

A Summary for Genetic Mitigation of Greenhouse Gas

1. Role of Genetic selection for greenhouse gas (GHG) mitigation

Genetics can contribute to reducing GHG emission in two ways according to the information we have so far:

1.1 Genetic improvement of animal production efficiency can reduce GHG emission. Genetic selection for high feed efficiency leads to reducing nutrient excretion in feces, and therefore reducing GHG emission. An improvement of 0.1 point of feed efficiency results in a 3.3% reduction in nutrient excretion in swine, assuming similar growth rate and nutrient retention (Todd See 2003).

1.2 GHG emission and fecal chemical combinations may be genetically selected directly. Several studies (Herd et al. 2002; Waghorn et al. 2002; Golovan 2001) showed that genetics plays an important role in GHG emission directly from livestock and chemical compositions of animal feces.

2. Features of genetic mitigation of GHG emission

2.1 Apart from feed efficiency, genetic improvements in different traits such as growth rate, lean yield, litter size, piglet survival, sow longevity etc. can also serve the objective of reducing GHG emission. Increasing the efficiency and profitability of swine production are usually consistent with the goal of reducing the GHG emission.

2.2 Comparing with engineer methods for GHG mitigation, genetic method is very economical. Improved feed efficiency will be kept and transmitted to future generations. Genetic improvements will be accumulated from generation to generation for future benefit.

3.3 Reducing nutrient excretion is a fundamental solution for reducing greenhouse gas emission from swine. Genetic selection together with feed management are two important tools producers can use to improve rate of gain on less feed (Dr. John Basarab, a researcher specializing in livestock nutrition with AAFRD in Lacombe) and reduce nutrient excretion.

3. Actions needed to take for genetic mitigation

3.1 Keeping up the current genetic progress: Swine producers should keep up the current genetic progresses. Canadian Swine Improvement Program makes considerable genetic improvement every year. During the last ten years, Canadian Swine Improvement Program improves feed efficiency by -0.221 kg per kg growth, growth rate by -14.9 days, lean yield by 1.49% and litter size by 1.75 pigs at commercial level. It saves 18 kg feed per market hog. This not only means higher profitability, but also means tremendous reduction in greenhouse gas emission, considering the volume of Canadian swine production. So, keeping up the current progress of genetic improvement is an important step to take for instant mitigation of GHG emission.

3.2 Research on definition of breeding objective: Current swine improvement programs are increasing livestock production efficiency and therefore reducing greenhouse gas emission from animal sources. However, to achieve maximum genetic progress requires proper economic weights for the component traits in the breeding objective. Current breeding objective has considered the direct economic gain per unit trait improvement. The environmental costs and societal benefits associated with swine production have not been considered. See (2003) raised the question of breeding objective definition related to the mitigation of environmental risk. With the current public and legislative concerns over environmental risk, research for checking breeding objective definition is needed.

3.3 Research on direct selection of feed efficiency itself: In many breeding programs, feed efficiency of swine is indirectly selected with information on growth rate, back fat depth, etc. Direct measurement of feed intake will increase the selection accuracy of feed efficiency. Dave Kirschten showed (2004, Brian Kennedy Memorial Colloquium) that the individual feed consumption can be well predicted from the group feed consumption. There is no need to measure individual feed intake. This prediction technique will make direct selection of feed efficiency easier.

See (2003) pointed out that quantitative genetics approaches have been very successful in improving feed efficiency and its components. The heritability estimated for feed efficiency is 0.30. Several genes including IGF2, PIT1 and MCR4 genes, have been identified to contribute to efficiency of lean growth and reducing nutrient excretion (See 2003).

References

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