Minimizing Lameness through Conformation Analysis

Conformation analysis is a detailed evaluation of an animal’s physical structure. For Canadian Holsteins, the structural components considered are Frame/Capacity, Rump, Feet and Legs, Mammary System and Dairy Character. Because lameness is one of the primary reasons for involuntary culling, Feet and Legs receive a 20% weighting in the final conformation score. Here is a brief description of the measures which contribute to the Feet and Legs score:

Foot Angle

Foot Angle receives a 25% weighting in the Feet and Legs score. It measures the angle between the front of the hoof wall and the sole. Several studies have demonstrated a positive correlation between higher claw angles and increased herd life. The ideal angle for the hind foot is about 50-55 degrees. Although the trait represents the toe angle, Holstein Canada has determined that the most consistent and accurate method of assessment is to evaluate the angle of the hairline at the top of the foot as shown on the right. This angle is extended forward to the point it intersects the cow’s front leg or abdomen. A code 7 (ideal) produces a line from the hairline that intersects the front leg at the knee. This procedure is only minimally biased by hoof trimming and bedding.

Heel Depth

Heel Depth also receives a 25% weighting in the Feet and Legs score. The reference point for this trait is the distance from the hairline, at the back outside portion of the rear foot, straight down to the floor, as shown on the right above. A depth of at least 4 centimetres is required to receive the ideal code of 9. Canada is one of the few countries evaluating heel depth as geneticists in numerous other countries feel it is closely linked to the foot angle. Since the depth of heel is a focus of many Canadian Holstein breeders, and since several sires have been identified with less than usual links between heel depth and foot angle, Holstein Canada continues to use the trait to encourage deeper heels. Bedding and manure pack can complicate the assessment of heel depth.

Bone Quality

Bone Quality receives a 15% weighting in the Feet and Legs score. It is assessed by the flatness and cleanliness of bone in the shank, hock and thigh regions. An ideal code of 9 reflects bone quality that is extremely flat with cleanliness throughout and tendons well defined. Bone quality is an indication of fitness and good circulation through the legs without excessive swelling in the joints. A strong positive correlation exists between bone quality, dairyness and milk production.
Rear Leg - Side View

Rear Leg - Side View is often referred to as the set of the hind leg and is an assessment of the degree of curvature of the hock when viewed from the side. It receives a 15% weighting in the Feet and Legs score. Work done by Holstein Canada indicates that the set of the hock ranges from 135 degrees to 170 degrees with the ideal being 150-155 degrees. A line can be visualized from the pastern, up the middle of the shank through the centre of the hock and upward to the rump. A code is determined by the position where the line intersects the rump. A line that intersects with the pin bone is coded 5—intermediate curvature with an angle between 150 and 155 degrees. Lower codes are assigned to straighter legs where the line intersects between the pin and hip. When the line goes to the rear of the pins, it indicates excessive curvature and receives higher codes.

Rear Leg - Rear View

The remaining 20% of the Feet and Leg score is attributed to Rear Leg - Rear View which evaluates the straightness of the rear legs when viewed from behind. It is measured by the degree of inward deviation of the hocks and the corresponding degree to which the toes point outward. These reference points are assessed in relation to plumb lines going straight down to the ground from the pin bones. A code 9 (ideal) is given to legs that are wide apart and track in a straight line for ease of movement.

There is a strong relationship between the rear leg - rear view and the general health and soundness of the foot. Normally the legs should be straight from behind facilitating fluid, ‘straight ahead motion’ with the outer claw carrying a greater share of the weight.

Contusions to the corium of the outer claw will create sensitivity and pain and the cow will attempt to compensate by shifting more weight onto the inner claw. This results in a ‘toeing out’ and ‘hocking in’ posture as evaluated from the rear leg rear view. Cows with this posture have a paddling gait and lack the normal straight, fluid motion.

Environmental factors

Feet and leg traits are influenced by both genetic and environmental factors. The genetic component involves not only the conformation of the foot but also its resistance to injury and disease. The environmental component includes the effects of housing, flooring, nutrition, hoof trimming and other factors under the control of herd management. For purposes of genetic evaluation, environmental factors are removed using calculations based on within-herd and between-herd comparisons.

A combination of good management practices, improved facilities and intense selection for foot and leg conformation can substantially reduce the incidence and cost associated with dairy cow lameness.