

# Measuring Pork Quality on the Kill Floor

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## ■ Introduction

It should be possible both to evaluate (and reward) the degree of success a producer has reached in creating a premium pig, and to sort the top carcasses for premium market destinations.

The current state of industrial carcass quality evaluation, nationally and internationally, will be covered, followed by future possibilities with currently available equipment, and then what should be possible with upcoming technology. Basic information on current equipment may be obtained, in most cases, by visiting the manufacturer's website.

Issues surrounding the detection, evaluation, and prediction of carcasses with non-normal meat quality (ex: PSE) on the kill floor, will not be discussed, simply because this presentation is intended primarily for producers, and there are many ways in which meat quality can be strongly influenced after the animals are out of the producer's hands.

## ■ Carcass Composition

Currently, in Canada, the only hot carcass measurements being made commercially that impact the producers are those associated with grading: backfat and loin lean thickness, and hot carcass weight. Most plants use the Destron probe (Anitech, Canada), but some use the Hennessy probe (Hennessy Grading Systems Ltd., NZ). Both are based on fiber optics, and use reflected light of very different wavelengths. Both are also invasive, and must be passed through the carcass to take a measurement. The Fat-O-Meat'er in Denmark (SFK Technology A/S, Denmark) works on much the same principle as these two probes. The Danes have also taken this basic machine two steps further. The first step was reconfiguring to utilize ultrasound (UltraFOM 300),

which is physically non-invasive. The second was to expand the use of ultrasound to more than a single site, and create a cradle of transducers through which the carcass is pulled prior to evisceration (AutoFOM). Repeated readings are made on all transducers as the carcass moves past, creating a three-dimensional ultrasound image of most of the carcass, allowing predictions concerning primal yields.

The PIC200 system in Belgium measures ham conformation in addition to yield. It consists of a computer vision component (Rovi-Tech, Belgium), a fiber optic probe (CGM, Sydel, France) much like grading probes used in Canada, and a scale (Bizerba).

Researchers at the Lacombe Research Centre have developed a grading and conformation system (LCVS) based on ultrasound for grading site measurements, and video imaging for both 2-D and 3-D carcass conformation. Although still in the prototype stage, in addition to being completely non-invasive, it better estimates carcass composition than the current grading probes (Fortin et al., 2003).

However, it should be possible to determine more than just overall carcass yield on a routine and automated basis. For example, on an intact carcass, grading site measurements have been shown to be moderately good predictors of belly leanness (Schroeder and Rust, 1974; Fredeen, 1980; Johnson et al., 1984).

## ■ Marbling

At this point in time, there is no good non-invasive way of determining marbling. The Danish Meat Research Institute (DMRI) has developed a multi-needle probe for beef that is inserted into the rib-eye from the dorsal surface of the carcass. Through electrical impedance tomography (EIT), marbling can be determined. Recent work with a fiber optic probe following a sampling pathway horizontally perpendicular to the current grading pathway gave a correlation of 0.70 ( $P < 0.0001$ ) between probe reading and chemically determined percent marbling of pork loins (Uttaro, 2002). There has been some attempt to determine marbling ultrasonically, but likely because the fat distribution is so fine, there has been little success with this method.

## ■ Fat Firmness

Measuring fat firmness on a regular basis has recently become desirable. Approaches to date center around physical determination of fat firmness through compression or penetration. For example the probe developed by

Dransfield (Winstanley, 1987 in Swatland, 1995) measured firmness mechanically, taking into consideration fat temperature using a built-in temperature probe. Another approach, currently being used in Japan, is a probe, which determines fat melting point. Fat becomes firmer with increased fatty acid saturation. As saturation increases, so does fat melting point. Therefore a higher melting point indicates a firmer fat. The advantage here, is that beyond ensuring that the carcass is below normal hog body temperature, fat temperature need not be considered.

## ■ Odour/Flavour

Odour and flavour are very closely related, and both have long been known to be associated with fat composition of pork. A strongly objectionable odour of pork is that of boar taint. There have been a number of determined efforts over the years to identify this odour while carcasses are still on the kill floor, so they may be sorted before cooling. Methods developed have ranged from spectrophotometry to the use of customized electronic noses (Bonneau and Squires, 2000). Although successful, the speed of detection is far below line speeds.

The predominant theory concerning odour detection by humans has been that dedicated sensors in our nose identify odours based on the shape of the molecules involved. Electronic noses are built with this theory in mind. Within the last decade, a new theory of smell has been proposed, suggesting that we detect smells based on the way in which molecules vibrate (Turin, 1996; Burr, 2002; Turin and Yoshii, 2002; Turin, 2002). If this theory continues to hold up as well as it has to date, the electronic detection of odour could be revolutionised, enabling almost instantaneous objective identification of odours. Detected odours could be matched with desired and undesired odours stored in an internal database.

## ■ Conclusion

Join the following thoughts: marbling evaluation (whether invasive or not); fat firmness evaluation through fat melting point; odour emitted from melting fat; odour detection and identification by next generation electronic nose; close relationship between odour and flavour, and between fat composition and flavour. It should be quite apparent that there is potential for identifying carcasses with superior eating properties, while still on the kill floor. From there, it is only a small step to expand the current reward system for yield production to include a component to also reward producers for the production of flavourful pork.

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