for FL. The Highest Posterior Density 95% of rg distributions included zero value with some exceptions. The rg between BS and AFC was negative (favourable) in all breeds (-0.175 to -0.393); rg between FI and AFC was negative and favourable in M cows (-0.144) only; rg between MU and CI was negative and favourable in C cows (-0.302) only; and rg between FL and CI was positive (i.e., favourable) only in R cows (0.373). In conclusion, selection for type in M, C and R breeds produce small favourable effects on the CI, whereas AFC is indirectly positively improved by the current selection on factorials.

O022

Histological muscle characterization in hypertrophied Marchigiana cattle breed

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Myostatin (MSTN), also known as GDF8 (Growth Differentiation Factor 8), is one of the major regulators of skeletal muscle development. Mutations on *MSTN* gene are responsible for double muscling phenotype in several livestock animals. This phenotype occurs at a high frequency in some cattle breeds such as Belgian Blue and Piedmontese, and it was also identified in Marchigiana cattle, one of the most important Italian beef cattle breeds. A transversion mutation at nucleotide 874 in exon 3 (g.874G > T) of MSTN gene was found in Marchigiana breed.

In this work a Polymerase Chain Reaction - Restriction Fragment Length Polymorphism (PCR-RFLP) test was used to determine the genotype at MSTN locus. Besides, histological analysis were carried out to investigate on differences in muscle morphology between the three genotypes. Furthermore, considering the important role played by myostatin during myogenesis, a satellite cell specific marker (PAX7) was considered to verify if a myostatin deficiency leads to an increase in these stem cells. Ten bullocks aged between 18 and 24 months (except one which was 13 months old) were sampled. Blood and muscles were collected at slaughtering. All animals were genotyped at the *MSTN* locus. Three different muscles were characterized: *semitendinosus*, *psoas major* and *longissimus dorsi*. Formalin-fixed paraffin-embedded sections of muscle tissues were stained with haematoxylin/eosin. Myofiber cross sectional area (CSA) was used for muscle comparison. Part of each muscle samples were lysed and analysed for the expression of PAX7 by Western blotting. Genotyping at *MSTN* locus showed that two bullocks were homozygous for the mutation (TT), five were heterozygous (GT) and three were normal (GG). The CSA values in homozygous (TT) and normal (GG) were quite similar but microscopy analysis revealed muscle hyperplasia in homozygous (TT) bullocks, in accordance with previous studies. Western blotting analysis showed different expression levels of PAX7 in the three genotypes, with an increase in the mutant homozygous one. These findings confirm that lack of myostatin influences the proliferation of muscle precursor cells during myogenesis. Further studies about the mechanisms by which myostatin inhibits muscle growth are needed to better understand the particular muscle development in the hypertrophied Marchigiana cattle breed.

O023

"QualiPiem" - Innovative tools for selection of meat quality in Piemontese breed

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Genetic improvement of meat quality is complicated by the large number of traits involved and is usually limited by difficulties and costs related to sample collection and analytical procedures, which involve time-consuming lab methods.
The "QualiPiem" project is aimed at exploring the possibility of selecting meat quality traits in Piemontese cattle, with a particular concern to application and to cognitive aspects. The study provides the development of innovative tools for phenotypes detection on large scale at operational level based on visual and near-infrared spectroscopy (Vis-NIRS), the understanding of the genetic basis of meat quality traits and the implementation of genomic tools for selection.
Samples collection started on April 2015 and was carried on until February 2017. Twenty-four hours after slaughter, individual samples of the *longissimus thoracis* muscle were collected between the fifth and sixth thoracic vertebrae from 1,234 Piemontese young bulls, which were progeny of 193 A.I. purebred sires and 1,212 dams, all registered in the Italian Piemontese Herd Book. Animals were fattened on 135 farms and slaughtered at the same commercial abattoir. The SEUROP conformation of carcasses was also recorded at slaughter. Vis-NIRS spectra were collected on all fresh

samples over a spectral range of 350 to 1,830 nm, in reflectance mode. After 8 d of aging physical attributes of meat samples were assessed by measurement of lightness (L*), redness (a*), yellowness (b*), pH (pH8d), drip loss (DL, %), cooking loss (CL, %) and shear force (SF, kg). Data on farms management were recorded to investigate environmental effects on quality traits.

Average age at slaughter (± Standard Deviation) was 542 d (± 62 d), average carcass weight was 437 kg (± 46 kg) leading to 0.820 g (± 0.11 g) of average carcass daily gain. "S", "E", "U" carcass conformation classes accounted for 26%, 67% and 7% of animals respectively. Average values (± s.d.) of physical parameters were 40.03 (± 5.98), 18.22 (± 3.09), 15.65 (± 2.75) for L*, a*, b* respectively and 5.56 (± 0.06), 4.60 (± 1.33), 16.53 (± 3.43) and 4.25 (± 1.15) for pH8d, DL %, CL % and SF kg respectively.

Five main management systems were identified by cluster analysis.

Next steps will concern the development of calibration equations for traits prediction from Vis-NIRS spectral data, the investigation of phenotypic and genetic variability and the implementation of genomic analysis for the selection of beef quality traits.

O024

Twinning project: increasing of twin births in Maremmana breed

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The vast majority of fattened calves in Italy are imported. Therefore it is desirable an increase in national production of weanlings. Producing an extra calf in twin calving would be an opportunity to enhance the production output since an additional calf would be available for slaughtering purposes. Twinning is associated with a number of negative effects, as abortions, retained placentas, dystocia, longer interval before return to oestrus and reduced calf survival. The aim of twinning research project was to investigate the feasibility of selection for twinning in the local Italian breed of Maremmana cattle. The Maremmana herd of CREA-PCM experimental farm was the case study. From 2012 the herd is reared in two separate groups, one purebred and another crossed with Piedmontese bulls, to produce calves with a better beef conformation. A database containing all genealogical and phenotypic historical data (vital events, live weight, health data, and culling reasons) was set up. Calving records, including type (single or twin) were available since 1983 and all twins were considered dyzigotic. For this study, data from 1,260 individuals born from 1963 to 2014, 527 males and 733 females, were used. Statistical analyses were performed by the package Multivariate Mixed Models DMU. A total of 2,130 calving were recorded from 1983 through 2015: 2009 single and 121 twin births. During the four year of the experiment from 2012 through 2015 the twinning rate grew from 5.63% to 12.77%. Breeding values for twinning were estimated using two different animal models. Heritability estimates of twinning were 0.014 and 0.062 for the linear and the threshold model respectively. Also we calculated (chi-square test) the relation between twinning and calf mortality, purebred vs Piedmontese crosses and overall. Considering together single and twin calving, mortality from birth to weaning was significantly higher in purebred (7.60%) than in crosses (1.26%; $p=.01$). Genome-wide association study was performed on the corrected phenotype of all calving during the lifespan of each cow, using the Illumina BovineSNP54 BeadChip and DNA from119 cows living on farm in 2012. Different chromosomal regions and some candidate genes associated with twinning were identified. The preliminary results of this twinning project suggest that increasing twinning rate could offer an opportunity to improve the productivity of the Maremmana and of similar breeds kept on range conditions.

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