Ver2.0

農業技能測定試験

Agricultural Skill Assessment Test

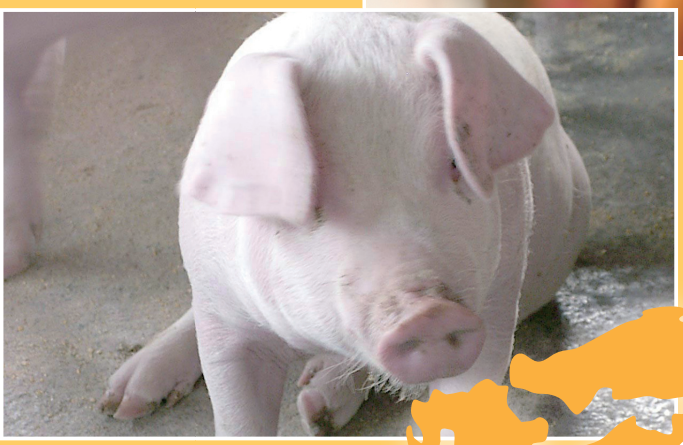
テキスト 畜産農業全般

text : General livestock farming

English

英語版

English Edition



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National Chamber of Agriculture（NCA）

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1.0	October 18, 2019	Original version drafted	Original version drafted
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Preface

Labor shortages in Japanese agricultural workplaces have become a serious problem. For this reason, as a new framework for accepting foreign human resources (Foreigners for Agricultural Support) who can work immediately in Japanese agricultural workplaces, the "Specified Skilled Worker" designation has been established. Along with the Technical Intern Training Program, expectations are high of this mechanism to support and develop Japanese agriculture.

In order for foreigners to work in agricultural workplaces through this project, they need to meet the requirements specified by the Japanese government, such as knowledge and skills concerning agriculture.

The National Chamber of Agriculture has therefore received aid from the Ministry of Agriculture, Forestry and Fisheries, and has decided to start examinations (Agriculture Skill Assessment Test) from FY2019, to confirm and evaluate the knowledge and skills of foreigners concerning agriculture, etc. before entering Japan. As part of these examinations, tests on two subjects will be carried out: 1. General crop farming and 2. General livestock farming.

This text is organized in an easy-to-understand manner using photographs and illustrations highlighting the knowledge and techniques that should be learned by those who take exams on general livestock farming. We hope that it will be helpful for learning and that the examinees will utilize it.

In addition, the examination of general livestock farming includes questions to confirm and evaluate whether the examinees have ability in Japanese language necessary for engaging in Japanese agriculture. For the examination, please also use the text for learning Japanese, separately prepared by the National Chamber of Agriculture.

Finally, in creating this text, we received great cooperation from each committee member of the Livestock Subcommittee, and the Planning Committee of Agriculture Skill Assessment Test, including Miyao Yoshida (dairy cattle), Koji Misumi (pig farming), Akihiro Kinoshita (beef cattle), and Kan Sato (chicken farming). We are deeply grateful for their support.

October 2019

National Chamber of Agriculture

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Introduction

Precautions when entering Japan

When you enter Japan and engage in agriculture, you must follow the following rules to prevent the invasion of livestock infectious diseases and pests.

- Please do not touch livestock within a week before coming to Japan.
- As a general rule, please do not enter a barn or its surroundings for 1 week after entering Japan (including re-entry).
- Do not bring dirty work clothes, work shoes, or boots used overseas.
- Meat products such as meat, ham, sausage, and bacon must not be brought into Japan without an inspection certificate.
- Please tell your family and friends not to send meat products to Japan in small packages or small mail (international mail).
- In addition, let's work safely according to the instructions of the manager of the farm.

I Features of animal husbandry

1 Dairy (dairy cattle)

1 Dairy cow

The majority of Japanese dairy cows are of the Holstein species (its country of origin is the Netherlands), with an average milk yield of more than 8,000 kg per year.

A dairy cow which has given birth is called a delivered cow, and a cow that has given birth for the first time is called a primiparous cow.

Holstein

Photo supplied by:
National Livestock Breeding Center

Jersey

Photo supplied by:
National Livestock Breeding Center

Brown Swiss

2 Form and scale of dairy management

(1) The dairy industry in Japan is mostly run by families.
(2) In recent years, however, the number of corporate bodies run by multiple farmers and company management has been increasing.
(3) Dairy farms with a large number of cows are called mega farms.

The number of dairy farmers in Japan has been decreasing every year, but the number of cows kept per dairy farmer has been increasing.

Changes in the number of delivered cows per dairy farm

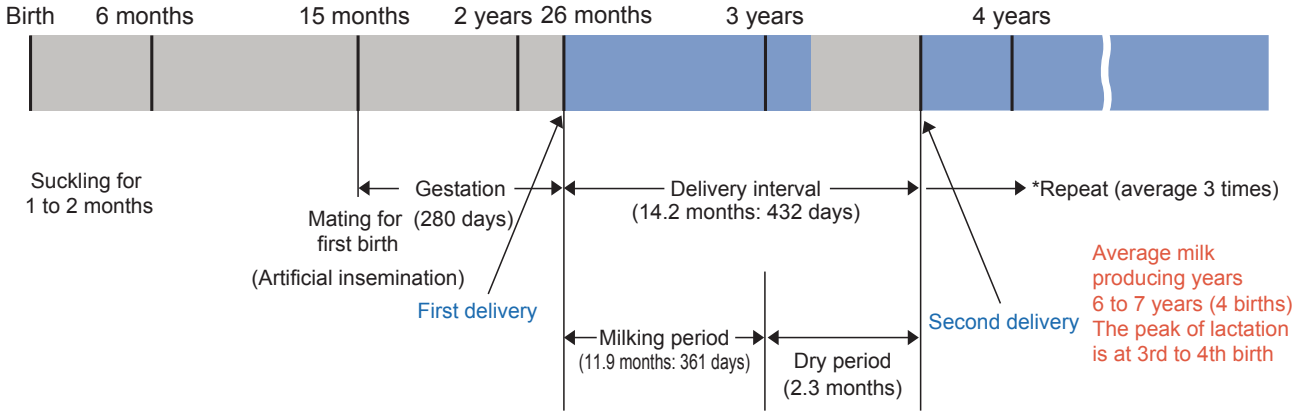
2005	2010	2014
38.1cattle	44.0cattle	48.0cattle

3 Milk yield of Japanese delivered cows

The average annual milk production of Japanese delivered cows is increasing. In 2014, we weighed 8,316 kg, which is a significant increase from 7,619 kg in 2004, 10 years ago.

4 Life cycle of dairy cows

- Dairy cows are called calves about 6 months after birth, after that they are called raised cattle until about 2 years old, and adult cattle after the first calving.
- In general, cows get pregnant by artificial insemination at 14 to 15 months old.
- It is desirable that the delivery interval of dairy cows is 365 days and 1 delivery per year, but the delivery interval of Japanese dairy cows has become longer. In 1989, it was 405 days, but in 2015, it was 433 days.
- The dairy cow's gestation period is 280 days (9.3 months).
- After delivering calves, cows are milking for about 1 year, and during this process, artificial insemination is performed on the cows being milked for the next gestation to delivery.
- At 2 to 3 months before the next delivery, stop milking so that nutrients transfer to the mother's body and fetus.
- Dairy cows repeat this cycle every 400 to 430 days and a fertile mother bears 7 to 8 calves, but on average a dairy cow bears about 4 calves.



Life cycle of dairy cows

5 Milk producing years of dairy cows

(1) The mating period of dairy cows to deliver their first calf (first delivery) is generally 14 to 15 months old.

(2) The period after delivery when a dairy cow is not pregnant is called non-pregnant days. The delivery interval is the period of non-pregnant days plus gestation period.

(3) For example, if the number of non-pregnant days is 120 (4 months), the delivery interval is 13.3 months (399 days).

(4) After the first delivery, the calves cows are called second, third, fourth... which are also called calving numbers.
(5) The milk producing years of Japanese dairy cows (delivered cows) tends to be shortened, with 4.2 in 2002, 4.0 in 2007, and 3.5 in 2015.
(6) The shortening of the milk producing years of dairy cows is caused by disuse of cows due to mammary organ disorders (mastitis, etc.), breeding disorders, limb and hoof disorders (hoof disease), digestive disorders, and astasia (milk fever).

6 Feedstuff

- Feed to be fed to dairy cows includes concentrate and roughage.
- Concentrate is mainly supplied in the form of formula feed.
- Roughage has silage produced domestically and hay imported from abroad or produced in Japan.
- Major cereal in formula feed is imported corn.

7 Inspection of milk quality

- There is a difference in the milk quality of each dairy cow.
- Milk shipped by dairy farmers is inspected for milk quality.
- For inspection of milk quality, there are ingredient quality: milk fat percentage, milk protein percentage, milk solid nonfat percentage; and hygienic quality: somatic cell count, bacterial count.

8 Summer heat and dairy cow

- The comfortable temperature zone of Holstein dairy cattle is 13 to 18°C; they are vulnerable to heat.
- When the humidity is high and the temperature rises to around 30°C, the dry matter intake of the dairy cow decreases and milk yield and ingredient quality drop.
- Dairy cows have a fermentation tank called rumen so that their body temperature is higher than that of humans, and their normal body temperature is 38.5°C.
- Due to global warming, the number of “tropical days” (days with a maximum temperature of 30°C or higher) and “extremely hot days” (days with a maximum temperature of 35°C or higher) are increasing in Japan.

・Dairy cows sometimes die out because of summer heat. In the summer of 2010, 959 cows died or were disused due to the heat.
・The table below shows the state of dairy cows under conditions at 18°C, 26°C, and 30°C. With increasing temperature, feed intake decreases, body weight decreases, and milk yield decreases.
・As the ambient temperature rises, body temperature and respiratory rate increase.

Increase in the ambient temperature and the conditions of dairy cows (example)

	18°C	26°C	30°C
Formula feed intake kg/day	12.0	10.3	8.4
Hay intake kg/day	6.1	4.5	3.7
Body weight (at the end of the study) kg	561	543	528
Body temperature °C	38.3	39.2	40.2
Respiratory rate per minute	33.7	58.3	73.1
Milk yield kg	27.5	23.3	19.3

How to overcome the heat problem for dairy cows is one of the big problems of dairy farming. For that purpose, it is important to improve the structure of the cowshed, maintenance and management of cooling facilities such as electric fans and water sprayer, afforestation around the barn, and nutrition control.

In addition, dairy cow livestock drink plenty of water and they are sensitive to the water quality, so that especially in hot summer season let them drink clean and cold water at any time.

9 Treatment of excreta

・The law stipulates that the treatment of livestock excrement, such as odor problems, shall be performed correctly.
・It is important to make compost of good quality, use it in grassland, and supply it to upland field farmers and rice farmers.

Because the number of dairy cows fed by dairy farmers is increasing, the amount of livestock manure discharged from farms is also increasing. On the other hand, there are few cases where the area of grass and forage crops increases proportionately to the number of livestock, and the

amount of manure excreted in excess of that returning to their own meadow, becoming excessive manure, often becomes a problem.

Compost house

2 Beef production (beef cattle)

1 Beef cattle

Japanese beef cattle produced in a large amount are of the following three kinds: Japanese black cattle (Japanese cattle), dairy breed steer (Holstein), and hybrid type (F1) of Japanese Black Cattle and dairy breed. Each fattening period is different.

2 Raising beef cattle

The management of beef cattle production in Japan is divided into the following three types.

（1）Breeding operation

Raising female Japanese cattle for breeding and letting them bear calves and raising them for around 10 months, then shipping them to the livestock market as fattening cattle.

Farmers aim to produce one group a year. Breeding cows produce about 7 cows on average, and with some farmers, cows produce an average of more than 10 births.

Grazing

Female Japanese cattle

（2）Fattening operation

Japanese cattle (around 10 months old), dairy breed steer (calves), or hybrids (calves or around 8 months old) are introduced as fattening cattle, and they are fattened for about 30 months for Japanese cattle, 19 to 20 months for dairy breed steer, about 25 months for hybrids before shipping.

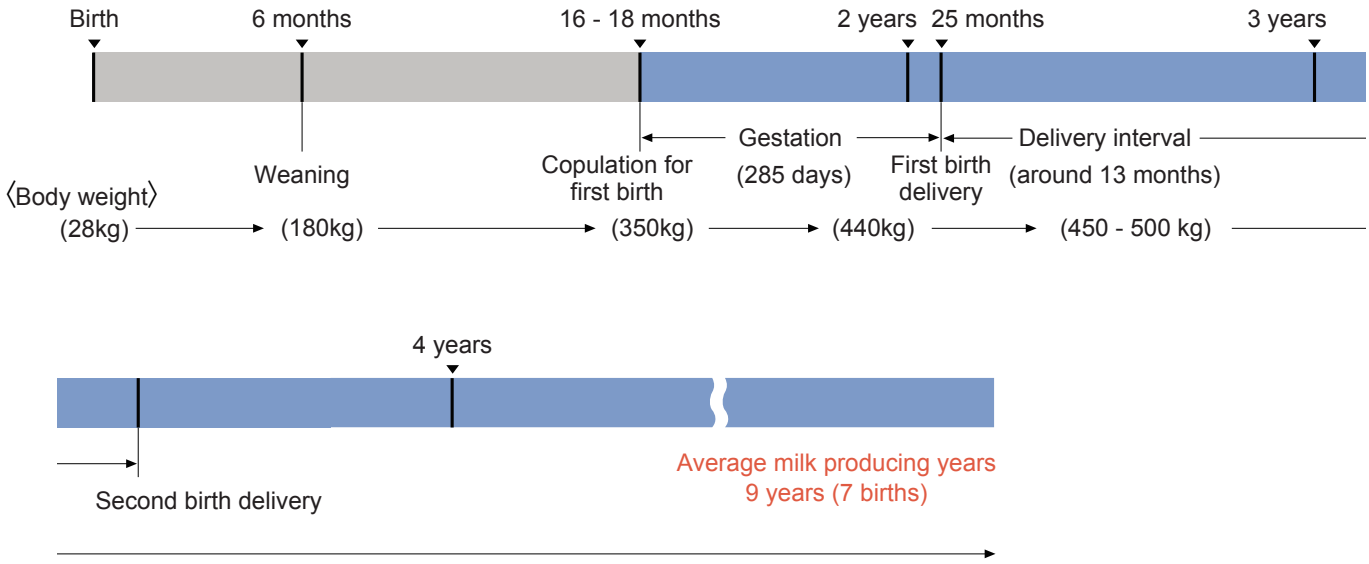
（3）Consistent management

The form of continuous operation that performs breeding and fattening is called consistent management, but there is not much management of this form in producing Japanese cattle.

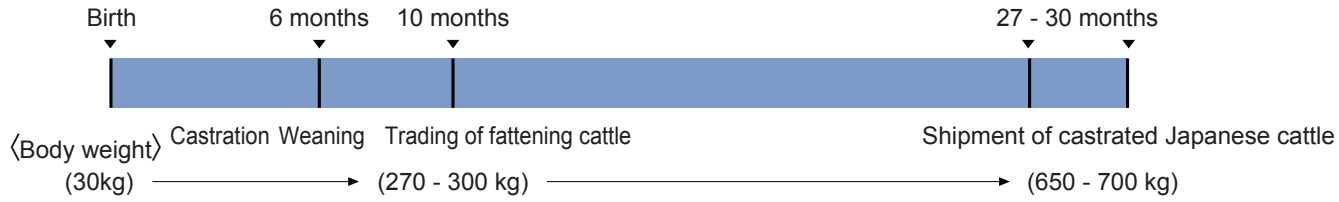
（4）Other

In some cases, dairy farmers artificially inseminate dairy cows with the semen of Japanese cattle to produce hybrid calves for shipment to fattening farmers. Hybrid calves weigh around 30 kg at birth, which is smaller than that of dairy calves (about 45 kg), and have the advantage of preventing dystocia in primiparous dairy cows.

■Cow for beef (in the case of a cow for calf production)



■Beef cattle (in the case of fattening cattle)



3 Fodder and feeding

（1）Calf, raising cattle

Fodder from the time of calf to raising term changes: breast milk → milk replacer → synthetic milk → hay and formula feed, in case of Japanese cattle, dairy breed steer, and hybrids.

Calf

（2）Fattening cattle

As feed during fattening period, formula feed and rice straw are supplied for Japanese cattle, silage (rice silage, grass silage, and corn silage), hay, and formula feed are supplied for dairy breed steer, and in case of hybrids, silage, hay, rice straw, and formula feed are supplied. Regarding the proportion of the fed amount of roughage and concentrate, formula feed is higher in fattening cattle.

Fattening cattle (for beef)

4 Points of feeding management

In raising beef cattle, the following are the subjects of feeding management. It is important to conduct day-to-day feeding management while always taking into consideration the following issues.

（1）Uniform growth of each cattle herd

It is important to raise a heavy body weight, having high quality flesh by taking into account appropriate nutrition control and stabilization of feed intake, and by preventing fights between cattle. Especially in the case of Japanese cattle, the production of marbled beef is regarded as important.

（2）Health management of calves

Because calves tend to suffer pneumonia and diarrhea, it is important to perform observation, nursing care, and curing properly.

Keeping calves warm (heating clothes)

（3）Prevention of virus invasion

Be careful enough against virus invasion into the farm.

（4）Treatment of excreta

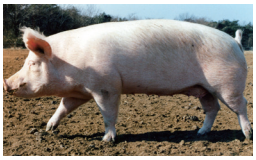
The same efforts as described in 1. Dairy 9 are necessary.

3 Pig farming (pigs)

1 Breeds of swine

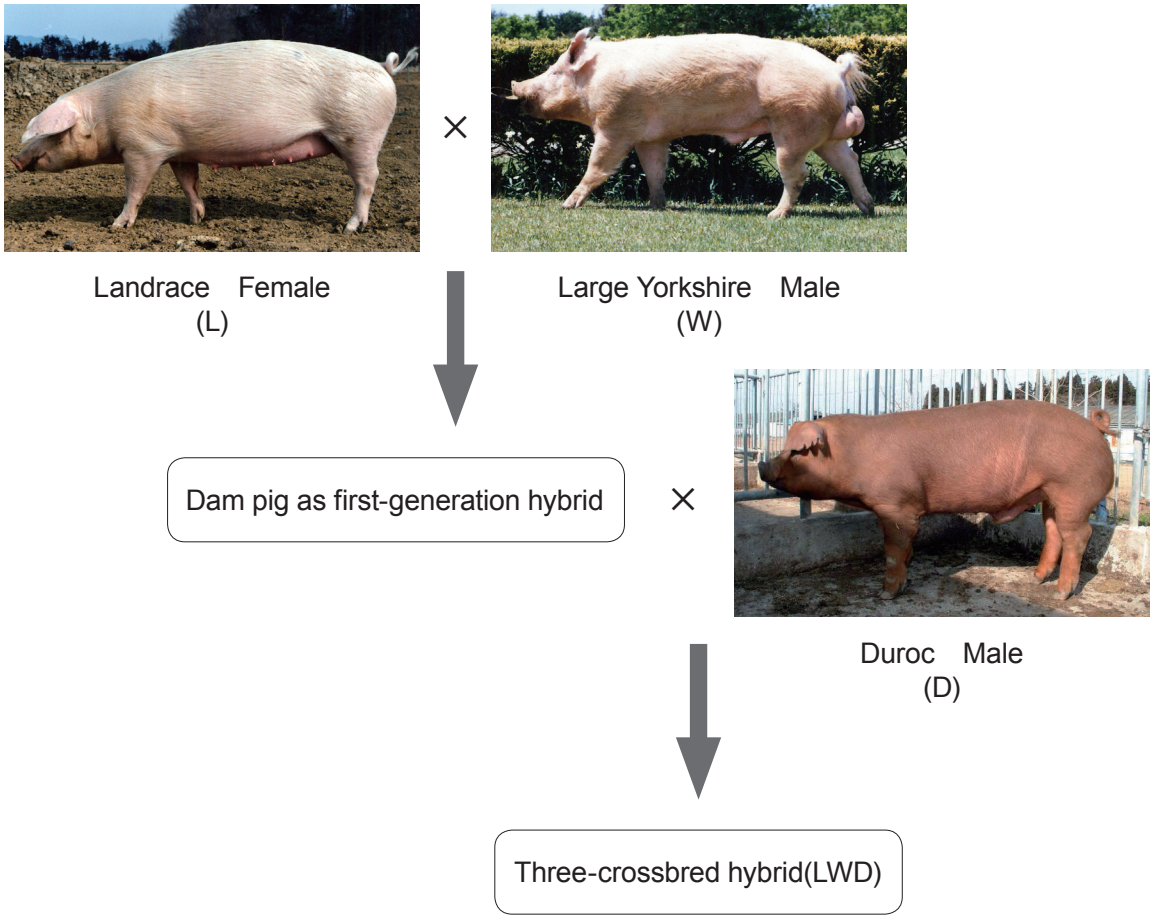
Pigs are animals of improved wild boars that have been domesticated by humans to enhance their meat production capacity. The main swine breeds raised in Japan are Landrace, Large Yorkshire, and Duroc.

Breeds of swine

Breed(abbreviation)	Appearance	Characteristics
Landrace (L) 	White, having a long torso.The face is slender and ears are drooping.	Large litter size. Rearing rate of piglets is high.
Large Yorkshire (W) 	White, ears are erect.	Superior breeding performance
Duroc (D) 	Brown to black, ears are drooping.	Flesh quality is good, and they are disease resistant and fast growing.
Berkshire (B) 	A black pig, while the tips of the limbs, face, and the tail are white. It is called Roppaku (meaning “six white parts” in Japanese).	Both litter size and growth are inferior to the breed described above, but they are excellent in meat quality.
Hampshire (H) 	Black with the white belt wrapping.	Used as a male instead of Duroc, which is used for three-way crossing.
Yorkshire (Y) 	Having a forward jutting face with erect ears.	Growth is slow. The meat quality is good.

When these 3 breeds are crossed (mated) to produce a mix, the rearing rate is high, growth is fast, and meat quality is also good. This is called "three-way cross" and is widely held all over Japan. First, cross Landrace (L) with Large Yorkshire (W). The female born there is raised as a breeding pig. The female is crossed with a Duroc (D) male, and the piglets (LWD) are generally raised as fattening pigs. In other words, most of the fattening pigs in Japan are hybrids. Crossing breeds in this way increases the ability (productivity) of the offspring, which is called heterosis.

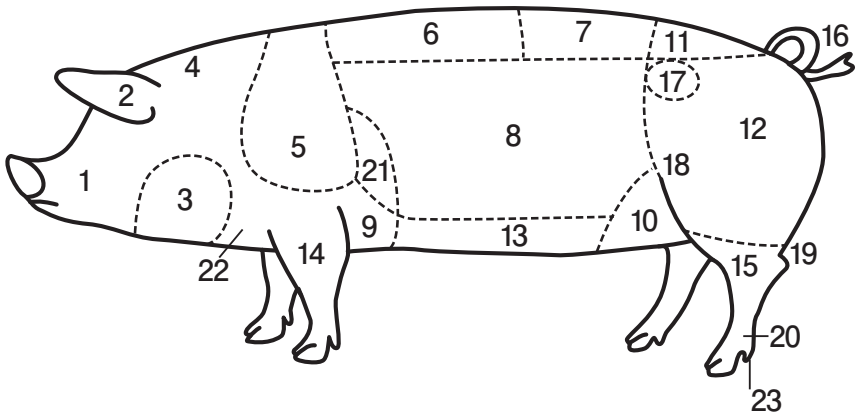
Other breeds include Berkshire, Hampshire, and Yorkshire.



Typical three-way cross combinations

In addition, there are female and male breeding and fattening pigs called hybrid pigs, which are produced by crossing several breeds. The objective of this project is to eliminate the drawbacks of time-consuming three-way cross and to supply a large number of breeding pigs with excellent uniformity.

Names of parts of the pig's body



1.Snout 2.Ear 3.Jowl 4.Neck 5.Shoulder 6.Back 7.Loin
8.Side 9.Fore flank 10.Rear flank 11.Rump 12.Ham 13.Belly
14.Forelimb 15.Hind limb 16.Tail 17.Hip bone 18.Stifle joint
19.Hock 20.Pastern 21.Chest (includes belly) 22.Anterior chest
23.Spur

2 Life cycle of pigs

Pigs can be divided into fattening pigs and breeding pigs according to usage. Fattening pigs are those which we eat as meat. They are also called pork pigs. The dam pig is the parent of the fattening pig. A male pig to be mated with a dam pig is called a stud pig. It is also called Tanebuta in Japanese. The dam pig repeats mating, gestation, delivery, and lactation.

Pigs are omnivores and eat various feeds. The basic structure of a pig's digestive system is the same as that of human, who is also omnivorous. Feed is first digested in the stomach, then digested further in the small intestine, and absorbed. Later, in the large intestine part, the indigestible fraction is fermented and absorbed.

(1) Fattening pig (pork pig)

Fattening pigs are nursed by the female breeding pig, their mother pig, for a while after birth. About six months after birth (about 180 days later), the weight becomes about 115 kg, and they are slaughtered for meat. The period from about 30 kg of body weight to shipment is called the fattening period.

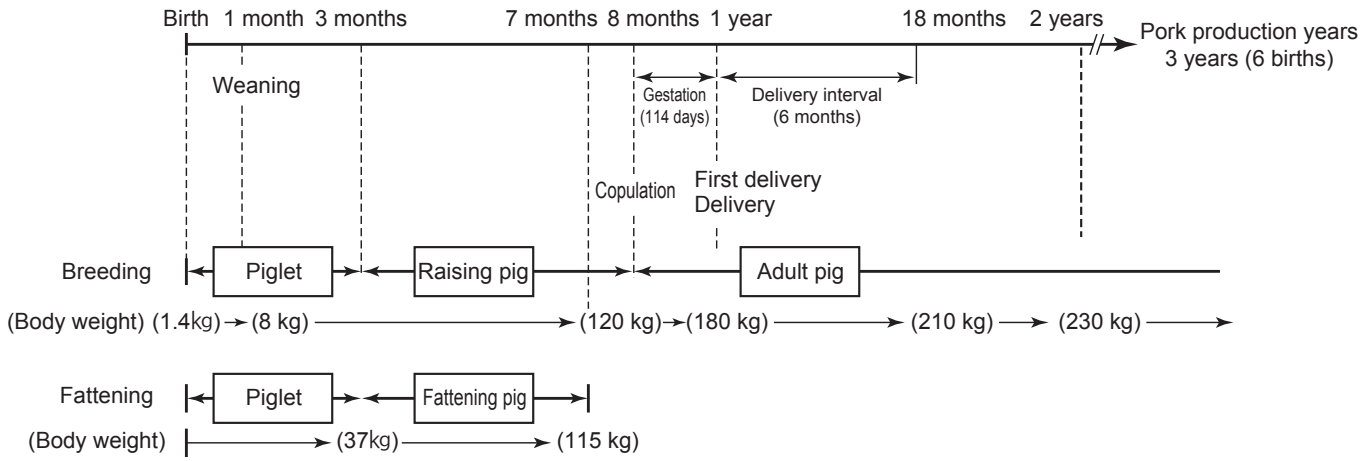
(2) Dam pig (female breeding pig, also called mother pig)

The dam pig first breeds at about 8 months after birth when her body weight is about 120 kg. The gestation period is 114 days. The litter size is 10 to 15, and after a nursing period of 3 to 4 weeks after delivery, mating is performed again. The dam pig controlled healthfully can be pregnant / give birth 4 to 5 times in 2 years. The dam repeats this cycle and usually becomes

pregnant 6 to 10 times. The estrous cycle of pigs is 21 days.

（3）Stud pig (male breeding pig, sire pig, also called tanebuta in Japanese)

Stud pigs sexually mature in about seven months. Among mating, there are natural mating (Honko in Japanese) and artificial insemination (AI), with artificial insemination increasing now.



Life cycle of breeding pig (dam: sow pig)/fattening pig

3 Management style of pig farming

There are 3 types of pig farm management: "consistent management," "breeding operation," and "fattening operation."

Breeding operation involves raising dam pigs and stud pigs, and shipping their piglets for fattening.

Fattening operation is a method of purchasing piglets from breeding operation, fattening them, and shipping them.

Consistent management is a management style in which dam pigs, stud pigs, and fattening pigs are raised together and management is conducted consistently from breeding to fattening. Currently, consistent management constitutes the majority. The main reasons for this are the expansion of the business scale and the prevention of disease invasion.

Currently, the main form of breeding operation is to produce and improve dam pigs and stud pigs, and sell them to farms that practice consistent management.

They range in size from large businesses with tens to more than 100 employees, to small family-run operations. Large-scale management is sometimes called corporate pig farming.

In addition to production on pig farms, meat product manufacturing, meat wholesaling, and meat retailing are also carried out consistently within the same group, which is called “integration.”

As a classification of farms from the viewpoint of sanitation management, there is "SPF (absence of a specific pathogen) farms" apart from ordinary farms, and their sanitation management is stricter than that practiced at general farms. In contrast to SPF, normal farms are called “conventional.”

4 Feed and its production, purchase, and feeding

Most feed ingredients for pigs are imported from overseas.

After arriving at the port, corn and other raw materials are pulverized at feed mills for better digestion, formulated in consideration of nutritional balance to suit the stage of pig growth, and sold as formula feed. Corn and soybean meal (defatted soybean) are mainly used as raw materials.

The forms are finely ground mash, compression molded pellets, and crushed pellets. Liquid feed is also used.

There are two feeding methods: "ad libitum feeding" and "restricted feeding."

Ad libitum feeding is also called free feeding. There is always feed in the trough and pigs can eat it at any time.

Restricted feeding is a feeding method to give a fixed amount.

Fattening pigs are often fed with ad libitum feeding, and breeding pigs with restricted feeding.

Mash

Pellet

Liquid

Shape of feed

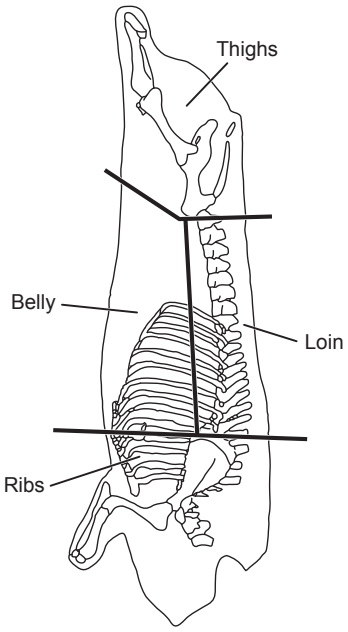
5 Dressed carcasses and pieces

The shipped fattening pigs (pork pigs) are slaughtered and traded as "dressed carcasses."

A dressed carcass is the state that the head, limbs, and internal organs are removed from the whole body. About 75 kg of dressed carcass can be taken from a 115 kg pig. Dressing percentage is about 65%. The dressed carcass divided into left and right parts is called side (“Hanmaru” in Japanese). Dressed carcasses are graded on the basis of the trading classification for pork carcasses and are graded in order of quality as excellent, high, medium, ordinary, and substandard. First, dressed carcass (side) weight and back fat thickness are measured, then the appearance and meat quality are judged.

Dressed carcasses are further divided into parts. The cut meat is then either sliced further and sold as dressed meat, or processed into ham, sausage, and so on.

Half-carcasses



Portion of divided pork carcasses in Japan

There are criteria for meat color and fat color, and the meat color should not be too dark or too light (too thin), with a medium light (thin) meat color being ideal. It is determined by the pork color standard. White is desirable for fat color, rather than yellow fat. When the fat is soft, it is called a soft fat pork and the evaluation is low.

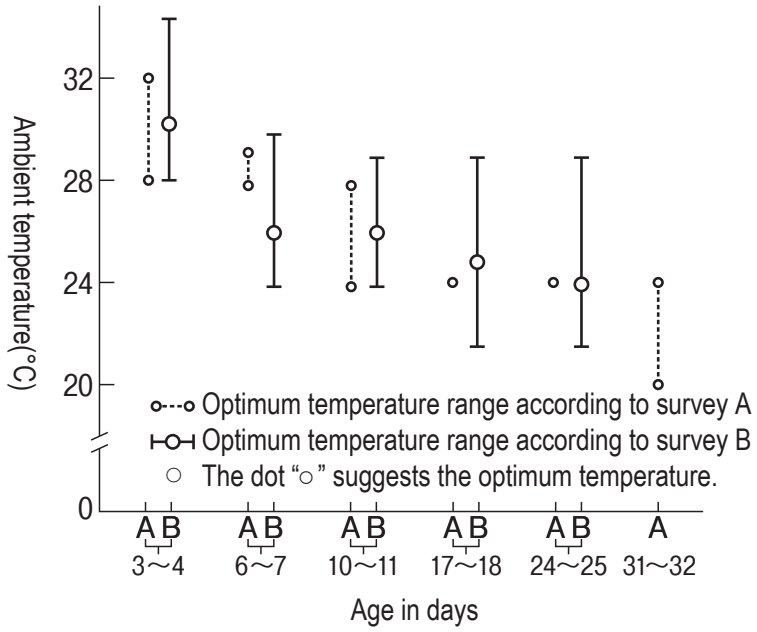
6 Points of feeding management

（1）Management of piglets

A piglet weighs about 1.4 kg. Newborn piglets have thin subcutaneous fat and immature thermoregulatory function. To prevent occurrence of accident death and growth stagnation, it is

necessary to properly manage the temperature in the raising environment. It is desirable to keep the environment above 30°C especially in the first week after birth.

Keeping piglets warm

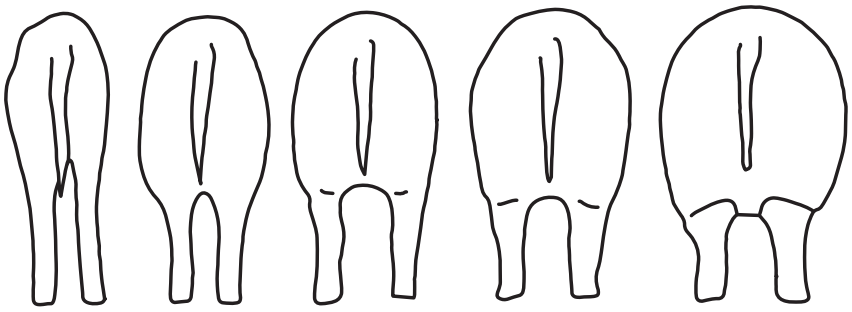


Estimation of the optimum temperature range of piglets at each age in days

（2）Score of gain

The intake of feed increases with the growth of pigs. The increase in body weight per day is called "daily gain (DG)." After weaning, daily gain increases with increase of the feed intake, and standard daily gain is 0.78 kg at body weight of 30 to 50 kg, 0.85 kg at 50 to 115 kg.

The amount of feed required for 1 kg increase is called "feed conversion ratio." It usually ranges from 3.2 to 3.6. If it exceeds the range, it is necessary to re-examine the contents of the feed.



Score	Condition	Body type
1	Too thin	The hipbones and spine are visible to the naked eye.
2	Thin	By pushing with the palm of your hand, you can easily feel the hipbones and spine.
3	Ideal	The hipbones and spine can be felt by pressing hard with the palm of your hand.
4	Fat	The hipbones and spine cannot be felt.
5	Overweight	The hipbones and spine are covered with thick layers of fat.

Body condition scores of dam pigs

（3）Infectious diseases

Pigs are affected by many diseases, in particular, if legal communicable diseases, namely foot-and-mouth disease, swine cholera, and epidemic encephalitis occur, promptly notify the Livestock hygiene service center and take measures according to the instructions. We must take care of it accordingly.

It is necessary to introduce a strict quarantine system when transferring people, feed, and materials.

There are various kinds of swine diseases seen in pig farms, and vaccinations will be given if effective. Currently there are few diseases that lead to death as soon as acute symptoms appear, and there are many diseases of chronic symptoms. As representative diseases, transmissible gastroenteritis (TGE), and porcine reproductive and respiratory syndrome (PRRS) are viral diseases; *mycoplasma* spp., *Escherichia coli*, and *Streptococcus* spp. are pathogenic bacteria, and the large pig roundworm (*Ascaris suum*) is a parasite.

（4）Treatment of odor and excretion from piggery

Breeding pigs excrete 2 ~ 3kg of feces and 5.5kg of urine per day, and fattening pigs 1.9kg of feces and 3.5kg of urine. Foul odors from feces and urine are the most frequent kind of complaint as pollution caused by livestock production, and are a major cause of the poor impression of the pig farming industry and the survival of management. In addition, since it leads to environmental pollution such as adverse effects on the health of pigs and humans and the inducement and propagation of pests such as flies, it is necessary to control the occurrence.

The odor inside the piggery derives mainly from ammonia and sulfur compounds generated from feces and urine, and volatile fatty acids such as butyric acid, propionic acid, and acetic acid. These odors are harmful for both pigs and humans who manage them, so reducing odor is necessary. For that purpose, separate feces and urine as much as possible to avoid contact with each other, and suppress the reaction between urine and enzymes in feces.

Feces and urine must each be properly treated; generally feces are processed at composting facilities while urine is processed at purification facilities. In addition, there is a method of processing mixture of feces and urine, and this manure mixture is called a slurry.

A large portion of the compost is composed of microorganisms; that is, the compost is the product made by aerobic microorganisms that grow in the feces by breaking down putrefactive organic matters. For compost preparation, it is important to create an environment suitable for aerobic microorganisms that require oxygen.

（5）Heat and cold

Swine have vestigial sweat glands and it is difficult to release body heat from the skin. Especially in summer in Japan, the heat does not dissipate, because of high temperature and high humidity. Therefore, it is necessary to remove moisture from a piggery in summer with an electric fan and the like.

A hot environment caused by heat in summer has a bad effect on breeding pigs. A decrease in the number of sperm, a decrease in sperm motility, and a decrease in mounting motivation occur in males, and a decrease in overall breeding performance occurs in females, such as delayed estrus, stillbirth, a decrease in body weight at birth, and a decrease in milk production due to decreased appetite.

Also in the case of fattening pigs, loss of appetite occurs and affects weight gain performance. If the temperature rises rapidly, they may die of heat stroke.

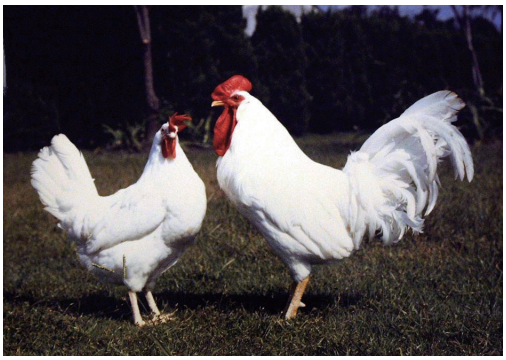
On the other hand, since both temperature and humidity are low in winter, the body heat is excessively released as opposed to summer. Therefore, in winter, pay attention to the temperature control of the piggery, especially the temperature control for piglets vulnerable to cold.

4 Chicken farming

① Laying hens

1 Breeds of laying hens

Among chicken breeds kept in Japan, the most common and representative race (chicken breed) is Single-Comb White Leghorn (its country of origin is Italy). As a laying hen laying white eggs, White Leghorn and its hybrids are raised widely. In addition, Rhode Island Red (its country of origin is the United States) or its hybrids as laying hens that lay brown eggs, and races (chicken breeds) that lay eggs in intermediate color between white and brown are also raised.



Single-Comb White Leghorn

Rhode Island Red

2 Scale of raising and management of laying hens

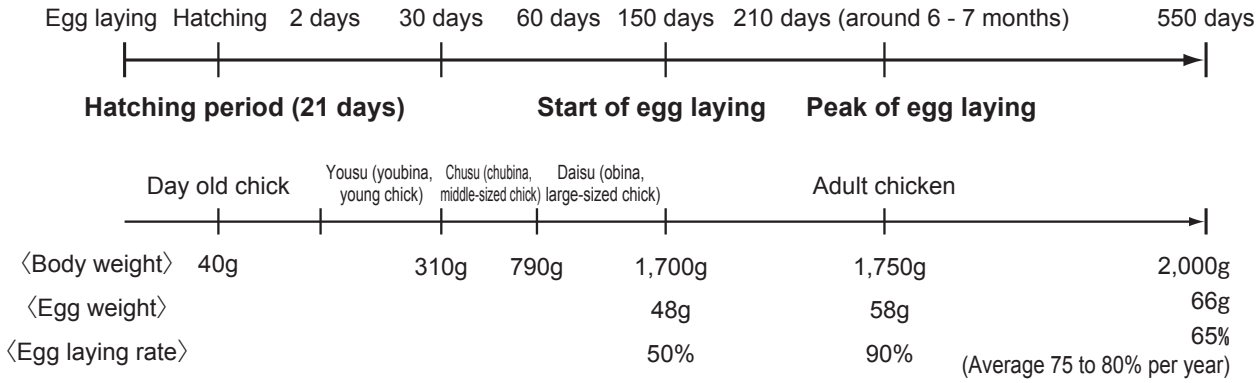
As of February 1, 2018, the number of adult female chickens was 139.03 million, and there has been no significant change over the past 20 years. The number of poultry farms raising laying hens is 2,200 and is decreasing every year, mainly in small groups.

For management of laying hen farms, 25% is run by farmers and 75% by companies. The companies operate a small number of farms, but keep about 70% of the total number of hens. Many companies are run by individuals or families.

One management style is to entrust brooding companies with brooding up to the stage of mid-sized chicks (chubina) or large chicks (obina), and to manage adult chickens mainly, and the other style is to consistently manage the entire process from brooding to adult chickens on the farm.

3 Life cycle of laying hens

Chickens live 5 to 15 years with careful rearing. The case of egg production from an economic point of view is shown in the figure as the life cycle of the laying hen. Hatching eggs (fertilized eggs) hatch and chicks are born after 21 days of incubation under appropriate temperature and humidity conditions. This female chick grows to an adult chicken in about 150 days and begins to lay eggs (start of egg laying). It begins to lay the largest number of eggs around 210 days after birth (peak of egg laying). After that, It lays eggs for about a year or a year and a half, but gradually it comes to not lay eggs, so that it is shipped (culled chicken) as processed meat in roughly two years.



Life cycle of egg-laying hens

4 Feed and its production, purchase, and feeding

In order to raise chickens, many chicken farms use commercially available formula feed prepared by blending several raw materials, according to the growth process and use.

Most of the corn, milo and soybean meal used as raw materials are imported from overseas.

Feed manufacturers sell a variety of formulated and mixed products. At present, formula feed for chicken farming produced in Japan accounts for 42% of the total compound feed production, which is the largest share.

Of the formula feed for chicken farming, 7.8% is for chicks and 58.2% is for adult laying hens. 66% of the formula feed for chickens is for laying hens.

Formula feed developed for one's own chicken farm without depending on the products of a feed manufacturer is called in-house formula feed.

The formula feed for adult chickens contains 60% of cereals such as corn and milo as an energy source, 15% of soybean meal from vegetable oil meal as a protein source, 10% of fish meal as an animal feed, 5% of corn gluten feed as bran, and 10% of vitamins and minerals. Blending ratio, raw materials, constituent etc. vary depending on the chicken breed, age, and rearing environment.

5 Points of feeding management

（1）Hygiene management

To be thorough in preventive hygiene. First of all, prevent the invasion of pathogens into the breeding control area and improve the poor environment of breeding areas. According to the Feeding and Health Control Standards in the Domestic Animal Infectious Diseases Control Act, sanitation control areas must be set up to prevent the invasion of pathogens.

Because poultry houses grow in size and keep large numbers of chickens, health control of chickens, environmental management inside the poultry house, and hygiene management such as removing feces and cleaning tend to be insufficient, so that the cause of diseases and damage must be thoroughly eliminated.

① Hygiene management of poultry houses and other facilities

Be thorough with removing feces, cleaning, washing, and disinfection

② Health control of chickens

Attention must be paid to diseases of the respiratory system caused by alteration in the environment.

For chickens, prepare a vaccination program for diseases with strong infectivity and carry out vaccination faithfully.

（2）Avian influenza

It is important to check up-to-date information on animal quarantine; especially, information on highly pathogenic avian influenza provided by the Livestock hygiene service center must be checked and the guidance of the center must be followed. Set up a bird net, etc. around the poultry house in the breeding area to thoroughly prevent the invasion of wild birds, observe the health of the chickens, and report immediately when abnormalities and specific symptoms are found (this is mandatory). In addition, if you find dead bodies of wild birds and the like near the poultry house, it is important to inform the administrator immediately.

② Meat chicken

1 Breeds of meat chicken

More than 85% of meat chicken comes from young meat chickens (broilers), which are highly improved to enable them to grow quickly and to be shipped quickly, and to ensure that they grow well. The breed is a first-generation hybrid chicken for practical use produced by crossing a white Plymouth Rock female with a white Cornish male. Although native chickens account for only 1% of the entire meat chickens, they are high-quality meat chickens produced as a hybrid using game fowls, Nagoya breeds, Rhode Island Red breeds, and other local breeds in order to improve meat quality.

White Cornish

White Plymouth Rock

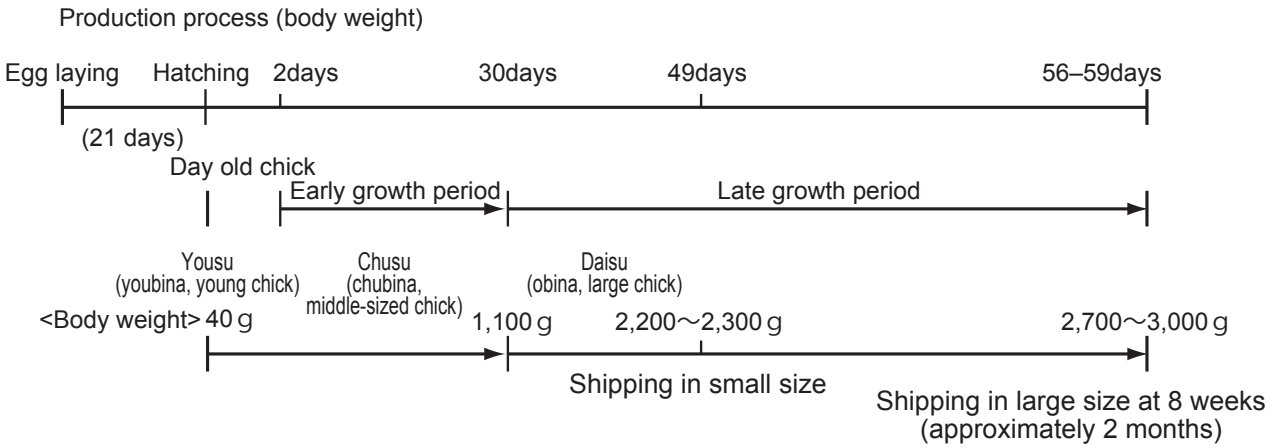
2 Scale of raising and management of young chickens for meat (broilers)

As of February 1, 2018, there were 2,260 poultry farms and 138.77 million chickens, for an average of 61,400 chickens per farm. The number of chickens per farm is increasing year by year, and the scale is expanding to achieve more efficient management.

Most of the broiler breeding is controlled by general trading companies, agricultural cooperatives, or individuals, and all stages from raising to processing and distribution are linked (integration). Farmers are contracted to raise broilers. Also, with the rapid growth of mass retailers such as supermarkets, there is a system in which distributors produce broilers and the whole process is affiliated.

3 Life cycle of young chickens for meat (broilers)

The life cycle of a young chicken (broiler) used as meat is shown in the figure. Chicks to be finished in small size are raised for about 7 weeks after hatching and shipped with a weight of about 2.3 kg. Chicks to be finished in large size are raised for about 8 weeks and shipped with a weight of about 3.0 kg. In the case of native chickens, it takes more than 80 days to raise and many of them are kept for 4 to 5 months to produce good taste and texture and then shipped.



Life cycle of a young chicken for meat

4 Feed and its production, purchase, and feeding

Rearing broilers is mostly carried out using commercially available formula feed prepared by blending several raw materials, according to the growth process. Feed manufacturers sell various formulated products. At present, formula feed for broilers produced in Japan accounts for 14% of total formula feed production and 34% of formula feed for chickens (accounting for 42% of total formula feed).

Formula feed for broilers contains cereals (corn) and milo in the largest amount as energy sources, followed by soybean cake, a vegetable oil cake, as a protein source, and fish meal as an animal feed. It also contains corn gluten feed as bran and vitamins and minerals. Blending ratio, raw materials, constituents, etc. vary depending on the chicken breed, age, and rearing environment.

5 Points of feeding management

（1）Hygiene management

To be thorough in preventive hygiene. First of all, prevent the invasion of pathogens into the breeding control area and improve the poor environment of breeding areas. According to the Feeding and Health Control Standards in the Domestic Animal Infectious Diseases Control Act, sanitation control areas must be set up to prevent the invasion of pathogens.

Breeding and improvement of broilers has been remarkably improved, especially in weight gain performance. Raising a large number of birds has become common, and the raising period is short, so feeding management tends to be delayed. Therefore, it is important to eliminate factors that cause harm or adverse effects in daily feeding management.

① Hygiene management of facilities

In the Chicken coop, the removal of feces, cleaning, washing, and disinfection are carried out thoroughly so that no pathogenic microorganisms, sanitary insects, and antibacterial substances remain.

② Health control of chickens

As for fast-growing broilers, you should not neglect ventilation control and should pay attention to respiratory diseases.

For chickens, it is important to prepare a vaccination program for diseases with strong infectivity and carry out vaccination faithfully.

（2）Measures against avian influenza

It is necessary to take the same measures as for laying hens (page: 21).

5 Others

① Light breed horses

1 Light breed horses (Thoroughbred)

- There are five kinds of light breed horses, Thoroughbred, Thoroughbred pedigree, Arabian, Anglo-Arabian, and Arabian pedigree. Most light bleed horses produced in Japan are Thoroughbred.
- The annual production of Thoroughbred horses is approximately 7,000 (2018), mainly in Hokkaido, Tohoku, and Kyushu. Among them, Hokkaido accounts for more than 98% of the total production.
- Most Thoroughbred horses are used as racehorses after they have been trained for horse racing.
- Thoroughbred horses used for horse racing are limited to those produced by natural mating. Horses produced by artificial insemination cannot be used for horse racing.
- Thoroughbred is a species whose pedigree is strictly controlled by the pedigree registry. Only horses born from registered father horses (stud stallions) and mother horses (broodmares) can be registered. Also, a horse without a pedigree cannot be a racehorse.
  A pedigree registration certificate is issued to the registered horse from the registration agency.

2 Life cycle

- The age of a horse is called in a unique way. The year of birth is called weanling (“Tousai” in Japanese), and the years after the year of birth are called yearling and 2-year-old.
- The gestation period of Thoroughbred is about 11 months, and in Japan most foals are born between February and May.
- From birth to summer, the foal is raised with the mother horse, but after weaning in autumn (about 6 months after birth), it is raised separately from the mother.
- From around the fall of weanling, young horses begin training (breaking) to wear tack, such as saddles and bits, and to get used to being ridden on their back.
- After breaking, they do running training with a rider on the back to build up their physical strength.
- The 2-year-old trained horses are moved to a race track or training center, registered as a racehorse, and trained further for running.
- Among racehorses that have retired, mainly those that have performed well or have a good pedigree are returned to the production area as breeding horses.

① Mating (March to May)
(Gestation period: 11 months)

② Delivery
(February to May of the following year)

③ Lactation
(until 6 months of age)

④ Autumn: weaning
(approximately 5 to 6 months of age)

⑤ Winter - summer: grazing foals together (separated by sex)
(6 months of age to yearling in summer)

⑥ Yearling in autumn: breaking

⑦ Yearling in winter to 2- year-old: training

⑧ 2-year-old after April: race debut

⑨ Retirement, some horses are subjected to breeding

3 Management of stock farm

There are two main types of management in the light breed horse stock farm.

- Breeding farm
  A mother horse is raised and a foal is produced and sold at auction markets and the like.
- Yearling training farm
  Breaking and training of young horses are performed.

In addition, there are some farms that do the consistent work of the breeding and training farms.

Breeding farm

Yearling training farm

② Apiculture

1 Species and characteristics of honeybees

（1）Species

There are 2 species of bees in Japan, the European honey bee (Apis mellifera) and the Japanese honey bee (Apis cerana japonica), but most bees kept as livestock are the European honeybee (hereinafter referred to as honeybees).

（2）Characteristics

Honeybees live in groups and have their own roles within the group.

・Worker bees (female)

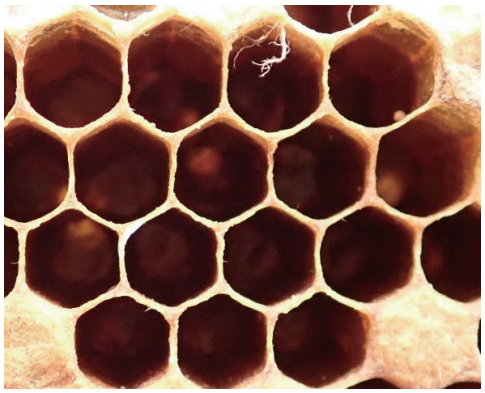
Worker bees are raised in their normal cells (hexagonal compartments that form the comb of bees). During the larvae stage, royal jelly is given in the first half, pollen and honey are given in the last half, and they become adults in about 21 days. The life span (survival time) is about 1 month, but in the cold winter times, they may live for about 6 months. After they become adults, they first clean the cells of the hive, then raise the larvae and finally go out of the hive to feed (the collection of nectar or pollen from flowers).

・Queen bee (female)

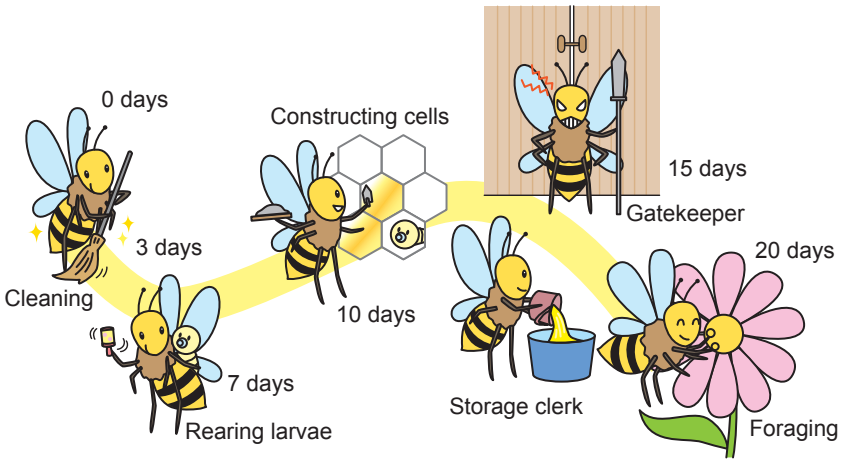
Queen bees grow in special cells called royal cells, where only royal jelly is given to the larvae. Usually there is one queen bee in a hive and it only lays eggs. The queen bee is heavier than worker bees and has a lifetime of 2-3 years.

・Drones (male)

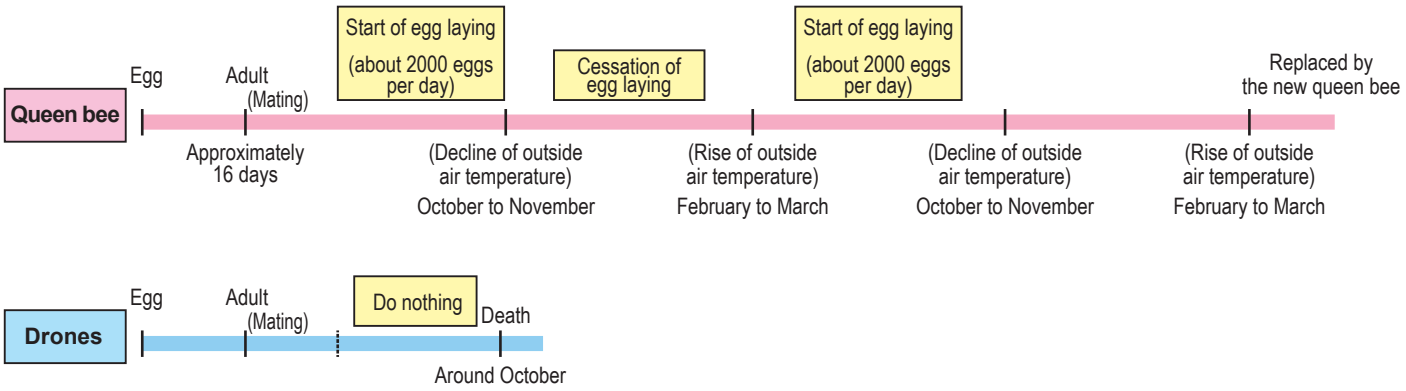
Drones are born during the mating season of the queen (In Japan, April to June is the best season), when worker bees make special cells for them in the hive. Drones do not work in the hive but mate with the queen bee in the air.



Worker bees' cells (hexagonal compartments)



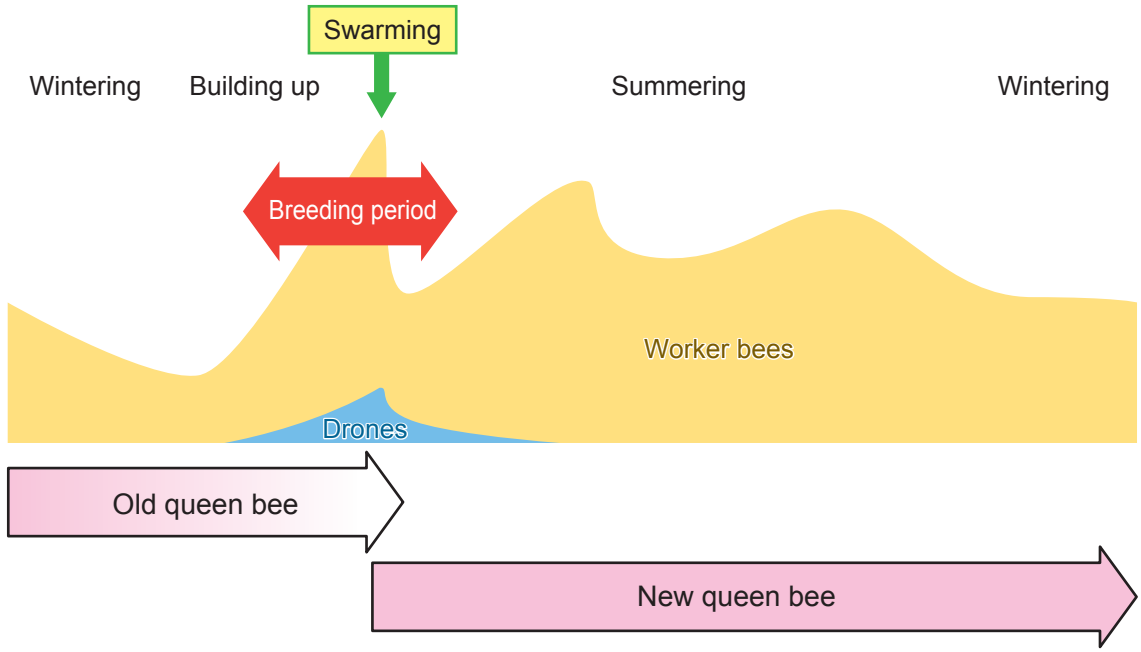
Life of worker bees



Life of queen bee and drones

2 Activities of honeybees during the year

Seasons	Activities
Spring (building up)	In spring and summer, when many flowers bloom, honeybees forage and breed. When a hive reaches a certain size, the production of drones for breeding and the construction of the royal cell begin. A few days before the birth of a new queen bee in the royal cell, the old queen bee leaves the hive with about half the worker bees and builds a new one in another place. This is called swarming.
Summer (summering)	Except for highlands with many flowers, there are few flowers, so it is a difficult time for honeybees. That's why bees sometimes run away from hive boxes in search of new land and don't come back. This is called escaping.
Autumn	It is the time when bees have to store enough honey in the comb before winter. They do their best to collect nectar from flowers whose odors people dislike.
Winter (wintering)	Bees huddle together in the comb to endure the cold. They stop egg laying and rearing larvae during winter, but start laying eggs when spring approaches. In addition, bees sometimes starve to death due to a lack of stored honey.



The annual flow and the number of bees in a hive

6 Questions for confirmation

For the following questions, answer ○ if correct, and × if incorrect.

＜Cattle＞

1. The average milk yield of Japanese dairy cows per year is about 5,000 kg. (　　)
2. The gestation period of the Holstein breed is 280 days. (　　)
3. The milk quality of a dairy cow is the same as that of any other cow. (　　)
4. Feed intake by dairy cows decreases on hot summer days and the milk yield decreases. (　　)
5. Feces and urine discharged from a cowshed are allowed to be left in the field. (　　)
6. All beef cattle raised in Japan are Japanese black cattle. (　　)
7. In fattening operation of Japanese black cattle, cattle at around 10 months old are purchased on the market and fattened until around 30 months of age. (　　)
8. For fattening cattle, the proportion of roughage is higher than that of concentrate (formula feed). (　　)

＜Pigs＞

1. Japanese fattening pigs develop fast and weigh 100 to 110 kg in 5 to 6 months. (　　)
2. The average litter size of Japanese dam pigs is 5. (　　)
3. The dam pig and piglets are raised together for 2 months after birth. (　　)
4. The dam pig can become pregnant and give birth 4 to 5 times in 2 years. (　　)
5. Since diseases seldom occur in Japanese pig farms, vaccination is not needed. (　　)

＜Chicken＞

1. The development of chicks is divided into four stages, namely, yosu (youbina, young chick), chusu (chubina, middle-sized chick), daisu (obina, large-sized chick), and adult chicken. (　　)
2. Formula feed is most frequently used as feed for laying hens. (　　)
3. Chickens will not die even when infected with avian influenza. (　　)
4. Growth of meat chicken (broiler) is slower than growth of egg-laying chicken. (　　)
5. The weight of the broiler is about 5 kg for males at 7 weeks of age. (　　)

Answers

＜Cattle＞

1．× (Reason: The average milk yield of Japanese dairy cow / Holstein breed exceeds 8,000 kg.)

2．○

3．× (Reason: The milk quality differs among cows.)

4．○

5．× (Reason: It is decided by law that composting process, etc. should be employed properly.)

6．× (Reason: Other than Japanese cattle, there are types of dairy breed steer and hybrids (F1), there are thus 3 types in total.)

7．○

8．× (Reason: Proportion of formula feed is high during fattening period.)

＜Pigs＞

1．○

2．× (Reason: The litter size of Japanese dam pigs is 10 to 15)

3．× (Reason: Nursing period of piglets is 3-4 weeks.)

4．○

5．× (Reason: Various diseases occur in the pig farm so that appropriate preventive injection is necessary.)

＜Chicken＞

1．○

2．○

3．× (Reason: When infected with a highly pathogenic virus, it will die within one week.)

4．× (Reason: Broiler is characterized by its faster growth rate than laying hens.)

5．× (Reason: Male broiler grows to about 3.3 kg at 7 weeks of age.)

II Basic knowledge on livestock and their feed

1 Dairy cattle

1 The nature of dairy cattle

Dairy cows are animals with a strong wariness and irritability, so that people should contact them with a friendly attitude.

Dairy cows sometimes eat concentrate rather than roughage, this is called “choosy eating”.

In hot summer days, the dairy cow increases frequency of respiration and evaporates water to prevent the body temperature from rising.

To measure the temperature of a dairy cow, usually a thermometer is inserted into the anus.

The milk yield by dairy cows gradually increases after delivery and the daily yield reaches maximum at 5 to 7 weeks, and many dairy cows yield daily milk around 50 kg.

Milking is finished (stopped) about 60 days before delivery, and it enters the dry period.

2 Structure of the cowshed

For raising method of dairy cows, there are “grazing” that is grazing the cows in grassland and “housing” that is raising cows in the cowshed.

There are 3 ways of housing: “tied housing”, “freebarn” “freestall”.

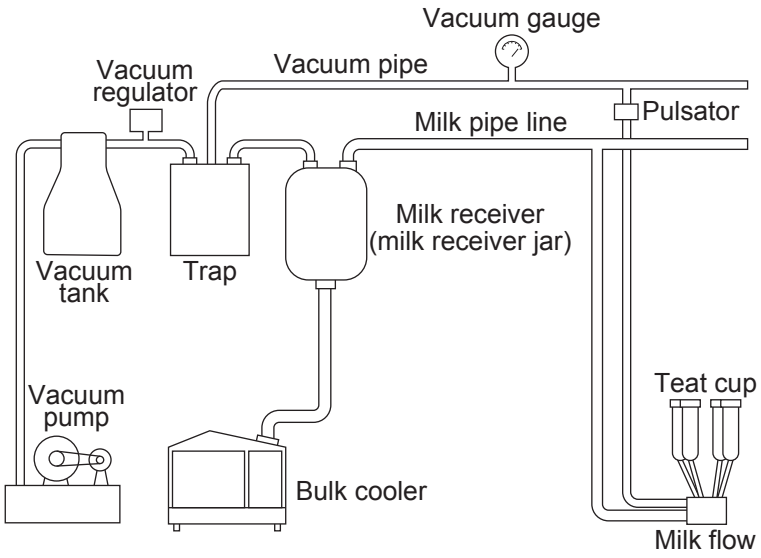
Tied housing refers to a raising method that each cow is tied and fixed to a pillar with a stanchion, a rope, a chain, etc.

A water cup is often used as a water supply. Milking is done in the place where dairy cows are tied and the milk collected goes through a milk conveying pipe above the head of a cow and enters a refrigerator (bulk cooler).

Stanchion barn

New York style tie stall

Milking in a tied barn



Milking system

Freebarn is a raising method that let the cow move freely without being tied in the large roofed enclosure. Litter is laid entire floor except feeding space. Sawdust (powder of wood), reusing compost (fermented/manured dry compost) are often used as litter. A water tank is often used as a water supply. Milking is done in a separate room, milking parlor.

Freebarn cowshed

Milking parlor

Milking robot

In freestall, beds (cattle floor) is individually partitioned as shown in the picture. This is the difference from freebarn.

Trough in freestall cowshed

Bed (cattle floor) in freestall cowshed

In cowsheds of freebarn and freestall, weak cows may be kicked out of the trough by strong cows, resulted in the decrease of the amount of feed intake.

3 digestive system of dairy cows

- There are four stomachs in dairy cows.
- The biggest stomach is the first stomach, which is called lumen.
- Many microorganisms live in rumen and they decompose feed and supply nutrients (volatile fatty acids) into the body of dairy cows.
- Dairy cows return feed once they are eaten to their mouths, mush with teeth, finely grind and swallow again, which is called rumination and mastication.
- Feed becomes finer by rumination and mastication, decomposition and digestion by microorganisms in the rumen proceeds fast.
- In the first stomach of a dairy cow (rumen), volatile fatty acids (acetic acid, propionic acid, and butyric acid) are produced from cereal starch and roughage fibers and are absorbed into the body to produce milk and maintain the body.
- The proteins needed to produce milk and maintain the body are made from amino acids absorbed from the small intestine.

4 Feed

- Commonly used roughage is grass silage, corn silage, sorghum silage, hay, rice fermentation roughage (rice whole crop silage), rice straw etc.
- Commonly used concentrate is formula feed, corn, soybean meal, rapeseed meal, bran, food production byproduct (bean curd lees, beer lees), beet pulp and so on.
- Formula feed is made by mixing various feed ingredients at a formula feed factory, but mainly

corn and soybean meal is used as grain and oil meal, respectively.

- Silage is made by storing minutely cut grass, rice or corn (stem / leaf / grain mixed) in the absence of oxygen (air).
- The grass reaped earlier has higher protein content, fiber digestive efficiency and the nutrition value than that reaped later.

Types of feed

Hay

Silage

Concentrate

Feed facility

Tower silo

Bunker silo

Formula feed tank

5 Nutritional value of feed

(1) The composition of feed is indicated by the content of crude protein, crude fat, carbohydrate, minerals, and vitamins.

(2) Nutritional value (energy) of feed for dairy cows is indicated by TDN (total digestible nutrients) in Japan.

(3) Cereals have a high TDN content due to the high digestibility of starch, and corn has a very high TDN content of 93.6% of the dry matter.

(4) Grasses are rich in fiber, but their digestibility is lower than that of cereal starch, so their TDN content is lower than that of corn.

(5) The crude protein content and fiber digestibility of gramineous pasture grass differ depending on the mowing time, as shown in the table. The nutrition value of pasture grass is higher when mown at an earlier time.

Grass mowing time and nutritional value (Italian ryegrass, timothy)

	Before heading	Heading time	Flowering time
Italian ryegrass			
Crude protein content: %of dry matter	18.4	13.7	8.3
Total fiber digestibility: %	75	60	50
Timothy			
Crude protein content: %of dry matter	17.5	10.0	8.8
Total fiber digestibility: %	70	60	47

6 Feed production

(1) Silage is a stored feed made by lactic fermentation using stored pasture grass, rice, and corn (with stem, leaf, and seed mixed) in an oxygen-free, air-tight environment.

(2) In order to produce good silage, it is important to cut the material into small pieces and to give sufficient tread power and pressure.

Preparation of grass silage Stack silo

Mowing by a mower conditioner

Grass harvesting operation

Creating stack silo

Stack silo

Round bale system of grass silage

Mowing by a mower conditioner

Baling operation by a round baler

Wrapping by a wrapping machine

Round bale silage

7 Feeding

- Separate feeding is a method that gives roughage and concentrate separately, whereas total mixed ration (TMR) is supplied by mixing both feeds with a mixer in advance.
- In lactating cows (milking cows), intake of feed also increases accompanied by increasing yield of milk after delivery.
- Accompanied by increasing the amount of lactation, the intake of concentrate increases, but in separate feeding, considering the ratio of roughage to concentrate (balance), care must be taken not to take exceed concentrate. On that regard, giving total mixed ration (TMR) has an advantage that can increase both intakes in good balance.
- When feeding separately, it is recommended that first feed a roughage such as hay or silage, and later feed concentrate.

An example of feeding to milking cows is shown in the following table.

Hokkaido: 40 kg of milk per day

10 kg of grass silage, 14 kg of corn silage, 10 kg of formula feed, 2 kg of alfalfa hay, and 3 kg of beet pulp

Ibaraki Prefecture: 28 kg of milk per day

4 kg of timothy hay, 2.9 kg of alfalfa hay, 3.4 kg of bermuda grass hay, 6.3 kg of formula feed, and 3 kg of beet pulp

8 Quality of milk and mastitis

(1) The quality of milk is checked by the mixed milk to be shipped (a mixture of milk from many cows).
(2) The price of milk varies depending on the test result of the mixed milk.
(3) The milk quality of each cow is checked once a month if the herd test is conducted.

Criteria for milk quality (e.g.)

	Excellent milk quality	Normal milk quality	Milk quality that needs improvement
Milk fat: %	3.9 or more	3.5 ~ 3.89	3.0 ~ 3.49
Milk protein: %	3.4 or more	3.1 ~ 3.39	2.8 ~ 3.09
Solid non fat: %	8.8 or more	8.5 ~ 8.79	8.0 ~ 8.49
Somatic cells: tens of thousands/ml	Less than 10	10 ~ 29	30 ~ 99 or more

- Milk produced immediately after delivery is called colostrum.
- Since content of milk constituent in colostrum differs from normal milk (average milk), for 5 days after delivery the colostrum can not be shipped.
- Mastitis is a disease caused by the proliferation of pathogenic bacteria in the breast of a cow. When infected with mastitis, inflammation occurs in the breast and it shows clinical symptoms such as fever, swelling of the breast and pain. When the breast become infected with pathogenic bacteria, leukocytes increase and they engulf the foreign bodies such as bacteria, and then the leukocytes excreted in milk and the number of somatic cells increases. Somatic cells in milk consist of the leukocytes and exfoliated pieces of epithelial cells form the mammary gland. The number of somatic cells of healthy dairy cattle is generally no more than 200,000/ml. In addition, the number of somatic cells in milk is used to evaluate the hygienic quality of milk.

9 Gastrointestinal and hoof diseases

(1) Dairy cows were originally herbivorous animals that ate grass, but now they are fed a large amount of cereal starch to achieve high milk production.

(2) The digestion rate of cereal starch in the first stomach (rumen) is much faster than that of grass fiber. The production of volatile fatty acid and lactic acid increases as a result of feeding a large amount of cereal starch.

(3) Therefore, when a large amount of cereal is fed, the pH of the rumen (hydrogen ion concentration) decreases, which may cause subclinical rumen acidosis and hoof disease.

(4) In Japan, there are many cases of disuse due to limb and hoof disorders (laminitis and hoof disease).

(5) For dairy cows, limb and hoof disorders may also result from the selective eating (choosy eating) of concentrate feed.
(6) The following table shows the conditions of cows with abomasal displacement, rumen acidosis, and laminitis.

Digestive disorders and laminitis of dairy cows

Disease	Cause	Symptoms of dairy cows
Abomasal displacement	It is likely to occur due to a shortage of roughage immediately after delivery and a large supply of concentrate feed.	Anorexia, loss of energy, and decreased milk production
Rumen Acidosis	Lactic acid accumulates in the rumen due to the intake of large amounts of cereal starch, and the pH decreases drastically.	Anorexia, decreased rumen movement, decreased milk production, and decreased liver function
Laminitis	Lactic acid and histamine formed during rumen acidosis act on capillaries in the dermis of the hoof, causing inflammation	Difficulty in walking, inability to access troughs and water suppliers, decreased feed intake, and decreased milk production

10 Breeding of dairy cows

- Dairy cows after delivery repeat estrus every 21 days on average.
- It is important that artificial insemination is due without overlooking estrus. Recently, not only artificial insemination but also transplantation of fertilized egg, which transplants fertilized eggs of Japanese black cattle, has become popular.
- Frozen semen is used in most cases
- When a cow is in estrus, the vulva is congested and mucus is secreted.
- In the prime of estrus, a state that allows other cows to ride on the back (standing estrus) appears, and observation of the state is important.
- The conception is confirmed by having diagnosis of pregnancy.
- Delivery interval of dairy cows is ideally one birth per year.

Artificial insemination

11 Delivery

- The calf weighs about 45 kg at delivery.
- Natural births without help by humans are ideal, but when calving difficulty, midwifery is necessary.
- When practicing midwifery, care must be taken not to damage the birth canal of the mother cow and not to cause bacterial infection.
- The placenta (after birth) is discharged within about 6 hours after the calf is born.
- The mother cow licks the newborn calf to dry the body surface, but it is important to transfer the calf on the dry litter.

12 Giving colostrum

- It is important for the newborn calf to drink colostrum that contains a lot of immunoglobulins to acquire immunity.
- It is preferred that colostrum is given to the calf at least for 3 days of birth.

13 Nursing and raising calves

(1) The early weaning method, in which weaning is carried out at 6 weeks of age, is recommended. The feeding method is shown in the following table.

Feeding by the early weaning method (example)

Colostrum	1 to 2 liters within 4 h after birth and 2 liters between 4 and 6 h
Milk replacer, breast milk	When only liquid milk replacer is fed, the amount is 600 g/day (fed after dissolving in warm water). When only milk is used, the amount is 4.5 kg/day until the sixth week.
Calf starter	Concentrate feed for weaning (synthetic milk) from about 1 week of age. 1 ~ 2 weeks of age: 0.1 kg/day, 2 ~ 3 weeks of age: 0.2 kg/day 3 ~ 4 weeks of age: 0.5 kg/day, 4 ~ 5 weeks of age: 0.8 kg/day 5 ~ 6 weeks of age: 1.2 kg/day (Thereafter, it gradually increases until 3 months of age, reaching a maximum of 2.5 kg/day.)
Hay	Free feeding of good hay

(Japan Feeding Standard: Dairy Cows, Production Medicine System: Dairy Cows 1)

(2) We aim to achieve the following two goals during the raising period of dairy cows.

① Sufficient development of the first stomach (rumen) should be carried out by feeding roughage preferred with good quality.

② Moderate exercise helps develop their muscles and bones.

14 Health management of calves

- Calves are prone to be infected with diarrhea, septicemia, pneumonia etc.
- It is important to keep calves in a well ventilated, sunny and clean environment.
- For raising calves, calf hutches and calf cages are often used.
- It is important to keep the calf hutches and calf cages clean using a lot of litter.

Calf hutch

15 Body condition score

(1) Body condition is the degree of accumulation of subcutaneous fat in dairy cows.
(2) The numerical value of the body condition is called the body condition score and is expressed in BCS.
(3) BCS has a range of 2.0 ~ 5.0.
(4) BCS is determined by observation of the coxa, hip bones, ischium, transverse processes, sacrosciatic ligaments, and sacroiliac ligaments.
(5) Because BCS is closely related to milk production and breeding performance, the following target values are set according to the production period of dairy cows.
① In case of delivery, the target is about 3.50 with the range of 3.25 ~ 3.75.
② The maximum decrease after the start of lactation is 0.75 ~ 1.0.
③ The recovery should begin by 100 days after delivery at the latest.
④ The range is 3.25 ~ 3.75 during the dry period.

Body condition

<Judgment sample of simple body condition score>

Simple BCS = 2: Thin

Whole body: The photograph shows extreme thinness.
Vitality is lacking and the belly is hollow, so the ability is not expected.

Rump: V-shaped
The hip bones and ischium are angular.



Simple BCS = 3: Average

Whole body: The photograph shows slight fat accumulation, but within the normal range.
Each part of the body is clearly outlined, and it seems to show the ability sufficiently.

Rump: V-shaped
The hip bones and ischium are rounded.



Simple BCS = 4: Heavy

Whole body: The photo shows extreme heaviness.
Excess subcutaneous fat is deposited and the outline is very blurred.
Problems after delivery are expected.

Rump: U-shaped
The hip bones and ischium are hidden under fat.



Photo (3 whole body photos): Akiko Nishiura, chief researcher, National Agriculture and Food Research Organization
Photo (6 rump photos): Tochigi Prefectural Livestock and Dairy Experimental Center

16 Types of excreta

- There are three types of excreta from dairy cows, that is, solid matter, slurry and liquid matter.
- The solid matter is a mixture of feces and litter made by removing of urine, from which compost is made.
- The liquid matter is urine separated from feces.
- Slurry is a mixture of feces and urine stored in a tank and used for the production of fertilizer and methane.

Feces and litter moved out from the cowshed with a barn cleaner.

Slurry tank

17 Manufacturing and usage of compost

- Compost is a product that decomposes feces of dairy cows and mixture of feces and litter aerobically (in the presence of oxygen) and reduces moisture content.
- To make high-quality compost, it is necessary to supply sufficient air, and for this reason it needs turning (stirring and mixing).
- Compost is used as fertilizer. Dried compost sometimes used as litter inside the cowshed again, and this is called “reusing compost”.
- Compost is considered to be the best when having a moisture content of about 60 to 65%, and for this purpose, secondary materials are mixed to produce compost.
- If composting proceeds well, the temperature will rise. The resulting temperature is 70 to 80°C, which kills pathogenic bacteria, parasites, and weed seeds.

Compost house

2 Beef cattle

1 Japanese cattle (Japanese black cattle)

Japanese cattle are indigenous to Japan, have been bred and improved by Japanese producers over a long period of time, and are carefully protected. There are Japanese black cattle (black), Japanese brown cattle (yellowish brown), Japanese shorthorn cattle, and Japanese polled cattle, but the most common breed is Japanese black cattle. Japanese black cattle are gentle in nature.

（1）Nutrition management of breeding cows

① Nutrition management of breeding cow in natural nursing

○ Terminal stage in gestation
- Fetuses rapidly grow from two months before delivery to delivery.
- Nutrition for maintaining the body of the mother cow and that for growth of fetuses are necessary.

○ Lactation period
- The amount of feed according to lactation amount is necessary.
- It is necessary to increase or decrease the amount of feed according to the nutritional condition of the mother cattle.

② Nutrition management of breeding cow in artificial nursing

There is little lactation period compared with the mother cow of the natural nursing.

○ Gestation period
- It is the same as the mother cow of natural nursing .

○ Lactation period
- Continue the feed amount given in the end of the gestation period.
- The amount of feed should be according to the nutritional condition of the mother cattle.

（2）Breeding of beef cows

- Beef cows after delivery repeat estrus every 21 days on average.
- It is important that artificial insemination is due without overlooking estrus.
- Semen and fertilized eggs of Japanese cattle are very important to Japanese producers, so it is important to store them in a place that can be locked so that they are not lost.
- When a beef cow is in estrus, the vulva is congested and mucus is secreted.
- In the prime of estrus, a state that allows other cows to ride on the back (standing estrus) appears, and observation of the state is important.
- The conception is confirmed by having diagnosis (inspection) of pregnancy.
- Delivery interval of beef cows is ideally one birth per year.

Estrous behavior

（3）Delivery

- The calf weighs about 30 kg at delivery by mother beef cows.
- Natural births without help by humans are ideal, but when calving difficulty, midwifery is necessary.
- When practicing midwifery, care must be taken not to damage the birth canal of the mother cow and not to cause bacterial infection.
- The placenta (after birth) is discharged within about 6 hours after the calf is born.
- The mother cow licks the newborn calf to dry the body surface, but it is important to transfer the calf on the dry litter.

（4）Management of calves of Japanese black cattle

① Body weight at birth

The calf of Japanese black cattle weighs about 28 kg at delivery.

Immediately after delivery

Natural nursing

Artificial nursing

② Giving colostrum

The calves are given colostrum for 2-3 days of birth. Since colostrum contains immunoglobulins which is resistant to infection of calf diseases, be sure to make calves drink colostrum.

③ Program of feed supply after birth

The following table shows the feed providing program (after giving colostrum) of early weaning in Japanese Feeding Standard: Beef Cattle (2008).

Milk replacer includes powdered skim milk, dried milk whey and cereal powder. Synthetic milk is a solid feed used in nursing period and includes wheat, barley, corn and soybean flour.

Age in days after birth	Amount of milk replacer supplied (air dry matter: g/day)	Amount of synthetic milk supplied (air dry matter: g/day)	Hay
8－13 days	400		
14－17 days	500		
18－21 days	500	100	
22－28 days	500	200	
29－35 days	500	300	
36－42 days	500	500	Free feeding
43－49 days	250	800	
7－ 8 weeks	(250)	1200	
8－ 9 weeks	(250)	(1000)	
9－10 weeks	(250)	1400	
10－11 weeks		(1200)	
11－12 weeks		1500	
12－13 weeks		(1300)	
13－14 weeks		1600	
		1700	
		1800	
		1900	

Values in parentheses: The amounts of supplied feed when lactation is continued after 7 weeks of age.

Milk replacer: The temperature of the water used to dissolve milk replacer should be approximately 38 to 40°C, the same as that of breast milk, when the calf drinks it. For this purpose, it is preferable to dissolve in hot water at 45 to 50°C. When dissolving milk replacer, prepare hot water, put the milk replacer in it, and stir and dissolve them (National Beef Cattle Advancement Funding Association (NBAFA), Japan Livestock Industry Association, "Technology of feeding management for dairy cattle and beef cattle" 2006).

④ Key points of calf management

Since newborn calves are less resistant to pathogenic bacteria, they are raised by transferring to a facility dedicated for calves such as calf hutches to prevent bacterial infection from mother cow (refer to page 23, "14 Health management of calves" in the Section of Dairy cows).

Synthetic milk and hay to be fed should be freshly prepared. The hay to be fed should be in high quality.

Observe diarrhea and loose stools firmly.

Pneumonia occurs by infecting pathogens under following condition: "weakening of immunity by stress and shortage of nutrients", "damage of bronchial mucosa caused by coldness and dryness", "mucosal damage caused by ammonia gas". To prevent those, "removing ammonia from the barn", "Cleaning of the cowshed", "keeping warm the calf", "adequate feed to reduce stress" and "giving colostrum" are important.

(5) Key points for management of raising period

In the case of beef cattle used for fattening, raising period means the period from weaning to start of fattening. In this period, it is important to give high quality roughage adequately, to develop visceral organs and enhance muscle and skeleton.

Castration of male calves should be done by 4 to 5 months at latest.

(6) Fattening

Fattening of Japanese black cattle begins at about 10 months of age, about 300 kg, and is kept in groups of several fattening cattle (enclosure). Fattening is performed mainly by concentrate feed for about 20 months.

① Feeding of Japanese black cattle in fattening period

Feeds during the fattening period are mainly concentrate made mostly from grains (corn, barley), regarding roughage, hay and rice straw are fed together in the early stage of fattening (10 to 16 months old), but after that, only rice straw is fed as roughage. The feeding amount of rice straw in the early to middle stage of the fattening period is around 2 kg, and in the late stage of fattening, around 1 kg is fed.

② Feed intake and fattening results in the fattening period (one example of a study)

	Feed intake (dry matter: kg/day)		Daily gain kg/day	Body weight at the time of shipment kg
	Concentrate feed	Rice straw		
Prior period	6.2	1.8	0.97	
Latter period	7.2	0.9	0.67	725

Prior period: From 10 to 18 months of age

Latter period: From 18 to 27 months of age

③ Key points for management of fattening period

In the late stage of fattening, feed intake becomes non-constant and appetite may suddenly drop at a certain point, this is called “stop eating”, kuidomari in Japanese. Changes in the intake of feed should be carefully observed on a day-to-day basis, and when it is judged as “stop eating”, the cause must be identified by consulting with a veterinarian and measures must be reflected in the feeding method. “Stop eating” is often caused by ruminal acidosis. This is a disease caused by excess feeding of cereals.

Urolithiasis is a urological disease frequently occurring in fattening of steer cattle. At the early stage, fine grayish stones adhere to the genital area. In severe cases, it exhibits lumbar pain / urinary retention and may die due to appetite abolition, bladder rupture or uremia. It must be found in early stage as far as possible and had a diagnosis of the veterinarian.

In addition to urolithiasis and ruminal acidosis, as other diseases during the fattening period, bloating occurs in fattening cattle. This symptom is caused when gas generated in the rumen is not excreted well.

Since cattle support a large weight with four feet, it is essential for health care of fattening cattle to keep the hoofs in a normal shape, so that periodical hoof cutting is necessary.

Hoofs with normal length

Overgrown hoofs

④ Rating of the dressed carcass of Japanese beef

The beef trade is based on the rating of the dressed carcass. The dressed carcass is the part where internal organs and skin are removed from the cattle body. The rating is done by cutting between the 6th and 7th ribs of the dressed carcass, and regarding this surface, yield, fat marbling, meat color, meat firmness and texture, fat color and quality, and grading are determined. A characteristic of Japanese black cattle is that the grade of fat marbling is higher than that of other cattle (hybrid and Holstein steer cattle).

One of the reasons why Japanese black cattle have a long fattening period is to seek higher fat marbling grade. Fat marbling is also known as "marbling meat (shimo-furi in Japanese)".

Vitamin A feeding may be adjusted to enhance fat marbling.

2 Holstein steer cattle

Male calves of Holstein, a dairy cow, are castrated and raised as beef cattle. It is commonly referred to as Holstein steer fattening.

（1）Management of Holstein calves

① Birthweight of a Holstein calf

The average birthweight of a Holstein calf is about 45 kg.

② Feeding colostrum

The procedure is the same as for Japanese Black cattle, described in the previous section (page 49). Feeding colostrum is the first step to growing healthy cattle.

③ Program of feed supply after birth

As in the case of Japanese Black cattle, the feeding program during the nursing period is conducted in a similar manner. That is, after sufficient colostrum is fed, milk replacer, synthetic milk, and hay are fed (refer to the preceding section). When switching from colostrum to milk replacer, calves are more likely to develop diarrhea. Therefore, it is important to gradually switch to milk replacer by mixing a portion with the colostrum and checking the condition of calves.

The following table shows the normal fecal status of newborn calves.

Normal feces of calves

Classification of feces	Aspect of feces
First week after birth	The color of feces is yellow to light brown, and the hardness is gruel-like to tallow-like fatty, which is sticky and contains no solid components. The form at excretion is maintained.
After switching to milk replacer	Feces are yellow to grey in color. When hay or straw is first ingested, it assumes a tallow-like fatty and sticky powdery consistency containing solid components.

（2）Key points of calf management

It is the same as “Key points of calf management” of Japanese black cattle (page 50 (4)) in the previous section. The picture below shows the rearing in the calf hutch.

Calves of Holstein and calf hutch

① Dehorning

When managing cattle as a group, remaining uncut horns increases “danger to administrator” and “injury due to horn hustling between cattle”, calves of Holstein are thus undergone dehorning up to 3 months old.

② Castration

To lighten competition between cattle and improve meat quality, it is necessary to perform castration after 3 months of age.

（3）Key points of management during raising period

The main points of management in the raising period of 4 to 10 months old are “development of ruminant stomach and growth promoting of first stomach villi”, “Enrichment of muscles and skeleton”. For that purpose, it is important to give an adequate amount of formulated feed accompanied by constant feeding of good quality hay. Weight of mixed feed is 5 kg at 5 months of age and 6 kg at 6 months of age is a rough estimate of feeding.

（4）Fattening of Holstein steer

The fattening of Holstein steer is started from 7 to 8 months when its body weight is about 280 kg, and is slaughtered at around 20 months of age.

An example of feeding in fattening Holstein steer cattle in Kyushu is shown below.

Example of feeding at a fattening farm in the Kyushu region

Fattening age in months	7～11	11～18	18～22
Weight gain in the period: kg/day	1.3	0.7	0.8
Rice straw: kg/day	3	1	0.6
Hay: kg/day	1	0	0
Formula feed: kg/day	4	10～11	12

（5）Key points for management of fattening period

As described in the section on the fattening of Japanese black cattle, daily observation on ruminal acidosis and urolithiasis, consultation to veterinarians and medical examination are necessary.

3 Hybrids (F1)

Female dairy Holstein breed is inseminated artificially with the semen of Japanese black cattle and the calf is called hybrid (F1). The body weight of hybrid at birth is about 40 kg, it is intermediate between Japanese black cattle and Holstein. Because the calves are smaller than those of Holstein, there is an advantage that Holstein cows can feel at ease at primipara.

（1）Purpose of F1 cattle

The purpose of using hybrid cattle is to make beef cattle which has the characteristics of both Japanese black cattle superior in fat marbling in dressed carcass and Holstein superior in its growth.

（2）Management of calves, management in raising period and fattening management

This is basically the same as the Japanese black cattle and Holstein steer cattle as described above, so that refer to that part when you get a job to handle hybrid cattle.

（3）Fattening of hybrid cattle

The fattening of hybrid cattle starts from 7 months old, when the weight is about 250 kg, and shipping with weight of about 730 kg at 25 months of age is standard.

The following is an example of a feeding system for hybrid cattle.

System for fattening hybrid cattle (example)

	Prior period	Middle period	Latter period
	7 ~ 11.5 months of age	11.5 ~ 18.5 months of age	11.5 ~ 25 months of age
Daily gain: kg	1.0—1.17	1.17—0.83	0.67—0.33
Formula feed: kg/day	5.0—8.5	9.0—11.0	8.5—7.5
Alfalfa cube	1.2—0.7	0.5 (~ 13.5 months)	0
Rice straw	0.6—1.0	1.0	0.8—0.6

・Formula feed: include barley for the latter period, at 22 ~ 25 months of age

3 Pigs

1 Reproductive physiology and management of breeding pigs

The estrus cycle of female pigs is 21 days, and proestrus, estrus, metestrus, and anestrus during which estrus symptoms are not observed, are repeated. Female breeding pigs are mated by identifying the period suitable for mating. There cases of natural mating, artificial insemination (AI) or performing both. They are judged as pregnant if they do not express estrous again after 21 days of mating.

During gestation period, it is raised in individual pig room in the stall and when the delivery approaches, it is transferred to the specific piggery with farrowing pen.

With delivery of pigs, there are few difficulties and giving birth one by one at about 10 minute intervals. After the last piglet is born, after birth begins to appear and the delivery will finish within 2 to 3 hours. After delivery, the sow does not come into heat during lactation period. After weaning of piglets, the sow comes into heat again in 4 to 5 days.

Obesity of pregnant pigs causes fetal growth insufficiency and delivery difficulty, restricted feeding is thus necessary accompanied by observation whether physical condition is good or bad. In the late stage of gestation, increase the feed slightly to satisfy the growth of fetuses.

The sows during nursing are liable to lose their weight due to lactation, the amount of feed must be increased.

After delivery, gradually increase the amount of feed, and when the amount is insufficient, devise such as increasing the times of feeding. When piglets weaning and nursing has finished, adjust the feed with paying attention to the physical condition of the mother pig.

Male breeding pig (boar) is used after semen examination on the number and motility of sperm. In case of raising for natural mating, so as not to cause a big difference in body size against females, feeding control which suppress growing larger is necessary.

2 Nursing and raising of piglets

The accident rate is the highest in the piglet's nursing period and immediately after weaning. Born in an immature body, then rapidly prepare the immunity and digestive capacity, and it grows rapidly and the weight reaches more than six times the birth at weaning. For that reason, it can be also said that the piglet tends to break down the balance in the body. If the piglet's tail hangs down, it indicates bad condition. Healthy pigs have no adhered secretions in their eyes, their nose is moderately damp, the tails are rolling, and the hair is glossy.

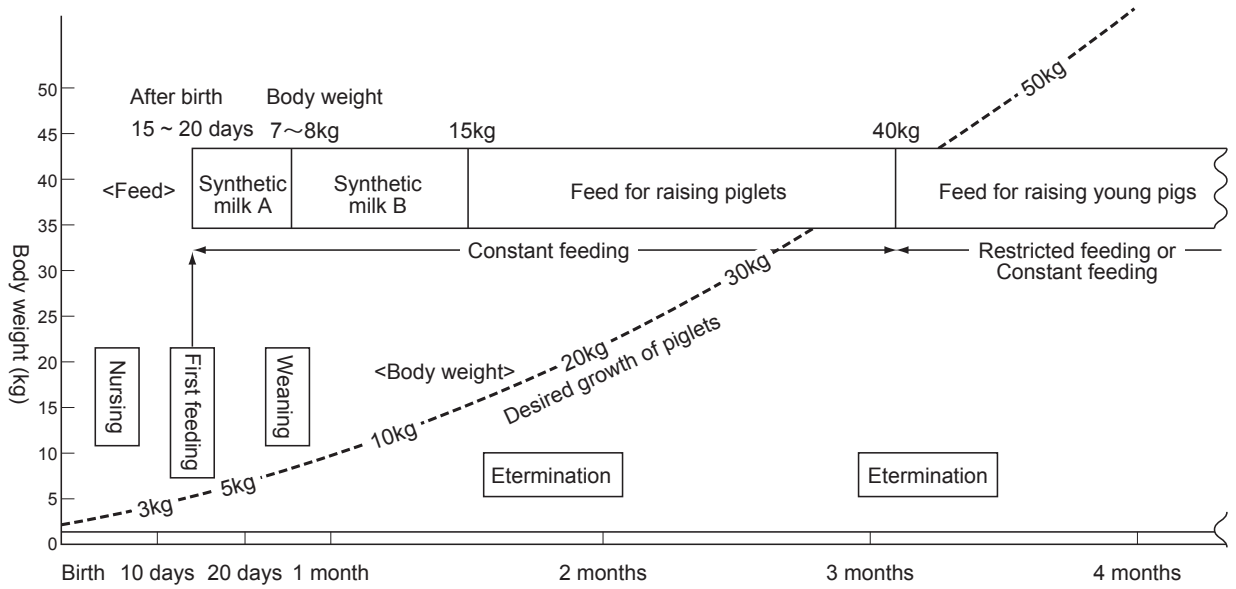
For piglets, it is necessary to drink enough milk of mother pig (colostrum) immediately after birth. Colostrum means breast milk from immediately after delivery to the 2nd day. Antibody against various diseases (immunoglobulin) is contained in colostrum, it is not until drinking colostrum that piglets gain resistance to external diseases.

In addition, iron, which is a material of erythrocytes in the blood, is insufficient, so that iron pills is administered as necessary.

A few days after birth, nursing starts in a short time at once. Nursing is usually carried out about 24 times a day. The health condition and milk yield of a sow are closely related to the growth of the piglets. Feed for first feeding (synthetic milk) is started at about 1 week after birth to familiarize the babies with solid feed other than breast milk.

Weaning from the dam is generally done 3 - 4 weeks after delivery. In some cases, early weaning called SEW is carried out, but if weaning is carried out within 2 weeks, estrus returns and conception rate of the sow will be adversely affected.

The feed after weaning is synthetic milk A, but it is mixed with the feed for first feeding for several days.



Example of development and raising management of piglets

3 How to keep the fattening pigs and facilities/equipment

Usually, fattening pigs are managed with herd of 10 or more pigs (group feeding). For fattening piggery (pork piggery), a drainboard floor style piggery is common. Since high rearing density causes stress such as fighting behavior, it is necessary to secure floor area per head of 0.7 m^2 with a body weight of 50 kg and 1.0 m^2 with that of 100 kg. Narrower floor area affects productivity.

In principle, feeding to fattening pigs should be done by ad libitum feeding. As a feeder, a constant feeder (self-feeder) is used to maintain the state that pigs can always eat feeds. An automatic feeder is used as feeder (trough) in the piggery. The feeder has a structure suitable for ad libitum feeding, and the wet feeder has a structure for mixing feed and water when eating.

4 Habits of pigs and how to contact with pigs

Pigs have herd instinct, that is, have a habit of creating group. In case of group feeding, the strength appears, so that care must be taken that even weak pigs can eat enough feed. Pigs are temperate in nature, well attached to humans and has ability to distinguish persons. A sense of smell and hearing are particularly developed. In addition, it is timid and susceptibly reacts to movement and sound. For that reason, contact gently and do not be surprised. Also handle pigs without getting stressed at the time of shipment. Stress also affects meat quality.

Make pigs excrete feces and urine into a fixed place and distinguish it from the place to sleep. Lower and wet places are prone to excretion place. In addition, when competition occurs between adjacent pig rooms, a habit appears that excreting feces near the fence, which is the boundary of each other.

5 Pig feed

Feed is roughly divided into synthetic milk for piglets, feed for raising and feed for fattening. The amount of the nutrients required varies depending on the growth stage, the nutritional design is thus adjusted to each stage. Specific numerical values of demand are decided based on feeding standard. Items to be confirmed as nutrients are energy (mainly carbohydrates and lipids), proteins, minerals and vitamins.

Synthetic milk is a powdered feed for piglets and contains skim milk at a high rate. Synthetic milk is further divided into synthetic milk as creep feed, synthetic milk A, synthetic milk B, etc.and these are fed up to 15 kg in order. Synthetic milk A is for early period after weaning, synthetic milk B is for later period after weaning. After that, feed for raising piglet rich in corn, feed for fattening pig of the early stage and that of the late stage. Feed for fattening pig for the late stage must not contain antimicrobial feed additives.

Synthetic milk

Feed for fattening

6 Device for reducing feed costs

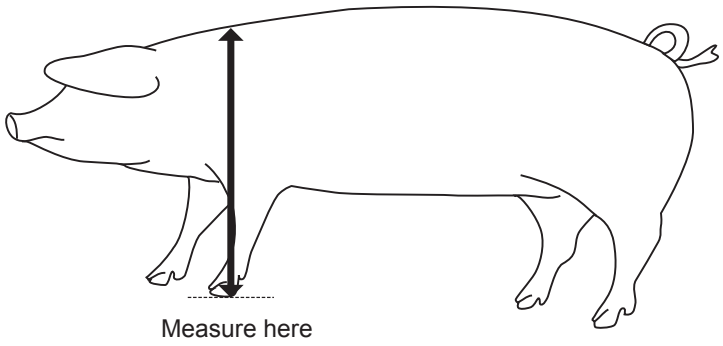
In pig farming management, feed purchasing costs is high, accounting for 60 to 70% of production cost. For that reason, it is desirable to reduce feed costs by equally using raw materials for feed that is cheaply available nearby. Representatives are food waste discharged from food production and food sales. In that case, attention must be paid to make a nutrition design. Especially when the fat content of feed is high, it adversely affects meat quality. Based on the Japanese feeding standard, blend the raw materials to meet the demand of nutritional ingredients according to the growing stage of pig followed by feeding. Be careful about balance between energy of feed (TDN or DE) and the feeding amount of protein, and also about lack of calcium and phosphorus.

7 Fattening period, body weight gain, and formula feed amoun

During the fattening period from 30 to 110 ~ 120 kg of body weight at shipping, body weight increases rapidly as feed intake increases. After exceeding 50 kg, the pig starts to eat more than 2 kg of feed per day and eventually consumes more than 3 kg. The daily gain during this period is 0.85 kg.

The body develops in the order of bones, muscles (lean meat), and fat. Therefore, in the prior period of fattening, they are fed so that the protein necessary for muscles remains sufficient. In the latter period, the amount of fat accumulated increases, so the amount of protein is reduced, and the amount of starchy feed is increased to produce fat that tastes good and has adequate hardness.

How to measure the withers height of pigs



8 Disease of pigs and its prevention

Take countermeasures from three perspectives against pig diseases.

① Isolation of infected pigs and carrier pigs as infection sources

Give the pigs medical treatment or selection so as not to spread the pathogens.

② Shutdown of infection route

Prevent invasion of pathogens adhering to humans, rodents, birds, vehicles, feeds, water, equipment and so on. For this purpose, disinfection is to kill pathogens using drugs ex vivo to block the infection route. As a physical blocking method, work clothes and boots exclusively for the piggery are used, and they are not used outside. Restrict outsiders to enter the piggery. If it is unavoidable for the outsiders to enter, have them put on protective clothing and boots for exclusive use. Select and use appropriate disinfectants according to the purpose. Be thorough to do disinfection by foot dips. Exterminate rats and prevent invasion of birds and other animals.

③ Strengthen resistance of uninfected pigs

Strengthen the immunity and resistance of healthy pigs which are not infected with pathogens by vaccination etc. Inoculate protective injection systematically according to the vaccination program appropriate for the disease condition of the pig farm.

SPF pigs at SPF farms are ones that do not have mycoplasma pneumonia, swine dysentery, AR (atrophic rhinitis), Aujeszky's disease, or toxoplasmosis. Sterile animals that are taken out by a Cesarean section or hysterectomy from a dam that does not possess these pathogens are used as parents for SPF pigs. It is very productive because there is no production failure due to disease. In order to maintain this hygienic situation, it is necessary to isolate the pig farm from the outside and to disinfect it strictly beyond the level of normal pig farms.

9 Treatment method of excreta

Collect the feces with the excrement machine (scraper) and compost it. Always manage in a place with a roof. Do not leave it exposed.

The essential points for composting are as follows.

① Oxygen supply

Sufficient oxygen supply is necessary for aerobic microorganisms to being active.

② Moisture adjustment

Excess moisture leads to poor air permeability, so that lower and adjust the moisture content to about 60% by, for example, mixing the secondary materials.

③ Temperature rise in compost

Before long, the temperature in the compost rises by microbial activity. This kills parasite eggs, pathogenic bacteria, weed seeds, etc. and the compost can be used safely.

Sewage containing urine discharged from the piggery is released after treated by the purification process. After solid-liquid separation of urine and feces, biological treatment such as using activated sludge is carried out, and then clear supernatant after settling of sludge is released.

4 Chicken farming

① Laying hens

1 How to raise laying hen and facilities/equipment

(1) How to raise

Methods for keeping laying hens can be divided into a cage rearing system which keeps the hens in cages inside the chicken house and floor feeding system which keeps them free-range in the area surrounded with a net or the like, or which keeps them on the floor inside the chicken house, and the majority is the cage rearing system.

① Cage rearing system

There is a single cage that keeps one bird in one cage and a double cage that keeps two or more birds. Because it stays away from the feces on the soil or the floor surface, hens are unlikely to be infected by diseases transmitted from feces. Normally, since rearing density can be heighten by stacking cages in multiple tiers, it is economically advantageous, but consideration must be given to the adverse effects on the health of the chickens.

Cage rearing system

② Floor feeding system

Because the chickens move around on the soil and floor surface freely to some extent, this rearing method fits the inherent behavior of chicken. However, grouped chickens take an offensive action such as attacking other party with a beak and jumping higher to give a kick to other party with a cockspur. This is an instinctive action to determine ranking among individuals, which keeps the social life of the group. This is called peck order. In addition, when they are in a narrow place, under condition such as high temperature/high humidity, or lack of nutrients, chickens take actions that peck each other or peck buttock of other chicken (butt pecking). In a severe case, a chicken kills others and sometimes it spreads throughout the

group if left as it stands. This is called cannibalism. In a hygienical aspect, the chickens are often infected by diseases directly transmitted from feces because they directly touch the feces on the floor. Therefore, it is not suitable for rearing a large number of birds.

Floor feeding system

（2）Style of chicken house

There are open-type chicken houses where light enters directly into the house and windowless (no windows) chicken house where light is blocked.

① Open-type chicken house

This is a chicken house which divide inside the house and outside with windows or curtains, so that it is likely directly affected by the external environment such as temperature, wind and rain, and sunlight.

② Windowless chicken house

This is a chicken house surrounded by walls with no windows to block sunlight and heat insulating material is applied to the walls and ceiling (roof). Light control is done with electric light and ventilation is done with fans. Because in this house it is possible to keep chickens in higher density than open type chicken houses, it is easy to mechanize and suitable for large chicken farms.

（3）Equipment and devices of chicken houses

In large-scale poultry farms keeping a large number of birds, feeding, water supply, egg collection and removing feces are mechanized and automation is proceeding in various places. However, in order not to damage the health of the chicken, and not to cause accident in the workplace, proper use according to the scale of the farm is important.

① feeder

For the cage rearing system, a gutter type feeder is installed, in addition, as a feeding device, there are self-propelled feeder cars and an automatic feeder capable of setting the feeding amount and time.

For the floor feeding system, feeding by hand (manual feeding) with round type feeder and automatic feeding from a hopper.

② Water pot

For the cage rearing system, a gutter type water pot or small water pot called nipple drinkers are often used.

For the floor feeding system, in addition to these described above, there is a hanging type, bell shaped water pot.

③ Automatic egg collector

In the floor feeding system, the floor of the laying box is tilted and eggs are rolled on the belt, and in the cage raising system, the device often used is that, a netted belt runs on the egg-receiving part to catch eggs and the conveyer automatically carries to the collection site.

④ Automatic feces removing device

There are scraper type which pulls collecting plate with wire rope to gather feces on one side, and a type suitable for cage rearing system that is installed a rotating net in a belt conveyor shape under the cages.

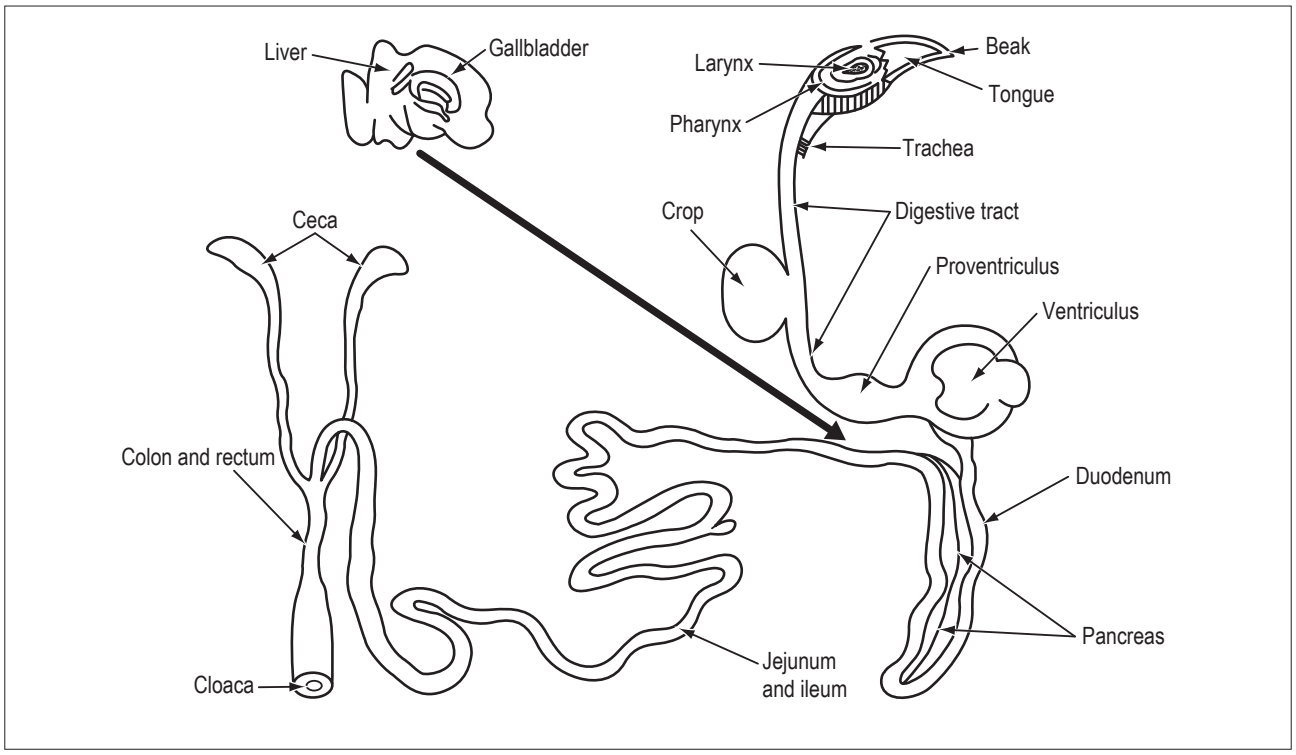
2 Structure of gastrointestinal tract and digestion / absorption of feed

（1）Necessary nutrients

Chickens ingest nutrients such as proteins, fats, carbohydrates, vitamins and minerals from the feed, and use it for the growth and maintenance of the body and the production of eggs. It is important to feed so that these nutrients do not run short. The Japanese feeding standard indicates the amount of nutrients necessary for raising.

（2）Structure of digestive system

The structure of the digestive system is as shown in the figure below.



Digestive system of chickens

（3）Characteristics of the digestive system

① Beak

A chicken's mouth has no teeth, but its tip is hard and keratinized, and its shape is suitable for pecking, eating, and repelling grain and insects on or under the ground.

② Crop

Located in the middle of the digestive tract, it temporarily stores feed and softens it with water and mucus from the pharynx in the oral cavity and esophagus.

③ Stomach

There are the proventriculus and the ventriculus. The proventriculus secretes gastric acid and digestive fluid. The ventriculus grinds and agitates feed by strong muscular contraction motion. Free-range chickens pick up pebbles (grit) and store them in their stomachs to help grind hard feed such as grain. In the case of recent corn based granular feed, it is not necessary to give pebbles, but if chaffy grains are given, pebbles should be given.

④ Intestine

Ingested feed is digested and absorbed in the digestive tract (mainly the small intestine). The small intestine is shorter in both length and volume than in other livestock. Therefore, feed is excreted through the intestinal tract in a short time. In the case of formula feed, excretion starts 2.5 hours after ingesting and the whole of it is excreted in 7 hours. Therefore, the digestion of fiber, which requires a long time to digest, is very poor compared with other livestock. However, other ingredients are not so different from cows and pigs, and cereals are rather excellent.

⑤ Ceca

There is a pair of cecum, which takes in part of the feed and keeps it for a relatively long time, and after it has been fully digested and absorbed, it is excreted. The feces are brown and thick. They are excreted 4 to 5 times a day and have a strong odor.

⑥ Colon and rectum

The colon and rectum are very short, and feces are stored in the cloaca and excreted with urine.

（4）Types and characteristics of feed

Since chickens have weak fiber digestion, chicken feeds are mainly easy-to-digest concentrated feed containing a lot of carbohydrates and proteins. The ability of chickens to produce livestock products such as eggs and meat from concentrate feed is higher than cattle and pigs.

① Cereals

Corn and milo are contained in poultry feed at the highest rate. It is mainly used as an energy source. In particular, maize is one of the most important raw materials for poultry feed.

Corn

② Vegetable oil cake

It is mainly used as a protein source. Soybean meal is often used, but soybean meal lacks methionine, an essential amino acid, it is thus used in combination with fish meal. In addition, cottonseed and rapeseed oil cake are used.

Soybean meal

③ Bran

In addition to cereals and vegetable oil cakes, it has been used through the ages to regulate energy and to supply micronutrients. Defatted rice bran is a kind of rice bran from which oil is extracted.

④ Animal protein source

Fish meal is good in amino acid composition, especially rich in lysine and methionine, and it is often used as raw material for feed.

⑤ Other raw materials for feed

Alfalfa meal is often used because it contains various vitamins and xanthophylls as green feed. Green leaf vegetables, meadow grass, wild grass, etc. are also familiar raw materials for feed. The laying hen needs a lot of calcium and phosphorus, so that shellfish, calcium carbonate, calcium phosphate, etc. are used as inorganic feed. In addition, salt must be given.

3 Feed for laying hens (nutrient requirements during growth period and concentration and feeding amount of formula feed)

（1）Nutrient requirements

Formula feed for chickens is composed of animal, vegetable, and mineral substances containing all nutrients such as energy, protein, minerals, and vitamins.

Nutrients in feed are divided into the digestible part and the undigestible part. Digested and absorbed nutrients are further divided into those used for the chicken body and those unused followed by decomposition and excretion (urine). Of these, those used for the body of chickens are used for the maintenance and growth of the body and production of eggs, and the surplus is stored as fat.

Since chickens preferentially take energy in nutrients, the amount of feed intake depends on the amount of energy intake. Other nutrients must therefore be present in amounts that do not cause extreme excess or deficiency within the range of their intake. With this in mind, the Japan Feeding Standard indicates the nutrient content (ratio) of feed that can satisfy the nutrient

requirements of chickens. The requirements for crude protein (CP) and metabolizable energy (ME) shown in the Japan Feeding Standard are as follows: CP 19% and ME 2,900 kcal in the period of young chicks, CP 16% and ME 2,800 kcal in the period of mid-sized chicks, CP 13% and ME 2,700 kcal in the period of large chicks, CP 15.5% and ME 2,800 kcal in the laying period.

For young chicks

For mid-sized to large chicks

For adult chickens

Chicken feed

（2）Concentration and feeding amount of formula feed

Generally, laying hens are fed commercially available formula feed. Different types of formula feed suitable for each growth stage are available in the rearing period, and those adjusted to the laying stage are available in the adult period. CP and ME are set slightly higher in commercial formula feed. Not only the ratio of CP and ME, but also the feed shape varies, and includes mashed raw materials (mash), hardened raw materials into granules (pellets), and coarsely ground pellets (crumbles), and many of them are preferable and digestive.

In general, feed for first feeding at the rearing period (CP 22%, ME 3,150 kcal) should be fed freely, and feed for young chicks (CP 21%, ME 2,950 kcal) should be fed freely up to 35 g/day.

After that, based on their weight, the feed should be switched to feed for mid-sized chicks (CP 18%, ME 2,800 kcal), then feed for large chicks (CP 15%, ME 2,800 kcal). Then, they are fed according to the manual of each chicken breed so as to be close to the standard weight of the chicken breed.

The amount of feed for adult chickens during the laying period (CP 18%, ME 2,850 kcal) depends on the breed of chickens, but a manual aiming at 115 g/day is generally used. Depending on the type of formula feed, feed may be divided into that for the prior laying period (CP 18.5%, ME 2,870 kcal) and that for the latter laying period (CP 17%, ME 2,870 kcal). There are also products with different blending ratios (CP 18.5% in summer and CP 17.5% in winter) depending on the season.

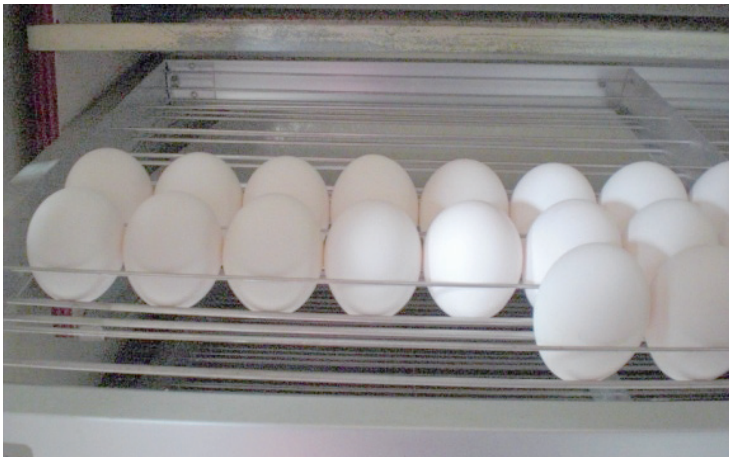
4 Collection and hatching of hatching eggs

（1）Collection of hatching eggs

Hatching eggs (fertilized eggs) are obtained by mating males and females. In floor feeding, mating takes place naturally, and 10 to 15 females are raised as a group for 1 male to obtain

hatching eggs. Insemination is done in cage rearing. Hatching eggs are laid from around the 3rd day after mating, and they lay eggs for about 10 days with one fertilization.

For hatching eggs, choose clean ones that have a normal shape and the size of 54 ~ 65 g. After disinfecting, the eggs are stored in a place where the temperature is 15 ~ 20 ° C and humidity is 40 ~ 70% with the blunt ends facing up. Eggs are usually kept for less than a week, and after that the hatching rate gradually decreases.



Hatching eggs laid on the egg tray in the incubator

（2）Hatching

① Process of hatching

Embryos develop when eggs are given a constant temperature (37.8°C) and humidity (60%). First, the blastodisc grows larger and nerves and blood vessels are formed. Subsequently, the skeletal structure, brain, respiratory organs, and circulatory organs are formed. On the 21st day, the egg shell is broken by the tip of the beak (egg tooth), followed by hatching by breaking the egg shell with the head and legs.

② Styles of incubators

All chickens for practical use are hatched artificially with incubators. There are two types of incubators, a flat type and a cubic type. Many flat types are small, and they are used for experimental purposes. The cubic type is large, and some can hold tens of thousands of eggs.

③ Operations before hatching

Before using the incubator, clean, wash, and disinfect it, and check the temperature and humidity controller. Hatching eggs are disinfected with invert soap and phenol disinfectant.

④ Management during hatching

Place the eggs on pockets or trays with the blunt ends facing up, mark them to indicate the breed and strain, and start hatching. During this period, air is ventilated to send fresh air to the eggs. In addition, the eggs are rotated so that the embryos in the eggs do not adhere to the shell membrane, and they are rotated 10 ~ 20 times a day from the day after the placement to the 18th day.

⑤ Egg inspection

Place the eggs on egg tray or trays with the blunt ends facing up, mark them to indicate the breed and strain, and start hatching. During this period, air is ventilated to send fresh air to the eggs. In addition, the eggs are rotated 10 to 20 times a day from the day after the placement to the 18th day, so that the embryos in the eggs do not adhere to the shell membrane.

⑥ Sexing and shipping of day old chicks

Newly hatched chicks are called day old chicks, and they are picked out from the hatchery basket, moved to the chick room, and undergo sexing. There are two methods of sexing chicks: vent sexing by the shape of the chick's anal vent (cloaca), and feather sexing by the difference in the color of feathers and legs and the growth rate of main wing feathers. Feather sexing is now widely used. The selected female chicks are vaccinated and shipped to chicken farms. In some cases, debeaking is performed before shipment.

5 Growth of chicks of laying hen

Nursing chicks for the purpose of using as a laying hen in the future (raising) is called brooding. The period from first feeding to laying is called the brooding period and it divided into three stages; that is, young chick (youbina) period (from 0 to 4 weeks of age), middle-sized chick (chubina) period (from 4 to 10 weeks of age), and large-sized chick (daibina) period (10 to 20 weeks of age, until laying eggs). When brooding chicks, it is fundamental of management to prepare optimum environmental conditions for chicks to raise them strongly. In addition, to prevent the occurrence of disease, it is important to conduct sanitation management such as vaccination systematically.

（1）Brooding method

① Method using box type brooder

A box type brooder is the most rudimentary equipment; that is, a wooden box equipped with a heat source. It is suitable for raising about 50 to 100 birds.

② Battery brooding method

Battery brooder is a facility that is space-saving and suitable for brooding a relatively large number of chicks; it is set up by stacking cages whose heat source and floor are made of metal gauze, mesh, or drainboard. Raise the chicks by transferring to the cage for middle-sized chicks, and then to that for large-sized chicks, according to the growth. Although it is not expensive, the temperature in the cages tends to be uneven in winter.

③ Floor brooding method

This is a method brooding on the floor of the room including umbrella type brooder, heating by hot-water pipes installed under the floor or cages, or heating the whole brooding facility with hot air. This method is suitable for raising a large number of birds, raising until transfer to a cage for large-sized chicks, or until direct transfer to an adult cage. The temperature is uniform, and work such as disinfection is labor-saving, but it is expensive.

（2）Management during young chick stage

① Entry of chicks (acceptance of chicks)

Because a considerable amount of time has been taken to arrive at the poultry farm after hatching, supply baby chicks with water immediately after arrival and rest for a while in a dark room to repair the body. When using any brooders, namely, Battery type, floor type umbrella-shaped brooder (using chick guard), or floor heating (using chick guard), warm the brooder to about 32 to 35°C in advance and adjust the humidity to around 65%. Transfer the chicks into the brooder while observing the condition of the chicks. If there are frail chicks, select them. This is called entry of chicks (nyusuu in Japanese). A chick guard is a circular enclosure of about 30 cm in height and young chicks are raised in this enclosure with warming.

Robust chick

Frail chick

② First feeding

The timing of first feeding is usually preferred around the time when most of the egg yolk remaining in the chick is digested, and 25 to 60 hours after hatching is a rough guide, but in fact the feeding time is often indicated at the hatchery.

After entry, let the baby chicks eat brooding feed tightly kneaded with water placed on paper or a box with a shallow edge (chick plate) on the floor of the heat source of the brooder. This is called first feeding. Times of feeding are 5 to 6 times a day for the first 3 days of feeding, after that decrease the times to 4 times a day. Arrange the feeder and the water supplier alternately and prepare for the chick to take it with ease. For the first week or so, it is good to turn on the lights so that the chicks can learn the position of feed and drinking water.

③ Beak cutting (debeaking or beak trimming)

It is effective as a measure to prevent bad habits such as butt pecking and feather eating after the middle-sized chick stage. Commonly, one-half of both the upper and lower beaks are burned off with a dedicated equipment debeaker between 1 to 2 weeks of age.

④ Raising density

Rough indications for open-type chicken houses: 33 to 44 birds / m^2 for battery cage brooding up to 6 weeks of age, 18 to 20 birds / m^2 for floor brooding up to 6 weeks of age. In addition, in case of windowless chicken houses, the raising density can be higher because the environmental conditions are better than in the open-type chicken houses.

（3）Management during the period of middle-sized chick

During the middle-sized chick stage, keep in mind to let them exercise as much as possible and accustom to open air to make robust body. When using a battery brooder, transfer the chicks to the battery for middle-sized chicks at around 4 weeks of age. The number of birds contained in one compartment of the battery is the extent to which all chicks can comfortably line at each feeder. Raising density influences later development and health condition of chicks. It is also a time to switch to feed for middle-sized chicks, and movement is a big stress for chick, so that it

is important to carefully handle it. For alleviating stress and preventing disease, it is also good to dissolve antibiotics, vitamins, and the like in water and feed for 2 to 3 days.

① Growth of chicks

The development of the chicks in the first half of the brooding period is very fast. Especially in early stage of brooding period, a chick grows 65 g or more at 1 week of age, 120 g or more at 2 weeks of age, and 190 g or more at 3 weeks of age. After that, although daily gain gradually decreases overall, the weight gain per day increases sharply up to around 10 weeks old (body weight 850 g or more) and in the late stage of brooding period, daily gain decreases with the onset of sexual maturity in the latter half of the brooding period and the rate of development becomes slow.

② Weight measurement of chicks and their average body weight

It is important to measure the weight of chickens because they are raised aiming to the standard weight shown in the manual. It is not desirable for chicks to weigh too little, but it is more important to have less variation (uniformity) in groups than to have large or small weights.

（4）Management in the period of large-sized chicks

The target for raising in the large-sized chick period is to make a body that can sufficiently cope with long-term laying and to start laying eggs at an appropriate age. In the case of battery brooding, it is important to transfer chicks with the same degree of growth to the same compartment of the battery for large-sized chicks. As for the period of middle-sized chick, the number of accommodating birds in one compartment should be that at which all chicks can comfortably line at each feeder.

Change the feed from that for middle-sized chicks to that for large-sized chicks. Feed intake increases with weight gain, and the amount of excretion of feces also increases. Since toxic gas such as ammonia generates when left unattended, cleaning such as removing feces is essential. Among large-sized chicks, precocious ones start laying from about 130 days of age, thus before that, transfer them to the adult chicken house.

① Raising density

In the case of open-type chicken houses, 22 to 25 birds /m^2 for battery cage brooding up to 18 weeks of age, while floor brooding 7 to 8 birds /m^2 up to 18 weeks of age. In addition, in case of windowless chicken houses, the raising density can be higher because the environmental conditions are better than in the open-type chicken houses.

② Light control

In the period of large-sized chick, light control, that is, regulation of day length (day length + lighting time) is conducted by installing illumination lamps in the chicken house. This is to adjust the sexual maturity of chicks; namely, sexual maturity is delayed as day length becomes shorter, whereas it accelerates as it becomes longer. Generally, chickens for practical use tend to sexually mature early, so that in the open-type chicken house, light control is done to suppress sexual maturation. Lighting during the brooding period is done to ensure sexual maturity (start laying) at the proper age. Because proper sexual maturation age varies with the chicken breed, it is better to target the sexual maturation age recommended for each chicken breed.

In windowless chicken houses, light control can be done systematically without influence by day length. The brightness of the lighting is preferred to be around 5 to 10 lux and lighting time after reaching adulthood is recommended not to be shortened.

③ Weight measurement and feed restriction

It is important to control the weight of large chicks. If the weight is brought closer to the standard score, good egg production will often be obtained after that. Weight is measured every week, and the feeding amount for the next week is decided. If the growth is good and the body weight exceeds the standard weight, a method to limit the amount of feed is taken.

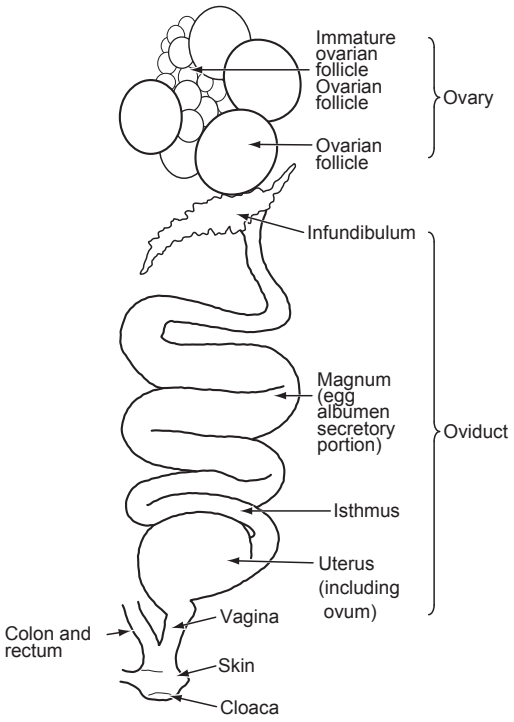
6 Laying of laying hens and management during period of adult chicken

（1）Initiation of laying

Laying hens start laying at around 18 weeks of age (around 130 days), and after that egg production number is the highest in 2 to 4 months, then gradually decreases. The feature of the laying process is called laying pattern. With chickens, the first day of laying egg is called first delivery age, which is also the time of sexual maturity. Early or late sexual maturity greatly influences the result of subsequent egg production. Early or late sexual maturity is strongly influenced by day length and nutrition supply as well as genetic component. Therefore, the method that makes them mature at appropriate age is taken by controlling light and feeding during the brooding period.

① Egg formation and ovulation

In the ovaries of chickens that started egg laying, there are follicles in various stages of development up to about 1 to 35 mm in diameter. When the follicle develops and become the largest, the outer membrane breaks and the egg (egg yolk) is ovulated and enters the fallopian tube from the funnel. With this egg yolk, egg white is formed in the magnum, shell membrane is formed in the isthmus, and shell is formed in the uterus, and then the egg is released from the cloaca. The interval between ovulation is said to be 25 to 26 hours.



Reproductive organs of chicken

② Laying cycle

The laying of hens shows a cycle in which hens lay eggs for several days, then rest for 1 day (or 2 ~ 3 days), and then lay eggs again for several days. This cycle is called laying cycle, and a continuous series of laying is called clutch.

③ Seasonal changes in egg laying

Hens lay eggs in the season when the day length is long, and under the natural day length, egg laying increases in spring and decreases in autumn. Therefore, the pattern of egg laying varies depending on the season of hatching, and chicks that hatched in spring and autumn and those hatched in winter and summer show contrasting egg laying patterns. The temperature suitable for egg laying is said to be 12 to 25°C.

（2）Management in period of adult chicken

① Feeding and water supply

Feed for adult chicken is usually fed while dividing the daily amount to before noon and afternoon, accompanied by observation on the condition of chickens and the situation of intake. With automatic feeders, it is possible to feed multiple feeding times a day, avoid selective intake and leftovers, and lead to the constant amount of intake.

Because egg production increases rapidly at the early stage of egg laying, high protein feed is fed and then according to the degree of laying and growth, a feeding method is carried out to lower the coarse protein (CP) level through the middle stage of the egg laying period (about

40 to 60 weeks of age) and the late stage (after about 60 weeks of age).

Let the chickens drink fresh water at any time; in particular, do not run out of water and prevent water from being high temperature in the summer season, and manage not to freeze in winter.

② Egg collection

Laying almost ends before noon. In a poultry farm where an automatic egg collector is installed, eggs are collected several times a day and shipped. In a poultry farm not equipped with an automatic collector, eggs are collected by hand as many times as possible to keep freshness, using an egg collecting basket or an egg tray and egg tray container.

③ Removing feces / cleaning

To keep the inside of the chicken house clean, work for removing excreta is periodically performed. In particular from spring to autumn when many flies occur, remove excreta frequently and treat it promptly in poultry manure treatment facilities. In addition, since ectoparasites and the like inhabit the cages around the laying hens, instruments, dirt, and dust on the walls and ceilings, etc., keeping clean by cleaning and removing is important.

④ Environmental management

The body temperature of healthy adult chickens is about 41°C.

i Response to heat and management in summer season

When the temperature rises, chickens exert a body temperature diffusion function such as breathing with open mouth, increase of respiration rate (panting), and open wing posture to prevent rising of body temperature. In addition, the amount of drinking water increases, and the feces become watery. It is said that when the temperature exceeds 30°C, egg production rate and egg quality are affected. In other words, at high temperatures feed intake decreases, so that egg weight decreases and the eggshell becomes thin.

ii Response to cold and management in winter season

When the temperature falls, the chickens round the body and ruffle their feathers to prevent diffusion of heat. Feed intake increases, but egg laying decreases.

iii Light control

This is a management technique to control sexual maturity and promote egg laying by installing illumination lamps in the chicken house and giving appropriate lighting time (day length + lighting time). In open type chicken houses, constant lighting time of 14 to 15 hours (day length + lighting time) is given to all adult chickens in the early laying period, and then the lighting time is gradually prolonged (gradual increase: 30 minutes per 2 weeks) from the time when decrease in egg production stands out, and after lighting time reaches 17 hours, this

level is maintained. Laying is not promoted further if lighting time is further extended.

In a windowless chicken house, 24 hours' lighting for 2 weeks from first feeding, 19 hours' lighting after becoming 2 weeks old, then shortening the lighting time in 30 minute increments for 2 weeks (gradual decrease), and finally the lighting time is 14.5 hours at 18 weeks of age. After that, in the period of adult chicken, lighting control is done in the same manner as for an open type chicken house.

iv Forced molting and its procedure

About 1 year after the first egg laying, the frequency of egg laying decreases, the egg shell becomes thin, and the egg quality decreases. During the 2 to 4 months from autumn to winter when the day length becomes shorter, hens stop laying eggs and natural molting occurs, in which old feathers naturally fall out and change into new ones. Artificial molting prior to natural molting improves the eggshell quality and extends the egg collection period. This method is called forced molting.

A common method is to make them fast for 10 ~ 14 days in summer and 7 ~ 10 days in winter at about the age of 60 weeks, and to stop lighting at the same time. After the fasting period, feed is gradually increased over several days.

v Selection of useless hens

Hens that lay few eggs or that are in poor health do not bring good egg production and are not profitable. These useless chickens (called "dakei" in Japanese) should be found and culled in daily management.

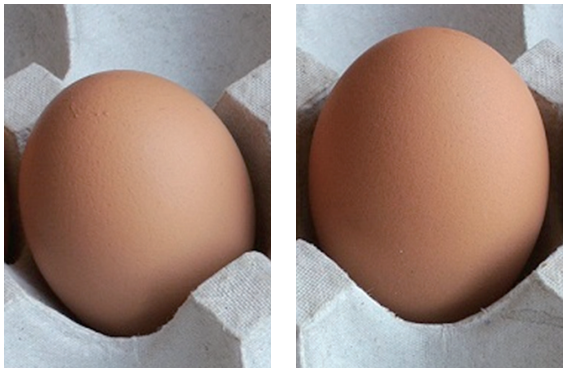
7 Egg quality

Most of the eggs are shipped as shelled eggs according to the trade standards. The quality of an egg is determined by the state of the eggshell, egg yolk, and egg white.

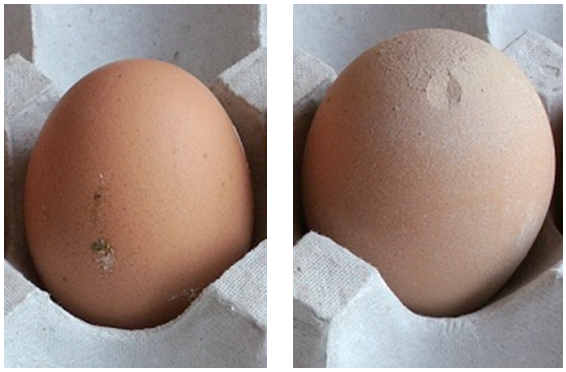
（1）Classification and quality of eggs

The classifications are as follows: LL for 1 egg weighing 70 g or more but less than 76 g; L for 64 g or more but less than 70 g; M for 58 g or more but less than 64 g; MS for 52 g or more but less than 58 g; S for 46 g or more but less than 52 g; and SS for 40 g or more but less than 46 g.

Eggs should be of normal shape, clean, and should have a moderately smooth and strong shell with no cracks. Also, when an egg is broken, the thick egg white should rise high and there should be no foreign matter (blood or meat spots).



Eggs suitable for shipment



Eggs unsuitable for shipment

（2）Factors that determine the quality

The quality of eggs is affected by genetic factors, feed, season, age in days of chickens, and rearing environment.

① Eggshell

It is mainly made of calcium carbonate. The closer and thicker the eggshell is, the stronger it is. If it is thin and weak, the number of broken eggs and damaged eggs increases and the commercial value decreases drastically.

The strength of an eggshell generally decreases due to a lack of nutrients, especially calcium and other minerals, heat in the summer, and aging of chickens.

② Egg white

It is transparent, light yellow to light yellow-green, and has a watery part (thin egg white) and a thick part (thick egg white). The higher the thick egg white rises, the better. The height of the rise of the thick egg white decreases with the number of storage days, making it an indication of freshness. Also, the younger the age of a chicken, the higher the egg white rises.

For this reason, Haugh units are introduced based on the height of the thick egg white and the weight of the egg, and are used as indicators of freshness. Small amounts of blood (blood spot) or fleshy clots (meat spot) in egg white are not a problem, but they are not recommended.

③ Egg yolk

The yellow pigment is the result of transfer of pigment contained in corn and green feed. The more elastic the egg yolk is and the more rounded it is, the better. This embossment will flatten as the days go by, and eventually the vitelline membrane will break.

Egg of a hen fed corn as feed

Egg of a hen fed rice flour as feed

8 Disease of chickens

(1) Observation of chickens and detection of diseased chickens

As the size of chicken houses grows larger and a large number of birds are raised, ventilation tends to be poor, resulting in the generation of toxic gases and high humidity, and respiratory diseases are likely to occur. In addition, in the case where the number of persons to manage decreases, be careful, because daily control, removing feces, observation of health condition, and hygiene management tend to be inadequate.

Especially important diseases must be addressed in accordance with the Domestic Animal Infectious Diseases Control Act as "legal communicable diseases," and the regulations must be complied with. Legal communicable diseases include fowl cholera, highly pathogenic avian influenza, Newcastle disease, and poultry salmonella infection (pullorum disease).

① Behavior of diseased chicken

- There is no vitality, movement becomes dull, and there is no appetite.
- The amount of feces decreases, the color of feces changes, and diarrhea occurs.
- In the case of adult chickens, egg laying stops and soft eggs or deformed eggs are laid.
- Sometimes letting out a strange noise.

② Appearance of diseased chicken

・Feathers are ruffled and wings are droopy.
・The color of the comb is paled out, or turns dark purple.
・The eyes get dirty with tears, the nose get dirty with nasal discharge. Eyes are often closed.
・Breathing with open mouth.

（2）Measures against diseases of chicken

① Preventing invasion of pathogens and transmission

Some infectious diseases do not occur if chickens are raised in a good environment, but some cannot be prevented by themselves, due to their strong infectious power. First of all, it is necessary to eliminate the pathogens in the chicken house facilities, to prevent invasion of pathogens from outside (measures against wild animals), and to prevent bringing pathogens into the facilities (people, vehicles, feeds, materials, etc.). In addition, to prevent pathogens from transmitting to neighboring chicken houses, administrators disinfect their hands and feet for each chicken house and prepare dedicated work clothes and footwear.

The Domestic Animal Infectious Diseases Control Act indicates “Feeding and health control standards for chickens”; it is thus important to surely comply with the standards.

② Control of disease by vaccine / preventive drug

For vaccination-effective diseases (Newcastle disease, chicken infectious bronchitis, fowlpox, Marek’s disease), prepare a vaccination program and execute it faithfully (vaccination). Vaccination methods include drinking water, nasal drops, ocular instillation, spray, injection, and needling; among these, choose the most appropriate method depending on the type of vaccine, chicken age, and health condition.

Leucocytozoonosis mediated by *Culicoides arakawae* (a biting midge species, niwatorinukaka in Japanese) is treated by adding sulfa drug to feed or drinking water, but measures to suppress occurrence and exterminate the nocturnal biting midge are necessary. Regarding mycoplasma infections with respiratory infections, tylosin and spiramycin have preventive effect. Although seldom seen in cage and battery type brooding, coccidiosis caused by protozoa which attack the intestinal tract often occurs in floor brooding. In many cases, the symptoms are acute in young and middle-sized chicks, whereas they become chronic in large-sized chicks. Sulfa drugs are effective for treatment, but adding prophylactic agents to feeds for brooding is more effective.

（3）Control of hygiene pests

Recently, red mite (wakumo in Japanese), an ectoparasite, frequently occurs and its damage includes occurrence of foul eggs due to the adhesion of excreta and blood of red mite, death of chickens, anemia, decrease of egg laying, severance of administrator due to discomfort, and mediating pathogens of zoonotic infection. Preventive measures include early detection of the red mite, early extermination, prevention of invasion, thorough washing and cleaning on a daily basis, and spraying of insecticides. Furthermore, *Ornithonyssus sylviarum* (a hematophagous mite species, torisashidani in Japanese) and *Culicoides arakawae* (which mediates leucocytozoonosisa) must be controlled as well.

Red mite exterminator

（4）Protection from wildlife

To prevent entry of excreta of wildlife such as rodents and wild birds into feeders, water supplier, and feed storage, install bird nets to prevent intrusion into the chicken house. There are numerous damages caused by rodents such as loss of feed, wear damage of constructions, and mediation of zoonotic infections. In addition to blocking invasive routes, protection measures include traps and use of rodenticides. In particular, intrusion of wild birds is largely related to the occurrence of avian influenza and thus chickens become threatened, so that thorough protection measures are necessary.

9 Avian influenza and its defense

（1）Avian influenza

Avian influenza is a disease of birds including poultry caused by influenza virus (AI virus) infection, and in chickens “high pathogenicity” and “low pathogenicity” are classified according to the nature or degree of the disease caused by the virus; “virulent type” and “attenuated type” are classified according to the difference in toxicity. “Highly pathogenic” and “virulent type” viruses show mortality of 100% between 4 and 5 days after confirming the occurrence of diseases.

（2）Defensive measures against avian influenza

Avian influenza has been designated as a legal communicable disease by the Domestic Animal Infectious Diseases Control Act and you must comply with the Feeding and health control standards with regard to the prevention of the occurrence of disease and prevention of spread.

① Prevention of wild bird intrusion into the area of chicken house

② Early detection by screening, etc.

③ Early selection at virus isolation (to prevent becoming virulent)

④ Implementation of monitoring

⑤ Maintain sanitary condition of chicken house

⑥ Perform health observation of chickens

⑦ Confirmation of specific symptoms of highly pathogenic avian influenza

Symptoms: In the same chicken house, the mortality of chickens per day is more than twice the average mortality in the target period.

10 Treatment method of excreta

Currently, most chicken feces is processed by a fermentation method and used as compost. Fermentation methods include the deposition method, the open type stirring method, and the closed type stirring method. However, in the case that the environment allows installation of chicken manure drying facilities, it is advantageous to produce dry poultry manure in warm and intermediate areas. For making poultry manure compost, in case that the feeding scale is 10,000 birds or less, manure sheds or box-type fermentation facilities using a moisture conditioner are advantageous. However, when the number of birds exceeds 30,000, an open type or closed type fermentation facility equipped with a stirring device is required, furthermore, and a moisture conditioner is available for open type and installing heating devices is safe for closed type.

11 Rearing plan and performance evaluation

（1）Rearing plan

The number of chicks to be introduced and the number of introduction are determined in consideration of egg production on the entire chicken farm. Ideally, the same number of chicks should be replaced (all-in all-out) at equal intervals in each chicken coop.

（2）Performance survey and evaluation

① Egg laying rate

The egg laying rate is calculated by dividing the number of eggs laid in a given period of a group by the number of laying hens kept in the same period and multiplying the result by 100 (shown in %). The rate indicates the percentage of laying hens that actually laid eggs. For example, at a simple egg laying rate, if 100 hens lay 90 eggs per day, the egg production rate is 90%.

The egg laying rate increases to about 90% at around 200 days after the first egg laying and reaches its peak. After high egg production is maintained for around 60 days, the egg laying rate gradually decreases to 65% at the time of selection at 550 days of age. Egg weight also increases with age in days. Increasing the egg laying rate is the most important aspect of technology in laying hens, and the business profit varies greatly.

② Amount of eggs

The egg weight gradually increases for 1 year after the first laying, and the average weight is 61 to 65 g. The total egg production is 17 to 20 kg per 1 hen per year. Daily egg production is calculated by dividing the total egg production of a group per day by the number of raising chickens. Daily egg production is related to the nutrient requirements of hens, and egg production gradually decreases unless enough feed is provided for egg production.

② Meat chicken

1 How to keep meat chickens, facilities and equipment

（1） How to raise

The growth of broilers is much faster than that of laying hens, and they are often shipped around 8 weeks of age. The floor feeding system that raises hens on the floor is the standard raising method for broilers because it is suitable for group management and labor-saving mechanization. However, due to the increase in production, the density of chickens tends to be high, and careful attention must be paid to the health management of chickens. Therefore, the floor of the chicken coop should be covered with litter of more than 10 cm thickness such as planar chips, sawdust, and cut straw. This helps to reduce overloading the feet, as broilers gain weight rapidly. In addition, the same burden is placed on the breastbone when the broiler is sitting, and inflammation (edema) is likely to occur, so litter may help prevent it.

Broiler farm

Native chickens (“jidori” in Japanese) produce less meat than broilers, but for the purpose of producing high-quality chicken, they have characteristics such that they are raised for 80 to 150 days or more for a long period of time, raised in a floor feeding system, in a free-range system, and in a low-density feeding system, and fed special materials.

（2） Styles of chicken coop

① Open-type chicken coop

This is a chicken coop which divides inside the house and outside with windows or curtains, so that it is likely directly affected by the external environment such as temperature, wind and rain, and sunlight.

② Windowless chicken coop

This is a chicken coop which has no windows, so as to block sunlight, and heat insulating material is applied to the walls and ceiling (roof). Light management is done by electric lights, and ventilation is done with fans. Because in this coop it is possible to keep chickens at higher density than in open type chicken coops, it is easy to mechanize and suitable for large chicken farms. In addition, the closeness of the chicken coop makes it hygienic. However, capital investment is required.

（3）Warming system

There is an umbrella type brooding method with an umbrella-type heater suspended for warming and a floor heating method.

① Umbrella-type or pancake-type brooding methods

Hang umbrella-type or pancake-type brooders from the ceiling and warm them from the top of the chicks.

Many of them use gas as fuel, and it is necessary to adjust the heating power finely according to the condition of the chicks. The floor is thickly covered with litter, but if the floor area is large, it is difficult to create a uniform environment, and it is necessary to devise insulation materials to prevent humidity and coldness in the floor structure.

② Floor heating method

It is a large facility and piping is executed under a concrete floor. Hot water is passed through the piping and warms the floor surface. Although it requires capital investment, it is suitable for Japan, where the humidity is high, and it is easy to observe chicks, and brooding under the same environmental conditions is possible. It is said that this makes chicks grow quickly and grow flesh well. There is an advantage that it is easy to control the feces by drying them, but if the dryness progresses, it will cause respiratory diseases, so humidity control is important.

（4）Facilities and equipment

① Chick guard

The chicks are placed in a circular enclosure about 30 cm high (long galvanized plate) for brooding of day old chicks, in which litter, heat source, feeder, and water supplier are placed. An umbrella-type brooder is placed near the center of the floor, and is surrounded by a circular chick guard 50 cm away from the umbrella. Chick guards are also used for floor heating.

Chick guards gradually widen the circle as chicks grow from around the 4th day. And they are removed at the age of 10 days in summer and 13 days in winter.

② Feeder

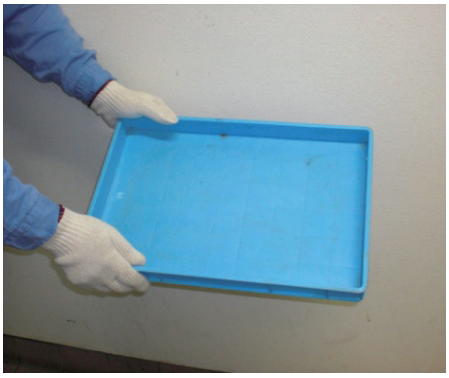
For first feeding, a flat shallow box (chick plate) is used.

In the case of automatic feeders, there are two types of feeders. One is the overhead type, in which the feeding line is connected to the ceiling of the chicken coop and the feed is dropped to the pan feeder. The other is the low level type, in which the feeding line is connected to the height of the chickens and the feeding line moves up and down according to growth. In any case, the feeding line, the height of the feeder, and the feed amount in the hopper are adjusted according to the chickens.

③ Water supplier

At the time of first feeding, a watering basin and an auxiliary drinker are used so that chicks can drink easily.

In the case of nipple drinkers and bell-type water suppliers, the height and water pressure are adjusted so that all the chicks can drink water.



Feeding box for the first feeding (chick plate)

Auxiliary drinker

2 Feed for meat chickens (nutrient requirements during growth period and concentration and feeding amount of formula feed)

Broilers should be provided with commercial formula feed (feed for the prior period and the latter period) without any restrictions (constant and free feeding). Upon shipment, from 7 days or more before slaughtering, they are provided with feed without medicine such as antibiotics (feed for a drug holiday).

According to the 2011 edition of the Japan Feeding Standard for Poultry, the nutrient requirements for broilers are metabolized energy (ME) of 3,100 kcal, crude protein (CP) of 20.0% in the prior period (0 ~ 3 weeks of age), ME of 3,100 kcal, and CP of 16.0% in the latter period (after 3 weeks of age). Many commercial feeds contain 2% higher CP than this.

Feeds include mashed raw materials (mash), raw materials hardened into granular (pellets), and coarsely ground pellets (crumbles). Pellets and crumbles are used for broilers because they are easy to ingest. In addition, the feed amount per 1 chicken during the breeding period is approximately 6.3 kg (The feed intake is 2.1 times the shipping body weight of about 3.0 kg.).

Since native chickens have less growth and a longer breeding period than broilers, they do not need high-protein and high-energy feed, thereby avoiding an increase in feed costs and excess fat. They are often provided with less nutrients and low-priced feed. In general, high-protein feeds are expensive, and high-calorie feeds are too fatty. In addition, feed for improving meat quality includes beer lees and fermentation lees of alcohol for whisky. For health trend and functional foods, there are additives such as fish oil.

3 Growth and changes in body weight of meat chickens

（1）Growth of a young chicken (broiler) for meat

The prior period of broiler development (0 ~ 3 weeks of age) is the stage of development of skeleton and internal organs, and feed intake is low and digestive capacity is not sufficiently developed. The body weight at first feeding is about 40 g and becomes about 850 g at 3 weeks of age. They gain weight, become more sensitive to changes in temperature, and the required ventilation rapidly increases. In the latter and final periods (4 to 8 weeks of age), muscles develop and they gain weight rapidly every day. The thermoregulatory function is completed and molting is finished. The chicks spread throughout the coop and become more adaptable to the environment. On the other hand, the house becomes overcrowded and the environment is likely to deteriorate, so ventilation management becomes important. At the time of shipment at 7 to 8 weeks of age, they weigh approximately 3.0 kg.

（2）Growth of native chickens

There are differences depending on the breed and brand of native chickens, but the body weight difference between males and females increases because the breeding period is long. After 20 weeks of age, the difference between males and females is about 1.0 kg (male: 3.0 kg, female: 2.0 kg). As a matter of course, the feed intake during the breeding period increases to about 13.0 kg for males and about 10.0 kg for females.

4 Feeding management (from entry of chicks to shipping)

After entry, the period from the time of first feeding to the age of 3 weeks is called the prior period and the period after that is called the latter period. At 8 weeks of age, the body weight of a typical broiler is over 3 kg in males and nearly 3 kg in females.

Rearing broilers is basically the same as brooding laying hens, but broilers are for fattening. Therefore, in order to increase the production per unit area, the rearing density is increased, exercise is restricted, and unhealthy conditions such as high protein and high calorie feed are often given. If the management is insufficient, it is easy to induce diseases, so you need to be careful.

（1）Management in the prior period

In the prior period of broiler rearing, in the case of floor feeding, it is necessary to put litter in the floor of the coop and heat it with a heating device for 2 to 4 weeks. It is important to control the brooding temperature. If the temperature is low, ascites (abnormal enlargement of the abdomen) is likely to occur. In addition, many underdeveloped chickens have abnormal feet, and are quickly culled.

① Entry of chicks (acceptance of chicks)

In the case of floor feeding, both the umbrella-type brooder and the floor heating are enclosed in a circle with a chick guard around the heating part, and the warmth should be supplied in advance. The chicks that arrived are placed in a chick guard and allowed to rest. The temperature and humidity inside the chick guard are important and should be adjusted to a temperature (32°C) and humidity (around 65%) that allows the chicks to disperse comfortably.

② First feeding

The feeder should be a flat shallow feeding box for first feeding (chick plate) or a feeding tray to be stabilized on the litter. As a water supplier, a nipple drinker or a bell-shaped water supplier should be installed, but an auxiliary drinker is added to make it easier to drink. These feeders and water suppliers are placed alternately and prepared so that chicks can ingest comfortably. If first feeding is carried out by kneading and churning the feed and a small amount of feed is given many times, the feeding becomes better. Feeding for broilers after the first feeding is done according to the management manual of chickens for practical use.

③ Raising density

The raising density should be about 15 birds per 1 m2 of floor space of brooding coop. It is said that it is easier to breed and gain weight when chicks are kept separately according to sex, but it is common to keep both sexes together to save time for differentiation.

④ Humidity control

With floor feeding, it is difficult to keep the humidity during warming and it gets too dry, so water should be sprinkled on the center of the litter at times. Humidity during warming (50% or more) greatly affects the subsequent growth.

⑤ Temperature management

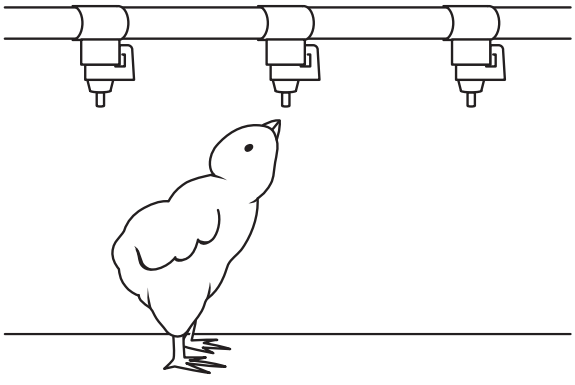
The brooding temperature is gradually lowered while watching the condition of chicks. The temperature is gradually lowered to 29°C at 7 days of age. Adjust the temperature so that chicks spread evenly. If the temperature in the house is not lowered after chicks are introduced, the environment will be hotter at the age of 2 to 3 days than at the time of first feeding. Such an initial high temperature will decrease the amount of feed intake and affect the subsequent weight gain, resulting in a large difference in body weight among chicks, so be careful about temperature control.

⑥ Warming abolition

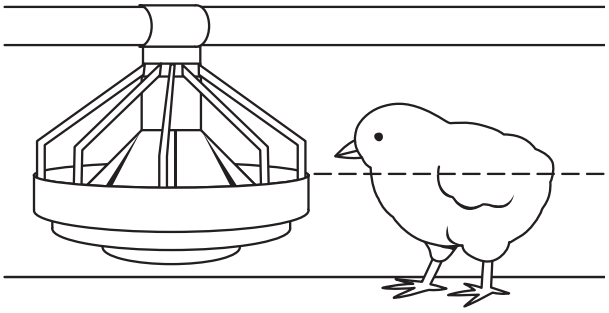
Stopping the warming is called warming abolition. In an open-type chicken coop, it is carried out when chicks are about 2 weeks old in summer and about 3 weeks old in winter. In a windowless chicken coop, however, warming abolition is not considered in particular, and it is important to balance supply between temperature and ventilation volume in the coop.

⑦ Feeding and water supply management

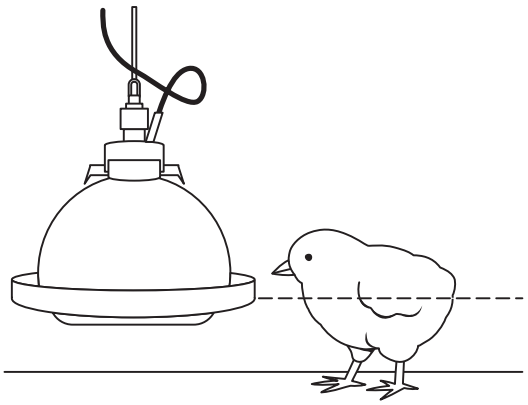
Since chicks grow rapidly, height, water pressure, and water level of nipple drinkers and bell-shaped water suppliers should be adjusted according to the growth of chicks.



Nipple drinker: Raised to the appropriate height



Feeder: Place the edge of the dish at the crop level of the female chick.



Bell-shaped water supplier: Place the bottom of the dish at the shoulder level of the female chick.

⑧ Chick guard management

After the first feeding, the circle is spread according to the growth of chicks. By 10 to 13 days of age, chicks start to get over chick guards, and then they are removed.

⑨ Ventilation

The raising density is high and the flock is large, so special attention is paid to ventilation.

⑩ Light control

In the case of a windowless chicken coop, the lighting is 5 lux for 24 hours until 1 week of age, 3 lux for 2 ~ 3 weeks of age, and 0.5 lux for 23 hours after that. In an open-type chicken coop, natural light is used in the daytime and this lighting is used at night.

（2）Management in the latter period

At 4 weeks of age, the feed is switched from that for early growth to that for late growth and finishing. As the chicks grow, their feed intake increases and their feces discharge increases. In addition, since the chicks are raised at high density from around this time, ventilation should be carried out. Especially in floor feeding, it is important to devise so that air flows on the floor. As a result, the litter dries moderately and generates less harmful gas.

In the latter period, the chicks' movement gradually slows as the body weight increases, and the difference in growth between males and females increases. At this time, the indoor temperature of the coop is 19 to 23°C, and the amount of feed intake is the largest and the weight gain increases accordingly. However, when it is hot in summer, it is necessary to take heat prevention measures such as blowing air or restricted feeding. Heat stroke is likely to occur when the temperature suddenly rises above 30°C.

（3）Shipment

Female chicks are shipped at about 6 to 7 weeks of age (this also serves as culling, “nakanuki” in Japanese). This is because the growth of the female is slowed down after that. The breeding space for the male is widened after culling (nakanuki). After culling (nakanuki), all chicks are shipped at around 9 weeks of age. It is standard to ship 32 to 35 kg of live weight per 1 m2, including the shipping accompanying culling (nakanuki).

5 Hygiene management of meat chickens (all-in all-out and disinfection)

（1）Cleaning after shipment and before entry of chicks

In general, broilers are raised in an all-in all-out system, in which only chicks hatched on the same day are stocked in the same coop (all-in) and are reared and shipped (all-out).

Since chicken coops are repeatedly used for rearing management (from entry to shipping) for a certain period of time, various pathogens may remain over time. The purpose of disinfection is to thoroughly eliminate pathogens, pathogenic microorganisms, and harmful insects that were left behind by chickens reared previously. Feces in vacant coops are removed immediately after shipment. Before the next chicks are stocked, remove the whole litter, kill insects, and wash and disinfect everything. Not only the inside but also the surrounding area should be cleaned and disinfected.

（2）Protection from wildlife

Metal gauze and bird nets should be set up to prevent entry of rodents and wild birds into the chicken coop.

（3）Use of vaccines and preventive drugs

Vaccination is effective for Newcastle disease, infectious bronchitis, infectious laryngotracheobronchitis, infectious bursa Fabricius disease, fowlpox, and Marek's disease, and vaccination programs are faithfully implemented for each vaccine. Most programs for broilers are based on live vaccines.

6 Treatment method of excreta

Currently, most chicken feces are processed by a fermentation method and used as compost. Fermentation methods include the deposition method, the open type stirring method, and the closed type stirring method. There are many open type fermentation facilities for broiler feces treatment. The mixture of broiler feces and litter is mainly low in moisture content, so if the fermentation process is carried out in a compost house or box-type fermentation facility, and initial moisture control is required. In closed fermentation facilities, treatment of excrement is completed rapidly, but care should be taken to avoid insufficient decomposition of growth impediments in the litter such as sawdust.

7 Rearing plan and performance evaluation

（1）Rearing plan

At present, most broilers are raised under contract with feed companies and trading companies. The date of introduction, the number of birds introduced, and the age at shipment are determined by the contract, so it is necessary to consider the facility and work schedule in advance.

（2）Method of performance survey

Since the growth is fast and the rearing period is short, weight measurement is done every week and feed intake is also measured. From the result, performance such as weight gain is calculated. Depending on the shipping ratio (the ratio of the number of units shipped to the number of entry), shipping weight (weight of living body shipment per unit area), etc., the profit in the business varies greatly.

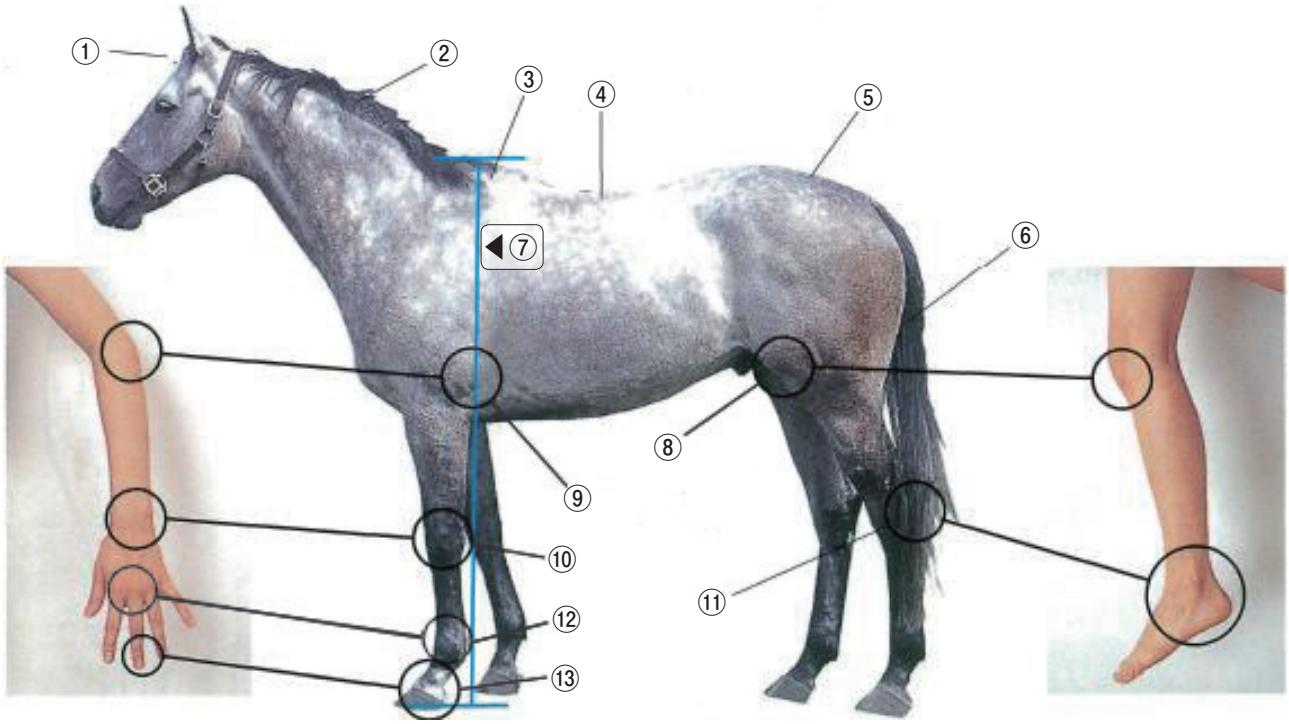
5 Others

① Light breed horses

1 Characteristics of Thoroughbred

- A Thoroughbred is a very cautious animal. Sudden movement of the person handling it may surprise them and cause them to run or act up. When you touch a horse, it is important to approach it from the front and call out gently to reassure the horse.
- The intestines of horses are longer than those of other animals, and colic (abdominal pain) is more likely to develop, so care must be taken in feeding management.

2 Names of main body parts of Thoroughbred (contrast with human)



① Forelock
② Mane
③ Withers
④ Back
⑤ Croup
⑥ Tail
⑦ Withers height
⑧ Stifle (human knee)
⑨ Elbow (human elbow)
⑩ Carpus (human wrist)
⑪ Hock (human ankle)
⑫ Fetlock (base of human finger)
⑬ Hoof (nail of human middle finger)

3 Individual identification

Individual identification of Thoroughbred is carried out using hair color, characteristics (white patches, hair whorls, etc.), microchip, etc. This information is on the pedigree certificate.

（1）Coat color

The following eight coat colors are present among Thoroughbreds.

Chestnut

Dark chestnut

Bay

Dark bay

Brown

Black

Gray

White

（2）Characteristics

・It is characterized by white patches on the face and limbs and hair whorls on the whole body.

（3）Microchip

・It is implanted in the center of the left neck before the pedigree is registered.
・The microchip number is on the pedigree certificate.
・To use Thoroughbreds in horse racing, you need to embed a microchip.

4 Feed

・Feed supplied to Thoroughbreds includes concentrate feed and roughage.
・Among concentrate feed, there are formula feed, as well as cereals such as oats and bran.
・Roughage includes dry grass imported from abroad or produced in-house.

5 Litter

- A partitioned room in a stable is called a stall, and straw and so on used as bedding in the stall are called litter.
- Rice straw, wheat straw, home-grown pasture grass, wood shavings, and sawdust are mainly used as litter.
- Rice straw and home-grown pasture grass are used in breeding farms, but wheat straw, wood shavings, and sawdust are often used in training farms to prevent eating of litter.

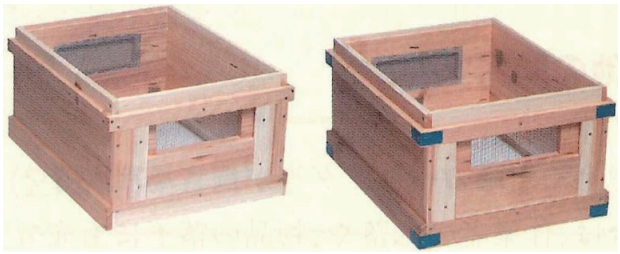
② Apiculture

1 Structure of a beehive

（1）Beehive and joint box

Honeybees are kept in hives (counted as a colony). A normal hive can hold 8 ~ 10 combs and about 20,000 worker bees live there. Also, when the colony grows large, a bottomless box called a joint box is placed on top of the hive box to cope with the increase in the number of honeybees.

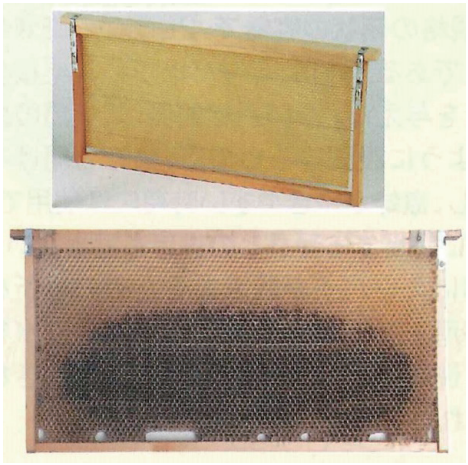
Beehive



joint box

（2）Honeycomb

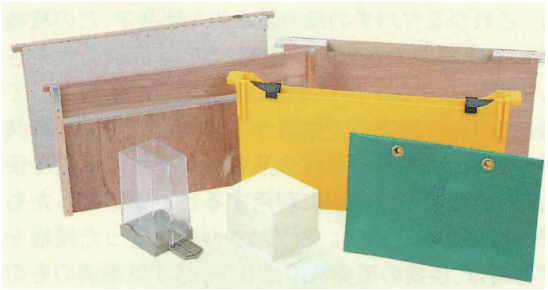
A cluster of cells is called a honeycomb. This is the basic part of a honeybee hive. The size of a colony is settled by the number of combs put in the hive and vice versa.



Comb

（3）Feeder

A feeder is a device to feed honeybees (sugar water, etc.). In the hive, it is put in the outermost part of the comb to feed them.



Feeder

2 Food and feed for honeybees

（1）Flower nectar and pollen

Honeybees only eat nectar and pollen. The nectar of the flower is the energy source and the pollen produces minerals and protein. Royal jelly given to queen bees and larvae is secreted from worker bees that eat pollen.

（2）Feeding

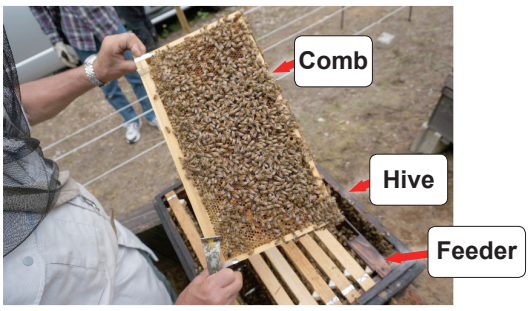
Honeybees do not need daily feed. However, when the nectar of the flowers is not gathered, bees are sometimes given feed (sugar water, etc.) to survive. When pollen levels are low, commercial feed (pollen substitutes) may be used instead of pollen.

3 Foraging behavior of honeybees

Honeybees usually fly within a 2 kilometer radius to collect nectar and pollen, but if there are no flowers around, they can fly as far as 10 kilometers. Honeybees prefer flowers with high sugar concentration and high nectar content. In addition, to avoid wasting energy, if there are good and poor nectar flowers at about the same distance from the hive, the inferior flowers are ignored. They comprehensively judge the 3 elements of flower "quality, quantity, and distance" and decide which flower to go to, depending on the situation of the surrounding flowers.

Honeybees also have separate collectors of nectar and pollen, but sometimes they collect both.

Nectar and pollen in cells



Hive and combs in which bees live

4 Honeybee diseases

（1）Foulbrood (American foulbrood and European foulbrood)

Foulbrood causes death during the larval and pupal stages. Larvae that die of American foulbrood become rotten, viscous, and emit an irritating odor (gluey odor). On the other hand, larvae that die of European foulbrood have no viscosity and smell of acid, which is different from the case of American foulbrood.

In Japan, Tylan soluble is approved as a foulbrood preventive medicine, but colonies that have contracted foulbrood must be incinerated.

（2）Varroa disease (Varroa mite syndrome)

Abnormalities caused by the infestation of Varroa mite (*Varroa destructor*) are called Varroa disease. Bees' blood is sucked by Varroa mites and honeybees (adult, larva, and pupa) are weakened. Many viruses are also transmitted by this kind of mite.

In Japan, Nichino Apistan and Apivar are approved as acaricides.

（3）Others

Others include Nosema disease (worker bees show diarrhea-like symptoms and the colony becomes weak) and chalk disease (pupae die in a white chalky state)

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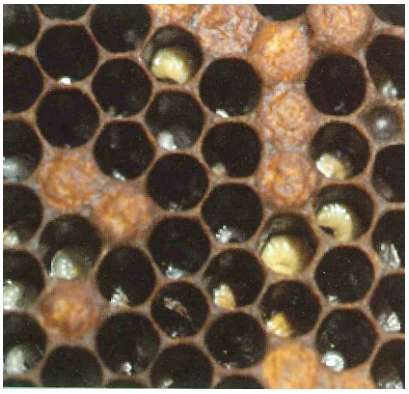
Larvae that have contracted American foulbrood
(Source: United States Department of Agriculture)



Larvae that have contracted European foulbrood
(Source: United States Department of Agriculture)

Larvae parasitized by Varroa mite

Adults strongly parasitized by Varroa mite

6 Questions for confirmation

For the following questions, answer ○ if it is correct, and × if it is incorrect

＜ Cattle ＞

1. The breathing rate of a dairy cow increases as it gets hot. (　　)
2. There is no bed in a freestall cowshed,but there is a bed in which cattle can sleep individually in a freebarn cowshed. (　　)
3. Cows have one stomach, like humans. (　　)
4. “Stop eating” of fattening cattle occurs due to overeating of roughage. (　　)
5. Somatic cell count decreases in mastitis cows. (　　)
6. Mother cows after delivery repeat estrus every 21 days on average. (　　)
7. A calf is put in an enclosure, and raised with shielding the sunlight. (　　)

＜ Pigs ＞

1. The main swine breeds raised in Japan are Landrace,Large Yorkshire, and Hampshire. (　　)
2. Mating of pigs in Japan is only natural mating. (　　)
3. Delivery difficulty is rare for pigs. (　　)
4. The body weight of a newborn piglet is normally around 0.5 kg. (　　)
5. Piglets obtain resistance against various diseases from colostrum. (　　)
6. Fattening pigs are fed a fixed amount once a day. (　　)
7. Since pigs have herd instinct, even if they are kept in groups, every pig can eat the same amount of feed. (　　)

＜ Chicken ＞

1. Hatching eggs are hatched in an artificial incubator for 10 days. (　　)
2. Chickens lay many eggs in the season with long day length. (　　)

3. Chickens continue laying for several days, then rest for 1 to 3 days, again continue laying for several days. ( )

4. The weight of chicken eggs as a product is an average value of 30 g. ( )

5. The egg production rate of chickens increases rapidly after 13 to 14 months of age. ( )

6. Feed intake of chickens decreases when the temperature rises. ( )

7. As chicken houses, there are open type chicken houses to which sunlight enters and windowless chicken houses which block sunlight. ( )

Answers

＜Cattle＞

1．○

2．× (Reason: There is an individual bed in the freestall cowshed, and no bed in the freebarn cowshed.)

3．× (Reason: The cow has four stomachs.)

4．× (Reason: Stop eating occurs with excess feeding of formula feed which mainly contains cereals.)

5．× (Reason: The number of somatic cells increases in mastitis cows.)

6．○

7．× (Reason: The calves should be raised in a well ventilated and sunny environment.)

＜Pigs＞

1．× (Reason: Landrace, Large Yorkshire, and Duroc.)

2．× (Reason: Natural mating and artificial insemination (AI) are conducted.)

3．○

4．× (Reason: The average weight of newborn piglets is 1.4 kg.)

5．○

6．× (Reason: In principle, feeding to fattening pigs should be done by ad libitum feeding.)

7．× (Reason: In case of keeping in groups, it is necessary to be careful because a poorly growing pig which cannot eat enough feed comes out.)

＜Chicken＞

1．× (Reason: Eggs hatch on the 21th day.)

2．○

3．○

4．× (Reason: MS size (52-58 g), M size (58-64 g), L size (64-70 g) are the central to trading eggs.)

5．× (Reason: Egg production rate declines rapidly at 13 to 14 months of age and the hens enter molting.)

6．○

7．○

III

Daily livestock management work

1 Hygiene management and safety management of farms

1 Status of malignant infectious diseases

(1) In Japan, foot-and-mouth disease broke out in 2010 and many pigs and cows were killed.
(2) A highly pathogenic avian influenza broke out in Japan in 2007.
(3) In Japan, epidemic diarrhea for swine has been a problem in various areas since 2013.
(4) These three infectious diseases are caused by viruses.
(5) Foot-and-mouth disease and highly pathogenic avian influenza have also occurred in neighboring countries of Japan.
(6) In recent years, the number of people and goods coming and going between countries has increased, increasing the risk of malignant infectious diseases invading Japan.

2 What farmers should be careful of

(1) When you go in and out of the barn, you should disinfect your rubber boots and work clothes sufficiently.
(2) You should carefully observe the condition of the livestock and report to the farmer if there is any abnormality.
(3) You should prevent wild animals such as wild birds and rodents from invading the barn.
(4) Since flies mediate viruses and pathogenic bacteria, and the occurrence of fly larvae also attracts flocks of wild birds, It is important to exterminate flies.

3 Farm area

As the sanitary control area, the farm area is supposed to need management to prevent infestation of pathogens.

There are two areas in the farm area, namely, the livestock area (barns and exercise grounds) and the management area (feed tanks, feed warehouses, pathways, offices, etc.), and in these two areas the entry of people and vehicles must be strictly regulated and controlled.

(1) It is necessary to prevent visitors to the farm from entering the barn without permission and to inform the farmer in such cases.
(2) When taking visitors to the farm into a barn, put boot covers (vinyl) on shoes, have them wear clean work clothes, and have them disinfected in a foot dip before entering the barn.

4 Disinfection facility at entrance of sanitation control area

（1） In the case that vehicles enter or leave

There are disinfection facilities such as "disinfection gate for vehicles," "disinfection sprayer," "vehicle disinfection tank," and "slaked lime belt."

For cars going in and out of the farm, disinfection of tires is carried out with a disinfection sprayer or a vehicle disinfection tank.

（2） In the case that persons enter or leave

When a person goes in and out of a sanitation control area such as a livestock area or a controlled area, disinfect their feet (rubber boots) and work clothes with "disinfection sprayer," "foot dips," "slaked lime belt," etc.

Foot dips

5 Management of disinfection apparatus / disinfection tanks / disinfection zone

（1） Disinfection gates for vehicles

When the vehicle enters, the sensor opens, chemicals are sprayed from the top and bottom, left and right, and as a result, the whole body of the vehicle including the underbody is disinfected. It is necessary to replenish disinfectants and to check spraying machines on a daily basis.

（2） Disinfection sprayers

These work manually; in the case of a vehicle, disinfect the lateral surface and tires of the vehicle, and in the case of a person, disinfect his or her feet. Always replenish disinfectant.

（3）Vehicle disinfection tanks

The vehicle slowly passes through the disinfectant solution and mainly the tires are disinfected. Since the effect of disinfectant solution declines with time, the chemical solution is required to be changed 2 to 3 times a week. In addition, contamination of the disinfectant solution with mud and sand decreases the disinfection effect, so cleaning is also necessary.

（4）Foot dips

For disinfection, immerse the rubber boots for 15 to 30 seconds in a container containing disinfectant solution. Since the effect of disinfectant solution declines with time, the chemical solution must be changed. Changing of the chemical solution is done every day, or every time it becomes dirty.

（5）Slaked lime zone (disinfection zone)

Spread slaked lime on the entrance to disinfect tires in the case of a vehicle or soles of rubber boots in the case of a person. Spreading lime must be done every day.

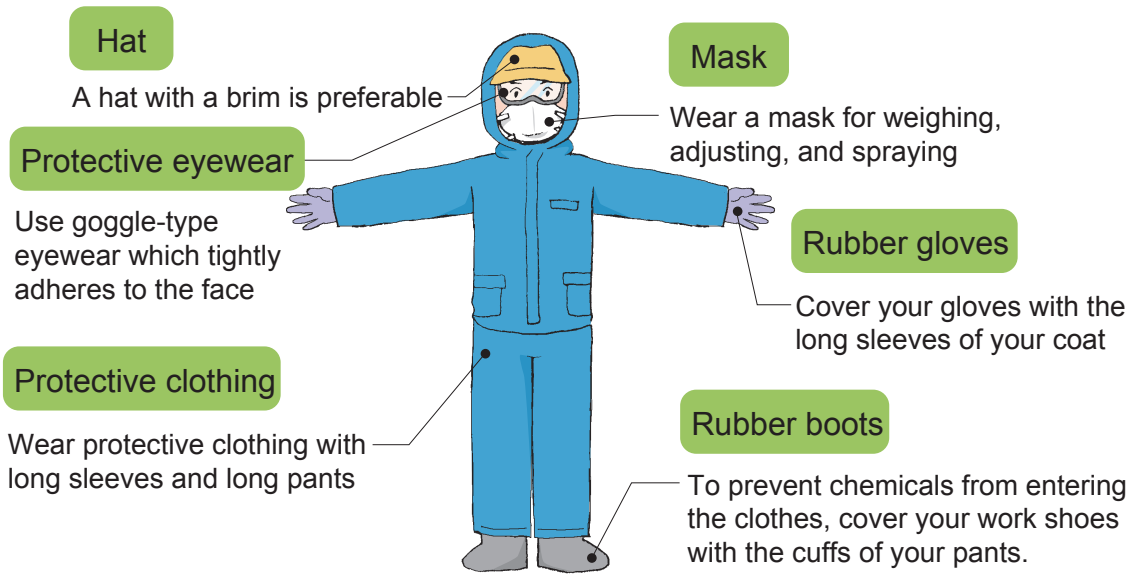
6 Cautions on use of disinfectant solution

When using disinfectants, the following must be preserved: “to obey usage and dose,” “disinfectant is freshly prepared,” “disinfectant (stock solution) is kept in a dry and dark place,” “do not mix with other disinfectants or insecticides,” and “Use safety gloves when handling, wear masks when spraying.” Wear work clothes when disinfecting, be careful not to put disinfectant solution on the body, and if disinfectant solution adheres to the body, it is important to wash well with water.

Storage of disinfectant

Wear the protective clothing properly.

How to correctly wear protective clothing



7 Safety management of barns

（1）Fuel oil and electricity

When handling fuel oil (petroleum, gasoline, etc.), be sure that there is no fire around it and be careful of fire.

You need to be especially careful with cigarettes and lighters. You should never bring them close to fuel oil.

（2）Electrical system

If the electrical outlet gets wet, there is a risk of electric leakage.

When cleaning, be careful not to get the outlet wet.

2 Dairy cattle

1 A day of a dairy farmer

Morning	Noon	Night
Cleaning of the trough Cleaning of tank and water cup Milking Feeding Sweeping of feed Cleaning of the passage	Sweeping of feed Treatment of excreta (Feeding)	Cleaning of the passage Milking Feeding Sweeping of feed

2 Management of facilities

(1) Passage

It is important to keep the passage through which dairy cows pass clean and not slippery.

(2) Feed warehouse

- Be careful not to allow wild birds or rodents to enter the feed warehouse.
- Keep clean by daily cleaning.
- Check that the feed does not get moldy.

(3) Trough

- Clean the trough before feeding in the morning.
- A trough with a smooth surface without small dents or holes is ideal.

(4) Sweeping of feed

It is important to sweep the feed close to the mouth of a cow so that dairy cows can eat feed easily.

Sweeping of feed

（5）Cleaning of tank and water cup

- In the morning, it is important to remove feed in the tank or water cup to clean up so that dairy cows can drink fresh water.
- It is preferred to change the water in the tank so that the cows can drink cold water in hot summer season.

Water cup

（6）Ventilation in the cowshed

- Prevent drafts during cold weather.
- It is important to promote convection of fans during the hot season.
- During the hot season the rectal temperature often rises to 39°C or more, respiratory rate increases, and feed intake decreases.

Ventilation of cowshed

（7）Stall

- Keep the cattle floor (stall) clean and dry.
- Maintain elastic condition by using litter to reduce damage on legs of dairy cows and give comfort.

Stall

（8）Protect from ectoparasites

- Prevent propagation of cattle flies, house flies, and the like in the cowshed.
- For that purpose, cleaning and removal of feces, replacement of litter, and removal of putrefied feed are necessary.

（9）Observation of cows

Observation should be done on “Competition between strong cow and weak cow” “Detection of depressed cow” “damage to cow body” “choosy eating of feed (selective eating)” and “condition of feces such as diarrhea.”

3 Milking Procedure

（1）preparation and principle

- Milking instruments should be inspected, cleaned, and sterilized before milking.
- The cows with high somatic cell count and mastitis cows should be milked at the end.

（2）Pre-milking

- Pre-milking is carried out for “detection of solids in the milk juice,” “discard milk possibly contaminated with bacteria invaded in the teat after the last milking,” and “discard dipping solution remaining in the teat after the last milking.”
- Hand disinfection and milking gloves: Prepare buckets for hand washing and hand towels.

Pre-milking

・Strip Cup: For each teat, perform forestrip to the strip cup and check the solid matter in the milk. In this case, if the teat is very dirty, wash it first. In addition, if the teat is very dirty, wash it first.

Strip cup

（3）Predipping (It is done in a farmhouse raising cows with less dirt on teats.)

① After pre-milking, fungicide is used instead of the next "teat cleaning".
② Dipping means "to soak in a chemical solution".
③ The purpose of dipping is to sterilize the teat and protect the surface of the teat.
④ Dipping liquid contains fungicide and a teat surface protection substance (glycerin, etc.).
⑤ After completion, wipe clean with a disposable paper towel to prevent the drug from remaining in the milk.

Dipping solution

（4）Cleaning of the teat

- Clean the teat with a towel soaked in disinfectant solution.
- The purpose of wiping is “to give stimulation for milking” and “sterilization of the teat surface.”
- Prepare one or more towels per head, and put the used towels in another bucket.
- In some cases, disposable paper towels are used instead of cloth towels.

Wiping of teats

（5）Drying of the teat

After wiping or predipping the teats, wipe them with a disposable paper towel to dry them.

（6）Attaching, milking, and detaching of teat cups

- Attach a teat cup 1 or 2 minutes after the start of pre-milking.
- Attach the unit correctly to 4 teats.
- As a guide, milking should be finished within 5 minutes.
- Do not over milk (machine stripping) trying to strip the remaining milk. Because it damages the teat end and papillary duct. Do not strip too much.
- After completion of milking, detach 4 teat cups from the teats at the same time.

Attaching a teat cup

Correct procedure of milking

Stop machine stripping (a bad example)

Shut off the vacuum, wait for a while, and then leave 4 cups at the same time by free fall

Damage around teat end by over milking

（7）Post dipping

・Dipping after removing the teat cup is called post dipping.
・The purpose is to prevent infection of the teat with bacteria until the next milking.

Dipping of the teat

Dip cup

（8）Temperature control of bulk cooler

・At the time of first injection, adjust the temperature below 10°C within 1 hour after milking and below 4.4°C within one additional hour.
・At the time of additional input, control the temperature not to exceed 10°C.

Bulk cooler

4 Detection of estrus

（1）Estrus cycle

The estrous cycle of cows is 21 days.

（2）Observation

・When estrus approaches, dairy cows become restless and rub against other cows or persons, or

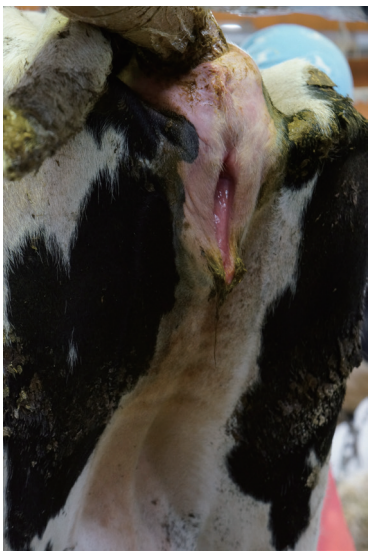
walk around at night even when other cows are quiet.

- In the past, it was said that the duration of estrus was about 12 ~ 18 hours, but it became shorter as the milk production of dairy cows increased. Recently, it is said that the duration of estrus is 7 ~ 8 hours as a standard.
- Observe the behavior involved in estrus (such as standing estrus) early in the morning and at night.
- A state that allows other cows to ride on the back without disgust is called standing estrus. It is regarded as a true estrus.

（3）Detection of estrus in tied housing

In the case of tied housing such as a stanchion barn,check the following situation.

- Loss of appetite
- Decrease in milk yield
- It looks restless
- It roars
- Leakage of estrus mucus
- Swelling of the vulva



Hyperemia and enlargement of the vulva

5 Nursing of calves at delivery (preparation)

- It is important to prepare a clean and dry nursing cage with enough litter prior to calves' delivery.
- It is important to prepare clean towels, transportation equipment, and disinfectant solution (such as iodine tincture) to wipe off the fetal fluid of the calf.

3 Beef cattle

1 Facility Inspection

This is basically the same as in III-2- 2 “management of facilities.” Refer to that part.

2 Health check

（1）Appetite

In the following cases, digestive organ disease, febrile illness, and dental disease are suspected.

- Keeping away from the trough
- There is leftover feed in a large amount
- Apart from herd

（2）Whether their eyes are mild and vigorous

Anemia, jaundice, and early- stage respiratory disease are suspected in the following cases.

- Lacking vitality
- Anemia of mucous membranes
- Hyperemia of mucous membranes
- Yellowing of mucous membranes
- Purulent conjunctivitis
- Lots of tears, eye mucus

（3）Condition of the nose

In the following cases, respiratory disease and febrile illness are suspected.

- Water soluble nasal discharge
- Yellow-white to yellow-green nasal discharge
- Drying of the nasal speculum

（4）Behavior and suspected diseases and problems

- Restlessness, salivation, bruxism, straining, pawing (scratching the ground with the forelegs), anguish, and seeing the abdomen → Pain in internal organs or poisoning

・Consciousness disorder or neurological symptoms such as gloom, abnormal excitement, circling, frenzy, convulsion, and paralysis → Infectious disease or vitamin B1 deficiency
・Claudication → Hoof disease
・Bruise, sprain, or arthritis → Defective floor structure
・Abnormal curvature of back and hock joint during urination and feces → Metabolic disease
・Rubbing the body against a wall or pillar → Skin disease
・Shaking shoulders and waist → Encephalitis or poisoning
・Sparse fur, swollen limbs, exophthalmos, and degraded vision → Vitamin A deficiency

（5）Condition of tail head, tail

Diarrhea is suspected in the following cases.
・The hair of the tail head is lost and the tail head has become bald
・Yellowish white or dark brown dirt attaches to the tail head
・Dirt attaches to the entire tail

（6）Condition of respiration

Respiratory illness is suspected in the following cases.
・Breathing with open mouth, labored breathing
・Breathing rate increases
・Abdominal breathing

（7）When coughing

Aspiration (accidentally swallowing foreign matter) and respiratory illness are suspected.

（8）Body temperature (rectal temperature)

Respiratory diseases and the like are suspected when having a fever of over 40°C or showing whole body tremor.

（9）Condition of the hair

- Coarse stiffness and lack of gloss → Malnutrition is suspected.
- Long, irregular, and torsional → Parasitic infection is suspected.
- Alopecia → Skin disease is suspected.
- Adhesion of white small calculi on the tip of pubic hair → Urolithiasis is suspected.

4 Pigs

1 Points to note during breast feeding by mother pig

With a mother pig, more than 12 teats in total line right and left in two rows. Milk yield from teats near the head is higher. A few days after delivery, the position of each piglet corresponding to each teat (teat order) is decided, and each piglet starts to drink from the same teat. Breast feeding is done once roughly every hour. The milk ejection time is actually 10 to 20 seconds.

During lactation, accidental deaths due to being squashed by the mother pig often occur. While it is natural not to surprise the mother pig, the management should be done while keeping in mind the following three points.

- Since the nutrition control of the mother pig is bad and the amount of lactation is small, the piglets do not move away from the mother pig.
- Because the mother pigs have difficulty drinking water, repeat standing and sleeping many times.
- If keeping piglets warm is inadequate, the piglets search for warmth and contact with the mother pig, sleep there, and then they are crushed.

2 Heating of piglets during nursing and raising

The optimum temperature of piglets is high and the ability to regulate body temperature is still low, so sufficient heating is necessary. The optimum temperature range changes with growth, so each time we decide whether or not it is appropriate. The optimal temperature is 36°C at birth, 30°C after 1 week, 28°C after 2 weeks, and 26°C after 3 weeks, gradually decreasing. If piglets overlap just below the heater, it is judged to be cold. On the other hand, if they sleep away from the heater, it is considered hot. Keep the piglets in a moderately scattered state.

Be careful when handling heaters. Most of the fire accidents in pigsties are caused by the fall of heating equipment and the outbreak of fire from heating equipment.

	Age in days and body weight	Optimum temperature
Piglet	1–3 days after birth 4– 7 8–30 31–45	30–32°C 28–30 22–25 20–22
Pork pig	15– 50kg 50–100	20–25 18–20
Adult pig	100 kg or more	15–18

Optimal temperature range of pigs

3 Points to note on piglet management

Piglets are susceptible to disease and often develop gastrointestinal problems (diarrhea) and respiratory abnormalities (pneumonia). In addition, parasites from the mother pig cause poor growth of the piglet; deworming of sows, mother pigs, are also important; the mother pig and the piglets are thus also vaccinated sequentially.

Piglet nursing

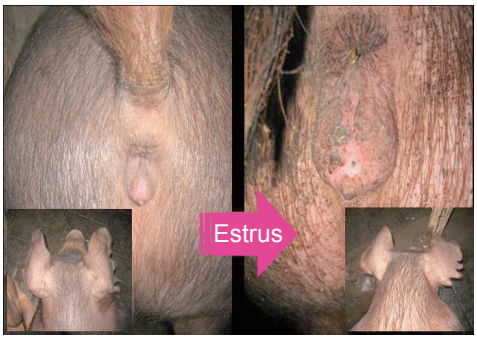
4 Precautions when castrating piglets

Male piglets are castrated before fattening. This is done to prevent the smell of the male from transferring to the pork. Castration is done within the time period between a few days after birth and before weaning, and it is often done within a week.

5 Precautions for estrus, mating, and delivery of breeding pigs

A short time after the piglets are weaned, estrus returns. Estrus cycle is 21 days and it lasts for 2 to 3 days, depending on the individual. The signs of estrus are seen in mounting, loss of appetite, tail uplift, swelling of the vulva, and mucus. It should be detected early in proestrus, when the vulva is congested and swollen, and when they enter estrus, mating is performed at the appropriate time. The best time for mating with the highest conception rate is 10 to 25 hours after the beginning of estrus. When a breeding pig enters estrus, it becomes quiescent when a human presses the loin backs of the pig with both hands (back pressure reaction test). In addition, when the male is brought closer, the permissive female remains immobile and quiet when mounted, and raises her ears. Sows that have not given birth may not show signs of estrus.

Confirmation of estrus



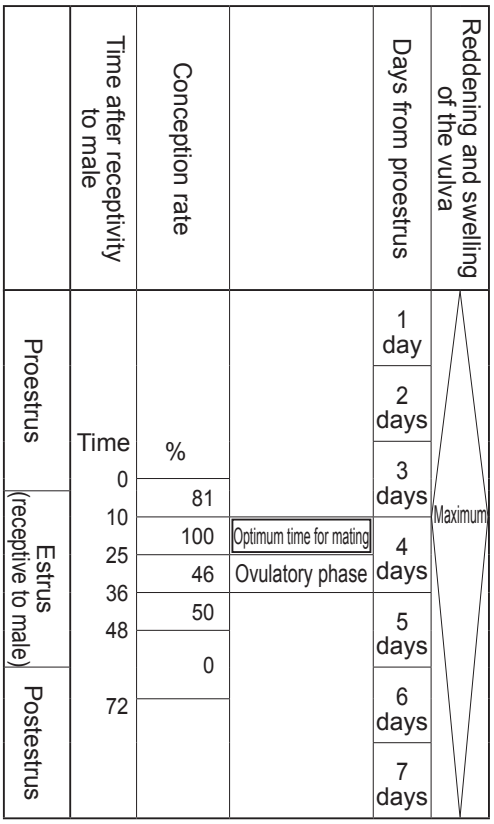
Reddening and swelling of the vulva

(photo supplied by: National Livestock Breeding Center)

（1）Proestrus : 2.7 days, development of vulvar reddening and swelling
（2）Estrus : 2.4 days, from the onset to the end of receptivity to males
（3）Postestrus : 1.8 days, regression of vulvar reddening and swelling
（4）Anestrus : 14.1 days

Since sows have a long estrous period, fertilization is attempted at least twice in one estrus period, regardless of whether the pig is naturally mated or inseminated artificially, to obtain high conception rate and as many offspring as possible per litter. Pregnancy is confirmed by recognizing no re-estrus after 21 days and by using the pregnancy diagnosis device. When pregnant, many pigs become quiet and their appetite increases.

Before putting pigs into farrowing pens, clean, disinfect, and dry the pens. Pigs give birth easily, and it is rare to have difficult delivery. If the piglet is not breathing, artificial respiration is performed.



Relation between signs of the vulva during estrus and the appropriate time for mating (fertilization) (in the case of natural mating and insemination with semen in liquid form)

6 Points to note in hot season

Piglets are weak to cold, whereas grown-up fattening pigs and sow pigs are weak to heat.

For raising environment of fattening pigs and sow pigs, about 20°C is appropriate. Since sow pigs and piglets have different optimal temperature range, if a high temperature around delivery affected the sow pig (mother pig), it adversely affects the piglets as well.

In hot season, ventilate forcibly with electric fans, especially maintain aeration near the floor. This is done to expose the pig body to the wind and to remove moisture. Wind speed of 1.0 m/s or more is a rough indication. Pay attention to the wind route caused by ventilation so that the wind direction in the piggery becomes constant. In case that the air supply is hot and the effect of blast is low, introduce, for example, duct blowing using an air cooler. Since the hot and humid environment

in Japanese summer is harsher than that in the West, it is often not practicable to adapt overseas heat management technology.

7 Management of trough and drinking water

Feeding pigs are fed ad libitum in principle. Always keep feed remaining in the trough. In the case of a wet feeder that adds water when the pig eats, pay attention to decay of the leftovers. Prevent birds and others aiming for feed from intruding, and regularly disinfect rodents. Pigs are allowed to drink water freely. With bite type and nipple type, pigs may not be able to drink enough water depending on water pressure, so be careful.

8 Points to note on storage and handling of feed

Store the feed in places as cool and dark as possible to avoid high temperature and high humidity. In particular, since synthetic milk tends to be deteriorated easily, finish it up as soon as possible. Do not supply moldy feed. Protect feed from damage caused by rodents, birds, and insects by keeping it in the warehouse.

9 Environment and sanitation management of piggery

Regulating the sanitary environment of the piggery is important not only for prevention of pig diseases and health maintenance, but also for health maintenance of workers. Maintenance of sanitary environment of piggery is to maintain working environment of workers. From the viewpoint of food hygiene and also from the viewpoint of preventing contamination of the surrounding environment, sanitary control of the piggery is important.

By separating the breeding area and the fattening area, arrange the flow line in the piggery into one direction. Only sow pigs are introduced from outside, so that a piggery for quarantine is built. Then, with the whole placement, fattening piggery should be located in a place facing outside to limit possible damage caused by invasion of pathogens to fattening pigs.

Symptoms of swine diseases appear in various forms. If symptoms are recognized, promptly report to and consult the veterinarian at the pig farm.

5 Chicken farming (egg laying hens and meat chickens)

1 Management of brooder

(1) Temperature management

Baby chicks are small in size, body temperature is low and adaptivity to environmental temperature is low, so that they cannot grow without warming. Whichever type of chicken house (open type chicken house or windowless chicken house) and whichever method of brooding (battery type brooder, floor type umbrella-shaped brooder, and floor heating) is employed, gradually lower the temperature from 32 to 35°C at entry of the chicks with observation of the baby chicks and condition them to live at the room temperature within 3 to 4 weeks, then stop warming.

(2) Humidity control

Condition baby chicks gradually from a humidity of 65% to indoor humidity. To keep the humidity of 65% under 35°C at entry of the chicks, every brooder must be humidified by placing a basin and the like. However, after around one week, excretion of feces increases and evaporation of water from feces increases, so that according to these, reduce the water supply. After the 10th day, the humidity should be rather dry.

(3) Ventilation management

In the case that the temperature in whichever brooder is high, ventilation occurs naturally due to the difference of temperature between the brooder and the room, but excessive ventilation lowers the temperature in the brooder. While observing the condition of the chicks, pay attention to harmony with keeping warm.

2 Management of feeder and water supplier

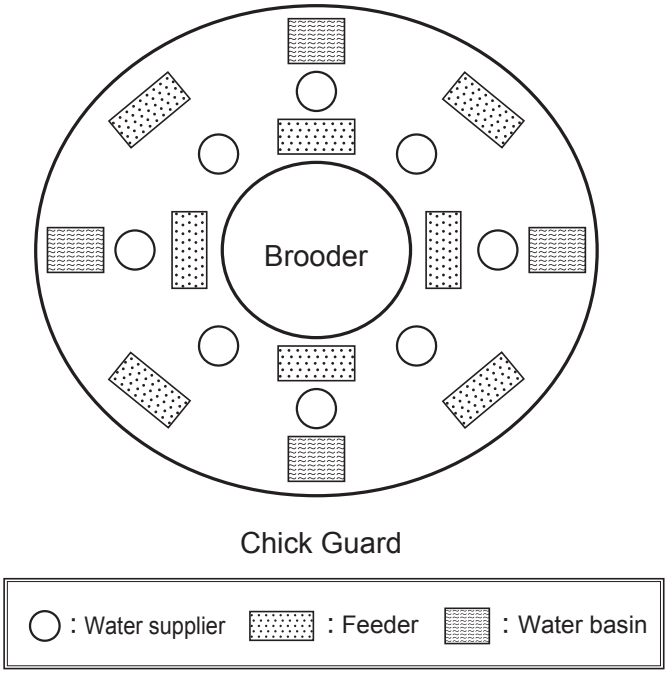
(1) Period of young chicks

With both battery brooder and floor type brooder (in the chick guard), to promote eating at entry of the chicks, feed a small amount of kneaded pre-starter many times as litter feeding in the feeder (with flat and low rim). To drink easily from water supplier as well, a water basin or auxiliary drinker should be used as a water supplier. Since young chicks frequently repeat eating and drinking, place the feeder and water supplier close to them.

In the case that proper temperature control (lowering the temperature of the heating part gradually from 32 to 35°C at the entry of the chicks) is performed, the chicks come out from the heating part day by day and have to come to eat and drink in the room temperature part. From two days after first feeding, prepare feed and drinking water in the room temperature part (in the

case of battery type, playground, and in the case of floor type, the periphery away from the heat source in the chick guard). When most of the chicks start eating in the room temperature part, stop feeding and water supply in the heating part.

During the period of young chicks, always prepare feed and drinking water and allow to eat and drink freely. The amount of feed to be placed in the feeder should be about half, to avoid feed spills during eating. To protect the chicks from entering the feeder, devise attachment such as an umbrella and separator. Supply drinking water constantly, and regarding bell-type water supplier whose dish stores water, cleaning and replacement must be done once a day because contamination of feed and feces occurs. A nipple drinker is sanitary because the chicks looking at the water drop drink it directly. Adjust the water level of both the nipple drinker and the bell-type water supplier according to the growth of chicks.



Placement of feeder and water supplier in chick guard

（2）Period of middle to large sized chicks

① Feeder management

In this period, the feeding space becomes insufficient, so that replenishing the feeding space using dishes in the playground side for battery brooder, in the space made by enlarging the chick guard for the floor-type. Afterwards, in the battery type, install a gutter-type feeder

on the side of the cage and guide chicks to feed with their face out of the cage. In floor type brooding, shift to a hopper type feeder by the time when the chick guard is removed, and in the chicken house with the feeding line, gradually shift from manual feeding to automatic feeding. Automatic feeding is a feeder installed with feeding lines; with the battery type the feed is supplied to the gutter-type feeder, whereas with the floor type it is supplied to the pan-feeders (dish type).

Observe the growth and feeding situation of the chicks and adjust the height of the feeder and the amount of food in the gutter and hopper. It is important that feed is uniformly spread in the feeding dish of the automatic feeder so that the chicks eat easily. In the battery type the chicks do not enter the feeder (gutter), but in the case of floor type, devise attachment such as an umbrella, a separator, and a spire to prevent the chicks from entering the feeder.

② Management of water supplier

Increase the number of water suppliers according to the enlargement/removal of the playground or chick guard, and evenly arrange them. In both battery type and floor type, considering the number of the nipple drinkers, adjust the height of the nipples to slightly higher than the eye line of the chicks and the water pressure to be easier to drink. In the floor type, adjust the position of the dish of bell-type water supplier to the height of the chest of the chick. With the broiler, adjust it especially to fit the female chicks. Since the amount of drinking water increases, management of water supply facilities (water supply equipment, water supply pipe, subtank, etc.) is also important, carry out cleaning regularly.

3 Methods of cutting the beak (debeaking)

Butt pecking often occurs among the chicks during brooding. When chicks are small, they only damage the area around the tail, but before the age at first birth, they often poke the intestines and cause unexpected damage in a short time. To prevent these damages, it is common to cut the beak (debeaking).

The beak is cut by using a debeaker to burn off the upper and lower beaks. In the case of egg-laying hens, debeaking is usually done at 3 to 10 days of age. Broilers undergo debeaking at the age of 1 day or as early as possible, but sometimes it is already done at the hatchery.

Debeaking prevents development of bad habits and reduces spilling of feed. The loss of eggs by eating eggs decreases after they become adult chickens.

Cutting the beak (debeaking)

4 Measurement of body weight

Body weight is an excellent indicator to fully demonstrate the development of chicks for egg-laying and future laying capacity, so that body weight must be measured for randomly selected chicks at least once every week or every two weeks. In addition, understanding the daily gain of the chicks for fattening is important for the broiler shipping plan.

Measure the body weight at about every 4 weeks after starting laying and also to find out whether nutrition is properly ingested without excess or deficiency; investigation on the change in body weight is necessary. It is preferred that body weight of adult chickens is measured individually for the same chicken.

5 Notes on receipt, storage, and handling of feed

(1) Receipt of feed

Feed tanks or storage sheds must be cleaned before carrying the feed in, and the feed delivery vehicle must be properly disinfected at the farm entrance and so on. The feed must originate in a factory periodically conducting salmonella inspection and the result of following inspection on the feed is required to be attached; no abnormality in appearance, color, flavor, and quality is observed, and no foreign matter is recognized. It is also important to know the name of the feed additives or materials that have been mixed, and the shipping restricted period.

（2）Storage of feed

Decide feed purchasing plan in advance and be careful not to keep in stock for a long time.

Feed must not contaminated with mold and the like, and ingredients (proteins, lipids, etc.) in the feed must not be deteriorated (decayed), furthermore, added substances (additives) such as vitamin premixes must be stored in a cool and dark place. In addition, it is important that in the storage shed, rodents and their feces and the like are not detected.

（3）Handling of feed

Feed is decided based on an appropriate feeding plan, in case of adding feed additives in the farm, it is important that mixing it homogeneously and that it is fed according to the method and dose. In particular, after entry of the chicks, various feeds according to the feeding plan (feeding system) corresponding to the growth and production stage of chickens can be fed by weighing the body weekly. In addition, comply with the shipping restricted period of feed additives that directly affect the quality of chicken products (eggs, meat), and feeding with care about the quality of feed (appearance, color, flavor, mold, deterioration, etc.) is important.

Feeding management records must be kept for at least 2 years

6 Management in hot season

In the open type chicken house in the summer, laying hens may die from heat even at the outside air of 32 to 33°C. The temperature inside the chicken house may be higher by 5°C or more than the outside temperature, because the roofs and walls are heated by the sunlight and further receive radiation heat from the ground; in addition, the temperature around the chicken body is higher. Taking measures against heat is thus necessary. In the open type chicken house, improve the ventilation inside the house; in case that the wind cannot escape, supply the wind at a wind speed of 0.5 to 0.8 m/s with a blower. Avoid direct sunlight by creating shade with trees and the like. Spraying water in the chicken house is also effective for lowering the temperature. When the temperature inside the chicken house rises, the water temperature of drinking water will also rise, and chickens do not drink warm water, so give them as cold water as possible.

In a windowless chicken house, devise a ventilation method so that the temperature inside the house is as uniformly lower than the outside temperature as possible. Generally, lower the chicken's sensible temperature by increasing the amount of ventilation. This is influenced by the quality of heat insulation of the ceiling and walls, and the better the heat insulating property, the less influence by the outside air temperature.

For broilers, prevention measures against summer heat are the most important aspect of management. Above all, ventilation is a lifeline for chicks. Therefore, the duct is connected from the air blower during the extremely hot season, and the air is sent directly into the house. In the peak of daytime heat, water is sprayed and the temperature in the house is lowered by the heat of vaporization. Death due to the heat is likely to occur in chickens that are grown enough to be shipped soon. At that time, the temperature around the chicken body is about 5°C higher than the

room temperature. Heat death happens suddenly, so it is important to take measures early on a hot day.

7 Management in cold season

In an open type chicken house, measures against cold weather are required to prevent cold winds blowing in the house with curtains or the like. Keep tightly closed but care must be taken so that ventilation failure will not occur. In windowless chicken houses, the amount of ventilation is smaller, but be careful not to cause ventilation failure.

8 Health management of chickens

It is important to observe whether the raising chicken has dirty rump, weak legs, abnormal breath sounds, abnormal walking, or abnormalities of clinical symptoms. The following are required; Temperature, humidity, and ventilation suitable for the age of chicken breeds are well controlled; ventilation suitable for the age and temperature (room temperature) is well controlled; and raising area suitable for the age is secured.

The manager observes the raising room every day to check the following; the presence of abnormal and dead chickens; measurement of the temperature, humidity, and the amount of ventilation; whether feed and drinking water are properly supplied.

9 Egg collection to shipment

Most eggs are laid before noon. Work process of egg collection → grading → candling → egg cleaning → shipment is carried out irrespective of the size and facility of the egg-producing chicken farm and depending on whether or not machines such as automatic egg collector, automatic egg grader, and egg cleaner are installed, it is divided into mechanical work and manual work.

It is important to collect eggs immediately after laying to avoid eggs hitting each other, injured by chickens (egg eating habit) and getting eggs dirty (dirty rump). Generally, bad eggs such as scratched and deformed ones are removed and the other eggs are collected with egg trays and shipped in containers. There are various methods, such as: cleaning and sorting eggs (grading by weight) are done by farm households; using home-delivery service after packing and boxing; selling directly to the consumer. Facilities in which egg collection line is connected to the GP center (a facility for egg collection, sorting, cleaning, and packing) adjacent to the egg production chicken house are called inline system.

Store the eggs before shipment in a place away from the chicken house, and control the temperature in the storage to the level that dew condensation is not formed on the eggs, comparing with the outside temperature. Keep the storage period as short as possible.

The operator must wash and disinfect hands before working. Collecting baskets, egg trays, and egg containers to be used must be cleaned and disinfected. It is necessary to check whether the egg

collection tools/machines operate normally and to prepare properly. Inspect egg collection tools/machines regularly and clean/disinfect them. In the case of manual collection, eggs are collected as many times as possible every day to keep freshness.

10 Shipment of young chickens (broilers) for meat

The chickens are provided with non-dosing feed (feed containing no antibacterial substances) for 7 days before shipment. If antibacterial substances are administered during raising, ensure that the shipment restricted period has passed. The lights should be on for 24 hours from 7 days before shipment. Stop feeding from 12 hours before the scheduled processing time (feed withdrawal). Start catching chickens to coincide with the time of shipment. While checking the remaining feed in the crop, healthy and clean chickens are shipped by culling underdeveloped chickens and chickens whose body surface is heavily contaminated.

11 Maintenance and hygiene management of facilities and equipment

The facilities are chicken house, feed storage facility, compost storage facility, waste storage facility, and incidental facility, and it is important that the facilities are located to be able to raise the chickens hygienically. Day-to-day management is important so as not to cause damage and inconvenience in the facility and to avoid unsanitary conditions due to dust and dirt.

6 Others

① Light breed horses

1 Health management

（1）Body temperature (rectal temperature)

The normal temperature is 37.5 to 38.4°C. If the temperature is 38.5°C or higher, it is considered attack of fever.

（2）Limb check

The extremities are susceptible to bacterial infection and swelling, which may interfere with training. Observe carefully before and after grazing and training, and if there is a wound, It is important to treat it as soon as possible.

2 Horseshoeing

- Horseshoes are put on to protect the hooves because they are easily worn away as the training progresses.
- The frequency of replacement of horseshoes is generally from 3 weeks to 1 month.

3 Management of pasture

（1）Trimming

At the pasture, cleaning and cutting the grass are performed periodically to shorten the plant height .

Horses like short grass and eat well, which leads to weed control.

（2）Hygiene management

Collect horse manure from the pasture and prevent the spread of parasites.

4 Points of feeding management

（1）Management of breeding farm

- Grazing management is generally carried out for mother horses and foals. In Hokkaido, the main production area, the temperature is low in winter and there is a lot of snow. Therefore, grazing is done only during the day, and horses are kept in the stable in other times, which is called daytime grazing. In other seasons, they are kept in the stable only for a limited time period of the day

and grazing is done in other time periods, which is called day-and-night grazing, or nighttime grazing.

- Concentrate feed is given at the time of confinement rearing, and the amount of the feed is increased for mother horses during lactation or late pregnancy.
- Grazing is done in a group, but the foals after weaning are grazed separately according to sex.

Daytime grazing

Nighttime grazing

（2）Management of yearling training farm

- The amount of concentrate feed is increased according to the intensity of riding training.
- Horses that are highly trained for riding are fitted with horseshoes on their hooves, so they are not grazed collectively to prevent injury by messing around. They are generally grazed individually on a small pasture (paddock).

② Apiculture

1 Annual workflow (example)

Season	Month	Work content
Winter	1	Checking the honey in cells and temperature control in the hive
	2	Checking the honey in cells, disinfecting and repairing the beekeeping equipment, checking bees in the hive, and providing feed and medicine
Spring	3	Increase the number of combs and check bees in the hive
	4	Increase the number of combs and check bees in the hive
	5	Collect honey
Summer	6	Collect honey
	7	Temperature control in the hive, providing feed and medicine
	8	Temperature control in the hive, providing feed and medicine, reducing the number of combs in the hive, and exterminating wasps
Autumn	9	Feeding, reducing the number of combs in the hive, and exterminating wasps
	10	Providing feed and medicine, storage of combs, and exterminating wasps
	11	Feeding
Winter	12	Temperature control in the hive

※ wasps = enemies of honeybees

2 Clothes

When you check honeybees in a hive or collect honey, you should wear a veil (face protection), gloves, and bright clothes that hide your skin.

3 Beekeeping equipment

（1）Smoker

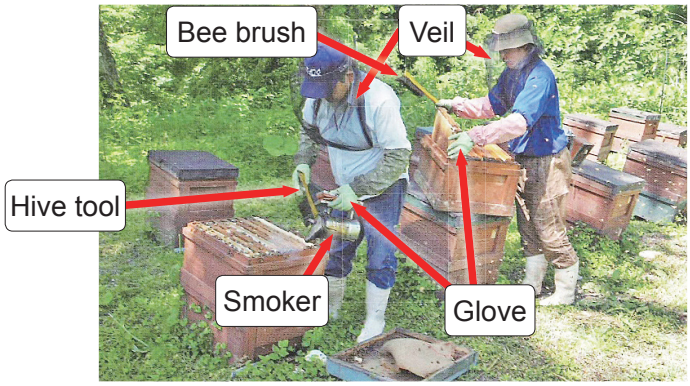
It is used to blow smoke on honeybees and make them less aggressive. Linen cloth, paper, fallen leaves, etc. are burned to smoke.

（2）Hive tool

It is an iron spatula and used to pull off the comb when it sticks to the hive.

（3）Bee brush

It is used to sweep honeybees out of a comb or a hive.



Beekeeping operation

4 Equipment for the production of honey

（1）Uncapping knife

This is a knife used to thinly cut off the cappings (beeswax) in the comb when collecting honey. It is used while being warmed with hot water, but there is also a electric heating type.

（2）Extractor

It is a machine to put in a honeycomb filled with honey whose cappings are removed and rotate it to extract honey by centrifugal force.

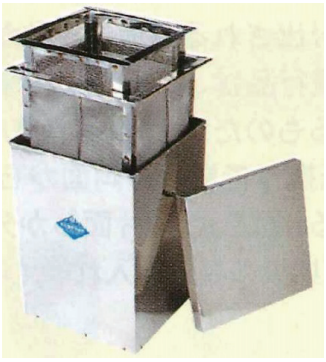
（3）Honey strainer

It is used to remove debris from the honey when the honey is transferred from a extractor to a storage container.

（4）Saccharimeter

It is used to measure the sugar concentration of honey.

Extractor

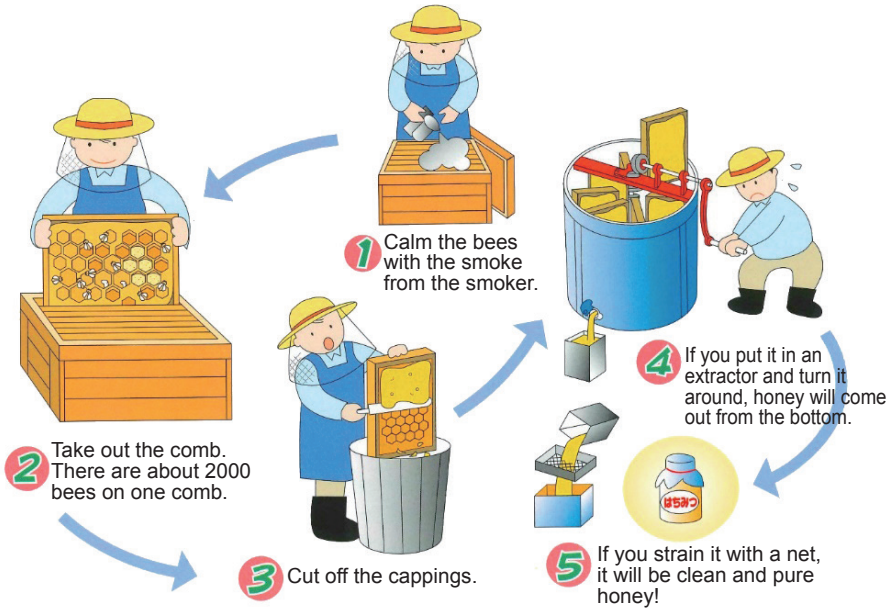


Honey strainer

Uncapping knife

Saccharimeter

5 Extract honey



Process of collecting honey

6 Using honeybees for agriculture

Bees visit flowers to get food, but they also carry pollen from flower to flower. As a result, honeybees are used at agricultural production sites where strawberries, melons, watermelons, cherries and so on are grown.

Bee carrying strawberry pollen

Hive set up in a strawberry greenhouse

7 Key points of management tasks and observation on livestock (for practical examination)

In everyday work on a farm, it is important to master the correct way to work and to observe livestock while learning from the administrator about the following things.

1 Cattle

- How to approach cows, how to draw, how to connect
- How to distinguish between healthy cows and weak cows
- Condition of hoofs and way of hoof cutting
- Confirmation of the name and role of the facilities (compost board, silo, freebarn cowshed, freestall cowshed, milking parlor, etc.)
- Confirmation of names and roles of instruments and devices used for dairy cows
- Hygiene management at milking and how to attach and detach milkers
- Observation of the properties and condition of feces (how to distinguish normal feces from diarrhea / loose stools)
- Confirmation of type and name of feed (difference between roughage and concentrate feed)
- Difference between separate feeding of roughage / concentrate feed and total mixed ration (TMR)
- Order of feeding of roughage and concentrate feed in the separation feeding of dairy cattle
- Points of day-to-day management of trough and tanks
- Observation of signs of estrus
- How to castrate bulls
- How to dehorn cattle
- How to feed on calves
- How to distinguish between colostrum and usual milk
- Confirmation of how to make a foot dip and how to pass through it

2 Pig farming

- How to guide pigs
- How to distinguish between healthy pigs and weak pigs
- Confirmation of type and name of feed
- Raising method of newborn piglets
- Observation of the properties and condition of feces (how to distinguish normal feces from diarrhea / loose stools)
- How to castrate boars
- How to distinguish sow pigs and fattening pigs
- Observation and confirmation of normal teat arrangement
- Confirmation of shipping time and the size of pigs

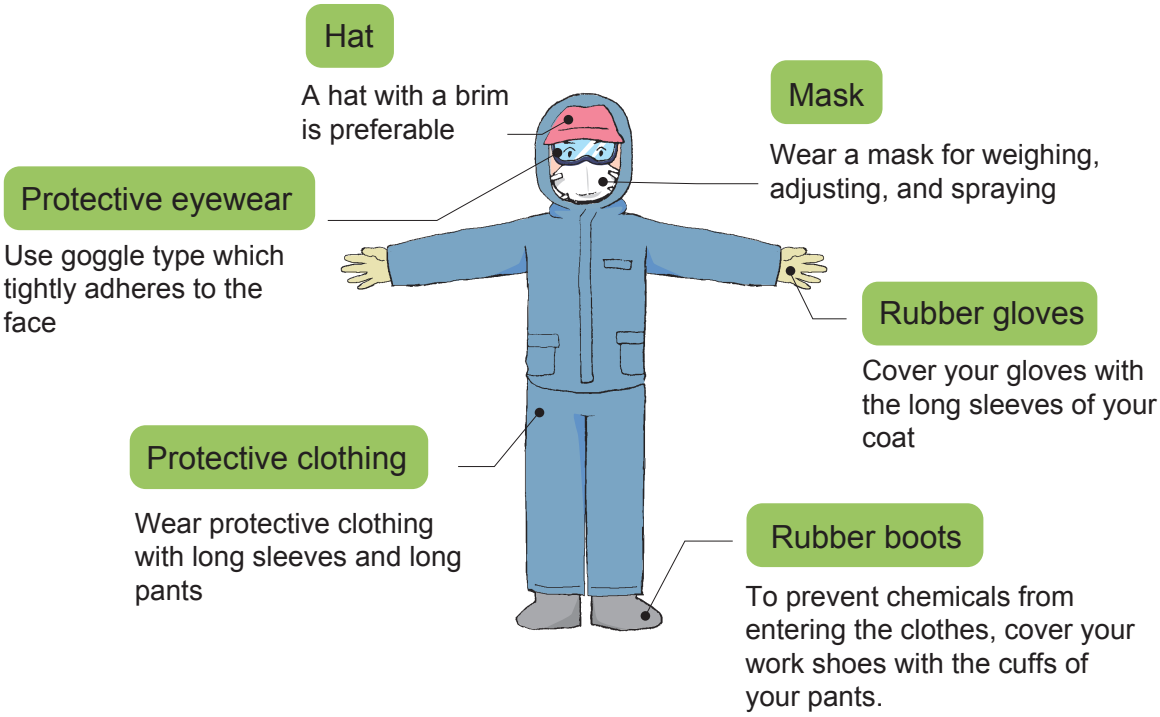
- Pig breeds
- Observation of dressed carcass of a pig
- Confirmation of how to make a foot dip and how to pass through it

3 Chicken farming (egg-laying chicken)

- Observation of fecal properties and condition
- Sorting contaminated eggs
- How to arrange the hatching eggs in the egg seat of the incubator
- How to distinguish fertilized eggs
- How to distinguish between healthy chicks and weak chicks
- Development process of chicks
- Observation on the temperature and the state of flocking / dispersing of the chicks in the control room
- How to distinguish between water supplier and feeder, and cleaning of them
- Vaccination method
- Debeaking method
- How to determine the nutritional and health condition of laying chickens (Method by observation of pectoral muscle)
- Observation of egg laying by laying hens
- How to use egg tray
- Confirmation of chicken breeds and egg color
- Determination of egg quality by egg breaking
- Confirmation of feed for chicks, middle-sized chicks, and adult chickens
- Confirmation of how to make a foot dip and how to pass through it

4 Hygiene management

1. Confirmation of clothes when entering the barn (hat, gloves, work clothes, towels, boots)
2. Request people coming from outside the farm to have a vinyl boot cover attached.
3. Things to be checked (intrusion of birds or small animals such as rodents, whether mold grows in silage, whether strangers are in the farm)
4. How to wear correctly protective clothing
5. How to dilute disinfectant solution



8 Questions for confirmation

For the following questions, answer ○ if it is correct, and × if it is incorrect

＜Cattle＞

1. It is necessary to always keep the tank and water cup clean. (　　)
2. Because dairy cows stretch their neck and consume feed, sweeping of feed in the trough is not necessary. (　　)
3. Even on hot summer days, the body temperature of a cow does not exceed 39°C. (　　)
4. When a cow has diarrhea, dirt is attached to the entire tail. (　　)
5. Do not over milk (machine stripping). (　　)
6. After completion of milking, detach teat cups from the teats one by one. (　　)
7. A cow becomes restless when it gets estrus. (　　)

＜Pigs＞

1. If keeping piglets warm is inadequate, accidental deaths due to being squashed often occur. (　　)
2. Piglets are weak to cold, whereas grown-up pigs are weak to heat. (　　)
3. Cleaning boots is not necessary if there is a foot dip. (　　)
4. There is one type of synthetic milk for piglets. (　　)
5. To prevent bad odor from the piggery, it is necessary not to hoard excreta in the piggery. (　　)

＜Chicken＞

1. If you find a dead bird near a chicken house, immediately discard it in a garbage bucket. (　　)
2. Since ventilation tends to be poor with raising a large number of birds, be careful about respiratory diseases. (　　)
3. It is important to have the chickens drink warm water on hot summer days. (　　)
4. At the period of the middle-sized chicks, some chicks attack others with their beaks. (　　)
5. The meat chicken (broiler) is allowed to be fed formula feeds containing antibiotics until the day before shipment. (　　)

Answers

＜Cattle＞

1．○

2．× (Reason: Sweep feeds to where cows can eat easily.)

3．× (Reason: When the temperature is around 30°C, the rectal temperature will be 40°C.)

4．○

5．○

6．× (Reason: Detach the four teat cups from the teat at the same time.)

7．○

＜Pigs＞

1．○

2．○

3．× (Reason: After washing away dirt such as mud attached to boots, disinfecting is done with foot dips.)

4．× (Reason: The synthetic milk is selected according to the growth of the piglet and fed.)

5．○

＜Chicken＞

1．× (Reason: Inform the farmer to pay attention to highly pathogenic avian influenza, and notifying the Livestock hygiene service center or the like is necessary.)

2．○

3．× (Reason: To have the chickens drink cold water on hot summer days is important.)

4．○

5．× (Reason: Feed containing antibiotics must not be fed to chickens for 7 days before slaughter.)

<Reference> Terms of animal husbandry often used in daily work

＜ Cattle ＞

Esa (in Japanese)..... means feed.

Feeding ..... giving feed to livestock.

Choosy eating of feed.... Livestock eat only the favorite feeds in the trough and leave the disliked feeds, also called selective eating.

Staphylococcus aureus ... Bacteria that cause mastitis which is difficult to cure if it grows in the papilla.

Dry matter intake..... Feed without moisture is called dry matter, and the amount (kg) of dry matter ingested per day is referred to as dry matter intake.

Herd test ..... This system checks the milk yield, milk quality, breeding status, etc. of the cows in the farm once a month.

Stop eating..... Condition that the intake of a cow suddenly decreases.

Non-pregnant days ..... Number of days from delivery to conception.

Close-up period ..... Refers to the second half of the dry period of dairy cattle. The period of three weeks immediately before delivery. It is also called perinatal period.

Foot-and-mouth disease.... An acute communicable disease having strong infectivity that cause water blisters on the mucosal membranes of the nose and mouth and on the skin of the hoof, caused by foot-and-mouth disease virus. It is designated as a legal infectious disease.

Litter..... Materials used to give comfort to livestock as well as to promote composting of excreta, and as litter, sawdust, chaff, and wheat straw are often used. To put the litter out of the barn is called borodashi in Japanese.

Colostrum..... Milk that appears in the first several days after delivery.

Artificial insemination.. For the purpose of pregnancy, inject semen artificially into female reproductive organs.

Stress ..... Refers to the condition that livestock suffer spiritual pain.

Abomasum displacement ... A disease in which the position of the abomasum changes to the left or right from the normal position, the feeding amount reduces and the milk yield decreases.

Laminitis..... A disease that the hooves of a cow are congested accompanied by severe pain and movement disorder.

Embryo replacement.... To inject embryos (fertilized eggs) artificially into female reproductive organs for the purpose of pregnancy.

Estrus ..... A state that a female allow male to mate. At the time of this estrus, artificial insemination is performed.

Rumination..... A motion in which cattle bring up bolus of feed from the first stomach (rumen), masticate (mash with teeth), and swallow again.

Solids (Butsu in Japanese) ... Miscellaneous small and large clusters contained in milk of mastic cow.

Delivery ..... Refer to a calf is born.

Delivery interval..... Regarding cows that have experienced two or more deliveries, refer to the interval between the latest delivery date and the previous delivery date.

Nursing ..... The period between immediately after delivery and weaning when supplying liquid feeds.

Body condition ..... Numerical expression of the accumulation condition of subcutaneous fat, it is used as a basis for judgment of overweight or underweight of livestock. The greater the value, the more fat accumulated.

Mega farm..... refers to a very large enterprise farm.

TDN ..... The total amount of nutrients in feed, the feed whose value is high has high energy content.

＜ Pigs ＞

Wet feeding..... A method of mixing feed and water and feeding it in a kneaded state.

Esa (in Japanese)..... means feed.

Feeding ..... giving feed to livestock.

First feeding..... Refers to giving newborn piglets feed for the first time after birth; synthetic milk is used for this purpose.

Ogako piggery..... A piggery where feces, urine, and litter remain unseparated.

Stop eating..... Condition that the intake of a pig suddenly decreases.

Three-crossbred pig..... A method of breeding hybrid pigs using three varieties or three breeds. It is bred by crossing the third variety male to the offspring (female) between two varieties.

Litter..... Materials used to give comfort to livestock as well as to promote composting of excreta, and as litter, sawdust, chaff, and wheat straw are often used.

Colostrum..... Milk that appears in the first several days after delivery.

Synthetic milk ..... Feed given to piglets during the nursing period, there is synthetic milk A that is fed until weighing up to 10 kg and synthetic milk B that is fed weighing up to 30 kg afterwards.

PRRS ..... Porcine reproductive and respiratory syndrome

PED ..... Swine epidemic diarrhea

SPF pig..... A pig having no specific pathogen.Sow pigs that are the basis of SPF pigs are made by hand raising of the piglets directly extracted from the womb of the mother pig by caesarean section.

(Note) Fattening pigs, sow pigs, mother pigs, and boar pigs are also referred to as “hiiku buta,” “hanshoku buta,” “haha buta,” and “tane buta,” respectively.

＜Chicken＞

Brooding.....raising hatched chicks.

Esa (in Japanese).....means feed.

Feeding .....iving feed to livestock.

Bait eating (Esagui in Japanese) .....Condition of eating a lot or eating a little.

Smoothing feed .....Smooth the raw materials for feed in the trough.

First feeding.....Refers to giving chicks feed for the first time after hatching. For chicks, give feed by kneading with water.

Molting .....Development of new feathers and dropping of old feathers, referred to as substitution. It is seen from the late summer to autumn. Resting is common in laying hens.

Cannibalism.....Group feeding chickens are affected by an adverse environment or malnutrition, and the chickens take actions of pecking each other. Sometimes a chicken kills others.

Warming.....To keep warming the room raising chicks.

Grid .....Pebbles grinding cereals in the stomach (gizzard) of a chicken.

Chickens for practical use....Also called commercial chickens. A chicken with high egg laying performance and high flesh quality, commonly spread chickens.

Jidori chicken.....Unlike practical chicken broilers, it is a traditional variety in the area and is a chicken used to produce high quality chicken meat.

Debeaking .....Burning out a half of the chicken's upper and lower beaks. This is performed to prevent butt pecking and feather eating after the middle-sized chick stage. It is also called debeak.

Pecking order.....Grouped chickens take offensive action such as attacking the other party with the beak and jumping higher to give a kick to other party. This is an instinctive action to determine ranking among individuals, which maintains the order of social life.

Raising at high density (Mitsugai in Japanese) ....To accommodate more chickens than the number of birds to be accommodated in a certain area. This adversely affects the health condition of chickens.

Support project to properly accept foreigners for agricultural support

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