Scientific Works. Series C. Veterinary Medicine. Vol. LXII (1)
ISSN 2065-1295; ISSN 2343-9394 (CD-ROM); ISSN 2067-3663 (Online); ISSN-L 2065-1295

CRITICAL REVIEW ON STURDINESS AS A RATHER FORGOTTEN TRAIT IN BREED IMPROVEMENT OF DAIRY COWS

Marcel PARASCHIVESCU[1], Marcel Theodor PARASCHIVESCU[2]

[1]Romanian Academy of Agriculture and Forestry Sciences, Mărăşti Blvd, no. 61, District 1, zip code 011464, Bucharest, Romania, Phone: 0213184450, E-mail: paraschivescu_marcel@yahoo.com
[2]Reasearch and Study Centre for Agriculture and Forestry Biodiversity, 13 Septembrie Street, District 5, zip code 050711, Bucharest, Romania, Phone: 021.318.81.06 int. 3542, Email: marceltheodor@yahoo.com

Corresponding author email: paraschivescu_marcel@yahoo.com

Abstract

The present paper intents to stress the importance of the body type in highly productive dairy cattle breeds. Arguments of the presented concept are deduced from the current practice of the Holstein Friesian Association of USA since the Holstein Friesian Breed of America has the highest genetic pressure for milk production. The high genetic merit of individuals concerning milk production is the result of using only one selection criterion for the discriminating reproduction with the registered in Herd Book individuals. Further the resulted genetic progress is sustained by a clever nominalization of pairs ensuring a strong sturdiness of the body to large quantities of feed to be ingested and a convenient dry matter content of milk. In addition to these breeding schemes some management measures are in use. Among these the most important are a good rest and a regular milking. Since Holstein-Friesian cattle are huge animals consuming concentrate feeds alternative trails to produce richer in dry matter milk are in course. In this case more forage feeds are used. In this kind of breeds the sturdiness of animals is an open question. Some experience in this respect could be finding in New Zeeland, but the farming system there is completely peculiar.

Key words: *dairy cattle breed improvement, body type.*

INTRODUCTION

There is long ago since humans understood advantages of keeping and breeding animals in order to have better food and other goods. Later breeders took control on domesticated animal breeding, closed reproduction and created breeds as artificial populations inside the domesticated biological species. After Bakewell (Paraschivescu M., 2015), concerning cattle, each breed must have a Herd Book as a closed reproduction tool. The principle of closing reproduction is to breed recorded in the Herd Book individuals to individuals recorded in the same Herd Book, only. Registered items in the Herd Book refer to the individual identity, to the individual recognition items or code and to the attributed mark for the individual recognition item. One main identity item is the at least 3 generations pedigree with some specifications for one or other ancestor. Such specifications refer to traits enlisted in the wanted type of the breed. Usually the wanted type of cattle breeds mentions data referring to the live body weight of adult animals, to the wanted daily gain performances, to the annual milk yields, protein or fat % content of the milk and peculiar body traits expressing animal resistance to particular climatic conditions of the environment. The last commandments are frequently treated as indicators of sturdiness.

WHAT IS STURDINESS?

In the world of the living things there is a strong connection between function and format. ”The function creates the organ” it was said that time. The elder of the authors of this paper knew a breeder who claimed he can predict the milked yield of a Simmental cow just looking her conformation and he pleaded to have anytime a body evaluation of all animals involved in the breeds’ improvement activity. But of course introduction of the milk control techniques has given much more precise results concerning the milk production of cattle.

Later, when Genetic science discovered the laws of traits' inheritance, part of experts in dairy cattle breeding considered that the body type appraisal isn't more necessary.
In the meanwhile great genetically progress concerning daily milk production was registered. Connection between milk production performances and peculiar body traits became more evident and the longevity of cows became more variable from cow to cow. Some cows were more resisting in the same conditions of environment than others. So, the question of the connection between function and format was reloaded. The body type of the dairy cattle became important from two points of view: some traits as stature or the chest depth are permitting more feed to be ingested and to synthesise more milk, other traits as support or suspension are giving resistance to the injuring stress caused by natural or artificial factors concerning the need of cows for homeostasis or for resting. This way the appraisal of the body type and the estimation of sturdiness of cows became targets and breed associations have to register these traits in the herd books and became obliged to inform members about pedigree animals' body type characteristics.
In the most advanced dairy breed improving concept, the one in use at the Holstein-Friesian Association of the USA, there are 4 main targets referring to the body type in cows:

- Stature
- Support
- Suspension
- Udder

Stature is important for the production potential. The Support and the Suspension have more relations with the animals' sturdiness. Udder is implicated both in production potential and in cows' longevity disposal.

STATURE IMPORTANCE

Stature expresses the overall building up of the animal body. With the same meaning the word"Frame" is used. Generally speaking there are 5 types of statures: Large, heavy, middle, stout, small.
In order to produce large yields of milk a cow has to eat much and must be fed on highly energy concentrate diets. Cows of large stature are the eating much. The energy concentration of diets is a question of management. The large stature is a question of body type and is induced by selection. In fact stature is determined by the animal's sizes. Large sizes of the organism give big external cavities of the body allowing greater mass of feed to be ingested. There is no interest to have big live body weights due to gross muscles in dairy cattle. For this reason the height in whither is treated as the most convenient indicator of large cattle, ignoring the body weight. Big body weight is a trait of heavy stature and is wanted in beef cattle intensive farming.
Recently, because of increasing demand to use cereals as food for humans, a new idea to restricting concentrates in feeding highly productive large dairy cows is promoted. The idea is to select breeds of dairy cows for the dry matter content of the milk. This kind of cattle need fodder feeds and could have a small stature. Such dairy cattle could be kept in areas where cereals cultures are not convenient for the farmers. It is the case of New Zeeland where Jersey and Frisian breeds are kept on the pastures of the North Island, with no concentrate feed in the diet.
But new Zeeland has an oceanic climate with high values of the relative humidity of the air similar to the one of original locations of these breeds. The novelty is to extend the idea in continental climate areas and accommodate animals to a dryer atmosphere. There are not too much knowledge concerning the wanted traits concerning the statures in small dairy cows breeds.

IMPORTANCE OF THE SUPPORT

Dairy cattle even having less muscle but being large have to be heavy. The cow's body weight enters in contact with the floor trough the small surface of the hoofs only. The sturdiness of the support is given by verticality and straight direction of legs and by the elasticity resulting from the angle made by the pastern bones with the soil, which must be of about 45^0.
Sturdiness of support is helped by a mild floor. Cattle can't stand the entire time trough. They need to lay on the ground and rest preferring clean, dry, soft and warm places. In the barn the best bed is made of straws. Grazing on wet

pasture has to be avoided causing rumen tympani. On the other hand the soft soil of pasture might be bad for the herbage. American farmers recommend less than 30 herd mates of Holstein-Frisian cows in a grazing group. The small type of dairy cattle fits better for grazing.
In intensive farming with large dairy cattle hoofs' injuries are very frequent causes of culling cows. The small type of dairy cattle is less exposed to hoofs injures.
Unchained animals are in favourable condition concerning protection of the support apparatus of dairy cattle because animals can walk and lay when they want to have a rest.

SUSPENSION IMPORTANCE

Organism of dairy cattle is under the pressure of atmosphere and of the gravity. Organs' stability inside the body is ensured by the large mediastinum which attaches them to the spinal cord. In situation of firm suspension the superior line of the body is straight and horizontally directed. Distortion of the superior line could be convex or concave. Both of them are deficient. The strongest alteration of the loin joint causes a vacillating walking.
May be "suspension" is the main indicator of good or bad sturdiness. Weak suspension is frequently noticed in old sires used in AI Centres. It might be transmitted to the daughters.

IMPORTANCE OF THE UDDER

Udder is the milk synthesising organ. It should be large, glandular and well irrigated by blood vessels. Its teats must be small to fit the milk machine's cups. When European breeders have selected cows for larger udders the organ descended to the floor and the teats were stepped by the hind hoofs and hurt. The sturdiness of cows was depressed.
American breeders taking in view that the milk production is precisely measured by the milk control techniques requested to the udder format do not descend under the line of hocks and do not surpass behind the edge of thighs. In this way the udder is protected against injuries and culling cows is avoided.
Enlargement of the udder have been produced mostly by increasing the formers quarters and by the enlargement of the entire organ. The cleft between the left and the right half of the udder became well marked denoting good sturdiness of the median ligament of the udder. The main veins should be evident under the skin on the udder.

GENERAL APPRAISAL OF THE BODY TYPE

Each selection target related to the body type is evaluated in points. Total points for the ideal body type are 100. Udder might receive maximum 40 points, stature 30 points, support 20 points and suspension 10 points. The final classes are: "excellent" (over 90 points), "very good" (between 80 and 89 points) and "good" (over 70 points). The appraisal is very severe. In the emitted documents by Breed Associations the maximum appreciation we met was Ex. 97 and they were very few cases. In official contest appraisal was done by specially trained people.

WHY AND HOW GETTING STURDINESS IN DAIRY CATTLE?

Many, if not all, books writing about farm animal improvement insist that a shorter generation interval is helpful in obtaining faster genetic progress. But animals' sturdiness increases longevity and the generation interval, as well. Then why to want sturdiness breeding animals? And why owners of Holstein-Frisian American cattle are prizing their cattle longevity? Is it right?
Yes it is. There are two reasons for that. Genetic progress for milk production is a quantitative trait and is controlled by the "Low of growing factor" (Burlacu R. and al., 1995). According to this low the variation curve of such trait is a logistic one and goes up to an asymptotic line where stops growing. In order to receive some genetic progress, to the end of such biological processes the selection intensity must be increased. That is possible by higher longevity of cattle. On the other hand progeny testing of sires used in AI is very lately and costly. Sires with better suspension of organs living longer will show evident economic efficiency (Clark W., 1973). If a sire is progeny tested at 5 years of age and is in use for semen production up 10 years the cost per doses is

reduced to a half if the bull might be used up to 15 years of age.

Sturdiness is determined genetically, no doubt. But it can be helped by a clever management of young animals' growth. Managers of AI Centres farms, taking care of pedigree males to be tested by progeny for milk production, feed the young animals on graminaceous fodder exclusively (Clark W., 1973). This way they prolong the animals' growth resulting taller animals with better mineralized skeleton and higher longevity.

In Israel in one experiment to reduce the prepuberal period in imported Holstein – Frisian cattle, they managed to force heifers' growth to make the first insemination at 10 month of age (Paraschivescu M. Th. and al., 2000). There was no impediment with the fertility or the calving easiness but the cows were less tall and the milk production per year decreased. In order to have high milk production potential large stature of cows is a required condition .

Slow growing of calves ensures a better mineralization of bones and is good for sturdiness and the longevity in dairy cattle.

CONCLUSIONS

In the last time some geneticists' express great enthusiasm to Genomic Selection. They believe that using SNYPs and gene charts techniques will avoid the progeny testing of sires for AI getting so earlier and cheaper selection results (Noelia Ibanez-Esriche and H. Simianer, 2016). That means body type appraisal can be neglected, as well.

Of course a complete genes' chart of a genotype will allow knowing which kind of proteins have to be synthesized and this information is the one transmitted to the progeny (Mateescu Raluca, 2011). But that doesn't mean all descendants will receive the same quantitative genetic potential for milk synthesis since genomic DNA, in male especially, replicates so many times (Paraschivescu M., 2015)? And can gene chart of the genotype disclose the body architecture of the animal body?

At this stage of molecular genetics the answer is NO.

In order to have sturdiness in the large dairy cattle cows the best way to proceed is to follow the Holstein-Frisian American Association model with body type appraisal for stature, support, suspension and udder. This information has to be using the best with the best when the nominalization of breeding pairs is done. The model is indicated for advanced Breed Improvement Programs.

In dairy cattle breeding interesting fact is to create similar body type model helping to have cows' sturdiness in the future small dairy breeds of cattle, as well.

REFERENCES

Burlacu R., Cavache C., Surdu I., Nica A. 1995. Funcţii de creştere aplicate în agricultură. Copyright. SIAT-SA.

Clark W., 1973. Set of personal letters concerning keeping young bulls for AI Centres.

Ibanez-Esriche Noelia and Simianer H., 2016. Animal Breeding in Genomics Era. Animal Frontiers vol. 6 Issues 1, January, 2016

Mateescu Raluca, 2011. Marker Assisted Selection in Animal Breeding. Workshop in IBNA Balotesti - Romania

Paraschivescu M., 2015. Genetic Information Control upon Metabolism. Symposium – IBNA Balotesti – Romania.

Paraschivescu M. Th., Ilinca N., Constantinescu D.M., Veress Judith, 2000. Efectul folosirii înlocuitorilor de lapte asupra fertilităţii viţelelor. USAMV – Bucureşti, Fac. Zootehnie. Simpozion 2000.