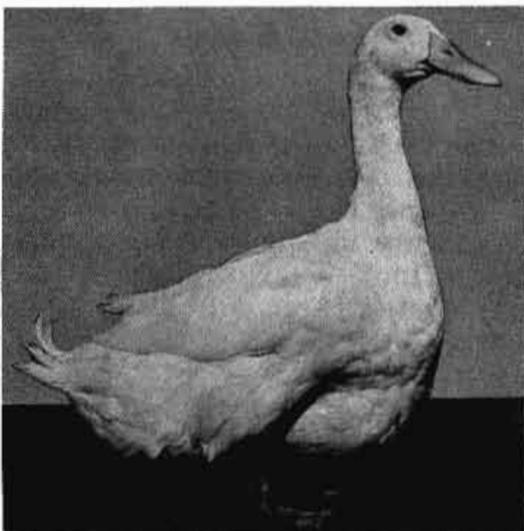
Figure 1.—White Pekin drake.

bills, reddish-yellow shanks and feet, and yellow skin. Their eggs are a tinted white. Adult drakes weigh 9 pounds and adult ducks (females) 8 pounds.

White Pekins are fairly good egg producers—average yearly production approximates 160 eggs—but they are not good setters and they seldom bother to raise a brood. They are nervous and should be treated gently to obtain maximum egg production.

Aylesbury

The Aylesbury (fig. 2) is as popular in England, where the breed originated, as the White Pekin is in the United States. Aylesburys



4947-C

Figure 2.—Aylesbury drake.

produce excellent quality meat, and like White Pekins they reach market weight in 8 weeks.

Aylesburys have white feathers, white skin, flesh-colored bills, and light-orange legs and feet. Eggs are a tinted white. Adult drakes weigh 9 pounds and adult ducks 8 pounds.

Aylesburys are not as nervous as White Pekins but they rank with the latter in their lack of interest in setting. Egg production is generally below that of White Pekins but extraordinary records of 300 eggs per laying year have been attained.

Muscovy

The Muscovy is unrelated to the other breeds mentioned in this publication. The breed originated in South America. Numerous varieties of Muscovies exist; the white variety (fig. 3) is the most desirable for market purposes. Muscovies produce meat of excellent quality and taste, provided they are marketed before 17 weeks of age. But their low egg production makes them unsuitable for use on large commercial duck farms. Muscovies have white skin. Adult drakes weigh 10 pounds and adult ducks 7 pounds.

Muscovies make extremely good setters. They will hatch and care for approximately 30 ducklings from the 40 to 45 eggs they produce annually.

Although they are not ideally



Figure 3.—White Muscovy drake.

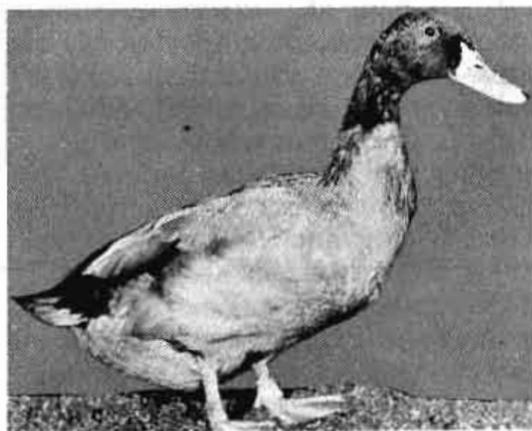
suited to commercial production, Muscovies have excellent possibilities for small general farms that have special retail outlets.

In some areas of the world, hybrid "mule ducks" are produced by mating female Muscovies to Mallard-type drakes. "Mule ducks" produce satisfactory meat yields but they are sterile.

Egg-Producing Breeds

Khaki Campbell

Amazing egg-production records have been made by the Khaki Campbell (fig. 4). Strains selected especially for high egg production



68224-B

Figure 4.—Khaki Campbell drake.

have averaged close to 365 eggs per duck within a laying year. The highest producing strains of chickens have yet to average 300 eggs per laying year.

Khaki Campbells originated in England as a cross of Fawn and White Runner, Rouen, and Mallard ducks. Khaki best describes the appearance of Khaki Campbells. Males have brownish-bronze lower backs, tail coverts, heads, and necks; the rest of their plumage is khaki. They have green bills and dark-orange legs and toes. Females have seal-brown heads and necks; the rest of their plumage is khaki. They have greenish-black bills and brown legs and toes.

Khaki Campbells are not valued

for their meat. Young drakes and ducks weigh $3\frac{1}{2}$ to 4 pounds at 2 months of age; adult drakes and ducks weigh $4\frac{1}{2}$ pounds.

Another variety, the White Campbell, has sprung from the Khaki but it has not become a popular egg-producer. White Campbells have orange bills and legs.

Indian Runner

The Indian Runner originated in the East Indies but its egg-producing capabilities were developed in Western Europe. Although at one time they were considered to be the best egg-producing duck breed, Indian Runners are now second to the high-producing strains of Khaki Campbells.

Three Indian Runner varieties are recognized: White (fig. 5), Penciled, and Fawn and White. All three varieties have orange to reddish-orange feet and shanks. Characteristically the Runners stand erect; their carriage is almost perpendicular. They weigh about the same as Khaki Campbells.



4986-C

Figure 5.—White Runner drake.

BREEDING STOCK

Selection of Breeders

Meat-type breeding stock is usually selected from market flocks hatched in April and May. The potential breeders are selected from the flocks when the birds are 6 to 7 weeks of age. At this time the distinctly different voices of males and females make it easy to separate the birds—females “honk,” males “belch.” Care should be taken to select the proper number of each sex—one drake to six ducks is recommended. Select a small percentage of extra ducks and drakes to allow for mortality and further selection during the conditioning period. Drakes should come from the earlier hatched flocks to insure their readiness for mating by the beginning of the following year.

Select breeders that are vigorous and have good weight, conformation, and feathering. Drakes that weigh 5½ pounds at 6 weeks should weigh 7½ pounds by 8 weeks; ducks that weigh 5½ pounds at 6 weeks should weigh 7 pounds by 8 weeks.

Selection of progeny from ducks having high fertility, hatchability, and egg production can be accomplished through a program of trapnesting and family or progeny testing. Fertility, hatchability, and egg production are as important as body weight, conformation, and feather covering to the producer of market ducklings.

Breeder Facilities

Most duck eggs are laid at night. It is common practice to confine breeders to the laying houses only at night. During the day breeders have access to yards and waterways. With this system there is little need for expensive breeder facilities. A simple shed or house is all that is needed.

Commercial growers often run as many as 500 breeders together in one flock. But smaller flocks, 50 to 60 breeders, may outlay and produce a greater percentage of fertile eggs than larger flocks. Laying house mortality may also be less in smaller flocks.

Provide 5 to 6 square feet of floor-space per bird in the breeder house and about 40 square feet per bird in the yard.

Breeder houses must be one-story because domestic ducks, with the exception of Muscovies, cannot fly. Keep breeder houses clean, dry, and well ventilated. Leave windows and doors open during the day to allow adequate circulation of air. Good ventilation is also needed at night to prevent overheating during summer and to reduce condensation during the winter. Care should be taken to prevent the entry of rain and snow through the ventilating system. Supplementary heat need not be supplied to breeding stock.

Straw makes good bedding material. Peat moss, peanut shells, or wood shavings can also be used. Litter should be added frequently and it should be kept dry by providing plenty of fresh air. Remove damp litter before it starts to mold.

Ducks will make their own nests in the litter, but simple nest boxes can be provided in long rows along the wall. Nests should be 12 inches wide, 18 inches deep, and 12 inches high. Place them at floor level.

The use of outside drinking facilities instead of water fountains within the building has the major advantage of preventing wet pens. Ducks can be left without water during night confinement provided they have no access to feed. If it is necessary to provide watering facilities within the house, place the water supply above wire flooring or a screened drain.

Yards should slope gently away from the breeder houses to provide good drainage. Failure to provide enough open, well-drained yard space will cause dirty runs and increase the danger of disease.

Although most commercial producers provide swimming water for their breeding flocks, swimming water is not needed for the production of fertile eggs. Swimming water can be provided in concrete troughs. They should be about 3 feet wide and 8 to 12 inches deep. Locate the troughs at the end of the yard opposite the breeder house.

Ducks are nervous and may run in circles if disturbed in the dark. The larger the flock, the more serious the problem. All-night lights should be used in the house if stampeding is a problem. One 15-watt lamp per 200 square feet of floor-space is adequate.

Egg Production

Ducks hatched in April through July will reach sexual maturity at 7 months of age. Those hatched in September through January will mature 1 to 2 months sooner because they will be subjected to increasing day lengths during the rearing period.

It is not desirable to bring birds into full production before 7 months of age, because of the problem of small eggs and low hatchability. Ducks can be brought into full production by giving them 14 hours of light daily. Give females light 3 weeks before the time desired for the start of egg production; give drakes light 4 to 5 weeks before the start of egg production so they will be ready for mating. The 15-watt lamps used to reduce stampeding will stimulate egg production, but larger lamps (40 to 60 watts) are best for this purpose.

Egg production increases rapidly once sexual maturity is reached.

The flock should be laying 90 percent or more of full production within 5 to 6 weeks. Daily egg production will remain above 50 percent for about 5 months in meat-type breeds. High-producing egg-type breeds will have greater persistency.

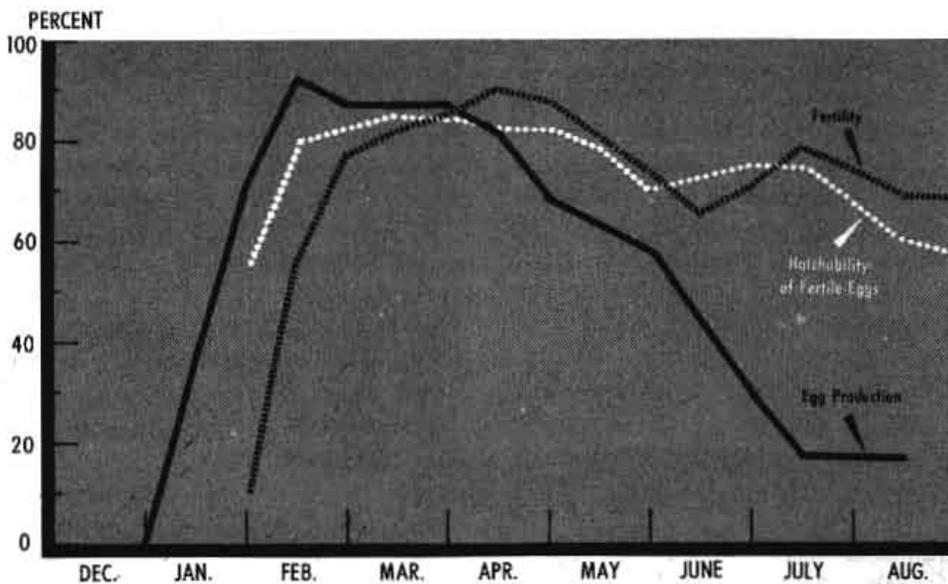
Producers have varying opinions about the value of keeping breeding stock once the level of egg production sinks below 50 percent. Some find it more economical to force-molt the birds at this level, then bring them back into production in 8 to 10 weeks. Others obtain all possible eggs until production reaches 30 percent; then they either rest the birds for an additional lay or sell them for meat.

Levels of fertility and hatchability generally parallel those for egg production (fig. 6). Highest values come when egg production is high; then it tapers off toward the end of the production cycle. Lack of mating experience is usually responsible for low fertility early in the season. Fertility should increase rapidly during the first few settings of eggs. Failure to obtain satisfactory levels of fertility and hatchability calls for a thorough inspection and evaluation of all phases of management.

Handling Eggs

Most duck eggs are laid before 7 a.m. It is advisable to gather them at this time because prompt collection lessens the problem of soiled and cracked eggs. Let the breeding stock out of the house when you start making the first collection. If some ducks are laying, let them remain on the nest and make a second collection a couple of hours later.

Clean, dry, breeder houses are essential for the production of clean hatching eggs. Good ventilation plus the frequent addition of litter and nesting material should be the rule. Wash soiled eggs with great



N-21378

Figure 6.—Typical rate of egg production and fertility and hatchability of the eggs from a commercial breeder flock of May-hatched White Pekin ducks.

care immediately after collection. Wash the eggs in water warmer than the eggs themselves—110° to 115° F is adequate. Do not use water colder than the eggs because cold water will cause contraction of the egg contents, and dirt, bacteria, and mold spores may be drawn through the pores of the shell. Good egg sanitizers can be purchased at most farm supply stores—follow the manufacturer's directions.

Cracked, misshapen, or abnormally small or large eggs should not be saved for incubation. Their hatchability will be practically nil.

Store hatching eggs at a temperature of 55° F and a relative humidity of 75 percent. Eggs do not need turning if weekly settings are made. Hatching eggs may be stored for 2 weeks without marked reduction in hatchability, but they should be turned daily after storage for more than 1 week. Eggs should be stored *small end down*.

Precautions should be taken to prevent the flow of air from the cooling unit from passing directly over the eggs. Excessive evaporation and enlargement of the air cell in the large end of the egg will decrease hatchability.

INCUBATION

Muscovy eggs require 35 days of incubation; all other domestic duck eggs require 28 days of incubation.

Artificial Incubation

Incubators designed for hatching duck eggs are available, but when only a few eggs are to be hatched the regular chicken-egg machine may be used. For best results, follow the manufacturer's directions.

Start the incubator a day or two in advance of the first setting. This will allow you to bring the machine into correct incubation condition before the eggs are set.

Remove duck eggs from the storage area 5 to 6 hours before being set. This gives them time to warm to room temperature and lessens the drop in temperature of the incubator when the eggs are set. Place the eggs in the incubator

small end down. In some small machines, eggs can be incubated level.

Most incubators are equipped with automatic turning devices. Set the device to turn the eggs every 3 hours. If manual turning is necessary, it should be done at least three or four times daily.

Candle the eggs after 7 to 8 days of incubation. This can be done by passing each egg over a small hand candler or by placing an entire tray of eggs above a bright light.

The living embryo of a fertile egg will appear as a dark spot in the large end of the egg near the air cell. Blood vessels radiating from this spot give the appearance of a spider floating within the egg. An embryo that has died before candling will appear as a spot stuck to the shell membranes. Clearly radiating blood vessels will not be visible and a dark ring of blood can often be observed. Infertile eggs will appear clear.

Remove infertile eggs and eggs containing dead embryos from the incubator. Cracked eggs and those with ruptured yolks can also be detected and removed during the candling operation.

Eggs are frequently candled again after 25 days of incubation (32 days for Muscovy eggs). At this time the bills of normally developing ducklings can be seen within the air cells. Considerable movement can also be seen.

On large commercial farms, ducklings are frequently taken from the machines as they hatch. However, great care must be taken to prevent chilling of newly hatched ducklings. It may be wise for small producers to keep the machine closed until hatching is completed (fig. 7).

Ducklings that must be helped from the shell should not be saved for breeding stock. Hereditary factors may be partially responsible for this condition.

FUMIGATION

The passage of bacteria through the pores of the shell into the interior of the egg will kill developing embryos and cause rotting and formation of gas inside the shell. These eggs may explode and spew contaminated material throughout the incubator. This problem can be prevented by fumigation of eggs within 12 hours after setting them in the incubator. The machine should be running at normal operating temperature and humidity.

To fumigate 100 cubic feet of incubator space, place 40 grams ($1\frac{1}{3}$ ounces) of potassium permanganate crystals in an earthen or Pyrex dish that is about 4 inches high and 8 inches in diameter. Place the dish in the incubator and add 80 cc. ($2\frac{2}{3}$ ounces) of formalin to the crystals. Shut the doors and vents tightly for 20 minutes, then open the vents to

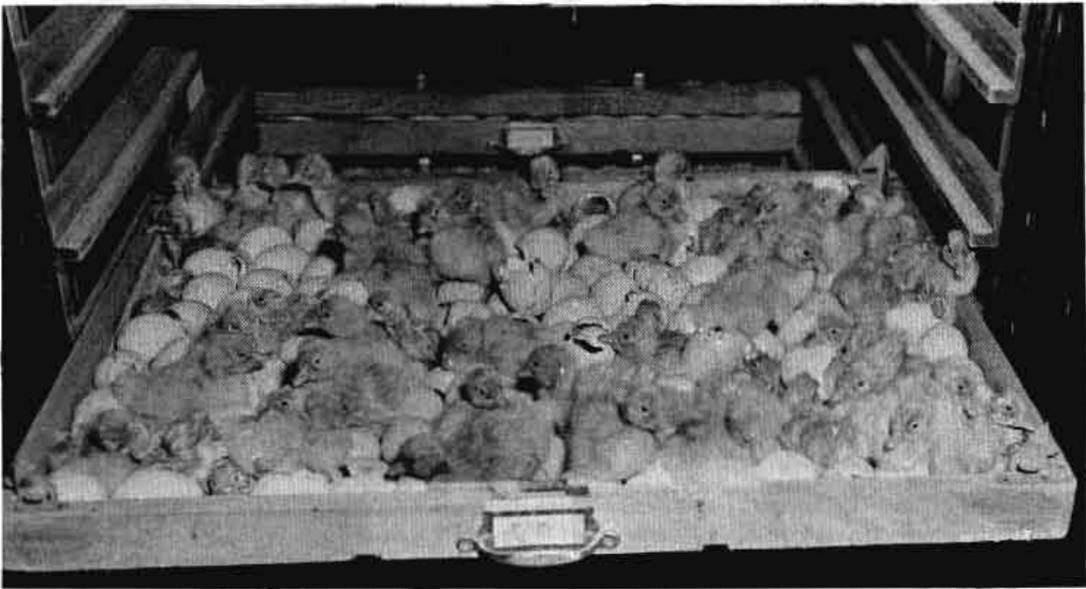
their proper positions and let the fumes dissipate.

Do not allow the eggs to become overheated during the fumigation treatment. Care should be taken not to expose the eggs to fumigation between the 24th and 84th hour of incubation.

Wash the hatcher thoroughly and fumigate after each hatch. Use the same proportions of potassium permanganate and formalin used to gas the eggs.

PRECAUTION

Do not inhale the irritating fumes of formaldehyde gas that are liberated when the potassium permanganate and formalin are mixed together. Provide plenty of ventilation in the incubator room and do not remove the reusable container from the incubator until the fumes have fully dissipated.



N-50453

Figure 7.—Tray of eggs about two-thirds hatched.

Natural Incubation

Natural methods of incubation are frequently used on small farms. This is especially true when Muscovies are raised. These ducks are excellent setters and will incubate their eggs without difficulty.

Other meat- and egg-type breeds do not set regularly. These breeds can be naturally hatched under broody hens if they are available.

Clean, dry nesting facilities must

be provided for setting hens and ducks. Feed and water should be within close proximity because the female must obtain her daily requirements within short periods of time. Delay in finding feed and water will result in undue chilling of the eggs. This situation is more critical with broody hens because they will have to keep their nests for 1 week longer than if they were setting on chicken eggs.

BROODING AND REARING

Move ducklings from the hatcher to comfortable brooding quarters as quickly as possible. Prevent chilling and do not overcrowd the birds during transit. Provide feed and water for ducklings as soon as they are placed in the brooder.

Buildings of practically any type can be used to brood ducklings as long as the birds are kept warm, dry, and free of drafts. Ventilation systems and windows should be designed so fresh air can be brought into the building without chilling the ducklings.

Floors can be either wire or litter. If the expense can be justified,

welded wire ($\frac{3}{4}$ -inch) about 4 inches above concrete is the most satisfactory type of flooring. It may be used over the entire floor space or over only part of the floor. Wire flooring has the major advantages of keeping ducklings away from manure and dampness, and it can be washed down daily if adequate floor drains are present.

Litter flooring may be more practical for most small producers. Straw, wood shavings, and peat moss make good litter. Make sure litter is free of mold. Moldy litter can cause high mortality in young stock.

Ducklings grow rapidly. Make sure they have adequate floorspace. For 3-week-old ducklings, allow $\frac{1}{2}$ square foot of space per bird on wire and 1 square foot per bird on litter. If confinement rearing is practiced, increase the floorspace to 2.5 square feet per bird by 7 weeks of age.

Ducklings need supplementary heat for about 4 weeks after they hatch. In hot summer weather, heat may be needed for only the first 2 or 3 weeks. Electric, gas, coal, or wood-burning brooder units can be used for small operations. For larger operations, forced hot-air or hot-water systems are more efficient because they require less labor and fuel.

Keep the brooder temperature at 85° to 90° F the first week, then reduce the temperature 5° per week during succeeding weeks. By 4 weeks the ducklings will be feathered enough to venture outdoors in all but extremely cold weather. If hovers are used the first week, use brooding guards to keep the ducklings confined to the comfort zone.

Ducklings need clean drinking water at all times. It may be supplied in hand-filled water fountains or by automatic waterers. To prevent wet litter, place the water supply above wire flooring or on a screened drain. Clean watering devices daily.

Give ducklings access to outside yards when they are old enough to tolerate weather conditions. The young birds will manage nicely on grassy areas that have adequate shade. Although they are waterfowl, ducklings cannot tolerate chilling rains until they are about 4 weeks old. Give young ducklings shelter at the first signs of precipitation. This precaution can usually be ignored when the ducklings are 4 weeks old. Birds 5 to 8 weeks of age need shelter only in extreme winter conditions.

Yards should slope gently away from the houses to provide drainage. Locate watering facilities at the far end—lowest point—of the yard. Most commercial growers provide swimming water for the



Figure 8.—Swimming water for ducklings at the low end of the yard.

ducklings at 5 weeks of age (fig. 8). However, ducklings can be raised without swimming water. Stagnant pools of water anywhere in the yards are sources of disease and every possible measure should be taken to prevent their formation.

Accumulations of manure will build up in yards after a few weeks. The rate will depend on the density of the stock—75 square feet per duckling is ideal for large flocks. If the yards are located on light sandy soil, it will be relatively easy to scrape off the top surface. Periodic cleaning of yards should be part of the planned work schedule.

Feather pulling beginning at 4 weeks of age may be a sign of overcrowded conditions in the yards and houses. Steps should be taken to stop this vice as soon as it starts. Give the birds additional space. If feather pulling continues, it may be necessary to debill the birds. This can be done by snipping off the forward edge of the upper bill.

Night lights should be used to prevent running and to insure that birds find their feed and water. Use one reflected 15-watt lamp per 200 square feet of floorspace. String some 20- to 25-watt lamps with reflectors on poles if the birds are confined to outside yards.

NUTRITION

Maximum efficiency for growth and reproduction can be obtained by using commercially prepared diets which are sold in pellet form. Pellets are recommended instead of mash because they are easier to consume, they reduce waste, they do not blow away, and feed conversion is usually superior. Lack of pelleted feed should not discourage farmers who wish to produce ducklings on a small scale. Satisfactory results are possible with mash.

Four diets are recommended: Starter, grower, breeder-developer, and breeder. Examples of each are presented in table 1. Use pellets $\frac{1}{8}$ inch in diameter for the starter diet; use pellets $\frac{3}{16}$ inch in diameter for the grower, breeder-developer, and breeder diets.

Feed ducklings the starter diet the first 2 weeks after they hatch. To encourage early consumption, place the feed in baby-chick sized hoppers and locate them close to the water supply. When ducklings reach 2 weeks of age, switch them to the grower diet. Feed this diet until the ducklings are ready for market.

Young drakes and ducks selected

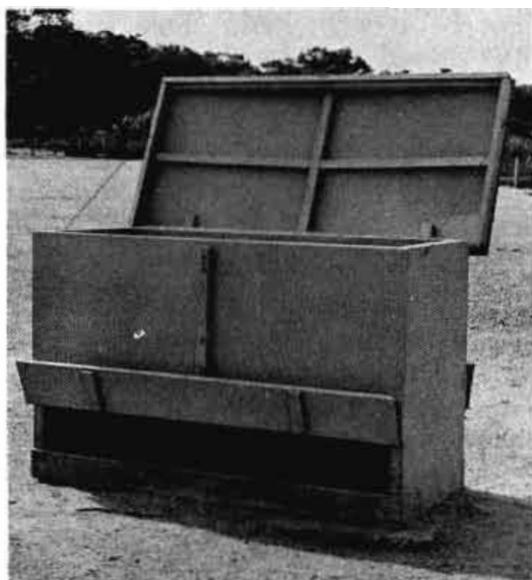
as potential breeders should be fed a breeder-developer diet. This special diet contains less energy per pound of feed than the starter or grower diet. When fed in restricted amounts, the diet will keep the breeders from putting on excess fat but it will provide the nutrients needed. For each 100 breeders feed 45 pounds of the breeder-developer diet daily. Feed half in the morning and half in the late afternoon. Scatter the pellets over a large area so all birds get a chance to obtain their daily requirements. If mash is fed, use a large number of feed hoppers.

Increased requirements for reproduction make it essential to feed breeding stock a breeder diet. Switch the breeders to the breeder diet about 1 month prior to the date of anticipated egg production. To insure good eggshell quality, give the breeders oystershells. They can be fed free choice in separate hoppers within the breeder pens.

Many types of feeders can be used for ducks. Ordinary hoppers used in commercial chicken production work well provided they are arranged at floor level. Since ducks

grow at fairly rapid rates and consume large quantities of feed in short periods of time, it is advantageous to use hoppers that hold large quantities of feed. Small feeders can be used until the ducklings are 2 weeks old. Larger feeders should be used for older market ducklings and breeding stock (fig. 9). Feed hoppers that are used outdoors should have lids that fit securely.

Provide water whenever feed is available. This is especially important when breeders are confined during the night. If hoppers are within the building and water supplies outdoors, hoppers should be closed overnight to prevent the breeders from choking on dry feed. Open the hoppers in the morning as soon as the birds have access to water. Breeders will adjust to this routine and egg production will not be affected.



4-50444

Figure 9.—A self-feeder for outdoor use. It holds about 500 pounds of pellets and is ideal for breeding stock or ducklings over 2 weeks of age.

MARKETING

Pekin-type meat ducklings are ready for market between 7 and 8 weeks of age if they have been fed high-energy diets and have undergone some degree of selection for early maturity. Muscovies are not ready for market until 10 to 17 weeks of age. Ducklings should have good finish and be free of pin feathers when sent to slaughter. Careful observation of both traits should be made during the latter part of the rearing period.

Pekin-type males and females perform differently. Males grow to heavier weights by 7 to 8 weeks and they convert their feed more efficiently than females. These differences become apparent after 6 weeks of age. More economical feeding costs are possible if females are marketed at 7 weeks of age.

Keep feed from the birds 8 to 10 hours before slaughter. Provide cool water up to the time of killing.

Clean, uncrowded rearing facilities will help to prevent bruising, cutting, and other factors that cause poor market acceptability. Ducklings can be transported in crates or herded into trailers for delivery to the slaughterhouse.

Construction of elaborate slaughtering facilities is justified only for large commercial operations. If live markets are not available, small farm flocks can be processed by using facilities similar to those used for small chicken flocks.

For slaughter, hang ducklings by the feet or place them in special slaughtering funnels. Take a long, thin, sharp knife and draw it across the outside of the throat high up on the neck just under the lower bill. This will sever the jugular vein and allow swift, complete bleeding.

When bleeding has ceased, birds can be scalded and picked or they

can be dry picked. Dry picking has the advantage of producing exceptionally attractive carcasses, but it is slower and there is greater danger of tearing the skin. For scalding, immerse the ducklings for 3 minutes in hot water (140° F). Pick immediately after scalding and remove all remaining pin

feathers; grasp the pin feathers between the thumb and a dull knife.

In large commercial slaughterhouses, ducklings are dipped through a molten wax after they have been picked. When the wax hardens—by immersion in cold water—it can be peeled free to remove any feathers that remain.

TABLE 1.—*Ingredients needed to mix 1 ton of feed for complete duck diets*

Ingredients ¹	Unit	Starter diet	Grower diet	Breeder-developer diet	Breeder diet
Cornmeal, yellow.....	lb.	1, 265	1, 443. 2	660	1, 080
Oats or barley, pulverized.....	lb.	-----	-----	195	95
Wheat, standard middlings.....	lb.	-----	-----	800	200
Soybean oil meal (44 percent protein).....	lb.	-----	-----	100	-----
Soybean oil meal (50 percent protein).....	lb.	540	360	-----	150
Alfalfa meal (17 percent protein).....	lb.	20	20	200	100
Fish meal (60 percent protein).....	lb.	60	60	-----	100
Fish solubles, dried basis.....	lb.	10	10	-----	-----
Meat scrap (50 percent protein).....	lb.	-----	-----	-----	100
Brewer's yeast, dried.....	lb.	-----	-----	-----	50
Whey, dried product.....	lb.	20	20	-----	50
Grain distiller's solubles, dried.....	lb.	20	20	-----	-----
Dicalcium phosphate.....	lb.	26	28	20	-----
Limestone, ground.....	lb.	20	20	10	60
Salt, iodized.....	lb.	6	6	5	5
Manganese sulfate, feed grade.....	lb.	0. 6	0. 6	0. 5	0. 5
Zinc oxide.....	lb.	0. 2	0. 2	0. 2	0. 2
DL-methionine, feed grade.....	lb.	2	2	-----	-----
Stabilized vitamin A.....	IU ²	5, 000, 000	5, 000, 000	2, 000, 000	5, 000, 000
Vitamin D ³	ICU ³	1, 000, 000	1, 000, 000	1, 000, 000	1, 000, 000
Vitamin E acetate.....	IU	10, 000	10, 000	2, 000	20, 000
Vitamin K (menadione sodium bisulfate).....	g. ⁴	4	4	1	1
Riboflavin.....	g.	8	8	2	4
Niacin (50 percent).....	g.	160	160	25	20
Vitamin B ₁₂	mg. ⁵	12	12	2	6
Calcium pantothenate.....	g.	16	16	5	8
Choline chloride (25 percent).....	g.	2, 400	2, 400	112	-----

¹ Vitamin premix—the last nine ingredients named—equals approximately 10 pounds.

² International unit.

³ International chick unit.

⁴ Gram.

⁵ Milligram.

Wax can be reused if it is remelted and the feathers are screened out. Small quantities of wax can be purchased for use in small farm slaughtering operations. Wax is highly combustible; care must be taken to prevent wax from coming in contact with an open flame.

After picking, birds can be eviscerated immediately or they can be stored in slush ice overnight until it is convenient to complete the processing. Wash the eviscerated bird

thoroughly and stuff the giblets into the clean birds. If birds are to be marketed frozen, package them in shrinkable plastic bags. If special "New York Dressed" markets are available, chill the ducklings and sell them uneviscerated.

Commercial processors sell the feathers, feet, heads, and viscera as byproducts. Small producers generally do not have a large enough volume to develop a byproduct market.

DISEASES

Ducks raised in small numbers and in relative isolation suffer little from diseases. But where large numbers of ducks are concentrated, diseases may be extremely widespread. Muscovies appear to be resistant to diseases common to Pekin- and Runner-type ducks.

The list of common diseases presented here is far from complete. It should not be used as a substitute for accurate diagnosis by competent personnel.

Amyloidosis.—This disease is one of the most common in adult stock. Amyloidosis, also called "wooden liver disease," can be easily recognized by the hardness of the liver. Frequently, there is a large accumulation of fluids within the body cavity. Laying house mortality may reach as high as 10 percent in some flocks. The cause of the disease is not known and there is no known cure.

Botulism.—This disease occurs in young and adult stock. It is caused by the bacteria *Clostridium botulinum*, which grows in decaying plant and animal material. Ducks feeding on material containing the deadly toxins produced by the bacteria lose control of their neck muscles and they usually drown if swimming water is avail-

able. Direct action of the toxins will also cause high mortality in upland birds. Removal of dead birds and rotting vegetation, plus maintenance of clean facilities, will prevent this disease.

Fowl cholera.—High mortality in adult and young stock can occur from this disease. Strict sanitation will help control fowl cholera. Keep yards and houses clean. Do not allow mudholes and slimy areas to form. Burn or bury dead birds. The organisms of this highly infectious disease live for long periods of time in tissues of dead birds. They can be transmitted to clean flocks by flies, rodents, and wild birds. Bacterins and vaccines have been used to control losses from fowl cholera.

Necrotic enteritis.—This disease is very common in breeding stock. Breeder houses and yards must be free of wet litter and mudholes. Mortality may be sporadic over a long period of time.

Reproductive disorders.—Paralysis of the intromittent organ of drakes is commonly observed early in the mating season. This renders the bird useless for reproduction. Drakes having this condition should be culled from the flock.

Females are rendered worthless by prolapse of the vagina and

cloaca. Impacted oviducts and egg yolk peritonitis are other reproductive disorders in ducks.

Keel disease.—This disease occurs in young ducklings the first few days after hatching. Affected ducklings appear thin and dehydrated.

A number of easy steps can be taken to prevent keel disease. Fumigation of the hatching eggs and a thorough washing and fumigation of the hatcher between hatches will reduce the number of bacteria to which young ducklings become exposed. Reducing stress on the young birds by providing clean, warm brooding facilities, fresh water, and good feed will also help control the disease.

Virus hepatitis.—Serious outbreaks of virus hepatitis can cause 80- to 90-percent mortality in flocks of ducklings. This highly contagious disease strikes swiftly without warning. It occurs in ducklings from 1 to 5 weeks of age.

A vaccine that is administered to female breeding stock is available. Antibodies produced by the laying ducks are passed through the egg to the young ducklings. This gives the ducklings sufficient passive immunity to protect them against natural exposures to the virus during the first 3 weeks after hatching. Duck raisers who are troubled with losses from virus hepatitis should contact their local veterinarian for a supply of the vaccine.

Brooder pneumonia.—Good litter and a dry brooder house will help prevent brooder pneumonia. This disease of ducklings is caused by a fungus frequently present in litter. There is no treatment for the disease.

New duck disease (Infectious serositis).—This is one of the most serious diseases affecting ducklings. It is a bacterial disease caused by *Moraxella anatipestifer*. Symp-

toms resemble those of chronic respiratory disease of chickens. The first signs of the disease are sneezing and loss of balance. Afflicted ducklings fall over on their sides and backs. Losses up to 75 percent have been recorded. Death often is due to water starvation, rather than to the primary infection. Antibiotics and sulfa drugs have been used with some success.

Coccidiosis.—Although not as troublesome as in chickens, this disease causes trouble in occasional flocks of ducklings. The organism causing the disease in ducks is different from those causing it in chickens.

Duck virus enteritis (duck plague).—This acute fatal disease affects ducks as well as geese, swans, and other aquatic birds. It is caused by a filterable virus that is transmissible by contact and commonly occurs where water is available for swimming. The disease has affected ducks in commercial flocks in the Eastern United States.

Disease signs of watery diarrhea, nasal discharge, and general droopiness develop in 3 to 7 days after exposure, and last for another 3 or 4 days, frequently ending in death.

Post mortem examinations show multiple or generalized hemorrhages in body organs.

There is no satisfactory treatment. Strict sanitation, disposal of offal from infected birds, and rearing ducks in pens with access to drinking water only would greatly reduce and help control the disease.

Possible exposure of domestic ducks to duck virus enteritis from migratory waterfowl can be prevented by keeping susceptible ducks in houses or within wired enclosures.

Efforts are continuing to develop a vaccine that will protect waterfowl without spreading duck virus enteritis.