CATTLE RANCHING

The advance of the cattle herds

The bovine functional genome project will boost Brazil's competitive advantage in the international beef market

Published in June 2003

During 2002, Brazil counted some 183 million head of cattle and moved on to have the largest commercial herd in the world. This year it is going to take over first place among beef exporting countries. With sales forecast at 1.2 million tons, passing ahead of Australia – whose external sales should not be more than 0.95 million tons since they are suffering from a bad drought – and the United States – that have maintained the historic mark of between 1.05 and 1.1 million tons.

This performance, not at all bad for a country that twenty five years ago had registered a deficit in the trade balance of this product, must be accredited, in a large part, to the scientific research developed by the universities and specialized institutions in partnership with cattlemen's associations that have guaranteed genetic improvements, the increase of productivity and the health of the herds, and added value to Brazilian exports. Looking only at the figures of last year, the external beef sales accounted for US$ 1.1 billion. If this total were to be added to the results of all of the productivity chain – leather and leather goods and footwear –, one would arrive at an income of US$ 3.2 billion, out of US$ 60.3 billion coming from Brazilian exports during this period.

This competitive advantage gained by the country should widen with the research results from the Bovine Functional Genome Project, launched on the 7th of May of this year. The project is going to identify the bovine genes of animals belonging to the Nelore breed, a variety of Zebu (*Bos indicus*) – that make up 80% of the Brazilian cattle herds – in order to develop products and technologies that will permit overcoming limitations related to growth, quality of meat, health and reproductive efficiency, which still impedes greater competitiveness in the national cattle breeding. "This is a historic leap for the country", declared the São Paulo

State Governor, Geraldo Alckmin, present at the launching of the project. The studies will be undertaken by researchers with the Agronomy and Environment Genomes Program (AEG), at twenty research laboratories. The project has a budget of US$ 1 million, funded by FAPESP in partnership with the Central Bela Vista de Genética Bovina (*see* Pesquisa FAPESP *magazine, issue 87*). "The final objective is to improve the quality of the meat so as to achieve good prices and get into new markets", says Jovelino Mineiro from Bela Vista. "Biotechnology opens up a new window of opportunity for the country", emphasizes José Fernando Perez, FAPESP's scientific director.

Besides boosting the productivity of the herds and sustaining the outstanding position of Brazil in international beef commerce, the studies on bovine genome are going to allow the country to advance towards the demands of the World Trade Organization (WTO), responsible for establishing the rules for sanitation, genetics and zootechniques. These rules are based on research developed by countries with the most up-to-date scientific knowledge. "With the functional genome project, we can anticipate and even establish new rules that guarantee even greater advantages on the world beef market", forecasts the State Secretary for Science, Technology, Economic Development and Tourism, João Carlos de Souza Meirelles. A cattle producer himself, the secretary is a qualified observer: he has been the President of the National Council of Cattlemen, of the National Committee for Animal Health, Vice President of the International Meat Secretariat and coordinator of the Forum for the Productivity Chain in the Bovine Cattle Raising for Mercosul, among other positions.

From registers to research - The functional genome study represents an extraordinary advance in bovine research that began last century when the first genealogical registers of the Brazilian herds were established. "The first necessary piece of information to make any kind of genetic improvement is to know who the animal's father and mother are", comments Antônio do Nascimento Rosa, a researcher at the Brazilian Agriculture Research Corporation (Embrapa) Beef Cattle, with its headquarters in the city of Campo Grande, in the state of Mato Grosso do Sul. The first of these registers, dating back to 1904, was started in the town of Bagé, in the state of Rio Grande do Sul, and catalogued bulls and cows of European origin (*Bos taurus*). During 1918 a register for the Zebu breed (*Bos indicus*) was published by the Rural Society of the Minas Gerais Triangle (a cattle rai-

PHOTOGRAPH BY AGÊNCIA NATIVA DO MEIO RURAL

sing region in the state of Minas Gerais), currently the Brazilian Association of Zebu Breeders (ABCZ); the original breed having come from India. Starting in the 50s, there began to be carried out in Brazil the so-called Proofs on Weight Gain (PGP in the Portuguese acronym). "Animals from different herds were brought together in a confined environment or in a closed field and exposed to the same conditions so as to know which animals would gain weight the fastest", tells Rosa. At this point, the selection of the better animals would take place and they would be used for reproduction.

Classic genetics - In the 60s, the first great official leap forward in Brazilian production was registered with the establishing of the National Program for the Development of Cattle Breeding, when the country developed a cold store cycle and went on to invest in production technologies to improve the sanitary conditions of the slaughter houses. Ten years afterwards there was the start of classical research into applied quantitative genetics, implemented by universities, research institutions and associations of cattlemen in order to improve the herds.

These programs had as their objective the production of animals with improved commercial characteristics, or that is to say, animals that put on weight faster, had precocious reproduction and produced a better quality of meat. "Today, after more than three decades of research, we can say that Brazil is a world center of reference in genetic improvement research", declares Irineu Umberto Packer, from the Luiz de Queiroz College of Agriculture (Esalq) of the University of Sao Paulo (USP).

The Advanced Center of Technological Research in the Agribusiness of Beef Cattle belongs to the Zootechnique Institute of the Secretariat of Agriculture of the State of Sao Paulo, one of the pioneers in research towards the reduction of the animal's age for slaughtering, has registered scientific results and excellent practices. "We can confirm a weight gain in the order of 1% per year, or 3 kilograms, in the selected animals. With this a young animal of one year of age, weighs close to 60 kilograms more than a similar animal twenty years ago", explains Alexander George Razook, who headed the selection program of Zebu cattle (Nelore, Guzera and Gir) based on the post weaning weight and their effects on food conversion, reproduction and carcass, that started back in 1976. "This difference is translated in the weight at slaughter and in the carcass", he stated.

Since 1991, researchers at the São Paulo State University (Unesp) in the town of Botucatu, have also been carrying out research to accelerate the precocity of the animals. "In Brazil, cattle take on average three to four years to be ready for slaughtering. With our research into super precocious calves, we have reduced this time to thirteen months. The sooner the animal is ready for slaughtering the softer is its meat", explains Antônio Carlos Silveira, who coordinates the thematic project *Beef Cattle Growth on the Super Precocious Biological Model*, financed by FAPESP. Started in 1999, the project can count upon the participation of the Agrarian Sciences and Veterinary College (FCAV) of Unesp at Jaboticabal, the School of Medicine of USP at Ribeirão Preto, of Esalq and of the Biosciences Institute of Unesp at Botucatu. "Now we want to produce a super precocious calf using only animals of the Nelore breed which, it is recognized, are considered late developers. We have to discover how to accelerate the speed of the growth of bone and muscle tissue of the animal, and for this reason the Bovine Functional Genome Project is going to help us a lot", says the researcher.

The Southeast Embrapa Cattle has also been working to raise the productivity of national cattle raising by cross breeding among different breeds, but maintaining the Nelore as the base, explains Maurício Mello de Alencar. Five cross breeding systems involving bulls of the Nelore, Canchim, Angus and Simmental breeds along with cows of the Nelore or of high interbreeding of the Nelore, are being evaluated. The research is part of the thematic project *Cross Breeding Strategies, Management and Biotechnique Practices for the Sustained Intensification of the Production of Cattle Meat*, also financed by FAPESP. "It is a project for animal production that involves genetic improvement based on commercial cross-breeding", explains Alencar. "Our objective is to produce biologically different large calves in order to study their efficiency." After birth the animals are evaluated in various aspects (genetic, nutrition, reproduction, health and economic) throughout their lives. The researcher explains that the calves and heifers are produced in different seasons of the year so that it will be possible to study distinct techniques of feeding and managing. This is a lengthy project whose results should come out next year.

Pasture improvement - Besides the efforts to increase the productivity of the herds, there is also a search on for improving pasture. "The average animal productivity in the country is of five arrobas (one arroba is equivalent to 15 kilograms) per hectare annually and 1,000 liters of milk per hectare per year. These numbers can get as high as 58 arrobas and 45,000 liters of milk, respectively, depending on the degree of intensification of use of this pasture", reveals Moacyr Corsi from Esalq, who has been investigating forms of improving Brazilian pasture for some thirty five years and is the coordinator of the thematic project *Properties and Evaluation of Irrigated Pastureland and its Management* (*Capim*), financed through FAPESP. The quantity of pasturage depends on an increase of productivity of the fodder plant and of its management. "In Brazil the average efficiency in the pasture is around 30% to 50%, which means that between 50% and 70% of the fodder produced is lost. It is possible to raise the level of efficiency to between 70% and 80%", Corsi forecasts. The increase in production of pasturage might well be achieved through better soil conditions, by the use of liming and the application of fertilizers containing nitrates, potassium and micronutrients. In the states of Paraná, Goiás and São Paulo, they have been able to reach a productivity of around 60 arrobas per hectare per year in non-irrigated pasture and above 70 arrobas in irrigated pasture", says Corsi.

The economic and commercial results of the scientific research are unquestionable. In twenty years, the birth rate measured by weaning – generally occurring at nine months into the life of the calf – has fallen from 72% to 50%; the average age for slaughtering has been reduced from five years to

PHOTOGRAPH BY FABIO COLOMBINI

Scientific research has guaranteed genetic improvement and greater productivity of the herds

three and a half; and the production from the carcass – measured by the quantity of meat and bone after the animal has been gutted and its skin removed – has increased from 190 kilograms to 220 kilograms. This gain in productivity last year allowed the country to produce 8.2 million tons of meat, to register an internal consumption of 37 kilograms of meat per capita, "one of the highest in the world", according to Meirelles, and to export almost 1 million tons.

It has been this constant increase in productivity of the herds that during 1978 allowed Brazil to invert the inflection of the curve of importing and exporting. Up until that point, the country had exported beef to Europe, mainly to Great Britain, but imported an even greater amount from the Argentine and Uruguay. "During 1979 we became net exporters and we began thinking in a strategic manner about Brazilian cattle rearing", the Secretary recalls. Starting at the beginning of the 80s, the Productivity Chain of Beef Cattle, in the environment of the National Council of Beef Cattle was established. The Council organized the productivity sectors – "from the calf to the beef steak, passing through the leather industry", says the Secretary –, started up scientific research, the production of inputs, refrigerated slaughterhouses, the tanneries and the artifact sector and the leather industry. "Today this conjunction of activities makes up the productivity chain with the largest number of direct jobs in the country: 8.5 million workers", emphasizes Meirelles. Currently the cattle industry represents two of every three hectares occupied by rural activities, or that is to say, of the 3.8 million square kilometers of the land where agricultural activities are being developed in the country, 2.6 million are dedicated to cattle rearing.

Epic zoo-sanitation improvement - However, to win over the external beef market, Brazil had to declare war on tuberculosis, on brucellosis and above all, the illness that terrorizes cattlemen: foot and mouth disease. Various countries will not import fresh meat from regions with foot and mouth disease, among them the European Union, which is currently the main importer of Brazilian beef. Scientific research and official vaccination campaigns against foot and mouth disease today guarantee that 140 million head of cattle, from a total number of 183 million, are raised in zones free of this illness, in a production belt that runs from the states of Rio Grande do Sul to Bahia, passing through Tocantins, Mato Grosso and Rondonia. The expectation is that the illness will be completely eradicated by the year 2005.

Recent research is also promising advances in combating bovine brucellosis, which brings about abortion in cows starting at the fifth month of gestation. The vaccine most widely used in Brazil is produced starting from live microorganisms but Sérgio Costa Oliveira, from the Biological Sciences Institute of the Federal University of Minas Gerais (UFMG), has developed a DNA vaccine, already successfully applied in mice, which is currently under test with cattle. "In genetic research we have evolved in a spectacular manner. From the sanitary point of view the evolution of the Brazilian herds has perhaps been the greatest epic zoo-sanitation improvement in history, when one considers the size of the herds and the dimensions of national territory", commemorates Meirelles. "We have most definitely left the state of being mere shop assistants." •