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Fundamentals of cattle breeding

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Role of cattle breeding as a branch of animal husbandry

Current state of dairy cattle breeding in Russia and worldwide

Current state of beef cattle breeding in Russia and worldwide

Economic and biological characteristics of cattle

1. Role of cattle breeding as a branch of animal husbandry

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Cattle breeding is

- a branch of animal husbandry that involves raising cattle for the purpose of producing milk, beef, additional products, and byproducts.
- Cattle are raised on farms with various ownership structures.

Number of farm animals, thousand heads

(all categories of farms; according to Rosstat)

Animal species	2018	2019	2020	2021	2022
Cattle	**18,152**	**18,126**	**18,027**	**17,651**	**17,488**
Pigs	23,726	25,163	25,850	26,193	27,606
Sheep	21,136	20,655	19,785	19,148	19,083
Goats	1,992	1,963	1,874	1,811	1,748
Horses	1,283	1,311	1,302	1,298	1,311

Categories of agricultural producers:

- Agricultural organizations
- Households
- Family-owned farms
- Individual entrepreneurs engaged in agricultural activities

Structure of livestock production by category of farms in the Russian Federation, % of total production volume

Farm category	Livestock and poultry for slaughter (live weight)	Livestock and poultry for slaughter (slaughter weight)	Milk
Farms of all categories	100	100	100
Including agricultural organizations	**79.6**	**82.6**	**57.6**
Households	16.6	14.3	33.4
Family-owned farms and individual entrepreneurs	3.8	3.1	9.0

2. Current state of dairy cattle breeding in Russia and worldwide

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Milk production and cow numbers by country in 2022

Country	Gross milk production, mln tons	Cow numbers, mln heads
1. European Union (27 countries)	143.9	20.2
2. USA	103.0	9.41
3. India	97.0	59.5
4. China	39.2	6.4
5. Russia	**32.9**	**7.7**
6. Brazil	23.7	16.9
… 13. Belarus	7.9	1.45

Cow productivity by country in 2022

Country	Milk yield per cow per year, kg
1. USA	10,943
2. Canada	10,525
3. Japan	10,353
4. South Korea	10,049
5. UK	8,155
6. Argentina	7,697
7. EU countries	7,124
8. Australia	6,404
9. China	6,125
10. Belarus	5,455
11. Russia	**5,194**

Changes in the numbers and milk production on farms of all categories in the Russian Federation

Parameter	2010	2015	2021	2022
Cattle numbers, thousand heads	19,794	18,621	17,650	17,488
Including cows, thousand heads	8,713	8,115	7,783	7,735
Milk production, thousand tons	31,508	29,888	32,339	32,984
Milk yield per cow per year, kg	3,776	4,134	4,988	**5,194**

Cattle numbers and milk production in the Russian Federation in 2022

Farm category	Total number, mln heads	Including cows	Milk production, mln tons	Milk yield per cow, kg
All categories of farms	17.5	7.7	32.9	5,194
Including agricultural organizations	7.9	3.2	19.0	**7,410**
Households	6.7	3.0	11.0	3,572
Family-owned farms and IEs	2.9	1.5	2.9	3,989

Average milk yield per herd per 305 days of lactation for the best farms of the Russian Federation in 2022

Farm, region	Breed	Milk yield, kg	Fat, %	Protein, %
1. Gomontovo Stud Farm JSC, Leningrad region	Holstein Black-and-White	**14,346**	**3.78**	**3.33**
2. Grazhdansky Stud Farm JSC, Leningrad region	Holstein Black-and-White	14,274	3.86	3.37
3. Rodina JSC Krasnodar Territory	Holstein Black-and-White	14,160	3.86	3.37
4. Mir LLC Republic of Tatarstan	Black-and-White	12,168	3.69	3.19
5. Istok LLC Republic of Mordovia	Red-and-White	11,369	3.87	3.23

Milk yield on farms of all categories, thousand tons, by federal districts

Federal district	2021	2022	2022, % by 2021
Russian Federation	32,339	32,984	102.0
Central	6,382	6,655	104.3
Northwestern	2,012	2,065	102.6
Southern	3,746	3,859	103.0
North Caucasian	2,825	2,938	104.0
Volga	**10,034**	**10,144**	**101.1**
Ural	1,968	1,962	99.7
Siberian	4,396	4,399	100.1
Far Eastern	977	961	98.4

Per capita consumption of livestock products in Russia (according to Rosstat)

Parameter	2018	2019	2020	2021
Meat and meat products expressed as meat, kg	75	76	76	78
Milk and dairy products expressed as milk, kg	229	234	240	241
Eggs and egg products, pcs.	284	285	283	281

Recommended **milk** consumption rate per year: **322** kg, including:

Milk, kefir, yogurt with fat content of 1.5–3.2%:	56 kg
Animal oil:	2 kg
Cottage cheese with fat content of 9–18%:	7 kg
Cottage cheese with fat content of 0–9%:	9 kg
Sour cream, cream with fat content of 10–15%:	3 kg
Cheese	6 kg

Meat and meat products: 74 kg

Eggs: 260 pcs.

Self-sufficiency of the Russian Federation in staple food, %

Parameter	2019	2020	2021	2022
Milk and milk products (expressed as milk)	84	84.1	84.2	84.9
Meat and meat products (expressed as meat)	96	99.4	100.3	100.9

The Food Security Doctrine of the Russian Federation provides for the following threshold values for the self-sufficiency rate (food security):

for milk and milk products: 90%;

for meat and meat products: 85%.

3. Current state of beef cattle breeding in Russia and worldwide

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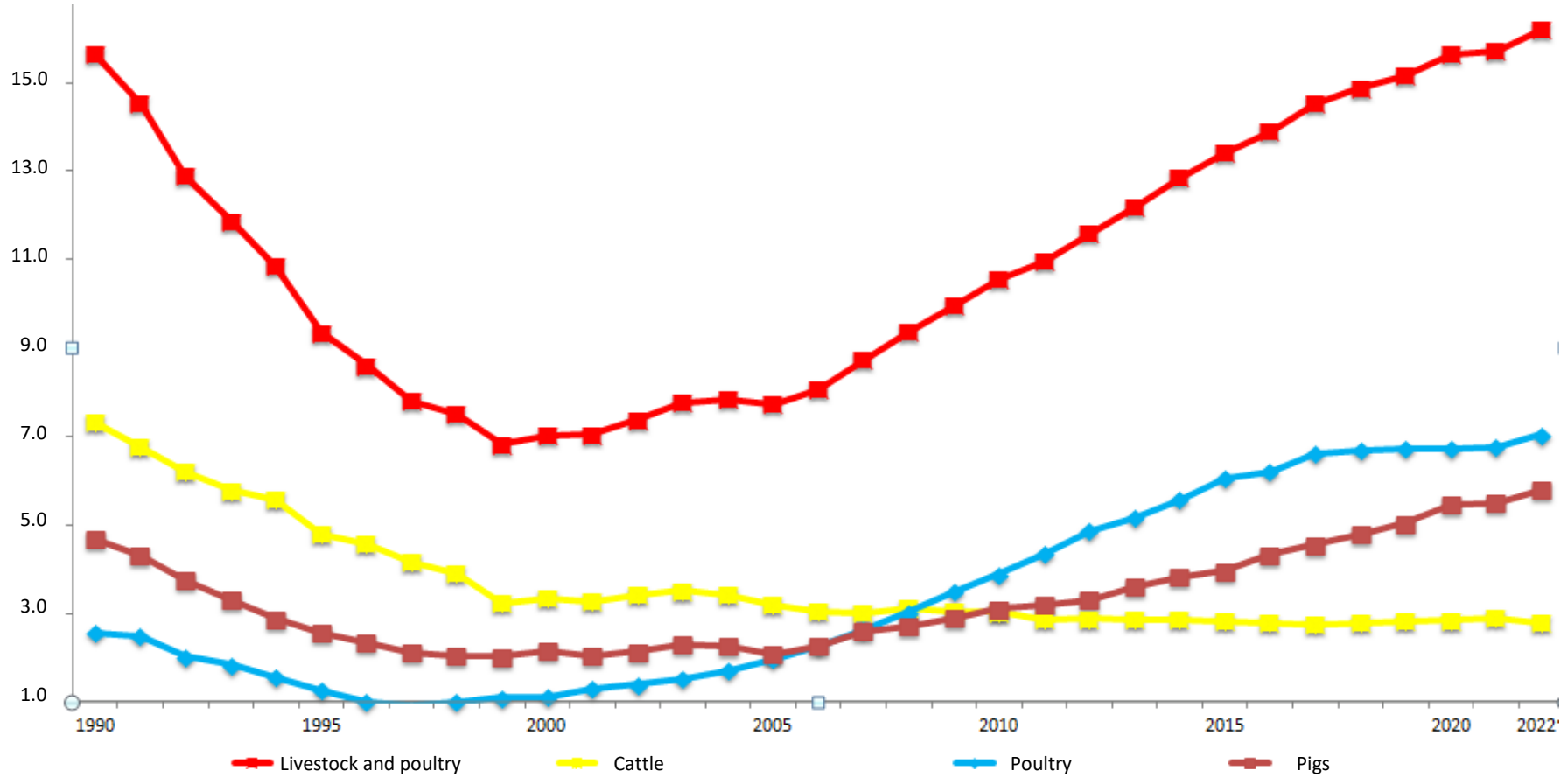
Livestock and poultry production for slaughter in the Russian Federation (live weight), thousand tons

Animal species	2020	2021	2022	2022 to 2021, %
All cattle and poultry species, thousand tons	15,624	15,721	16,188	103.6
Including cattle, thousand tons	2,840	2,884	2,790	96.7
%	18.1	18.3	17.2	–

Livestock and poultry production for slaughter (live weight) on farms of all categories of the Russian Federation (mln tons)



*Data excluding the statistics for the Donetsk People's Republic (DPR), Lugansk People's Republic (LPR), Zaporizhzhia region, and Kherson region.

Structure of livestock production by category of farms in the Russian Federation, % of total production volume in 2022

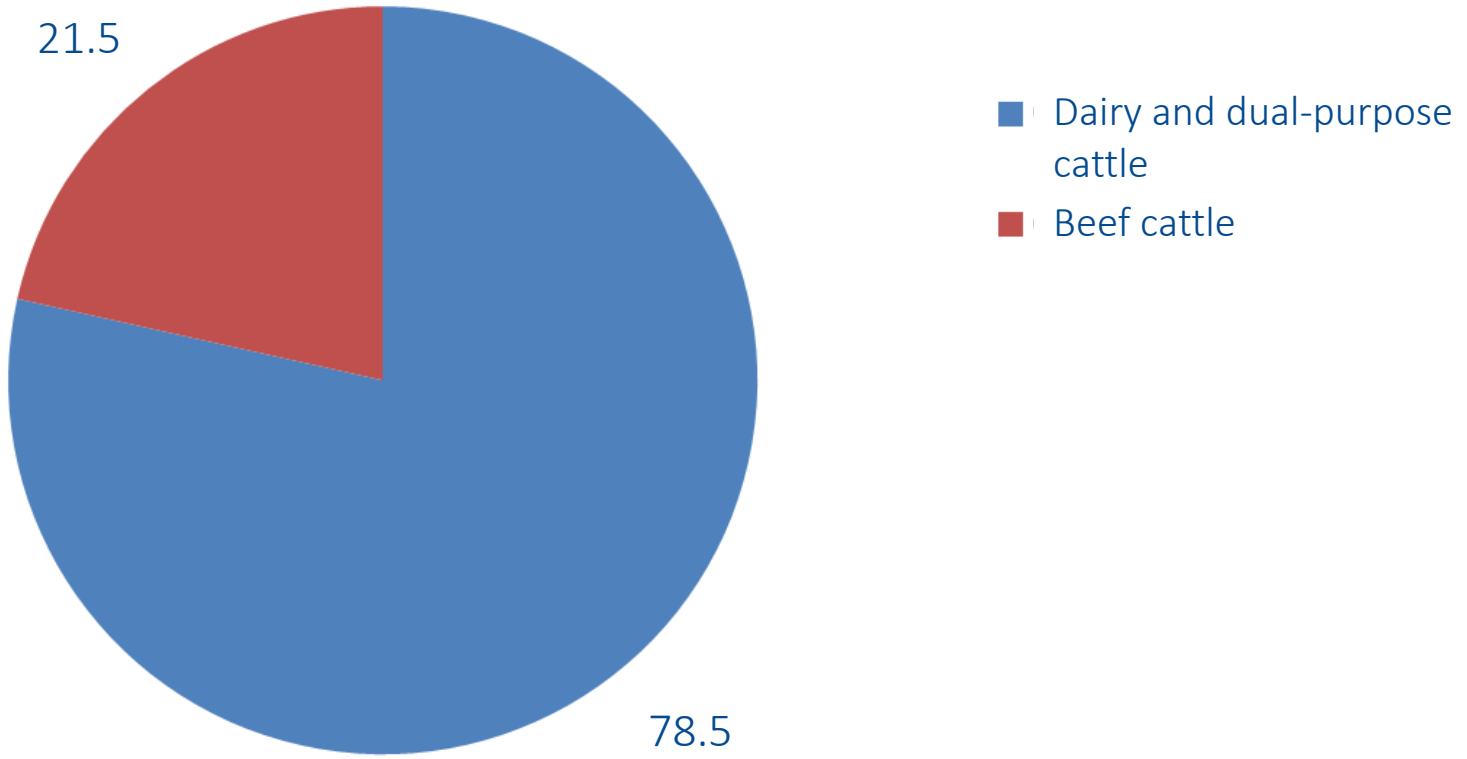
Farm category	Livestock and poultry for slaughter (live weight)	Cattle
Farms of all categories	100	100
Including agricultural organizations	79.6	38.5
Households	16.6	**49.7**
Family-owned farms and IEs	3.8	11.8

Production and consumption of beef and veal from beef cattle worldwide in 2022, million tons

(data from the United States Department of Agriculture Foreign Agricultural Service)

Country	Production	Consumption
1. USA	12.89	12.8
2. Brazil	10.35	7.52
3. China	7.18	10.66
4. EU countries	6.73	6.48
5. India	4.35	2.91
6. Argentina	3.14	2.32
7. Mexico	2.18	1.95
8. Canada	1.40	1.03
9. Russia	**1.32**	**1.53**

Structure of cattle production for slaughter (%) on farms of all categories



Parameters of cattle breeding industry in agricultural organizations of the Russian Federation

Parameter	2021	2022	2022, % by 2021
Cattle raised, thousand tons	813.6	804.3	98.9
Cattle produced for slaughter, thousand tons	798.6	768.0	96.2
Average daily live weight gain, g	635	**577**	90.9
Average live weight at slaughter, kg	444	**448**	101.0
Calf yield per 100 cows, heads	76	76	100.0

Cattle produced on farms of all categories, thousand tons, by federal districts

Federal district	2021	2022	2022, % by 2021
Russian Federation	2,833	2,791	99.0
Central	516	502	97.2
Northwestern	101	96	94.2
Southern	439	441	100.3
North Caucasian	301	306	101.4
Volga	**804**	**787**	**97.8**
Ural	137	130	94.5
Siberian	385	388	100.7
Far Eastern	148	143	96.5

Recommended meat and meat product consumption rate (Order of the Ministry of Health of 2022)

Product group	Recommended consumption rate, kg/year/person
Meat and meat products, total, including:	74
Beef	14
Mutton	5
Pork	10
Poultry	40
Meat from other animals (horse meat, venison, etc.)	5

Actual meat and meat product consumption rate, including category 2 byproducts and raw fat, in 2021: **78** kg, including beef: **14** kg.

4. Economic and biological characteristics of cattle

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According to the zoological classification, cattle (Bos taurus) belong to:

- Class: **Mammalia**
- Order: **Artiodactyla**
- Suborder: **Ruminantia**
- Family: **Bovidae**
- Genus: **Bos**

Digestion features

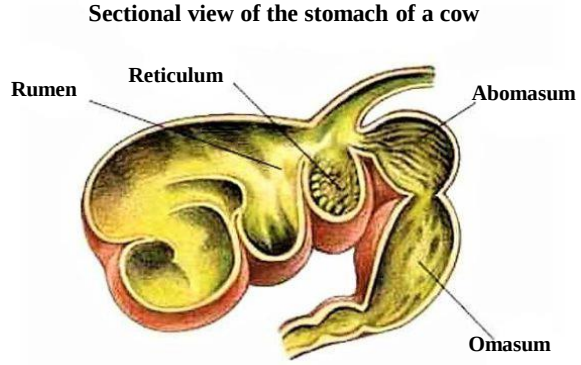
Cattle are **herbivores** by type of nutrition, and **ruminants** by their ability to regurgitate ingested feed and chew it.

A multichambered stomach allows cattle to efficiently utilize cheap, bulky vegetable feed, as well as sugar, oil extraction, brewing, and other food industry bypass. Cattle digest fiber-rich feed 2–3 times more efficiently than pigs and horses.

The stomach of cattle consists of four chambers: **rumen, reticulum, abomasum, and omasum**. The first three chambers have no digestive glands and are called forestomachs.

The forestomachs are colonized by symbiotic microflora (bacteria, protozoa, fungi).

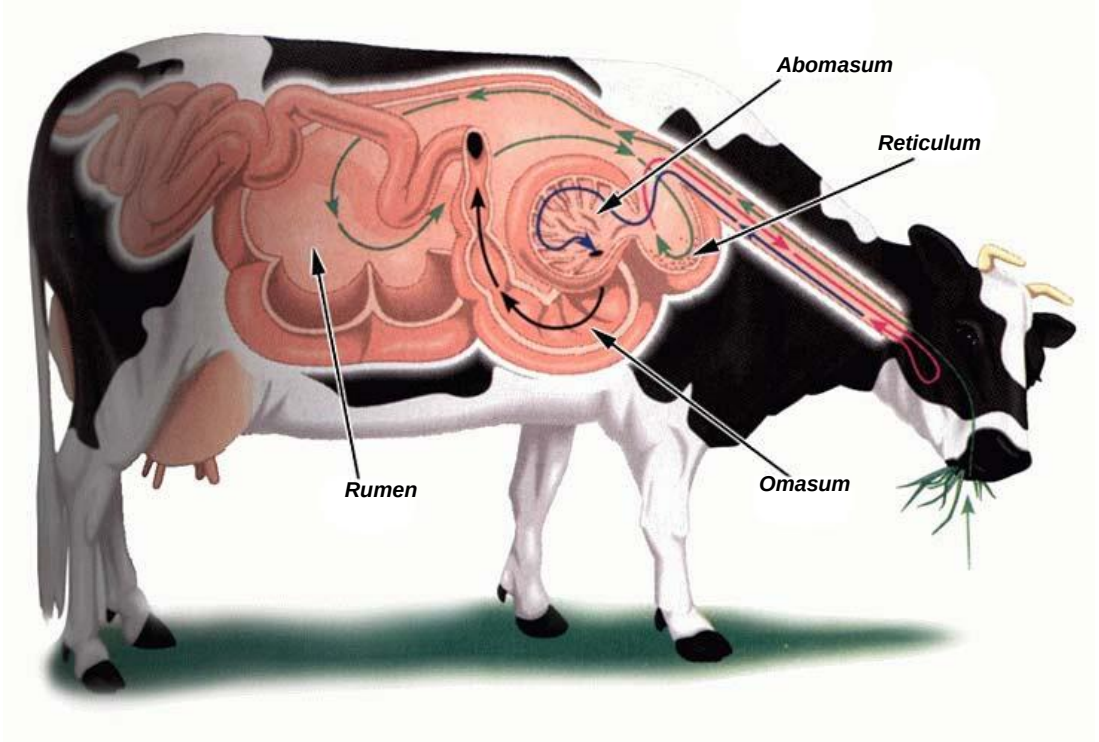
The function of the omasum is similar to that of the single-chambered stomach.



When consuming feed, cattle chew it poorly and superficially, swallowing it into the rumen.

The feed is then regurgitated from the rumen into the mouth and chewed thoroughly and for a long time, with abundant saliva secretion (rumination).

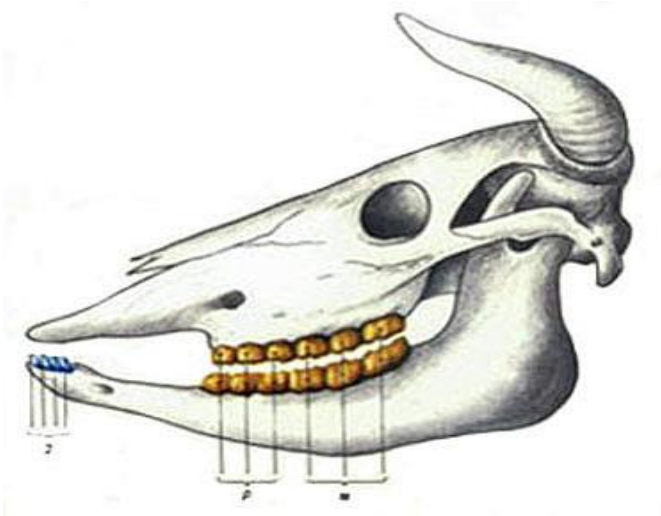
Rumination in cattle takes 6–8 hours per day; an adult animal produces 90–150 liters of saliva per day.



A distinctive feature of ruminants is the absence of anterior upper incisors; they are replaced by a hard palatine plate. The latter should be considered when organizing animal nutrition: root crops should be chopped, be chopped, and pasture grass height should be monitored, as animals consume feed with their tongues.

Adult animals have **32** permanent teeth, while young animals have **20** milk teeth.

Adult animal dental formula:
Maxilla: I0 C0 P3 M3
Mandible: I4 C0 P3 M3



Reproductive features

Farm animals in general, and cattle in particular, are **self-reproducing** means of production.

Male and female calves become **sexually mature** at the age of **6–10** months. However, they reach adulthood **(economic maturity)** much later: at 16–18 months in females and at 15–17 months in males. At this age, provided the animals are properly developed, they are allowed to breed.

In intensive rearing, heifers of early maturing breeds are inseminated at the age of **13–15** months.

The live weight of a heifer at first fertilization should reach **70%** or more of the live weight of a full-grown cow.

Female cattle breeding **does not follow any seasonal patterns**.

The **sexual cycle** duration in females averages 21 days.

The average duration of pregnancy in cattle is **280–285** days. **Calving** is the term used for labor.

Cattle are **monotocous**, that is, a cow gives birth to one calf per pregnancy. Two and more calves are born in 2% of cases.

The **live weight of a calf at birth** averages 6–7% of the mother's live weight.

Offspring per year for various animal species, heads

Animal species	Per 100 females	Per 1 female
Cattle	**76**	**0.76**
Pigs	3,520	35.2
Sheep and goats	86	0.86
Horses	56	0.56

Life expectancy

- The **natural** life expectancy of cattle is 20–25 years.
- **The** economic lifespan **is** 10–12 years**.**
- The longevity **record** is 40 years.

Average age of cows of different breeds on stud farms of the Moscow region, in calvings

Breed	Age
1. Ayrshire	3.21
2. Holstein	2.37
3. Jersey	3.00
4. Kholmogorskaya	2.50
5. Black-and-White	2.40

Acclimatation abilities

Cattle are relatively **low-maintenance and well-adapted** to a variety of soil and climate conditions, which contributes to their widespread distribution.

Due to biochemical processes in the rumen associated with the release of heat, large body weight (500–700 kg), and other anatomical and physiological features, cattle tolerate low temperatures well.

The **thermal comfort** zone for cattle is **2 to 18 °C**.

Ethological features

- Cattle have a well-developed **herd instinct**.
- A herd has a **rank hierarchy**, which divides the animals into dominant and subordinate.
- Dairy cows have poor **maternal instinct**: caves are weaned immediately after birth, and machine milking is used for calf rearing.
- Beef cows have very good **maternal qualities**: calves are raised at foot until 6–8 months of age. Beef cows are not milked.

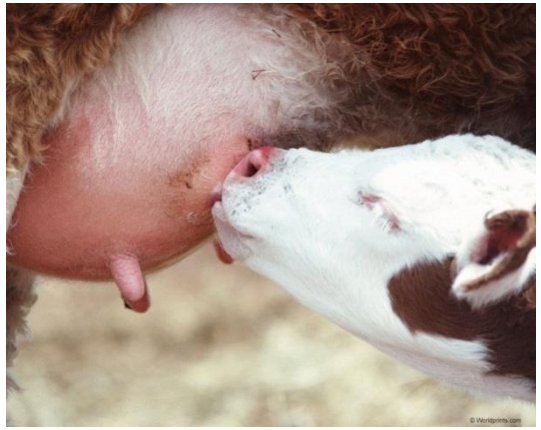
Calf rearing

Rearing using a nursing bottle

In dairy cattle breeding

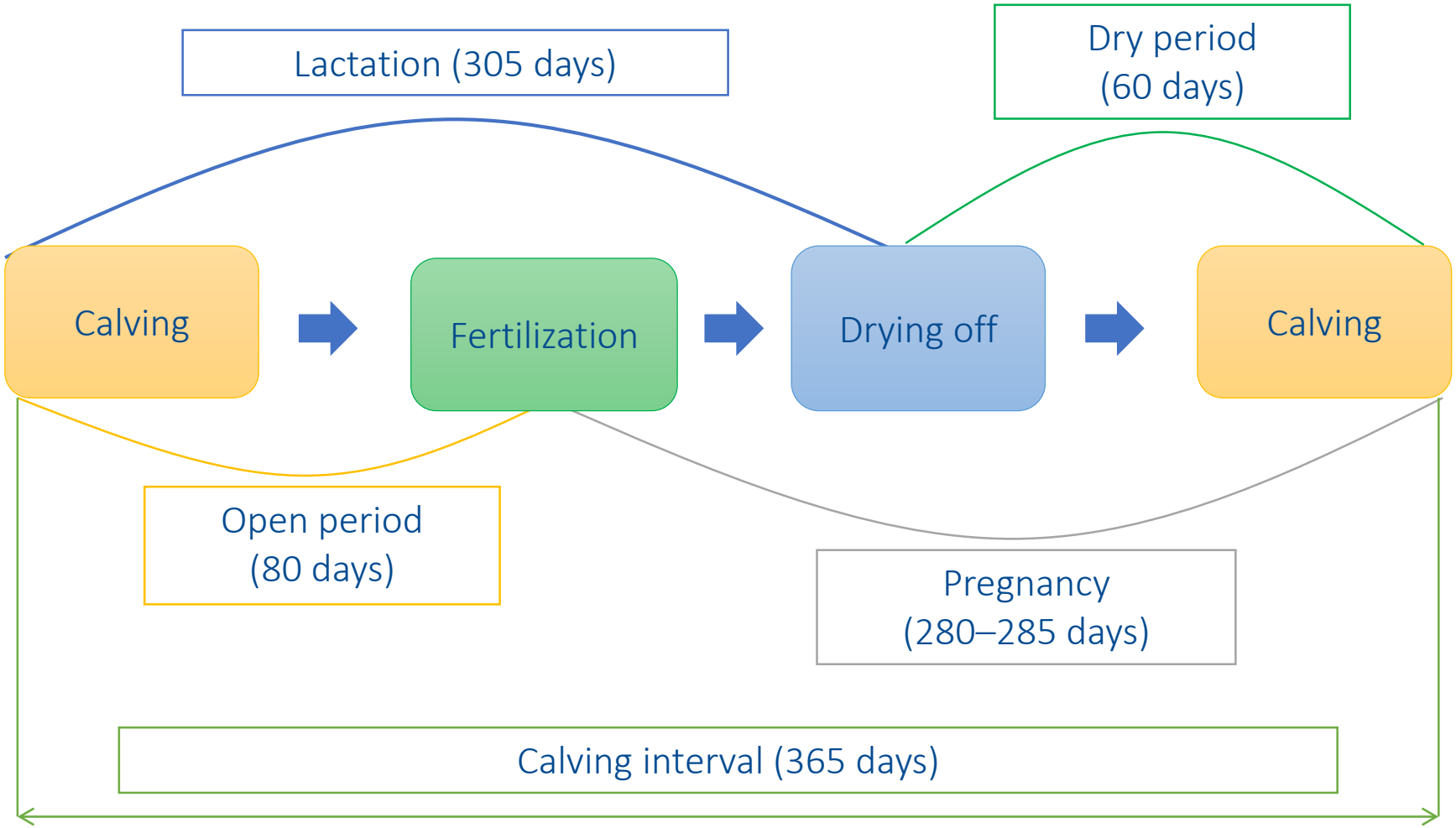
Drencher

Cows with calves at foot



In beef cattle breeding

Productive cycle of a dairy cow



A productive annual cycle (if the calving interval is 365 days) includes the following periods:

Lactation (from Latin lactis, milk): the formation and accumulation of milk in the udder and its excretion during suckling and milking. The lactation period lasts from calving until drying off. The optimal duration of lactation is 305 days.

Dry period: the period from the start of drying off till calving. The average duration is 45 to 60 days. Cows are not milked during this period. Shortening the dry period has a negative effect on fetal development and milk yield in subsequent lactation, while prolonging it is economically inefficient.

Open period: the period from calving till successful insemination. The optimum duration with the annual calving interval of 365 days: 80–85 days.

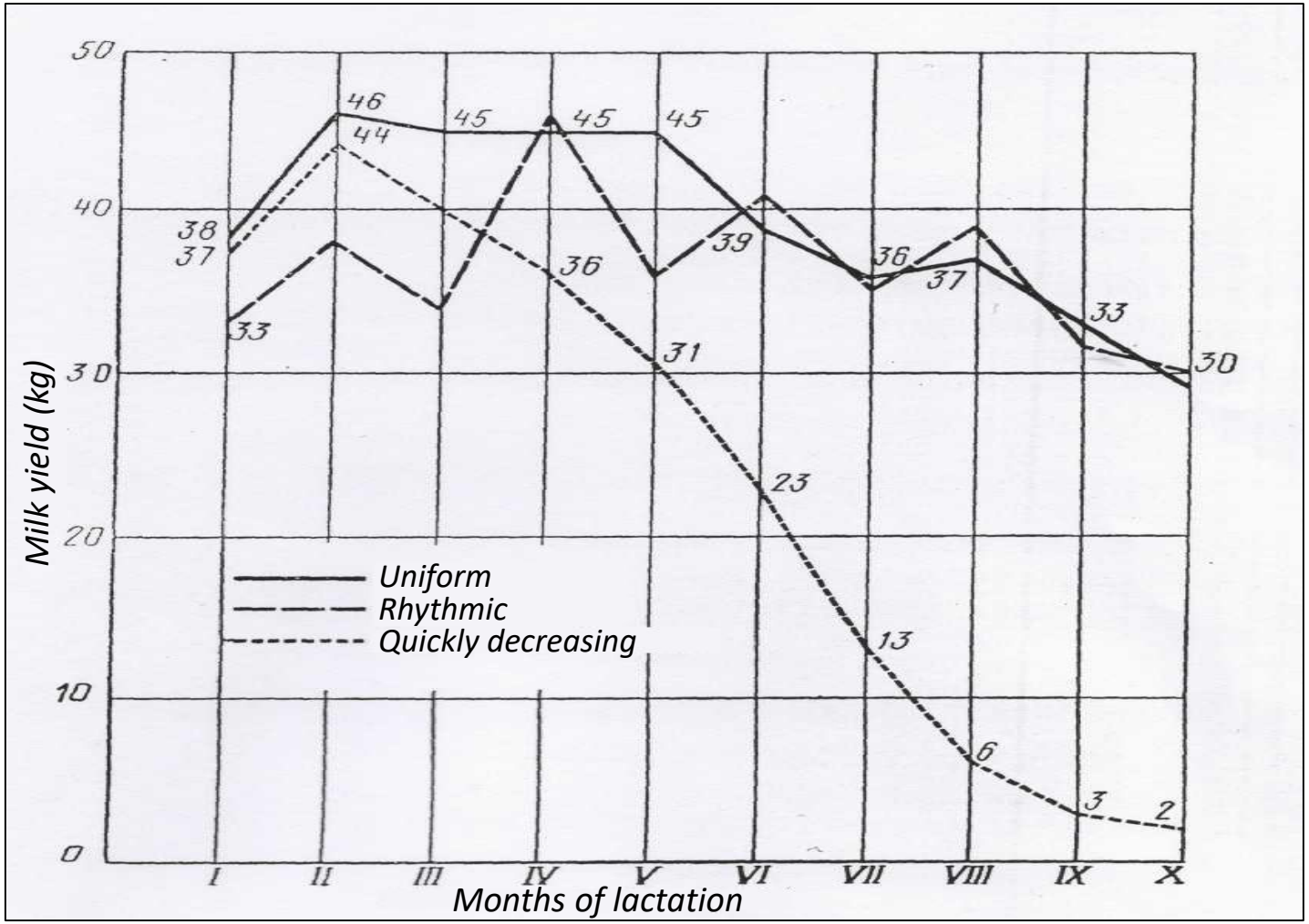
Pregnancy: pregnancy in cows. The average duration is 280–285 days.

Drying off: procedures aimed at stopping lactation in cows before calving. In a **conventional** drying off, the milking rate is gradually reduced, and the diet is modified to exclude milk-making feed.
In **immediate drug-induced** drying off, cows are injected specific drugs that inhibit lactation into the udder after milking.

Role of the open period

- “Rest” from the stress of pregnancy
- Genital tract restoration
- Obtaining maximum milk yields in the first months of lactation
- Maintaining the lactation period of 305 days

Lactation chart (lactation curve)



Role of the dry period

- “Rest” from the stress of lactation
- Accumulation of essential nutrients in the cow's body for the upcoming lactation
- Successful formation of the fetus
- Remodeling of the udder tissue

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