RUMINEWS MONOGRAPH

"Transition and fertility"

by Alessandro Fantini

dottalessandrofantini@gmail.com

The Italian Holstein is the most breeded dairy cattle breed in the world for its high productive performance and for the quality of milk. In Italy there is a large nucleus of selection of this breed, especially when compared to the number of bovine raised in this country, which counts 11400 farms and 110000 Holstein cows. In 2016 these cows produced on average 97 tons of milk with 3.86% fat and 3.42% of protein. However, analyzing the difference between these performances and genetic potential, there is a difference, in 2016, of 15 tonnes of milk. There are many reasons to explain this phenomenon. The most obvious is that the not good fertility of this breed leads to a slower but progressive stretching of the days in milk, which immediately influences the expression of the genetic potential. For example, if a livestock produces an average of 30 kg of milk per year in 305 days with an average of 180 days in milk it would produce a good 3 pounds more if the DIM were averagely 156, which is considered to be ideal for a farm. The only way a farm has to reduce DIM is to increase the frequency of the calvings and thus having the average open days and interval between calvings even shorter.

The causes of poor reproductive performance are many, being the "sub-fertility syndrome" the most multifactorial pathology. To get a new pregnancy, or rather a new calf, genetic, environmental, managerial, health and nutritional factors participate at various extents. These aspects should all be taken into account when improving the production performance of a single cow or a whole dairy farm, in order to reduce average lactation days and reduce the number of culled cows due to infertility. The need to quickly solve this problem sometimes lead to unnecessary and expensive measures, but people forget that to get an oocyte that becomes or remains fertile and able to evolve into an embryo, and then a fetus and finally a calf, it is necessary that the key stages of its development proceed without incident. To understand this essential concept, you can use the example of corn cultivation. In order to have a satisfactory crop, previous preparation of soil, seeding, adding fertilizer. Irrigation, and even harvesting must be made in the best times and with proper techniques. Errors or omissions will generate irreversible damage to the crop, limiting the success of any late intervention that may be adopted. For the dairy cow a typical example is that of ovarian cysts, a major alteration in the maturation cycle of a follicle.

Experience tells us that prevention of this serious issue must be articulated in the long run. The only possible rational interventions are either pharmacological or a veterinary medical act. The bovine uterus is generally unable to accommodate a new pregnancy until after 50-60 days after calving. Therefore, all follicles and resulting oocytes after that period are potentially fertile. It is also true that the breeders often wait longer, because too early pregnancy may have a negative influence on the persistence of lactation. In any

case, the dominant follicles that are formed after the end of the voluntary waiting period, and the follicular cohorts that "support" its activity, mature over a long period of four months.

A concept that needs to be clear, for which follicular growth and corn growth parallel is a good example, is that all the stresses that the follicles undergo in this long period give irreversible alterations that can result in anestrus, cysts, missed pregnancies and even embryonic deaths. But why did natural selection create this condition? For any mammal, pregnancy is a major metabolic effort, and in particular for the dairy cow because we are trying to get it pregnant when it is still in lactation, or in nature it would still be milk-feeding the calf of the previous pregnancy. In this context, before starting a new gestation, or rather taking the "decision to mate" the cow makes a careful assessment of its metabolic state, its body reserves, and how much nutrients it can ingest. In addition, genetic selection for milk, fat and protein production has put the udder at the highest priority, while many other metabolic functions and reproducing have been relayed to a lower level. Calendar in hand, then, to have oocytes and follicles of quality you have to manage them by the last months of the previous gestation. All cows from the second calving or more are granted a dry period, often called transition, that generally coincides with the last two months of gestation and is contemporary with the key phase of the mature follicles at the end of the voluntary waiting period. The transition is an important investment for the farmer because many cows, especially those on first lactation, continue to produce a lot of milk by that time. This costly investment is needed for health and fertility reasons. Transition has important health and metabolic goals, and its length is justified by the fact that it takes time to achieve these goals. First, during this phase you want to free the liver from the fat, or triglycerides, that have accumulated mostly because of the weight loss during the early lactation period. This is also the period in which the immune system will work more to free the udder from the bacteria present in it. During transition cows have quite high nutritional requirements of well-defined substances. If this period is properly managed, the cow can accumulate glucose and amino acids that will be useful to reduce the risks during the first few weeks of lactation.

Nutritional needs during transition are high because the calf fetus gains 50% of its weight at birth. Moreover, young cows still need to grow, and all cows need to build or reconstruct the udder tissues. Nutritional deficiencies or feeding disorder during transition will also negatively affect the quality of the follicles. The last three weeks of gestation are very critical for countless reasons, mostly physiological, the cow’s feed intake is reduced and it becomes very easy that feeding or management errors expose the cow to severe metabolic diseases such as acidosis and ketosis. Fodder with too much concentrate, sometimes given a few days before calving, when the rumen cannot yet fully absorb ruminal fatty acids, easily cause an acidosis. Cows react to that risk with a self-medication action, reducing feed intake. The poor nutrition that results from acidosis, or from the use of unappetizing foods, or social stresses in the herd, or intercurrent illnesses, may lead to the use of fat reserves already during transition, and increase the risk of metabolic ketosis post calving. In addition, mineral nutritional disorders during the transition are often the causal factors of post calving hypocalcemia and hypomagnesiemia, will cause a series of disorders that are certainly not favorable to future fertility. Transition cow nutrition requires little creativity but a lot of discipline applying the well-established nutritional needs . Because of the nutritional value variability of feed ingredients and also management aspects, it is good to use clinically relevant biochemistry and the most sophisticated veterinary diagnostics to spot metabolic diseases early or to check if things are handled properly. Close-up periods are short and so important for the productive and reproductive future of a cow, so it is good to adopt all those environmental, managerial, nutritional and functional considerations during that time to minimize risk factors.

All metabolic dysfunctions of this period will leave an irreversible negative imprint on follicles present on the ovaries during that time. The same can be said after calving. It is known that cows, especially those of high genetic potential (HMG), experience a post calving more or less long period and more or

less severe energy and protein negative balance, due to a paraphysiological inability to ingest all the nutrients that are needed for the early lactation phase. During this period cows eat much less than it would be necessary, also because of the pathological conditions acquired during the transition period such as acidosis, ketosis and mineral disorders. The puerperium is probably the most delicate and difficult period to standardize during the whole production cycle of a cow, and when most of the dairy cow diseases can occur, such as placental retention, puerperal collapse, displaced abomasum, puerperal metritis, ketosis, etc. All these pathologies, on top of representing a risk of leading cows to culling, will have a direct influence on milk production and fertility indexes of the farm. The farmer and his technical staff, represented by the veterinary, nutritionist and zootechnicians, must adopt various strategies to minimize health issues in the first few weeks of lactation, and reduce the time and amplitude of the energy and protein negative balance, the most important risk factors of dairy cow 'sub-fertility syndrome'.

For more information:

federico@bioscreen.it