As part of the on-going effort to maintain and enhance Canadian pork’s reputation for high quality, a new gene test is being applied to Canadian AI boars. About 300 boars will be tested in February 2001 for the RN gene mutation, which research has shown to cause losses of about $12 per carcass in hogs carrying the mutant gene. Research so far has found high incidence of the gene in Hampshire, and low incidence in Duroc, Yorkshire and Landrace breeds. This study will provide the broadest sampling ever done in the Canadian population, and allow the industry to develop a plan for dealing with the gene.

What is the RN gene?

The economic losses associated with genes that have negative effects on pork quality can be considerable. Many of those involved in the pork industry will have already heard of the halothane gene and of its effect on meat quality through the production of pale soft exudative (PSE) meat. Once the gene was discovered, testing for the halothane gene became simpler, and many breeders and breeding companies have now removed it from their breeding lines.

There is another gene which has a large negative effect on meat quality. This is the RN or Napole gene, also known as the “acid meat” gene or the “Hampshire effect”. The gene exists predominantly in the Hampshire breed, but has also been found in other breeds. It is a mutation that results in a dramatic increase in the glycogen content of various muscles (about 70%). As a result, the meat tends to have a lower pH after 24 hours (it is “acid”), a higher drip loss, and studies on processed hams from RN animals have shown a much higher cooking loss (7-9% or about 3 standard deviations from the average of normal animals). The RN gene therefore creates a lack of uniformity in meat quality when there is a mix of pigs with and without the gene.

The gene also has some positive effects, such as a slightly increased loin eye area (2-3 cm²) and decreased backfat (1-2 mm). However, on the whole, the costs associated with the gene are substantially greater than its benefits. Several studies have estimated the average cost of the RN gene to the pork industry at about $12 per carcass.

Unlike the halothane gene, which is recessive in its effect on stress and intermediate in its effect on meat quality, the RN gene appears to be completely dominant. This means that if a boar carries two copies of the RN gene, the carcasses of all the progeny will be affected. If it carries one copy of the gene, an average of half the progeny will be affected.

For these reasons, several European countries have been working to eliminate the gene from their lines, particularly those that contain Hampshire blood. This work is becoming much easier now, because after about 10 years of research (in France, Sweden and Germany), the gene has finally been identified and a genetic probe developed.

The RN gene mutation causes high glycolytic potential.
Source: W.J.Meadus and R. MacInnis, 1999, Meat Science
What is the situation in Canada?

In 1999, Dr. J. Meadus, and R. MacInnis, at the Lacombe Research Centre, estimated the frequency of the RN gene in a sample of pork chops purchased from retail outlets in Alberta, by measuring the glycolytic potential of the meat. As the gene probe was not yet available, this was an indirect but reasonably accurate way to test for the gene. They found that about 25% of samples had an excessively high glycolytic potential and were probably carriers of the RN gene. One possible explanation for this relatively high frequency might be the use of synthetic lines in the pedigree of many of the pigs that are produced in Alberta, especially if these lines contain Hampshire blood.

On the other hand, preliminary results from tests carried out in Quebec, based on glucose levels, seem to indicate that the frequency of the RN gene in the Canadian Duroc, Yorkshire and Landrace breeds is relatively low (less than 3%). One would therefore expect progeny from Duroc boars and Yorkshire x Landrace sows to have a much lower frequency of the RN gene than the pigs tested in Alberta. Combined with the known superiority of the Duroc breed for traits such as marbling and color, these results suggest that a cross between these well-established breeds produces progeny with superior meat quality.

What are we doing about it?

To obtain more information on the frequency of the RN gene in Canadian breeds and, if possible, confirm these findings, the Canadian Centre for Swine Improvement Inc (CCSI) in cooperation with Drs. Alain Houde and Claude Gariepy of the Centre for Food Research and Development have planned an across-Canada study whereby the boars in AI studs participating in the Canadian Swine Improvement Program will be tested for the RN gene. To keep the number of boars at a reasonable level, only those that are used for the production of nucleus replacements will be tested. However, these are the boars with the largest impact on future generations of breeding. About 10 AI units across Canada will be participating with about 90-100 boars tested for each of the Duroc, Yorkshire and Landrace breeds. In addition, about 70-80 Hampshire animals will be tested for reference, since the frequency of the RN gene in this breed is expected to be high. The collection of blood samples will take place between February 1 and February 21, 2001.

Once the results of the study are known, it will be desirable to establish a program for continuous testing of the RN gene. If the study confirms that the frequency of the gene is low in the Canadian Duroc, Yorkshire and Landrace breeds, the program will be designed to ensure it remains so in future. Then, only a limited number of animals would have to be routinely tested (those at the top of the breeding pyramid) to ensure that commercial pigs resulting from crosses among these breeds do not carry the RN gene. The pork industry as a whole may have to coordinate its efforts to develop the testing program and obtain a licence for commercial testing of the RN gene. However, the required investment would be small compared to the benefits of preserving the superior quality of Canadian pork.

For more information contact:

Canadian Centre for Swine Improvement  
Central Experimental Farm  
Building 54, Maple Drive  
Ottawa, Ontario, Canada K1A 0C6  
Tel: (613) 233-8872  Fax: (613) 233-8903  
email: info@ccsi.ca  internet: www.ccsi.ca

Or visit the on-line newsletter at:  
http://www.ccsi.ca/newsletters/