



*International*  
**TAURUS**

THE INTERNATIONAL MAGAZINE OF  
MARCHIGIANA, CHIANINA, ROMAGNOLA,  
MAREMMANA AND PODOLICA CATTLE

15<sup>th</sup> YEAR Number 3/2008



# *Ville Unite Romagnola*

**Progressive genetics with a taste of tradition**

*Our results are built on passion,  
dedication and brood cows like this:*

## *Ville Unite Ira*

**Excellent 90 points (000M) Cow Index 117 Rank 97**

*(V.U. Eolo x V.U. Clara by Azzurro)*

**Grand Champion Cow - 18th Romagnola Nationals Rocca  
S. Casciano, Forlì - June 3rd -5th 2005**



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# SUMMARY

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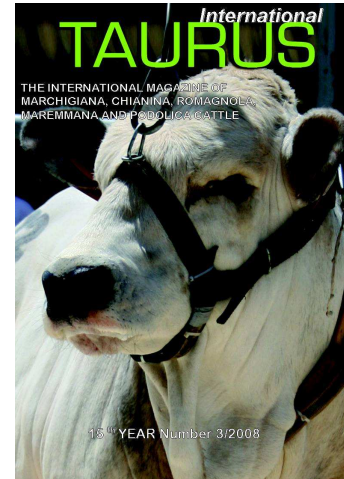
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*La scelta giusta  
per allevare  
meglio*



*La nostra esperienza,  
al vostro servizio.*



# Shows

## A leading role for Chianina at Ponte Presale!

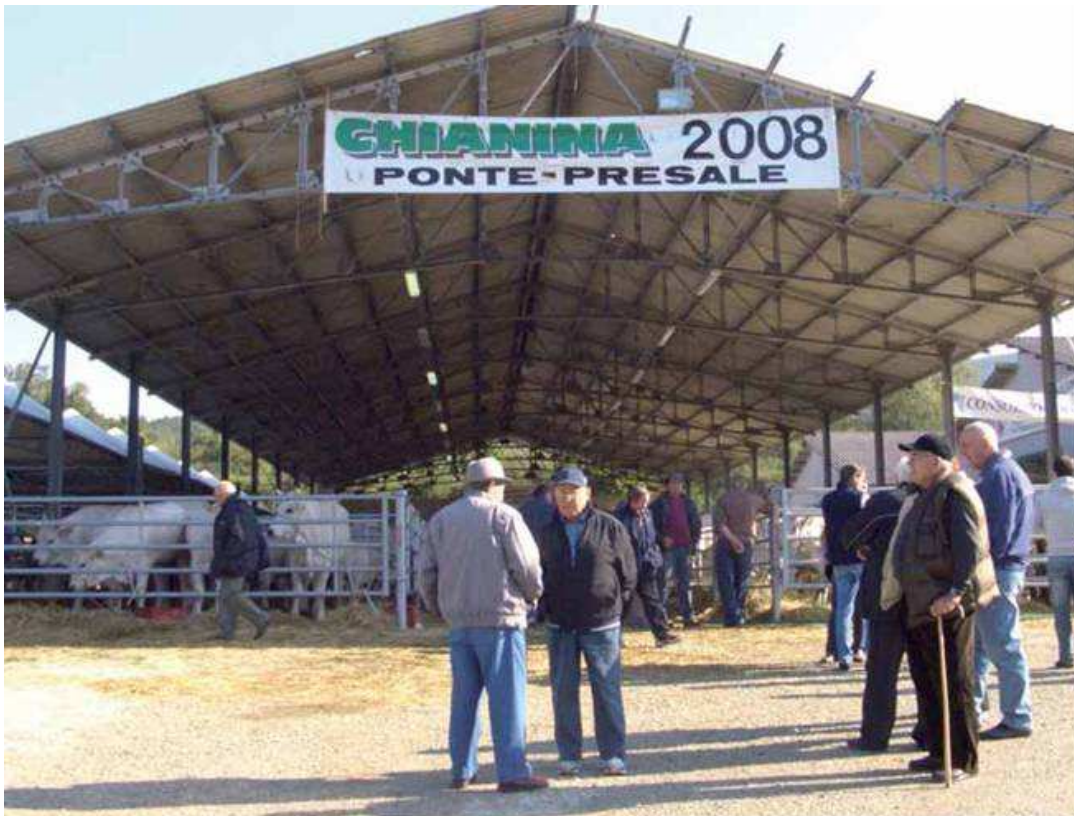
by Matteo Ridolfi and Chiara Matteucci  
Morphological Evaluations Office and ANABIC Shows Office

**A**s is now traditional, from 27<sup>th</sup> to 29<sup>th</sup> September, the spotlight focused on Ponte Presale for the 15th edition of the **National Exhibition of Farms Breeding Summer Grazed and Loose Housed Chianina Cattle listed in the National Herdbook**. Given the numerous activities programmed, it proved to be an extremely important appointment for all operators in the sector and not only.

Organisation of the event was handled primarily by the Associazione Aretina Allevatori (Arezzo Breeders Association), will

the collaboration of ANABIC and a significant contribution by the Tuscany Region, as well as Arezzo Provincial Administration, the Municipalities of Badia Tedalda and Sestino, the Valtiberina Toscana Consortium of Mountain Communities and Arezzo Chamber of Commerce, sponsored as always by the Ministry of Agricultural, Food and Forestry Policies and the National Association of Chianina Cities.

About 200 heads of cattle were on show, presented by 18 exhibitors from the Provinces of Arezzo and Rimini. Saturday



*A National Exhibition's view of Ponte Presale*

# Shows

was dedicated mainly to the arrival and accommodation of the livestock, whilst on Sunday the event really got underway with the usual evaluations and a series of related initiatives, ranging from a display of smithery and grooming to a historical archery display by the Compagnia Arcieri dei Graffiti and theme lunches based on Chianina meat.

The event also included a conference-meeting entitled “What are the economic prospects for Chianina meat?” coordinated by Luisa Rubechi, chairman of APA Arezzo, with the participation of Clara Sargentini of the University of Florence, Fausto Luchetti, chairman of ANABIC, Siro Veri, manager of Valtiberina Mountain Community, Valentino Valentini, chairman of Restipica, Giancarlo Renzi, chairman of the National Association of Chianina Cities and Roberto Vasai, Councillor for Agriculture of the Province of Arezzo.

The auction of stock calves, a popular opportunity for breeders to meet and discuss the current situation was held on Monday.

Despite the efforts of the auctioneer, the auction left everyone with a bitter taste in their mouth given the poor sales recorded.

Apart from the financial aspect, the show continued successfully with the popular judging competition between agricultural institutes, awarding of the “Mario Casini” and “Silvio Datti” trophies and the prize to the best animal in show, with a trophy awarded by the National Association of Chianina Cities.

Once again this year, restaurateurs from the Municipalities of Badia Tedalda and Sestino offered participants a food festival called “... live on Chianina...” with menus featuring exclusively PGI Chianina meat. Yet another opportunity to appreciate the flavour and quality of this excellent meat: after all, the proof of the pudding is in the eating!

# Shows

## Judging at Ponte Presale!

by Matteo Ridolfi  
Morphological Evaluations Office

There were 14 groups in the competition, representing as many breeders, divided into 13 groups for the “summer grazing” section and just one group for the loose housing section. The incompleteness of the second section limited competition to just 11 groups bred using summer grazing methods, which were judged by Umberto Basagni, with the assistance of Marco Corbucci.

The groups in the competition were from the Provinces of Arezzo and Rimini and honoured the event thanks to the high quality of the subjects presented, confirming the positive trend of recent years. Also worthy of note was the tone of the livestock, which was presented in excellent show conditions. In evaluating the group competition, the judge took into account the overall value of each individual, which in compliance with the rules consisted in four head of cattle - two heifers and two calves. In this edition, it was the details that determined the final classification. The judge decided the winners were the group from the Mi.PAF CFS farm from Pieve S. Stefano, Arezzo, commenting the placement due to the larger size, the better definition of the rumps and the superior width of the transverse diameters compared to the group from San Patrignano Cooperative, which came second due to slightly lower uniformity. However, the latter group won a special mention given the clear breed characteristics of the four heifers, which were all young. This meant the group was placed ahead of Alberto Gerace’s group, which came in third, thanks in particular to the uniform muscularity of the 4 dams which were slightly smaller compared to the first two groups. Competition for the top spots was particularly

close, as the yellow rosettes awarded up to the 8<sup>th</sup> place shows:

- 4th: Gori Marcello, Rofelle, Arezzo
- 5th: Sensi Gianni, Sestino, Arezzo
- 6th: Ferri Marini Gino, Sestino, Arezzo
- 7th: Rosati Carlo, Sestino, Arezzo
- 8th: Az. Agr. Casalecchio, Castel Focognano, Arezzo

The “reserve” positions deserve some comments given their importance such as, for example, Marcello Gori’s group, which was extremely competitive and thanks to “Libellula” won the trophy for the best cow on show. A similar consideration should go to the group from Ferri Marini Farm whose heifers, which impressed thanks to their uniformity, muscularity and style, won the prestigious trophy in memory of Mario Casini. The trophy in memory of Silvio Datti, another coveted award destined to the two best calves in the show, was won by two subjects presented by MiPAF CFS, part of this edition’s winning group.

With regards to the section reserved for loose housing, traditionally with a lower turnout than the former section, the group from Renato Trippi’s Terranova Farm stood out in particular. Although it included uniform and upright subjects, it was considered incomplete. Nevertheless, the judge chose “Quella” from this group as best cow in show from the incomplete groups. Also from these groups “Tassa” from the farm owned by Adamo Bartolucci won the prize as best heifer thanks to her upright bearing and development in relation to age.

# Shows

## THE JUDGING COMPETITION BETWEEN AGRICULTURAL INSTITUTES

The judging competition for Technical Agricultural Institute students was held during the last day of the event. It was extremely popular and we wish to express our thanks to both the students taking part in the competition and their professors. Very special thanks should go to the institutes from the Veneto region that have always attended Ponte Presale and participated again with 5 tenacious teams representing 4 institutes - ITAS Duca degli Abruzzi from Padua, Istituto Sartori from Castelfranco Veneto, IPAA S. Benedetto da Norcia from Padova and Bentegodi from Verona. The other 10 teams taking part in the competition represented ITAS Vegni from Cortona, Istituto Camaiti from Pieve S. Stefano, Arezzo and finally, ITAS from Florence. The lively competition was coordinated by the undersigned, judging 4 special groups in the "Summer Grazing Farms" section.

The extremely close competition saw 7 teams judging in line with the official benchmark judgement and, after the reasons given by the various speakers, determined the following results table:

1st: ITAS Vegni from Cortona, Arezzo -  
Speaker: Alessia Nigi  
2nd: ITAS Duca degli Abruzzi, Padova -  
Speaker: Giorgia Zecchin  
3rd: ITAS Duca degli Abruzzi, Padova -  
Speaker: Luana Boldrin

The competitive spirit of the initiative added to the technical and promotional importance of raising awareness amongst young people, not only regarding the ethnical characteristics of Chianina but also regarding open range breeding techniques for Italian beef cattle breeds.



*A moment of the Judging Competition between students of Agricultural Schools*

# Sales

## “Lukewarm” autumnal auctions at the Genetics Centre

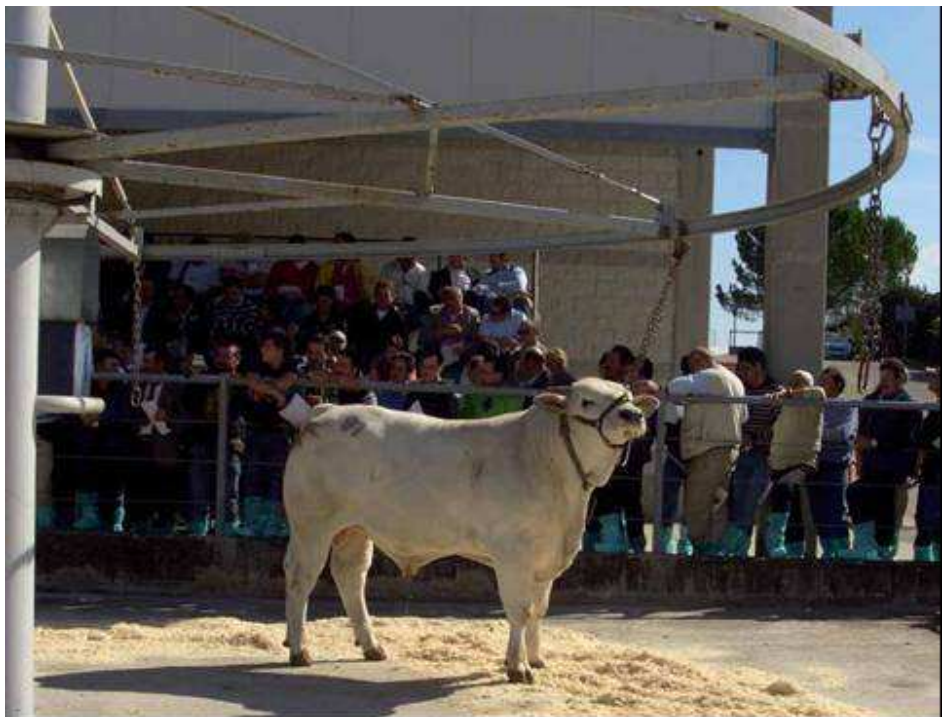
by Antonio Vagniluca  
ANABIC Genetic Centres

Last 23<sup>rd</sup> and 24<sup>th</sup> September, ANABIC genetics centre hosted the autumnal auctions reserved for specialist breed bulls leaving the centre, presented before the auctioneer in three interesting groups. The bulls of all three breeds showed all the ingredients necessary to make them particularly interesting. In fact, there were numerous subjects with extremely high selection indexes and as many important pedigrees, with long family lines and notable individual characteristics. There was also a good turnout amongst the public and potential buyers, although this was not enough to get sales going and buyers showed little interest, due to both lack of public funding and primarily a difficult period from a commercial point of view.

The first day of auction focused on the Marchigiana and Romagnola breeds, with 8 and 11 heads of cattle up for auction respectively. With regards to the Marchigiana, we should point out an excellent turnout, with a large and welcome group of breeders from Benevento, who recently took part in the excellent provincial show, held in San Giorgio La Molara and came to ANABIC on board two coaches.

We should mention that Turbo from Macerata, an offspring of Mugello bred by Lina Bestini and suitable for artificial

insemination, left ANABIC for Benevento after being purchased by Antonio Laudonio. There were also lots of breeders from Abruzzo and Lazio who helped to make the auction a little livelier. The top price went for Tiro from Ancona, bred by Mario Artegiani and bought for 4,500 euro by Antonio D’Amario of Teramo, the farm that recently hosted a practical refresher course for National Herdbook experts. Tiro, a typical, muscular and upright subject had a Bull Selection Index of 116, an ADG of 1,647 grams a day and 85



*Tiro, top price Marchigiana bull – Owner Mario Artegiani*

# Sales



*La Viola Tarzan, top price Chianina bull – La Viola Farm*

points for morphology. His pedigree, which presented the unusual combination Ponzio x Mirino x Doge, along with his solidity, justified the extremely interesting price he went for. With regards to the Romagnola, which featured along with the Marchigiana on the first day of auction, we should mention the considerably high quality levels of the subjects on auction. However, although they all found purchasers, they were sold at lower prices than expected.

We should point out the usual support offered by APA Forlì - Cesena to its breeders, who attended the auction arriving by coach. Finally, there were also buyers from areas that are far from the traditional breeding grounds, including breeders from Crotona who purchased two subjects. The highest price of the day went to Treno from Ravenna, bred by Simone Pozzi and son of Petrarca and Nara, a Lucas that has so far produced three top prices in Romaganola breed auctions and has become one of the breed's most interesting bull dams. Treno came to auction with an ADG of nearly 2 kg, along with a Bull Selection Index of 129 that makes

it suitable for artificial insemination and 85 points for morphology. It is characterised by its considerable muscularity and size. Slightly lower was the price for La Fattoria Tuareg, an interesting Mercurio x Boy of the Amanda family presented by Emilio Donati of Ravenna, certified for natural insemination and purchased by Sergio Damiani of San Silvestro (Forlì-Cesena) for 3,500 euro.

The following day, the Chianina breed took to the centre stage with 12 subjects equally divided between those suitable for artificial insemination and those for natural insemination. The highest price was recorded for La Viola Tarzan from Ravenna, son of Otello of the Drea line and presented by Gian Michele Graziani owners of La Viola farm. This subject also had an ADG of 1,954 grams, with a Bull Selection Index of 114.5 that makes it suitable for artificial insemination. With regards to morphology, what stood out in particular were its typicality, size and uniform muscles, which deservedly gained it a point score of 86. It went to the "Il Rio" farm of Arezzo. The second best price decided under the hammer of Roberta

# Sales

Guarcini was 4,100 euro and was for Taurus dei Colli from Perugia, a Lento with an excellent dam given that it is the son of the much-decorated Nabira, presented by Francesco Fedeli. Taurus is muscular and upright, as its 85 points confirm. Certified for natural insemination and with a Bull Selection Index of 99.5, it came to auction with a notable ADG of 1,830 grams. It was purchased by the Ferri Marini farm of Sestino, Arezzo. The third highest price was paid for Teo della Favorita, a subject certified for natural insemination with an outcross pedigree (Icarus x Faldo), bred by Danilo Migni and purchased by the Cecchetti-Bonaventura farm, Viterbo. This excellent subject closed a trio of auctions that did not go extremely well, but that nevertheless

proved to be an important opportunity for breeders to meet, as well as a promotional vehicle for illustrating the services that ANABIC is preparing for selection, as well as demonstrating firsthand the state of work for the renovation and expansion of the Genetics Centre.

All that remains is to arrange to meet at the winter auctions, in the hope that they prove to be more lively and gratifying.



*Treno, top price Romagnola bull – Owner Simone Pozzi*

# Meetings

## 59<sup>th</sup> Congress of the European Association for Animal Production (EAAP), Vilnius - Lithuania.

by Fiorella Sbarra  
Genetic Evaluation Office

Vilnius, one of the most charming capital cities of the Baltic region, provided the backdrop for the 59<sup>th</sup> Conference of the European Association for Animal Production. In fact, from 24<sup>th</sup> to 27<sup>th</sup> August 2008, Lithuania hosted the conference that is held annually in various European cities. The main theme of the conference in Vilnius focused on “Efficient and environmentally

friendly livestock farming”.

This international event drew 780 participants to Lithuania from 58 different countries worldwide. The conference hosted 37 scientific sessions, during which 580 presentations were given, including 20 by Lithuanian scientists.

The sessions focused on the main species of livestock farming animals, such as cattle, sheep, goats, pigs and horses, their impact

on the environment and their health, physiology and genetics applied to animal husbandry, nutrition and feeding.



*Vilnius – A view of impressive Cathedral Basilica and bell Tower*

# Meetings

The Minister for Agriculture of the Republic of Lithuania, Professor Kazimira Danutė Prunskienė (photo 1), attended the opening ceremony, which was held in the “Congress Concert Hall” in the charming old town centre of the city, welcoming and thanking all participants. Subsequently, several representatives of the European Association for Animal Production took to the stage and in turn, also welcomed and thanked participants.

ANABIC also attended the congress, presenting a piece of work in the form of a poster in the Genetics Session (Free Communication) (photo 2). The title of the article was “Heritability of traits obtained from slaughter data on Marchigiana, Chianina and Romagnola bulls”.

The study, which was carried out in collaboration with the Department of Animal Sciences of the University of Padua, used slaughter data gathered between 2004 and 2007 and provided by the consortium for the protection of the “White bullock of the Central Apennines”. The aim of this study was to predict the heritability of certain traits linked to slaughter, such as the age at slaughter, weight and average daily carcass growth and the points score regarding the SEUROP classification of PGI breeds. The results showed good heritability for weight and carcass growth characteristics, whilst the SEUROP points score showed low heritability. The age at slaughter demonstrated an unexpectedly high level of heritability and can influence the variance

components of the other traits if used as a covariate. During the Poster Session it was possible to discuss the work with other participants who showed particular interest in it.

Overall, a considerable amount of work was presented at the congress, all of which proved to be of particular interest and notable scientific importance. During this kind of events it is important to make and maintain contacts with the research world in order to draw information from it and propose new ideas for developing know-how on our breeds, as well as acquiring latest research and selection results both on a national and global level.



*Prof. Kazimira Danutė Prunskienė, the Agricultural Minister of Lithuania Republic*

# Meetings

## Chianina returns to Tressa!

### A great success for the 2<sup>nd</sup> National Meeting of the Chianina breed

by Matteo Ridolfi  
Morphological Evaluations Office

**T**he inclement weather, which at times turned to torrential rain, did not stop the annual edition of the National Meeting of the Chianina breed, held for the second year running at the local sports club in Ponte a Tressa. The event was organised by APA Siena and ANABIC, with the collaboration of the Ministry of Agricultural, Food and Forestry Policies, the Tuscany Region, ARSIA, Siena Chamber of Commerce, Siena Provincial Administration and the Municipality of Monteroni d'Arbia. After the official welcome by the local authorities, Roberta Guarcini, director of ANABIC, opened the work session by illustrating the activities of the association which, more than ever before, has been

working towards consolidating its institutional role. Work to expand the Genetics Centre, illustrated in detail during last year's meeting, is still in progress and the DNA bank has also been set up, as have services supporting selection.

The promotion of AI-certified bulls has led to the systematic online diffusion of the auction catalogue containing photos of the bulls, for which semen storage is also provided for breeding programmes. Alongside this, there has also been a review of the selection indexes that will soon be integrated with other tools, such as the Maternal Ability Index and the Relatedness Coefficient. This feverish activity, which sees ANABIC working on



*Some of the interested technicians and breeders at national meeting of the Chianina breed*

# Meetings

several fronts and with different priorities for the 5 breeds, comes at a particularly difficult time for the Italian stock raising system, currently dealing with important and decisive challenges.

Given this context, the meeting in Tressa, which was dedicated to the Chianina breed, provided an important opportunity for breeders and operators in the sector, increasingly interested and involved, to meet. During last year's meeting, the reasons that led to the review of selection trends and the subsequent review of selection indexes for bulls were illustrated, as was an accurate assessment of genetic anomalies, cases of which breeders were asked to report.

This year's meeting aimed to once again focus on these aspects, illustrating the latest information available, with the addition of a presentation on the physiology and grooming of the foot - of particular importance for the productive functionality of breeding livestock.

The first presentation was given by Andrea Quaglia, manager of the LGN (National Herdbook) Office. After an initial overview of the genetic progress achieved in terms of growth and muscularity characteristics through performance tests, he illustrated the changes made to the selection indexes for bulls and cows, underlining the subsequent variations in ranking regarding the Bull Selection Index for and, consequently, Cow

Selection Index, with particular reference to bull dams.

With regards to the latter, the importance of the Morphology Index was illustrated. This comes from assessment of heifers between 14 and 30 months of age.

The BLUP Animal Model method, used to calculate these indexes, is fundamental for the genetic assessment of livestock worldwide, but it tends to select by family and this can reduce genetic variability, particularly in breeds of average and limited consistency. To remedy this, ANABIC has defined the Average Relatedness Coefficient (AR), which was also illustrated through examples that aimed to show how a subject with a high consanguinity can be closely related to the breed population and vice versa. The objective is to take this parameter into account in order to guarantee that all existing lines are well-represented in the breed.

Another important selection tool that the association is working on is the Maternal Ability Index, based on calf weight records taken at a pre-set age and carried out during standard AIA (Italian Breeders Association) checks. ANABIC is also working on new indexes regarding ease of calving, a complex aspect and one that is of particular concern for breeders. In order to elaborate this information, the quality of data recorded

during breeding regarding the type of delivery is of key importance.

Andrea Quaglia then went on to illustrate the services that ANABIC offers breeders.



*Andrea Quaglia presents ANABIC activities*

# Meetings

New elements regarding the morphological evaluation included the adoption of new palm-pad computers that will shortly be distributed to experts and will make it possible to acquire not only assessment data, but also photos of each subject, which will then be acquired and filed along with the morphological records. The breeding programming service will also be improved, along with procedural criteria, comprehensively illustrated by the speaker after his presentation.

Work then continued with the illustration of the current situation regarding the prevention of genetic anomalies and in particular Congenital Pseudomyotonia and Congenital Ichthyosis. Professor Arcangelo Gentile of the Faculty of Veterinary Medicine of the University of Bologna and Professor Luciano Molteni of the Faculty of Agriculture of the University of Milan both spoke about these aspects. With regards to Congenital Pseudomyotonia, Professor Gentile underlined the substantial progress made by research that has offered the possibility to establish that the illness is the expression of an autosomal, recessive gene according to Mendelian inheritance, responsible for a distorted functioning of the calcium pumps, a fundamental element for the contraction of muscle fibres. These pumps normally free the calcium ions, determining muscle contraction. After this however, they recall the same ions more slowly than they should, thus considerably delaying muscle relaxation time. The gene that causes this anomaly has been identified and the University of Berne has defined a method for checking it, thus making it possible to identify carriers. In this respect, ANABIC has requested and obtained funds from the Ministry of Agricultural, Food and Forestry Policies to carry out tests on subjects entering the centre, immediately proceeding to test the first bull calves, without any increase in costs for breeders. Professor Gentile, who urged breeders to report any carriers of Congenital Pseudomyotonia, is the contact person for this anomaly and the

intermediary with the institute in Berne that carries out the tests.

The next presentation, regarding Congenital Ichthyosis, was given by Professor Luciano Molteni of the University of Milan. ANABIC has been collaborating with Professor Molteni for decades and karyotype analyses are currently carried out at his laboratory. His interest in our breeds has led him to study Ichthyosis, which does not only affect the Chianina but also various other breeds, such as Holstein and Charolais. Ichthyosis appears with the keratinisation of the skin, that becomes thick and loses hair becoming scaly, with scales separated by cracks in which scar tissue appears. Other aspects that feature with this anomaly, which is characterised by perinatal mortality, include smaller auricles and eversion of the lips and the third eyelid. For Ichthyosis too, which appears fairly early and even in the embryo, the gene responsible for the distorted constitution of the skin has also been identified; it too is autosomal and recessive and follows a Mendelian behaviour. For this anomaly too it is now possible to carry out tests to identify carriers; the speaker therefore urged breeders to report cases of the condition.

After the presentations, the director of ANABIC Roberta Guarcini thanked the distinguished speakers and underlined the desire of the association to deal with genetic anomalies, combating them through various strategies based on common sense and focusing more on the information available regarding carriers than on the systematic purge of the lines concerned.

# Meetings

The presentation that closed the morning's work was given by Professor Alberto Brizzi, Veterinary Podiatrist and lecturer at the University of Padua. The theme of his interesting speech included an overview of the anatomy and physiology of the foot, as well as the correct shape of hooves and their correct resting on the ground. Without going into detail regarding the biomechanics of the bovine foot, the speaker illustrated the stress the hoof is subjected to in its various parts and the various factors that affect normal production of the horny tissue by the fleshy part of the foot. Considerable space was given to the description of environmental effects, such as the presence of humidity in litters, gratings and particularly abrasive flooring and identification of the most common

pathologies, such as laminitis, pododermatitis, interdigital phlegmon (or foot rot) and white line disease.

The report also illustrated the principles and reference points that govern the functional balance of the foot and the practical ways to deal with the most common pathologies. The considerable production and financial losses that these pathologies determine have made them the subject of research particularly in countries with advanced stock raising techniques, some of which have been carefully monitoring their case histories proceeding to the subsequent genetic assessment of bulls. Dr. Brizzi's theoretical presentation was the prologue to a practical demonstration held by the speaker himself in the afternoon.

The "Guidino" prize was awarded during the lunch break, when naturally only Chianina meat was served. This prize is awarded each year to a person who has stood out for his or her work in favour of the Chianina breed. This year the award, created by Massimo Lippi and consisting in a terracotta medallion portraying a Chianina bull, was given to ANABIC and dedicated to the memory of Lucio Migni. The Chairman Fausto Luchetti and the director Roberta Guarcini, who were noticeably moved, received it from the creator of the piece on behalf of the association. The standing ovation that followed showed, more than words could ever do, the moral and technical status of Lucio Migni and the indelible mark his extraordinary personality



*Prof. Alberto Brizzi explains his presentation*

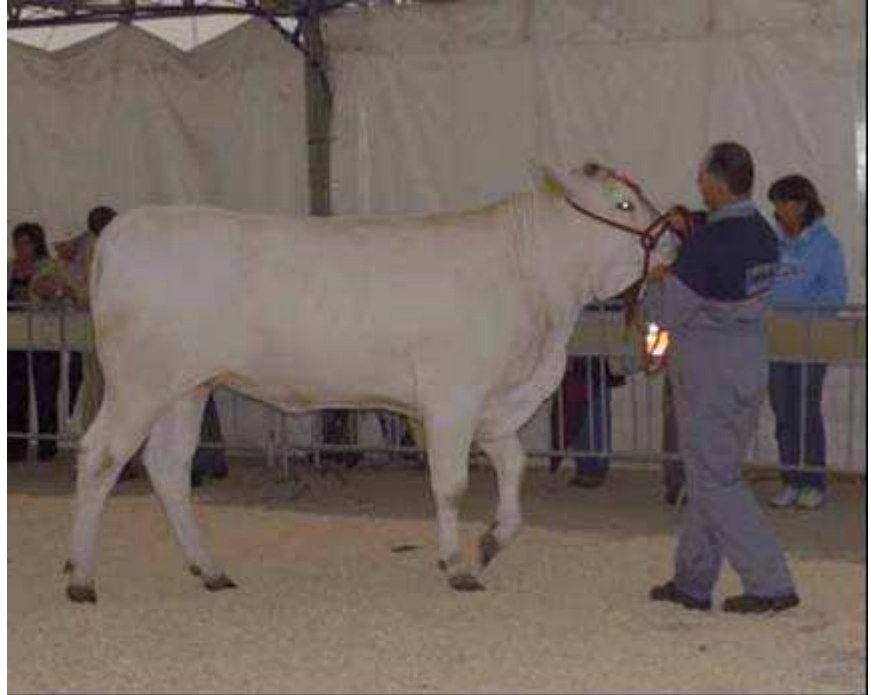
has left on the world of Chianina and other white breeds. On receiving the award, Roberta Guarcini affectionately recalled Lucio, confirming that his example was a daily inspiration for all those at ANABIC.

The second part of the meeting was a practical demonstration of the functional balance of the foot by Professor Brizzi who illustrated and commented on the various phases using a cow, kindly lent by breeder Roberto Barbi, whom we would like to thank. To close the event there was a technical commentary on some heifers, which were kindly lent by participating breeders from the Province of Siena, whom we would like to

# Meetings

thank mentioning them one by one: Giuseppe and Maurizio Fabbrini, Roberto Barbi, Emilio Massi and Lido Pecci. Work in the rings was conducted by Matteo Ridolfi, coordinator of the ANABIC experts, who presented the various subjects illustrating their birth information, pedigree, genetic indexes and main morphological traits. Adequate space was reserved to the most important functional morphological traits that determine the Cow Selection Index that help to qualify bull dams.

At the end of the presentation, breeders were presented with an award by the director of ANABIC Roberta Guarcini who, at the end, presented the director of APA Siena, Paolo Montemerani, a plaque by way of thanks for the precious organisational support for what proved to be an extremely successful event, despite the incessant rain.



*A heifer exhibited at the meeting*

# Meetings

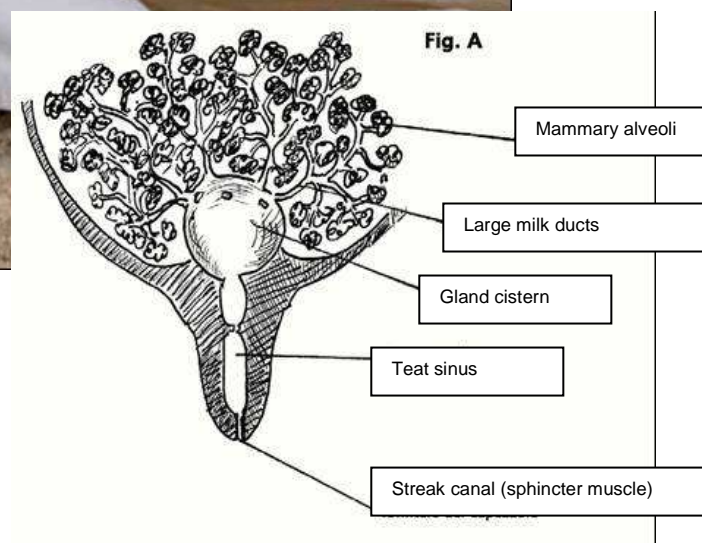
## Development, physiology and shape of udders

by Matteo Ridolfi  
Morphological Evaluations Office

**I**n beef cattle breeds themes relating to weight gain, feed conversion ratio, state of fattening, structure of the carcass and quality parameters of the meat are frequently addressed. Less attention is usually dedicated to the mammary apparatus, which nevertheless represents a fundamental

### INTRODUCTION

In cattle breeds, the mammary apparatus, which consists in two pairs of udders situated in the inguinal region, has a relatively simple structure. Each of the 4 teats has a single opening that leads into a papillary duct that in turn leads into a milk cistern into which a



element for the survival and development of the calf in the suckling phase, as well as determining the production capacity and functional longevity of beef dams.

# Morphological Evaluations

certain number of large ducts flow from the lobule-alveolar system, which constitutes the secreting apparatus (Fig. A).

## **DEVELOPMENT OF THE MAMMARY APPARATUS**

The udder begins to develop in the post-natal phase due to the oestrogens produced by the ovaries that, after having being responsible for the primordial development of the udder in the embryo, stimulate the formation of the ducts in the connective tissue of the fatty part that constitutes the undeveloped udder. During the phase between birth and puberty, there is a relative dormancy in the development of the mammary gland. During the next phase, under the effect of oestrogens, the tissues making up the ducts develop, in particular at the base of the teat. With puberty, the emission of oestrogen in the bloodstream gives a clear impulse to the development of the udder, stimulating growth of the ducts. This growth is more evident during the oestrous phase than during the anestrus phase when, due to progesterone, the secreting apparatus also begins to develop. After numerous oestrous cycles, the texture of the ducts will extend to the entire fatty body with an increase in the size of the ducts that will appear separated by noticeable support tissue. Virgin heifers may secrete a small quantity of liquid composed of lactose, casein and fat.

The level of oestrogen in circulation is high immediately after the start of pregnancy, determining a considerable development of the duct system in the region of the mammary parenchyma. Starting with the ducts, oestrogen also induces the formation and development of the mammary alveoli. From the 4<sup>th</sup> month of pregnancy, progesterone produced by the corpus luteus begins to prevail over oestrogen, giving way to the orderly formation of the alveolar tissue lobules. The development and generation of the alveolar tissue continues until the end of gestation. By the 7<sup>th</sup> month of pregnancy, the udder has reached such a level that lactation is in fact possible if pregnancy is interrupted, although it produces less than an udder that

begins to produce milk after gestation lasting a normal period of time. Milk secretion depends on stimulation of the mammary epithelium by the hormone prolactin, elaborated by the anterior hypophysis through the stimulation induced by oestrogen. This stimulation is reduced during the central phase of pregnancy due to progesterone. During the final phase of gestation, when blood progesterone drops, oestrogen induces the secretion of prolactin by the hypophysis, with the resulting start of lactation.

## **FUNCTIONALITY OF THE UDDER**

As we have already seen, low concentrations of oestrogen stimulate the hypophysis to produce prolactin whilst at high blood concentrations they inhibit it, as can be seen by the considerable fall in milk production in cows in oestrus. Progesterone is also important for mammary functionality, as it induces the formation of mammary alveoli and neutralizes the action of oestrogen on the synthesis of prolactin, causing a noticeable drop in milk production from the 5<sup>th</sup> month of pregnancy onwards. A similar production fall in non-pregnant cows is registered around the 10<sup>th</sup> month of lactation due to the gradual reduction of the sensitivity of the secretory cells to prolactin. Other hormones, such as thyroxine, for example, which is produced by the thyroid, can have an effect on the udder due to their influence on metabolism, leading to an increase in the fat content of milk rather than in the total volume of milk produced. Finally, oxytocin, produced by the posterior hypophysis following the tactile stimulation of the teats by the calf or by hand, reverses into the bloodstream and reaches the myoepithelial cells that are at the base of the mammary alveoli, determining their contraction and making the milk pass from the alveoli themselves to the ducts and from these to the milk cistern, thus constituting the key premise for expelling milk from the udder. In stress conditions, the adrenal glands secrete epinephrine into circulation, which inhibits the effects of oxytocin blocking milk ejection.

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## **MAMMARY INVOLUTION AND IMPORTANCE OF THE DRY PERIOD**

The start of a subsequent pregnancy leads to the reactivation of the lobule-alveolar system in the region of the mammary parenchyma. Milk production decreases considerably from the 5<sup>th</sup> month of pregnancy onwards due to the antagonistic effect of progesterone on the synthesis of prolactin. The gradual decrease in milk production preludes to a dry period or an interruption in lactation, which should ideally last around 55-60 days. When the calf has been weaned, any residual milk is slowly reabsorbed. Numerous alveoli remain that cease production, whilst at the same time new alveoli are formed that replace the fatty cells from the periphery of the gland. The udder begins its second lactation with a greater quantity of secreting tissue compared to the first lactation, thus producing larger quantities of milk. This increase in the quantity of milk produced is usually seen until the 6<sup>th</sup> lactation. Failure to dry off the cow between pregnancies will lead to a temporary increase in production, which however tends to subsequently decrease due to the failure to rest the udder and the failure to replace the secretory cells, which will also be less sensitive to the action of prolactin.

## **STRUCTURE OF THE UDDER**

A cow udder is divided into two distinct halves, separated by connective tissue and the median suspensory ligament. This division between the right and left half seems clear due to the presence of the inter-mammary groove, which can be seen when observing the udder from behind the cow. Each half consists in two glands, an anterior and a posterior gland, which are completely separate and distinct and are commonly known as quarters. The production capacity of the rear quarters is greater (60%) than the front quarters (40%). Each of the two halves that comprise the udder is supported by a support apparatus formed by a band of connective tissue that derives from the fusion of the median suspensory ligament with the lateral suspensory ligament. Both ligaments are well attached to the pubis and the median

suspensory ligaments of the two halves are held together by connective tissue.

Unlike the median suspensory ligament, the lateral ligament does not have elastic fibres. If the suspensory ligaments break, which happens considerably less frequently in beef cattle compared to milk cows that produce large quantities, the udder becomes pendulous and sags downwards, making it more sensitive to traumas and mastitis and increasing the risk of teat lesions.

## **MAMMARY VASCULARIZATION**

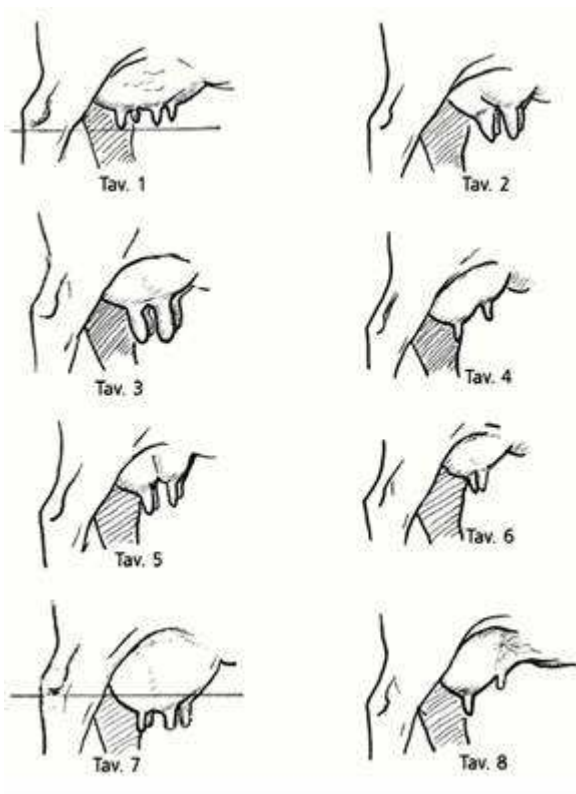
Blood from the heart reaches the udder through the external pudendal artery which, after having crossed the inguinal canal, originates the mammary artery that divides into three branches: cranial, caudal and posterior. The perineal artery also concurs in mammary vascularization. With regards to the veins, an important vascular bed is situated at the base of the udder, in the band that separates it from the abdominal wall and receives blood from the four quarters. Blood circulation continues at the front through the subcutaneous abdominal vein and at the rear through the external pudendal vein.

## **THE TEATS**

There are normally 4 functional teats in cattle. Their size is extremely variable in terms of length and diameter. The most common form is cylindrical, with a uniform diameter from the base to the tip. However, there are frequently different shapes such as for example, a conical shape that is fairly common. The teats are covered in hairless skin that is gland-free. Their walls contain a venous plexus that fills with blood due to stimulation caused by the sucking of the calf, favouring erection and helping to expel milk. The entire length of the teat is crossed by a papillary duct, which is about 8 centimetres long and with an average diameter of 4 millimetres. Along the duct there are specific anatomical structures that act as a barrier against penetration of micro-organisms. The effectiveness of this barrier decreases with the increase in the number of lactations. The papillary duct is surrounded by a sphincter muscle that is responsible for

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closing the duct, thus preventing the entry of external agents. The epithelium of the papillary duct also tends to scale continuously, producing a sebaceous-type material that flows into the lumen of the duct itself. This material would appear to mainly consist in long-chain fatty acids with a bacteriostatic effect against certain pathogenic agents. Additional or extra teats are frequent in cows and are usually found behind the normal rear teats. Their presence varies from 25% to 68% in various cattle breeds, with an average presence of around 40-50%, and can be found in both sexes. Sometimes the additional teats are situated between the front and rear teat on the same side whilst in other cases they are fused to a normal teat.



## MORPHOLOGY OF THE UDDER AND TEATS

In beef breeds, the muscle mass of the hind quarters develop considerably and the size of the adductor muscles of the thigh and the muscles of the buttock take space away from the development of the udder, particularly towards the rear. As a result, the udder seems to be a little further forward and the rear attachment tends to be lower and smaller. Therefore, it is preferable for the mammary apparatus to be well supported, presenting a wide attachment to the abdomen with a balanced development of the quarters and correct position of the teats. A close correlation between the shape of the teats themselves and the incidence of mastitis has also been found. Furthermore, the growing diffusion of summer-grazing farming methods and the frequent lack of assistance at calving probably cause selection to produce functional udders, with teats of the right size that simplify, in particular, consumption of colostrum by the newborn calf.

In its most desirable shape (table 1), the udder has a higher horizontal floor compared to the hock line, with smaller teats that are well spaced out. The most frequently found undesired shapes are conical teats (table 2) that frequently give rise to mastitis and if of excessive size, hinder sucking. A similar thing could be done in the case of teats that are too big (table 3), which are more common in bos indicus breeds than in bos taurus breeds.

The development of the quarters should be uniform but frequently, the front quarters are considerably smaller in size than the rear ones, resulting in notably reduced milk production (table 4). In other cases, the udder can present a clear division between the quarters (table 5) which are referred to as "split"; in this case the suspensory function of the ligaments is seriously compromised and the udder may collapse immediately after birth. In other cases, the teats may not be correctly inserted in the quarters and may be too close together (table 6), thus making sucking difficult. In pluriparous cows and milk cows that produce large quantities, the udder may become pendulous (table 7) with a floor

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that is considerably lower compared to the hock line. As well as making sucking difficult for the calf, this shape leaves the udder more prone to trauma, in particular the teats which are prone to lesions, and subjects the mammary apparatus to the risk of mastitis. Another undesired shape is given by the presence of blind teats (table 8) which are smaller than normal, as do the corresponding quarters, which do not produce any milk. This shape, which is extremely limiting for the growth of the calf, suggests anticipated culling of the cow and, as in the six previous cases, creates management problems that should lead the breeder to select cows with productive and functional mammary apparatuses.

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