

Introduction

Lameness in dairy cattle has become an animal welfare problem which impacts on the financial viability of dairy farms today. Reports indicate that as many as 60% of dairy cows exhibit symptoms of lameness at least once a year. Lameness can contribute to reduced milk yields, fertility problems and is the third most common reason for premature termination of dairy cows.



Aims and Objectives

This study aims to identify factors which are contributing to the lameness problem inflicting many dairy cattle today. Some of the factors to be studied include:



- 1) Bone fatigue from excessive standing and locomotion on hard unnatural surfaces.
- 2) The amount of vibration generated by locomotion on hard surfaces, and its effects on the bone .
- 3) The effect intensive production is having on the bones calcium levels and the resultant integrity of the bone.

Methodology

Test 1: Simulation of Locomotion on Hard and Soft Surfaces.

- 1) Tibiae from dairy cattle will be extracted and stored in pairs corresponding to the animal from which they were taken.
- 2) The tibiae will be mounted in the test rig as in Figures 1 and 2.
- 3) A tibia from each pair will be tested using either the hard (Figure 1) or soft (Figure 2) surface simulation depending on the rig set-up.
- 4) The tibia will either be loaded for a set number of cycles or until failure occurs.

Hard Surface

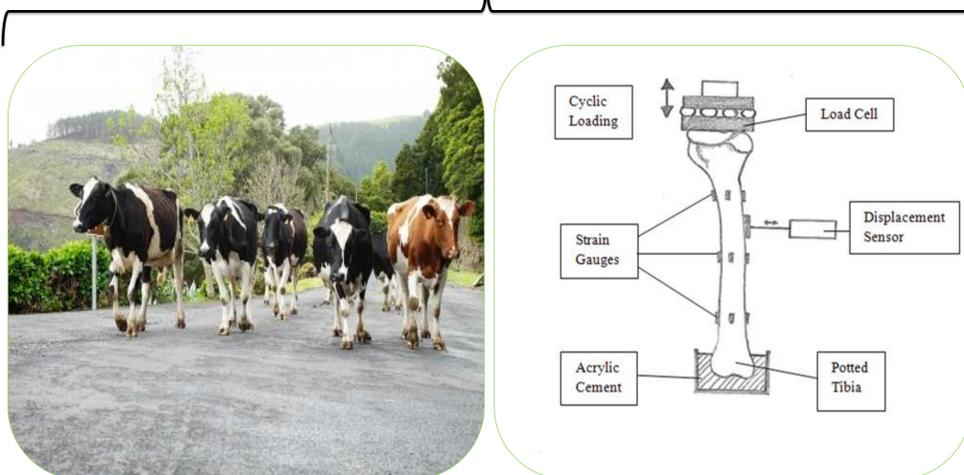


Figure 1: Illustration of Test Set-up for Hard Surfaces.

Soft Surface

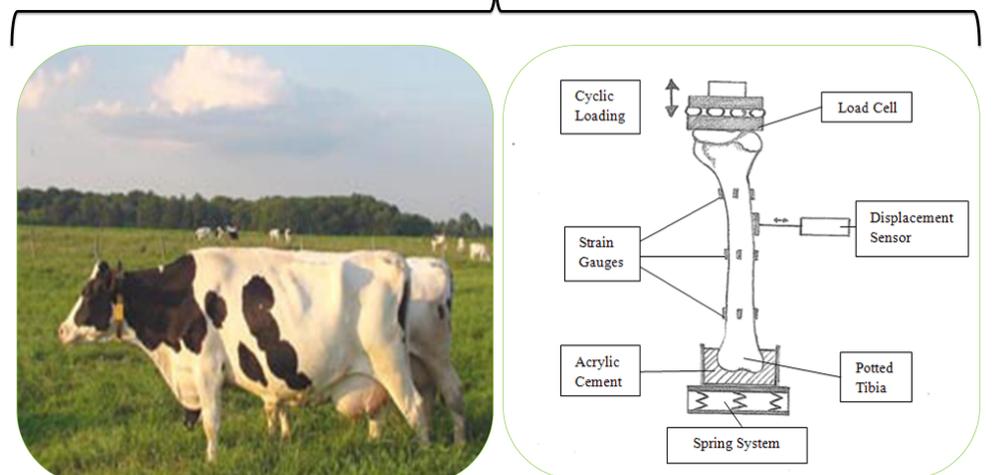


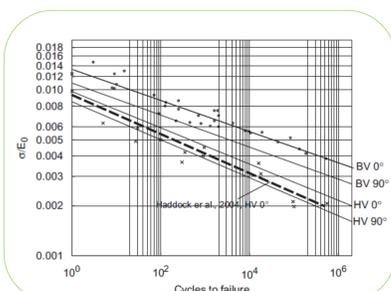
Figure 2: Illustration of Test Set-up for Soft Surfaces.

Test 2: Simulation of Locomotion on Hard and Soft Surfaces with Varying Bone Calcium Concentration.

- 1) The same test set-up will be used to perform a similar set of tests on tibia specimens with varying calcium levels.
- 2) Like in Test 1, Test 2 will be a comparison between hard and soft surfaces under cyclic loading.
- 3) The calcium levels will be varied by either sourcing suitable specimens of bone (provided sufficient history of the animal is available) or by physical manipulation using hydrochloric acid.

Results

The results obtained from these tests will be used to estimate the following:



- 1) The number of cycles required to cause failure in bovine bone under physiological conditions.
- 2) To quantify the role of calcium concentration in the bone during cyclic loading.
- 3) To measure the differences in stress and strain induced in the bone during locomotion on hard and soft surfaces.