Project number: 5366
Funding source: Teagasc
Date: August, 2012
Project dates: Jan 2005 – Dec 2007

Feeding and management of high performing sows in pregnancy and lactation

Key external stakeholders:

Pig Producers, Feed Industry Personnel, Teagasc Pig Advisors

Practical implications for stakeholders:

Improvements in genetics have resulted in sows with higher milk production and maintenance requirements. The results from this project demonstrate that liquid feeding curves for lactating sows can be increased by 30% and where dry feeding, ad-libitum feeders should be used to increase lactation feed intake so that

- lactation weight loss is reduced
- litter performance is improved
- subsequent litter size is increased

During the critical embryonic period, a foetus is highly responsive to environmental factors such as nutrition. This project found that increased maternal nutrition alters skeletal muscle phenotype in the offspring by changing fibre-type proportions but does not influence offspring growth or feed conversion efficiency.

Main results:

Feed intake during lactation can be increased by as much as 30%.
Increasing feed allocation from day 25-80 of gestation had minimal effects on offspring growth and feed efficiency.
Increasing feed allocation between day 80 and 112 of gestation improved subsequent farrowing rate.

Opportunity / Benefit:

Sow and offspring performance can be improved by increasing feed intake in late gestation and during lactation. Where sows are fed 30 MJ DE per day in gestation this can be increased to 45 MJ DE per day between day 80 and 112 of gestation to increases subsequent farrowing rate. Commonly used lactation feed curves are frequently too low and in the case of our study could be increased by 30% to increase lactation feed intake.

Collaborating Institutions:

RVC, London

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1. Project background:

Sow productivity in Ireland has failed to keep pace with improvements seen in other countries. Nutrition and management play a huge role in sow fertility and prolificacy. In particular, body reserves of fat and protein at each farrowing are very important. Current recommendations are based on data dating from the 1970s and 1980s, when sows had greater fat reserves, litter size was smaller and annual output was lower. Current feeding levels in pregnancy and lactation may be inappropriate for the modern high producing sow. The objectives of this study are: (1) to document current sow management practices and their relationship to body weight and condition, sow longevity and productivity; (2) to examine nutritional and management factors which could contribute to increasing sow output, namely feeding of pregnant and lactating sows. Criteria to be assessed include sow feed intake, changes in body weight, body condition and backfat, piglet birth weight, piglet weaning weight, piglet viability, post weaning growth rate, carcass composition, muscle histology.

2. Questions addressed by the project:

What is the appropriate feed curve for lactating sows when liquid fed?
Can *ad-libitum* feeders be used to increase feed intake in lactating sows?
What is the effect of increasing feed allocation during three different time periods of gestation on the muscle fibre phenotype in the offspring and on offspring growth and feed efficiency?
Is there a benefit from increasing the feed allocation for sows in late gestation?

3. The experimental studies:

Two lactation experiments each involving 75 sows were conducted to determine the optimum lactation feed curve for liquid fed sows. Another lactation experiment involving 75 was conducted to determine if *ad-libitum* feeders could be used to increase lactation feed intake where dry feeding is practiced and to compare the results achieved with liquid feeding using the optimum feed curve identified in the first 2 experiments.

A gestation study examined the effect of increased sow feed levels during early, mid and late gestation on sow and offspring performance. Sows (n = 238) were assigned to the following gestation feed treatments: 2.3 kg/d throughout gestation (C), increased feed allowance to 4.6 kg/d from gestation d 25 to 50 (E), from gestation d 50 to 80 (M) and from gestation d 25 to 80 (EM). A fifth treatment increased feed allowance to 3.5 kg/d from gestation d 80 to 112 (L). Backfat depth and body weight of sows was recorded at d 0, 25, 50, 80 and 110 of gestation and at weaning. Lactation feed intake and reproductive performance of sows were recorded. Muscle fibre analysis was performed on progeny at the RVC and progeny growth and feed efficiency was followed through to slaughter at ~100kg with pigs penned as individuals and in groups.

4. Main results:

Mean daily lactation feed intake was increased from 78 MJ DE / day to 105 MJ DE /day by increasing the standard liquid feed curve (25 MJ DE /day at farrowing to 98 MJ DE / day by day 21 of lactation) by 30% or by providing additional dry feed along with the standard liquid feed curve. Where the higher curve is used, feed should be provided in 3 splits (morning, mid-day and evening). In this case personnel should be prepared to monitor troughs (1 hour after each feed) and when significant quantities of feed are left, individual valves should be "minused". *Ad-libitum* dry feeding resulted in mean daily feed intakes which were intermediate between those achieved on the standard and the improved liquid feed curves.

The large gestation study definitively showed that increasing feed allowances at various gestation time points, did not benefit growth and feed efficiency in offspring compared to the recommended gestation feed allocation of 2.3 kg/d. Even the lighter littermates who would have been expected to benefit most did not benefit from increased maternal feed intake. However, nutritional intervention at d 50 to 80 may aid in the reduction of intra litter variation in piglet birth weight. In addition, increasing feed allowance at d 80 to 112 of gestation increased subsequent farrowing rate. Increased maternal nutrition altered skeletal muscle phenotype in the offspring by changing fibre-type proportions, leading to an increased oxidative capacity due to an increase in Type IIA fibres. No change in total muscle area, total muscle fibre number, or fibre cross-

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sectional area was observed. There were also some alterations in gene expression in response to increases in gestation feed intake.

5. Opportunity/Benefit:

Arising from this project we have more precise guidelines on feeding sows during gestation and lactation so that both sow and offspring performance can be maximised.

6. Dissemination:

Main publications:

Lawlor, P. G. and Lynch, P.B. (2005). 'Effect of sow feed intake during gestation on the growth performance of progeny to slaughter'. *Archives of Animal Breeding* 50: 48-55

Lawlor, P.G. and Lynch, P.B. (2005). 'Management interventions to keep piglets in large litters alive'. *Irish Veterinary Journal* 58(11): 640-645

O'Connell, M.K., Lynch, P.B., Bertholot, S., Verlait, F. and Lawlor, P.G. (2007). 'Measuring changes in physical size and predicting weight of sows during gestation'. *Animal*. 1(9): 1335-1343

McNamara, L.B., Giblin, L., Markham, T., Stickland, N.C., Berry, D.P., O'Reilly, J., Lynch, P.B., Kerry, J.P. and Lawlor, P. G. (2011). 'Nutritional intervention during gestation alters growth, body composition and gene expression patterns in skeletal muscle of pig offspring'. *Animal* 5: 1195-1206

Markham, T.C.W., Latorre, R.M., Lawlor, P.G., Ashton, C.J., McNamara, L.B., Natter, R., Rowlerson, A., and Stickland, N.C. (2009). 'Developmental programming of skeletal muscle phenotype/metabolism'. *Animal* 3: 1001-1012

Lawlor, P.G., Lynch, P.B., O'Connell, M.K., Hiet, C. and Mattras, D. (2007). 'Manipulation of liquid feed curves during lactation to increase sow feed intake and its impact on sow weight and back-fat and piglet performance to weaning'. In: *Book of Abstracts of the 58th Annual Meeting of the European Association for Animal Production*, p.325.

Lawlor, P.G., Lynch, P.B., O'Connell, M.K., Hiet, C. and Mattras, D. (2007). 'Manipulation of liquid feed curves during lactation to increase sow feed intake and its impact on sow weight and back-fat and piglet performance to weaning'. In: *Proceedings of the Agricultural Research Forum*, 12-Mar-2007, p.116

Lawlor, P.G., and Lynch, P.B., O'Connell, K.K., Karunaratne, J.F., Ashton, C., McEntee, G.M. and Stickland, N.C. (2006). 'Feeding and management of sows during gestation and its effect on muscle fibre, fat level, growth rate and carcass quality of progeny'. *Archives of Animal Breeding* 49: 56 (Abstract)

McNamara, L., Lawlor, P.G., Lynch, P.B., O'Connell, M.K. and Stickland, N.C. (2007). 'The influence of increasing energy intake during gestation on litter size, piglet growth and within litter variation from birth to weaning'. In: *Book of Abstracts of the COST 925 working group meeting*. September 6th-7th, Viborg, Denmark, p.7.

McNamara, L., Lawlor, P.G., Lynch, P.B., O'Connell, M.K. and Stickland, N.C. (2007). 'Influence of five gestation feeding regimes for sows on lactation feed intake, lactation weight loss and subsequent farrowing rate and litter size'. In: *Book of Abstracts of the COST 925 working group meeting*. September 6th-7th, Viborg, Denmark, p.8.

Lynch, P.B and Lawlor, P.G., (2007). 'Factors affecting voluntary feed intake in the lactating sow'. In: *Book of Abstracts of the 58th Annual Meeting of the European Association for Animal Production*, p.327.

Lawlor, P.G., Lynch, P.B., O'Connell, M.K., McNamara, L., Reid, P. and Stickland, N.C. (2007). 'The influence of over-feeding sows during gestation and piglet birth weight on piglet growth performance to slaughter'. In: *Book of Abstracts of the 58th Annual Meeting of the European Association for Animal Production*, p.50.

Lawlor, P. G., Lynch, P.B., O'Connell, M.K., Reid, P.T. and Stickland, N.C. (2006). 'The influence of over feeding sows during gestation, piglet birth weight and gender on pig growth performance to slaughter'. In: *Cost 925*, Turkey, 21-Sep-2006, 1

McNamara, L.B. (2010). 'Feeding and management of the high performing sow in pregnancy and lactation, and growth and development of progeny'. *Ph.D* Royal Veterinary College, London 191pp

McNamara, L.B., Lawlor, P. G., Lynch, P.B., O'Connell, M.K. and Stickland, N. (2007). 'The influence of increasing energy intake during gestation on litter size, piglet growth and within litter variation from birth to weaning'. In: B*ook of Abstracts of the 58th Annual Meeting of the European Association for Animal Production*, Dublin, Ireland, 01-Apr-2007, 47

Mcnamara, L.B., Lawlor, P. G., Lynch, P.B., O'Connell, M.K. and Stickland, N.C. (2007). 'Influence of five gestation feeding regimes for sows on lactation feed intake, lactation weight loss and subsequent farrowing rate and litter size'. In: *Proceedings of the Agricultural Research Forum, Tullamore*, 12-Mar-2007, 114

O'Connell, M.K., Lynch, P.B. and Lawlor, P. G. (2007). 'Monitoring of physical characteristics and productivity of multiparous sows'. In: *Proceedings of the EAAP*, Dublin, Ireland, 27-Aug-2007, 282

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O'Connell, M.K., Lynch, P.B. and Lawlor, P. G. (2007). 'Monitoring of physical characteristics and productivity in multiparous sows'. In: *Agricultural Forum*, Tullamore, 12-Mar-2007, 120
O'Connell, M.K., Lynch, P.B., Berthelot, S., Verlait, F. and Lawlor, P. G. (2007). 'Physical changes in sow body size during gestation'. In: *Agricultural Research Forum*, Tullamore, 12-Mar-2007, 57
O'Connell, M.K., Lynch, P.B., Bertholot, S., Verlait, F. and Lawlor, P. G. (2007). 'Physical changes in sow body size during gestation'. In: *Proceedings of the EAAP*, Dublin, 27-Aug-2007, 281
O'Connell, M.K., Lynch, P.B., Bertholot, S., Verlait, F. and Lawlor, P. G. (2007). 'Predicting body weight of sows in gestation from morphometric measurements'. In: *Proceedings of the EAAP*, Dublin, 27-Aug-2007, p. 282
McNamara, L., Lawlor, P.G., Lynch, P.B., O'Connell, M.K. and Stickland, N.C. (2007). 'The influence of increasing energy intake during gestation on litter size, piglet growth and within litter variations from birth to weaning'. In: *Agricultural Research Forum*, Tullamore, 12-Mar-2007, p.45
Lawlor, P. G., Lynch, P.B., O'Connell, M.K., McNamara, L.B., Reid, P. and Stickland, N.C. (2007). 'The influence of over-feeding sows during gestation and piglet birth weight on piglet growth performance to slaughter'. In: *Proceedings of the Agricultural Research Forum*, Tullamore, 12-Mar-2007, p 115.
O'Connell, M.K., Lynch, P.B., Bertholot, S., Verlait, F. and Lawlor, P.G. (2007). 'Predicting weight of sows in gestation from morphometric measurements'. In: *Agricultural Research Forum*, Tullamore, 12-Mar-2007, p.119.
McNamara, L.B., Lawlor, P. G., Lynch, P.B., O'Connell, M.K. and Stickland, N.C. (2007). 'Influence of five gestation feeding regimes for sows on lactation feed intake, lactation weight loss and subsequent farrowing rate and litter size'. In: 'Book of Abstracts of the 58th Annual Meeting of the European Association for Animal Production', Dublin, Ireland, 01-Apr-2007, 284

Popular publications:

Clarke, S. (2008). 'The two tonne sow!!'. In: *Teagasc Pig Farmers Conference,* Moorepark, 20-Oct-2008
Lawlor, P. G. (2006). 'Litter size - what factors are limiting it?'. In: *Teagasc Pig Farmers Conference*, Kilkenny, 16-Oct-2006, p52-63
Lawlor, P. G. (2005). 'Selecting Gilts for Increased Sow Longevity'. In: *Teagasc Pig Farmers Conference* - 17th, Longford, Kilkenny & Fermoy, 17-Oct-2005, p.39-44
Lawlor, P. G. (2004). 'Keeping piglets in large litters alive'. In: *Teagasc Pig Farmers Conference*, Kanturk, Kilkenny, Longford, 11-Oct-2004, p62 - 73
Lawlor, P. G. (2001). 'How well are your sows milking?' *Teagasc Pig Newsletter* October 2001, 4(4)
Lawlor, P. G. (2008). 'Increasing sow feed intake during lactation'. *TResearch* 3(4): 22-23

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