Feeding management of beef cattle in Japan

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1. Current situation of beef cattle in Japan

2. Summary of Japanese feeding standards of beef cattle

3. Research on recent Beef cattle such as rice or by-product for feeds.
Breeds of beef cattle in Japan

The major breed of beef cattle in Japan is Japanese black cattle which account for 66% of beef cattle in Japan. Subsequently, 20% of hybrids and 14% of Holstein.

- Japanese black cattle are excellent in meat quality. Known for marbling
- Holstein has a fast growth rate.
- Crossbred has both advantages.

Fig. Percentage of the number of beef cattle

Source: Ministry of Agriculture, Forestry and Fisheries of Japan
Current situation of beef cattle in Japan

As a result of aging of livestock farmers, price increase of feeds and so on.
The number of beef cattle and of farmers are decreasing.
The livestock production base of beef cattle is weakening.

The number of beef cattle and farmers is decreasing.

Fig1. Changes of farmer numbers in Japan
Fig2. Changes of beef cattle heads in Japan

Source: Ministry of Agriculture, Forestry and Fisheries of Japan
Market price of calf in Japan

Market price increase of calf with the decrease in the number of breeding cow and farmer.
→ It lead to press on fattening farmer incomes.

Source: Ministry of Agriculture, Forestry and Fisheries of Japan
Beef farmers can be divided into four types.

1. **Breeding farmer** ⇒ Production of calves, nursing, growing.
2. **Fattening farmer** ⇒ Purchase of calves from breeding farmers, fattening and shipping.
3. **Integrated management** ⇒ Production of calves, nursing, growing, fattening and shipping.
4. **Management of combination** ⇒ Production of calves, nursing, growing, fattening and shipping. ⇒ If the calf becomes insufficient, calves are purchased from other breeding farmers.
Common practice of breeding cow

Weaning: cow between 3 and 4 months of age. Artificial insemination: growing cattle between 14 to 16 months.

- **Birth**
  - Suckling period
  - Birth from 3 to 4 months

- **Weaning**

- **Growing** (+Pregnancy)
  - Artificial insemination
    - About from 14 to 16 months
    - More than body weight 300kg

- **Pregnancy**
  - Artificial insemination

- **Calving**
  - Calf

**Feeding**
- Milk or diluted powder milk
- Artificial milk
- Concentrate
- Good quality hay
- hay
Common practice of fattening beef cattle

Japanese black cattle

<table>
<thead>
<tr>
<th>Birth</th>
<th>Suckling period</th>
<th>Growing period</th>
<th>Fattening period</th>
<th>Shipment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>About from 3 to 4 months</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weaning</td>
<td></td>
<td>9 to 10 months of age</td>
<td>29 to 30 months of age</td>
<td></td>
</tr>
</tbody>
</table>

Feeding

- Milk or diluted powder milk
- Artificial milk
- Good quality hay, ad libitum
- Concentrate
- Rice straw, hay

About from 3 to 4 months to 29 to 30 months of age
Common practice of fattening beef cattle

**Holstein cattle steer**

- **Birth**
  - Suckling period
  - About from 2 to 4 months

- **Growing period**
  - 6 to 7 months of age

- **Fattening period**
  - 22 to 23 months of age

**Feeding**

- **Milk or diluted powder milk**
- **Artificial milk**
- **Concentrate**
- **Good quality hay, ad libitum**
- **Rice straw, hay**
Issues related to beef cattle production in Japan

Increase in the price of feed

Progress in aging of farmer

1. Improvement of feeding technology
   such as feeding technology of protein based on degradation property in rumen.

2. Development of feed resources
   Such as rice and by-product for feed.

1. Training of successors
2. Labor-saving technology
3. Labor-saving device such as robot

Promote a better beef production infrastructure
Japanese feeding standards are updated every 6 to 10 years.
Chapter 1: Unit of nutrients, requirement, dry matter, energy, protein, mineral (macro micro), vitamin

Chapter 2: Nutrient requirement (I) Nutritional requirements for maintenance and breeding of heifer, steer and bulls, demand for finishing of fattening cattle.

Chapter 3: Nutrient requirement (II) water requirement, mineral (macro, micro) requirement

Chapter 4: Factors influencing nutrient demand. Issues to be cautioned on feeding.
Chapter 5 : Issues to be noted with feeding.

Chapter 6 : How to use Japanese feeding standards and issues to be noted.

Chapter 7 : Calculation formula of nutrient requirement.

Chapter 8 : Reference
Basic concept of feed design

**Factor of feed**

- **Forage**
  - Grass species, Variety, Growth stage, Soil and weather condition, Preparation method and so on

- **Concentrate**
  - Type, Soil and weather condition, Preparation method and so on

**Factor of beef cattle**

- **Nutrient requirement of beef cattle (%)**, (kg)
  - Match supply and requirement

- **Nutritional supply (kg) from feeds**

- **Dry matter intake (kg)**

  \[ \text{Match supply and requirement} = \text{Nutritional supply (kg)} \times \text{Nutrient content (kg)} \]

- **Feeding standard of beef cattle**

  - Breed, Growth stage, Pregnancy, Lactation, and so on
Nutrients that must be considered in beef cattle are energy, protein, calcium, phosphorus, vitamin A and vitamin D.

It is also shown that recommended micromineral content of diets and maximum tolerable level for beef cattle other than calcium and phosphorus such as Sodium, Chloride, Magnesium and Sulfur.

It is shown that recommended trace mineral content of diets and maximum tolerable dietary level for beef cattle such as Iron, copper, cobalt, zinc, manganese, iodine, molybdenum, selenium.

It is also shown that approximate total dairy water intake at different temperatures and body weight.
Fattening cattle (heifer and steer)

Growing period
Nutritional requirement for body weight gain + Nutritional requirement for maintenance

Finishing period
Nutritional requirement for body weight gain + Nutritional requirement for maintenance
Concept of nutritional requirement

**End of pregnancy**
63 days before parturition

- Nutritional requirement for body weight gain
  - When there is growth

- Nutritional requirement for maintenance

- Nutritional requirement added at the end of pregnancy

**During lactation**

- Nutritional requirement for body weight gain
  - When there is growth

- Nutritional requirement for maintenance

- Nutritional requirement added during lactation
In general, feed intake of beef cattle falls within the range of 1.4 to 3.0% of body weight.

Dry matter intake is affected by these factors.

- **Weather condition:** Temperature, humidity, wind, solar radiation
- **Feed factor:** Ratio of concentrate and forage, energy content, protein content, processed form and so on.
- **Beef cattle factor:** Body weight, pregnancy, lactation.

When feed is fed, it is necessary to include the nutrient amount for feed that can be intake. Therefore, estimation of dry matter intake is important.
Dry matter intake estimate equation of steer is as follows.

**Dry matter intake (Kg /Day ) =**

\[-3.481 + 32.668 \times \text{DG} + 4.548 \times 10^{-2} \times \text{DG} - 7.207 \times 10^{-5} \times W^2 + 3.867 \times 10^{-8} \times W^3\]

DG indicates dairy gain (kg/day).
W indicates body weight (kg).
Nutrient requirement of protein

The amount synthesized of the microbial protein in the rumen and the digestibility of the protein in the small intestine. ⇒ MP (Microbial protein) system

MP requirement of beef cattle
Maintenance
Dairy gain
Pregnancy
Lactation

Feed information based on degradation characteristics in rumen.

<table>
<thead>
<tr>
<th>Feed protein</th>
<th>Degradable protein</th>
<th>Non-protein nitrogen</th>
<th>Amino acid</th>
<th>Peptide</th>
<th>Ammonia</th>
<th>Undegradable protein</th>
<th>Maximize synthesis of Microbial protein</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</table>

Digested and absorbed in the lower digestive tract.
Feed resources

- Many cereals such as corn are imported in Japan, and self-sufficiency rate of concentrate feed is about 14%.
- Price increase of feed, remain high, unstable feed price.

Approximately 40% of the production cost of beef cattle is for feed.

It is necessary to improve the self-sufficiency of feed and respond to high feed prices.

Rice for feed ⇒ It leads to effective use of paddy fields

By-product ⇒ It leads to a reduction in food waste.
In recent years, varieties of rice exclusively for feed have been cultivated.

Major rice varieties for feed

- Kusayutaka
- Yumeaoba
- Hokuriku 193
- Takanari
- Momiroman
- Kusayutaka
Due to rice is covered with rice hulls, most of them are excreted into feces when they are fed without processing.

Grinding treatment reduces the rate of excretion into feces and increases the TDN content of rice for feed.

Fig. The effect of grinding treatment on the rate of excretion to feces of rice for feed.

Fig. The effect of grinding treatment on the TDN content of rice for feed.

Quoted from Dr. Asai
It is also known that starch of brown rice was quickly degraded in the rumen rather than that of corn.

There is a possibility of causing acidosis when feeding brown rice excessively.

Therefore, it has been studied how much brown rice can be mixed with beef cattle feed.

Consequently, it has become clear that productivity does not decrease even if brown rice is mixed up to 30% in commercially formulated feed. Regarding the feeding of brown rice, it is necessary to avoid rapid change of feed and to adjust the amount by observing the beef cattle.
<table>
<thead>
<tr>
<th>By-products for feed</th>
<th>Chemical composition and nutritive value of by-product vary with materials and production lot. ⇒ It is necessary to clarify chemical composition and nutritive value.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brewer’s grain</td>
<td>There are by-products with high protein content and fat content. ⇒ As for fat content of feed, it is necessary to ensure that the crude fat content of the feed does not exceed 5-6%.</td>
</tr>
<tr>
<td>Tofu cake</td>
<td></td>
</tr>
<tr>
<td>Rice bran</td>
<td></td>
</tr>
<tr>
<td>Bean paste residue</td>
<td>It has been pointed out that there is no problem in productivity even if 10% of by-products are mixed into feed.</td>
</tr>
<tr>
<td>Green tea residue</td>
<td></td>
</tr>
</tbody>
</table>
With regarding to beef cattle, reduction of production cost and light labor is an urgent issue. For that purpose, it is necessary to shorten the fattening period and develop a feeding management technique using a robot.

In addition, precise feeding management is also important for reduction of feed costs and reduction of environmental burden by excretion of manure. Further research is necessary to improve productivity.