WORLD BEEF CATTLE PRODUCTION

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Summary

Ruminants have ability to use the products of photosynthesis. They can convert high fiber feeds into essential amino acids and B-complex vitamins. Cattle utilize much of the land that is not suitable for cultivation. Cattle can consume many by-products that have little or no value for human consumption. Cattle are a familiar domesticated species throughout human history. Cattle and their products have been vital commodities for trade among nations. Many breeds of cattle have evolved over time. All have attributes they may be needed in particular environments. Heritable traits such as growth rate, meat yield, reproductive performance, and milk production are important in commercial cattle production. Cattle are found in most areas of the world. Their numbers and importance to the economy varies from country to country. Cattle can be maintained in different production systems. The meat and by-products of cattle production are useful to humans and many different facets of our lives.

1. Introduction

Ruminants, such as cattle, have the ability to transform cellulose into high-quality human food. The major contribution of ruminant animals to the human population is their use for food. Approximately 80-85% of the nutrients consumed by cattle and other ruminant animals come from forages and nutrient sources that are not suitable as food for humans. More than 800 million acres of range and pastureland are utilized in animal production. This is land that is generally too dry, too wet, too rough or too high to be cultivated.

Geographical Region	% of total land that is agricultural	% of agricultural land that is cultivated	% of agricultural land that is permanent pasture
World	35	32	68
Developed Countries	36	34	66
Developing Countries	34	30	70
Africa	37	20	80
Asia	38	46	54
Europe	49	59	41
Oceania	61	9	91
North America	27	47	53
South America	31	17	83

Source: adapted from: http://apps.fao.org

Table 1. Characteristics of agricultural land in various geographical regions.

Plants supply over 80% of the total calories consumed in the world. Animals supply one-third of the protein consumed worldwide. Meat, milk and fish are about equal sources of animal protein, supplying respectively 35%, 34% and 27% of the world supply of total protein.

Cattle consume many by-products of the food industry and reduce residue waste disposal problems along with conserving nutrients for human food. Less than one-half of the dry matter produced by crops is edible by humans: The remaining stalks leaves and residues can be converted to human food by cattle. About two-thirds of grain milling by-products are fed to animals. More than 25% of all food by-products are used as a source of energy, protein and other nutrients in animal feeds. More than half of the by-product of fruit and vegetable processing go into livestock feed. An example of these materials include potato residues, corn cannery waste, sugar beet pulp, grain screenings, oil seed residues, brewer's grains, cottonseed residues, rice bran, wheat bran and bakery wastes.

Ruminants will become even more important when crops are introduced for industrial purposes that do not have any human food use. An example would be oil from crambe seed, which is used as a lubricant and in photographic film production. The meal cannot be used by monogastric animals but can be used by beef cattle.

2. History

The word "cattle" comes from the Old French word "chattel" which means possession. It is believed that cattle were first domesticated in Europe and Asia during the Stone Age. It is generally thought that cattle were domesticated after sheep, goats, pigs, and dogs. Remains of domesticated cattle dating back to 6500 BC have been found in Turkey. Some authorities date the domestication of cattle as early as 10 000 years ago, other assume half that amount of time. Modern domestic cattle evolved for a single early ancestor, the aurouch. It is believed that a poacher killed the last surviving member of the species in 1627 on a hunting reserve near Warsaw, Poland.
Cattle were not natives of the Western Hemisphere. The first cattle to reach the "Americas" were brought by Columbus on the second voyage, made in 1493 to the West Indies. Spaniards and other explorers continued to introduce cattle to North, Central and South America throughout the sixteenth century.

Early cattle provided meat, milk and labor to their owners. The international trade in beef cattle and their products generally consists of four phases: (1) trade in hides and tallow; (2) trade in preserved meats; (3) trade in live cattle, and (4) trade in fresh (and frozen) meats. These phases are also listed in typical progression of origin. All phases of the trade are carried out at the present time with the trade in fresh and frozen meat being the most economically important.

2.1. Trade in Hides and Tallow

Probably the first recorded instance of the shipment of animal products from the New to the Old World is that of a cargo of 1281 hides from Buenos Aires in 1616 valued at about 117 pounds sterling. While Australia and New Zealand were not able to export live animals successfully during "the age of sail power," the trade in hide and tallow formed the basis of

their international livestock trade for a considerable period of time until meat preservation techniques were perfected.

2.2. Cured, Preserved, and Tinned Meats

The preservation of meat by salting and drying is almost as old as civilization itself. Sailors and solders of both ancient and medieval nations existed upon such meats. Although salting beef is not as easy as pork to cure, it can be preserved in most climates by observing certain precautions. The most common method of preserving beef was to pickle it in strong brine.

The hermetically sealed container caused a revolution in the beef industry. The use of the tin can in preservation of beef was begun in Australia in 1847. This product was readily sold to maritime businesses. Canned meat was a welcome relief from the old "salt horse" and "pickled beef" to which sailors had been accustomed.

2.3. Exports of Live Cattle

A limited trade in live meat animals developed in some areas such as between European countries in the eighteenth century, and probably even before that. The importation of live animals favored the introduction of contagious diseases, many of which were prevalent in Europe at that time.

2.4. The Fresh Meat Trade

Mechanical refrigeration became a reality very early in the nineteenth century. The first British patent was issued in 1819. Between this date and 1876, the year in which the carrying of fresh meat in ocean-going vessels was begun on commercial scale, the British Government granted no less than 137 distinct and separate patents on mechanical refrigeration. Mr. Thomas S. Morse established the first artificial freezing unit in Sidney, Australia in 1861. T.C. Eastman made the world's first successful shipment of chilled beef in October 1875, from New York to England.

2.5. World Events can alter Beef Marketing

With the outbreak of hostilities in Europe in the summer of 1915, sources of beef were temporarily altered. Although North America was at the time exporting an almost negligible amount of beef to Europe, the interference of the War with all international trade caused a severe business depression in the continent. The recovery in the cattle business, however, came very quickly. With the realization that World War I would last a long time, came the recognition that North America, but six to nine days distant from Europe, would be called upon to furnish large amounts of meat for the Allied soldiers. South America and Australia were much farther away, and extensive trade with them would have required many ships badly needed for military cargos at that particular time. With the introduction the submarine to sea warfare and the enormous loss of shipping resulting from torpedoes, the advantages possessed by North America were pronounced. It was not possible to keep ships in both North and South Atlantic adequately protected. Consequently, all possible protection was afforded ships between Europe and North America and little or none for ships to and from South American ports. All surplus meat in North America met with a

ready sale to European countries, despite the fact that meat could be had for a much lower price in South American and Australia. Upon the end of hostilities previous export-import routes were resumed.

3. Breeds

The classic definition of a breed is animals that, through selection and breeding, have come to resemble one another and pass those traits uniformly to their offspring. However breed is perhaps a more elusive term as indicated by Dr. Jay Lush in The Genetics of Populations.

He stated: "A breed is a groups of domestic animals, termed such by common consent of the breeders, a term which arose among breeders of livestock, created one might say, for their own use, and no one is warranted in assigning to this word a scientific definition and in calling the breeder wrong when they deviate from the formulated definition. It is their work and the breeder common usage is what we must accept as the correct definition."

Probably the most convenient and complete set of pictures and discussion of breeds is located at the Oklahoma State University web site. For the sake of brevity a subset of these breeds are described with additional detail in this section. This should not infer that the other breeds are not important. For example the N'dama cattle are important in West Africa. These animals have through centuries developed a resistance to trypanosomiasis or sleeping sickness spread by the tsetse flay, which is fatal to most other breeds of cattle. Another example would be *Bos indicus-Bos taurus* crosses for milk production in some tropical regions.

Breed selection by producers is based on the following criteria: (1) marketability in the area; (2) cost and availability of seedstock, (3) climate; (4) quality and quantity of feedstuffs; (5) how the breeds used in crossing programs complement one another; and (6) personal preference.

Aficander	American White Park	Amerifax
Amrit Mahal	Antolian Black	Andalusian Black
Andalusian Grey	Angeln	Angus
Ankole	Ankole-Watusi	Argentine Criollo
Astruian Moutain	Alberes	Alentejana
American	Astruian Valley	Aubrac
Aulie-Ata	Australian Braford	Austraialn Friesian Sahiwal
Australian Lowline	Ayrshire	Australian Milking Zebu
Bachaur	Baladi	Baltata Romaneasca
Barka	Barzona	Bazadais
Beefalo	Beefmaker	Beefmaster
Belarus Red	Belgain Blue	Belgian Red
Belmont Adaptaur	Belmont Red	Belted Galloway
Bengali	Berrendas	Bhagnari
Blanco Orejinegro	Blonde d'Aquitaine	Bonsmara
Boran	Braford	Brahman
Brahmousin	Brangus	Braunvieh

British White	Brown Swiss	Cachena
Canadienne	Canary Island	Canchim
Carinthian Blond	Caucasian	Channi
Charbray	Charolais	Chianina
Chinese Black and White	Cholistani	Corriente
Costeno con Cuernos	Dajal	Damascus
Damietta	Danish Jersey	Danish Red
Dangi	Deoni	Devon
Dexter	Dhanni	Dolafe
Droughtmaster	Dulong	Dutch Belted
Dutch Friesian	East Anatolian Red	Enderby Island
English Longhorn	Estonian Red	Evolene
Fighting Bull	Florida Cracker/Pinewoods	
Fjall	Galician Blond	Galloway
Gaolao	Gascon	Gelbray
Gelbvieh	German Angus	Germain Pied
Gir	Glan	Gloucester
Greek Shorthorn	Guernsey	Guzerat
Hallikar	Hariana	Harton
Hays Converter	Hereford	Herens
Highland	Hinterwald	Holstein
Holando-Argentina	Horro	Hungarian Grey
Icelandic	Illawarra	Indo-Brazilian
Irish Moiled	Israeli Holstein	Israeli Red
Istoben	Jamaica Black	Jamaica Hope
Jamaica Red	Jaulan	Jersey
Kangayam	Kankrej	Karan Fries
Karan Swiss	Kazakh	Kenwariya
Kerry	Kerigarh	Khillari
Kholmogory	Krishna Valley	Kurdi
Kuri	Latvian Brown	Limousin
Lincoln Red	Lithuanian Red	Lohani
Luing	Main Anjou	Malvi
Mandalong	Marchigiana	Masai
Mashona	Meuse-Rhine-Yssel	Mewati
Milking Devon	Milking Shorthorn	Mirandesa
Mongolain	Morucha	Murboden
Murray Grey	Nagori	N'dama
Lelore	Nguni	Nimari
Normande	Norwegian Red	Ongole
Orma Boran	Oropa	Parthenais
Philippine Native	Polish Red	Polled Hereford
Ponwar	Piedmontese	Pinzgauer
Qinchuan	Ratien Gray	Rath
Rathi	Red Angus	Red Brangus
Red Pied Friesian	Red Poll	Red Polled Ostland

Red Sindhi	Red Steppe	Reggiana
Retinta	Rojhan	Romagnola
Romosinuano	Russian Black Pied	RX3
Sahiwal	Salers	Salorn
Sanhe	Santa Cruz	Santa Gertrudis
San Martinero	Sarabi	Senepol
Sharabi	Shetland	Shorthorn
Siboney	Simbrah	Simmental
Siri	Slovenian Cika	South Deveon
Susses	Swedish Friesian	Swedish Red-and-White
Swedish Red Polled	Tarentaise	Telemark
Texas Longhorn	Texon	Tharparkar
Tswana	Tuli	Ukranian Beef
Ukranian Grey	Ukranian Whitehead	Umblachery
Ural Black Pied	Vestland Fjord	Vestand Red Polled
Vosges	Wagyu	Welsh Black
White Caceres	White Park	Xinjiang Brown
Yanbian	Gronigen	White-headed

Table 2. Breeds listed at the Oklahoma State University website.

3.1. Selected British Breeds

Compared to breeds that originated on the continent of Europe, those that were developed in the British Isles generally exhibit the following characteristics: (1) they mature and fatten earlier; (2) they are smaller at maturity; (3) they are less muscular; (4) they have less difficulty calving. British breeds are often used as maternal breeds in cross breeding programs.

Angus cattle are black and polled. Mature cow sweigh about 500 kg and are considered good milkers. Angus females are known for fertility and calving ease. The dark skin pigment provides some resistance against cancer eye and sunburned udders. Some lines of Angus cattle appear to have propensity for marbling. Many packers will pay a premium for Angus-bred cattle. The breed carries a red hair color recessive gene at a low frequency (less than 10%) and the Red Angus breed was derived from this genetic factor. In crossbreeding programs, the Angus contribute polledness, pigment, fertility, early maturity, and carcass.

The **Devon**, sometimes referred to as the "North" Devon or "Red" Devon, should not be confused with the South Devon, which is larger-framed, lighter-colored, heavier milking dual-purpose breed. The Devon is dark cherry red in color and is horned. Although the cows are excellent milkers, the Devon is considered primarily a beef breed rather than dual purpose

Like the Angus, the **Galloway** is black and polled, although a few are dun-colored. Size of frame is similar to Angus but the conformation of the Galloway is more angular in shape

Although it is considered a separate breed, the characteristics of the **Belted Galloway** are similar to those of the Galloway. The obvious difference is the belt of white hair that

encircles the body o f the Belted Galloway.

Hereford and **Polled Hereford** cattle are similar except for the presence of horns. The Hereford's white face is a prepotent trademark that is transmitted through one or more generations of crossbreeding. However, the red body color is recessive to black. Herefords are noted for their ability to thrive and reproduce under range conditions. In crossbreeding programs, the Hereford contributes range adaptability, winter hardiness, fertility under limited feed conditions, and moderate mature size with adequate growth rates.

The **Lincoln Red** is a dark red, horned, dual-purpose breed that descended from the local Shorthorn cattle in Northeastern England. In some respects, it resembles the South Devon. However, the Lincoln Red is darker colored. In crossbreeding, the Lincoln Red could add milk production and some improvement in growth rate without an increase in calving difficulty.

The **Milking Shorthorn** and beef Shorthorn originated from the same foundation in England. Depending upon the country or region, they are also referred to as Dual-Purpose Shorthorn, Dairy Shorthorn or Durhams. In Australia, there is a heavier-milking strain of Dairy Shorthorn known as the **Illawarra.**

Murray Grey is an Australian breed that descended from the light roan Shorthorn cow mated in the early 1900s to black Angus bulls. The Murray Gray has many of the same attributes of Angus cattle.

The **Red Poll** is a deep red, naturally polled breed that was once classed as dual purpose but in recent years has become more of a beef breed. Ref Poll-sired calves are similar to Angus and Hereford sired calves in calving ease, growth rate and carcass characteristics.

Scotch Highland cattle were developed in the highland area western Scotland. Most Scotch Highland cattle are dun-colored. Long, widespread horned and a long, dense, shaggy hair coat are characteristics of the breed.

The **Shorthorn** breed’s color pattern can range from red-to-roan-to-white. As the name implies, the horns are relatively small. There is a polled gene in the breed. They are considered one of the most docile breeds. In crossbreeding programs, the Shorthorn contributes maternal traits-milk production, ease of calving, disposition, and early maturity.

The **South Devon** is a light red, horned, dual-purpose breed. They are probably the largest framed beef breed in Great Britain. In crossbreeding programs, the South Devon could contribute milk production and growth rate.

The **Welsh Black** is a horned, black; large framed long-haired breed that was developed in the Welsh Mountains. They are known for their ability to thrive under sparse feed conditions.

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Biographical Sketches

Stephen Boyles was raised on a research farm in south-east Ohio, USA. He received his B.S. degree from Virginia Tech in animal science, an M.S. from The Ohio State University in reproductive physiology and a Ph.D. in ruminant nutrition from Kansas State University. Upon graduation, Dr. Boyles served on the faculty of North Dakota State University as the Extension Livestock Specialist for seven years. His main focus was beef cattle but he was also the extension equine nutritionist and served as the dairy specialist for one year. Currently, Dr. Boyles is the OSU Extension Beef Specialist. His current area of focus in extension programming is Beef Quality Assurance. His research program involves forage use and also ultrasound as a tool to evaluate body composition. Dr. Boyles has served as a beef cattle consultant in Mexico, Chile, Argentina, Brazil, Slovakia, Russia and Mongolia. He is a member of the American Society of Animal Science and the American Registry of Professional Animal Scientists.

José María Pellegrino was born in Argentina. He obtained his B A degree from the Sacred Heart College of La Plata and his Higher Certificate of Proficiency in the English language from the British Council. He further received his Licenciate Degree at the School of Journalism - University of La Plata. He studied Meat Science under the American Meat Institute Foundation at the Ohio State University, Columbus, Ohio, USA. He worked for Swift Armour Argentina, then at the Argentine Meat Board and also at the Secretariat for Agriculture, Livestock, Fisheries and Food. He is a member of the American Meat Science Association. He was coauthor of the chapter "Meat Extractives" in the book "Edible Meat By Products" - Elsevier 1988. He also co authored the International Meat Science Dictionary (1978) edited by Prof. D.M. Kinsman, University of Connecticut. He wrote the history of the Livestock and Meat Industry of Argentina (2000) the Handbook of Argentine cuts (English Version) for the National Meat Board (1973). He contributed to the development of the Muscle Deboning Project at Swift Armour Argentina.