Bulletin UASVM Animal Science and Biotechnologies, 65(1-2)/2008
pISSN 1843-5262; eISSN 1843-536x

LIVESTOCK PRODUCTION – FUTURE CHALLENGES AND AVAILABLE BREEDING SOLUTIONS

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Key words: cattle, dairy, beef, pig, meat, breeding, genetics

Abstract. The aim of the present paper is to highlight on one side some of the challenges the animal science and practice is facing already globally while presenting the core strategy points considered by Genus – the world leading company in its field of expertise - as bringing the best solutions in current demanding times for both cattle and pig farmers. The proposed programs and implemented research work are related obviously to the core activity within Genus that is applied animal genetic improvement related to bovine and porcine species.

INTRODUCTION

The entire global industry involved in providing animal protein is becoming increasingly challenged by a multitude of factors. Among these global demography forecasts combined with decreasing resources – fuel, arable land, water - and new animal diseases are the ones, which will change dramatically current living standards of a population with dynamic demands and needs. Without any doubt animal science and practice it is already under a huge pressure to adapt its research targets and technologies in order to meet these demands. As such Genus, the leading global company in applied animal genetics is constantly investing in partnerships with stakeholders able to identify efficient solutions for those who are at the beginning of the food chain – the farmers. These solutions are obviously related primarily to the company's main fields of expertise: bovine and porcine breeding and genetic improvement.

CHALLENGES OF THE FUTURE

The global livestock production will face huge challenges in the decades to come. As such all organizations with related activities will need first to understand these changes, but more important to invest in providing viable and effective solutions (Ladoşi D. and I. Ladoşi, 2008). Global statistics are revealing that world population by the year 2050 will get over 9 billion people, mainly in the emerging countries (Fig. 1). Same statistics are claiming that today over 75 % of the world population is living in rural areas, being directly dependant to the livestock and agricultural output. In order to cope with this demography trend livestock production will need to double before 2020 this being already recognized as the „Livestock revolution" (Sere C., 2007).

On the other hand doubling livestock production puts enormous pressure on tree crucial resources: land, water and biodiversity. The signs of their scarcity were signaled already in several agricultural areas of the planet (Fig. 2).

Unfortunately these expected trends are becoming more challenging as increasing livestock population could have negative effects on fossil fuel usage, increasing greenhouse

gas emissions – 18 % of these are produced by livestock,- water depletion and soil erosion. And all these together will have an impact on livestock production systems (Steinfeld H. and al., 2006).

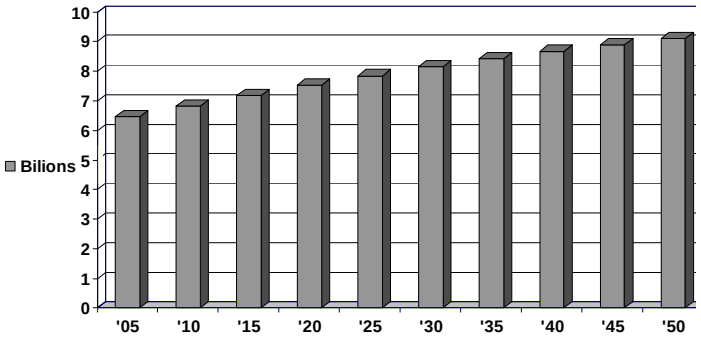

Fig.1 Global demography trend for the year 2050 (FAO, 2007)

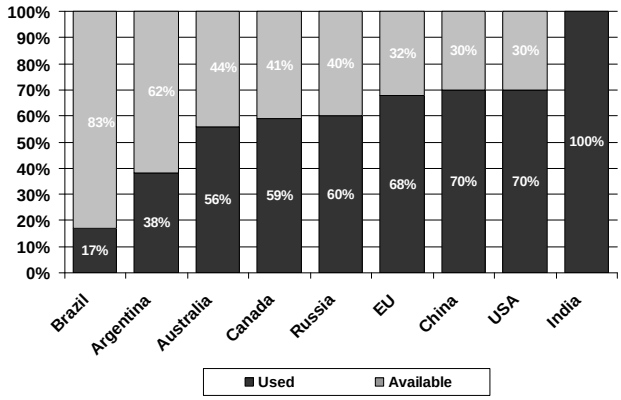

Fig.2 Agricultural land availability in selected countries (FAO, 2007)

The second large effect of the increasing need of livestock products is related to its economic side. Resource scarcity is the main driver for price / cost ratio, but as the market demand is growing food has to be produced somewhere. According to recent FAO/OCDE reports (Fig. 3) if we take only the example of meat production, more than its double will be produced in emergent countries, while the trend in developed countries will be rather flat.

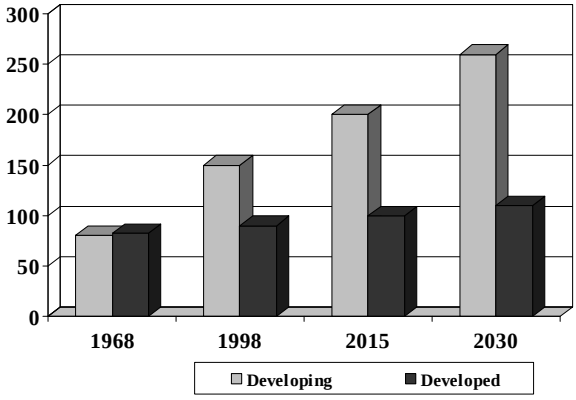

Fig.3 Meat production trend by the year 2030 (FAO/OCDE Statdata, 2007)

As we can already see fossil fuel scarcity began to have a huge impact on livestock farming profitability starting in 2007 when corn and soya prices increased unprecedently mainly due to the demand of grains for bio- ethanol production. Only in USA, in 2007, more than 350 millions of tones of corn were used both for farming and bio- ethanol. However, USDA estimates that the upcoming need just for biofuel production will increase in 2009 to more than 110 millions of tones.

Considering all above facts and figures it becomes obvious that on of the main tasks for the animal breeding sector will be to develop more productive livestock while reducing the cost of production.

CURRENT EUROPEAN CHALLENGES

According to the USDA Report released in August 2008, for the first half of the year, due to high beef and milk prices, EU beef production is expected to increase in 2008. This trend in production will only partly cover the tight supply in the EU as the enlargement cut off beef imports by Romania and Bulgaria. In the same time we should consider as well the fact that the European Commission expanded further the import requirements for Brazilian beef. This low supply is expected to reduce exports as well as domestic consumption. However, it might promote beef cattle farming in Romania and Bulgaria, and give a significant impulse to the production in France and Ireland.

Table 1

Cattle and beef population in EU 27

EU – 27 (‘000)	2007	2008	2009*
Total cattle herd	88463	88300	88000
Dairy cattle herd	24305	24176	24000
Beef cow herd	12075	12488	12400
Calf production	30927	30700	30500
*estimate FAS EU 2008			

In 2007, increased supply of pork and rising feed costs induced a “return of the pig cycle”. Difficult market conditions lead to a heavy restructuring of the EU pig production sector, affecting mainly the sow herd in new member states. As a result pig meat will be under supply affecting both EU exports and consumption.

In EU during 2007, 2008 and 2009, the cattle herd is expected to decrease, but at a relatively slow pace compared to the rate before 2007, but overall production might increase. In the first half of 2008, EU total beef imports declined by about 25% and European importers believe that entrance of Brazilian beef will decline further the remaining half as well. The main reason would be that is that Brazilian producers lost interest to regain eligibility to export to the EU. The second one would be the drop in demand for imported beef, as Brazilian beef prices went up in the first half of 2008. Further causes are the high Euro/US$ exchange rate, and cuts of export refunds. The elevated beef prices are expected to significantly reduce beef consumption throughout the entire EU.

In 2007, EU pig production increased by nearly 5% to a record production of 22.9 million mt. However, due to low carcass prices to the five-year average and feed costs huge raise, profitability in pig production became gradually eroded during the end of 2007. These unfavorable market conditions occurred mostly in Central Europe.

Table 2

Top 5 EU 27 cattle exports

Country (‘000)	2007	2008	2009*
Romania	157	90	70
Germany	46	50	60
Poland	62	59	55
Bulgaria	66	66	40
Hungary	45	38	40
*estimate FAS EU 2008			

In order to support the EU pig industry, the European Commission (EC) opened a Private Storage Aid (PSA) scheme, and increased export refunds. However, the scheme stopped in December 2007 as pig meat prices started to recover.

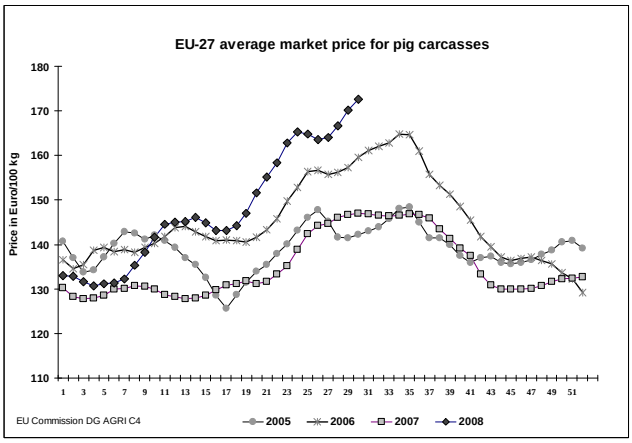

Fig.4 Comparison in pig carcass prices in EU 27

As it is anticipated that feed prices are not to decrease to the level of before 2007, margins on finishing pigs will not recover significantly. As such restructuring of the intensive pig sector is expected to continue, meaning that the most inefficient farms will close the gates with effect on a further cutback of the pig meat supply.

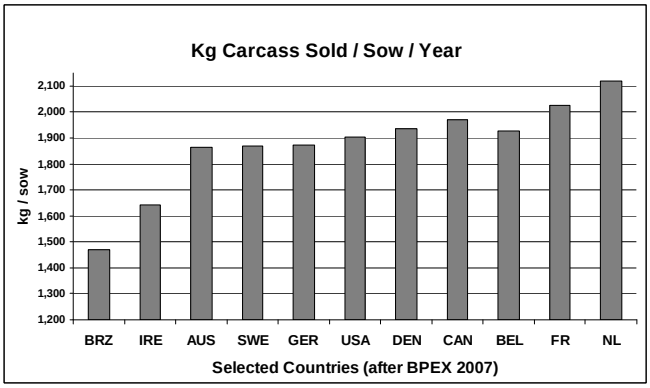

Fig.5 Sow efficiency in selected countries

Therefore, due to reduced slaughtering, EU pig meat production is expected to decline to 22.3 million mt in 2008, and to 22.1 million mt in 2009, with direct effects on EU’s exports in the second half of 2008.

Considering the increasing competition on the world market, the main net pig meat exporting countries are increasingly focusing on the domestic market, in particular on Central Europe. Also, due to the limited domestic supply and increasing popularity of poultry meat, EU pig meat consumption is expected to decline in the years to come.

AVAILABLE SOLUTIONS FROM GENUS

Breeding company Genus provides added value products for livestock farming and food producers by creating advances to animal breeding through biotechnology. Its non-Genetically Modified Organism (GMO) technology is applicable across all livestock species but is only maximized by Genus in the bovine and porcine farming sectors. Genus' worldwide activities are made in 70 countries under the trade marks "ABS" (dairy and beef cattle) and "PIC" (pigs) and comprise semen and breeding animals with superior genetics to those animals currently in production.

For the year 2008 Genus budgeted a record sum of over 17 million GBP only for the R&D, both in bovine and porcine species.

In the dairy and beef sector ABS Global, founded in 1941, is currently the main world supplier of frozen semen (conventional and sorted), in more than 60 countries, including Romania. The entire dairy breeding program is based on producing reliable proven bulls and driven to breed long life cows in the future while the selection criteria is based on sound type, easy management traits, improving fertility, longevity and maximizing profitability. Each year in own facilities ABS is testing over 500 sires in six countries and three continents, with similar program running in America, Australia, Canada, Italy and Brazil. In the UK there is a MOET evaluation herd, which helps to identify the very best bull mothers, giving added assurance when producing the next generation of test bulls.

Regarding the beef side Genus specialists search herds throughout the USA and Europe for the very best beef bulls in their breed population, initially using EBV's, pedigree information and physical attributes. Then every beef bull selected for own studs undergoes a routine of vigorous health and fertility testing. Only if they pass this test bulls will enter the next phase of the Genus Calving survey and their performance is assessed over thousands of dairy cows in the for Calving Ease, Calf Quality, Gestation Length & Beef Sire Index (BSI). Actually only 3% of the bulls tested make the grade of elite sire, while a huge 88% of beef bulls' sources are rejected.

ABS sexed or sorted semen is different to conventional semen and therefore needs careful management planning and preparation of both the animal and semen. Because of this the company is providing technical advice and support to help farmers out through all parts of the process. Any sires that are selected for sorted semen have to meet high criteria. They must be proven dairy sires, meet the high genetic improvement standards required for all Genus ABS bulls, meet all semen quality and sorting standards applied by the company and be scientifically proven to give the best possible chance of pregnancy.

For the pig division PIC, founded in 1962, the first 30 years were relatively 'simple' as the focus of the breeding program was on improving growth rate, feed intake, back fat and loin depth. All of these traits can be measured on candidate animals, being considered easy to measure traits. The huge dynamics of technical progress in computing has meant that large collected databases are now handled cost efficiently. Traits that were limited by sex (litter size in sows), by slaughtering (meat quality), or by 'natural' death (pig survivability), have been added to PIC's genetic improvement program. Other technologies, such as the DNA markers, implemented to large scale genetic testing in customer environments, increase the accuracy of

establishing the genetic value of animals. This means that there are big opportunities for PIC customers to improve their profitability with a sound genetic management.

PIC's Genetic Improvement Programs are based on 17 lines in the Genetic Nucleus (GN) herds where long-term goals are implemented. These objectives are annually reviewed by PIC teams around the globe. The change generated by the GNs sets the long-term direction of PIC products. Shorter term needs are met through ranking those same individuals on a 'Sales' Index, which re-ranks individuals on the basis of bringing the best short-term benefit to customers' profitability. For example, in the last year the emphasis on feed intake has increased with increasing feed costs. However, some customers with their own studs want to choose boars to impact their cost structure and the needs of their specific processor or meat customer. PIC's genetics services team consults with each of these customers to design a genetic response provided through a custom index.

Genetic markers in breeding programs

Recently we witnessed a considerable advance in the design of molecular technologies that allow a high throughput genotyping of the livestock species at relatively low cost. This significant progress led to an increased efficiency in the discovery of genetic markers associated with important production traits especially in swine where the germplasm is not shared by breeding companies like in cattle. PIC is leading the way with a relatively high number of DNA markers (>240) that have been applied in swine breeding. These markers have been utilized to improve a range of traits from growth, lean percentage and meat quality, to litter size and disease resistance. Today the genotypes of these markers provides valuable information that is incorporated into the genetic models to increase accuracy of estimated breeding values and the rate of genetic improvement.

What will be the importance of genomics technologies in animal breeding? We now know that there are a finite number of genes, which is around 30,000 for pig, a number though that is still very large and would justify the infinitesimal model. We also know we know that variation in some genes (or other sequences) can have a very large effect, with the "Halothane gene" the first example of a so called major gene in pigs. Based on these facts another very new approach is to perform whole genome selection (WGS). In WGS selection is performed based on the associations between a phenotype and a large number of markers across the genome. The breeding value of the animals will be estimated based on the value of each particular marker. This procedure will involve the genotypes of as many as 50,000 markers dispersed across genome. After the value of each particular marker is obtained using real phenotypic data the breeding values can be estimated by summing the value of each individual marker for animals with no phenotypes recorded. This will allow selection without recording performance especially for traits with some constraints like those with low heritability, sex-limited expression, high measurement cost, necessity to harvest the animal or measurements performed at sexual maturity, etc. This approach will allow an important improvement in the efficiency of the breeding programs, for example by eliminating progeny testing for dairy cattle. Simulation experiments showed encouraging results but this revolutionary approach will happen only if the field results that already started in cattle will provide accurate estimates.

CONCLUSIONS

There is only one main conclusion following the above statements. Demand for animal protein will increase in parallel with the human population. This means that farmers will have to produce more but under challenging circumstances considering the increasing scarcity of

the main inputs: fuel, water, land. Thus the remaining solution is to produce livestock products with the lowest cost of production possible. Here, Genus, through it's cattle and pig divisions is bringing the most updated an effective solutions, as the current genetic programs are constantly reshaped in order to meet not only current, but also the foreseened market needs.

ACKNOWLEDGEMENTS

Appreciation and special thanks to Dr. Daniel Ciobanu, from Memphis University, USA, for his ideas and comments related to genetic markers use in current livestock breeding programs.

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