2016 Group Sow Housing Seminar
Capturing Potential Through Nutrition: Feeding Group Housed Sows

Quincy Buis, M.Sc. and Laura Eastwood, Ph.D.

(Edited for clarity and conciseness)

Quincy: I'm very excited to have the opportunity to talk to you today about nutrition for group housed sows during gestation.

Before we talk about nutrition we need to talk about our objectives, because I think it's very important to always have a goal in mind.

(Slide 2) What is our goal when we're feeding sows? We want to increase sow lifetime productivity. We do this by optimizing the number of healthy pigs per sow per lifetime, which is achieved by increasing the number of pigs weaned per litter, increasing the size and uniformity of those pigs, decreasing the non-productive days of the sow, and increasing the reproductive lifetime of each sow. This is nothing new. But we have to achieve all this while considering our feed costs, maintaining good sow welfare, good sow health and considering reducing the nutrients into the environment.

(Slide 3) We are already well on our way to feeding sows productively. If you look over the last 10 years you can see that we've increased by almost two pigs per litter. This is impressive. And many sows in Ontario are now approaching and surpassing 30 pigs weaned per sow per year.

(Slide 4) But when you increase the number of pigs you can't underestimate the value of the size of them as well. This is a great example. When you look at the birth weight of individual piglets on their total body weight at days 156 days of age, you can see that the small piglets were still the small pig later in life, and the big piglets were the big pigs. So this is where gestation nutrition becomes a little bit more important. We want to make sure that not only are we getting more pigs, but that they are a good sized pig.

(Slide 5) The key to managing sows is to minimize the sow body weight and body condition changes throughout their reproductive lifetime. You're going to have some changes; your sow is going to get pregnant and she's going to gain weight, around 30 to 40 kilograms of weight just related to her pregnancy. That's the mammary, the uterus, and that's the piglets growing.

But then your sow also needs to grow towards maturity. It's often forgotten that your sows or your gilts are not a mature animal until sometime after the third or fourth parity. So she still needs to be growing on her own to reach her full potential. Plus, you're going to have to recover the losses from her previous lactation. We want to avoid is over conditioning; nobody wants over conditioned sows going to the farrowing house. For lactation, you want to make sure that all this hard work you put in isn't lost if she's losing all that weight during lactation.

(Slide 6) I'm going to focus right now on the body condition or the fat content of the sow. This graph is the lifetime body fat content of a sow. You can see at first she's weaned here. Then she begins to grow, she's bred, she goes through her gestation and she farrows. She loses body fat, and then she gains it again, and she farrows, and she melts it off and she gains it again.

(Slide 7) Our overall goal should be to try and flatten this line out as much as possible. This would increase the lifetime productivity of the sow by increasing the number of parities you're going to get from each sow. Not going through these giant ups and downs is less metabolic stress on the animal.

(Slide 8) You have to be careful because you don't want your sows over conditioned going into the farrowing house, because this can be just as problematic. This slide shows the impact of increased back fat at farrowing. Increased back fat led to reduced lactation feed intake, which resulted in a larger back fat loss throughout lactation. Research shows that if they lose more back fat during lactation that it will take longer to be serviced, or return to heat, and then there's a negative effect on the subsequent litter size. We have to pay very close attention to our sows going into the farrowing house.

(Slide 9) Our two most important nutrients are energy and protein, or amino acids. But you also have to consider other issues such as sufficient intake in vitamins and minerals, and the use of fibre to induce satiety, which Laura will talk about. I'm going to talk about the big two: energy and amino acids.

Now, you always hear it said that we need to feed sows their requirements. Requirements for this, requirements for that… But I think it's time to pull back the curtain a little bit and show you where these requirements are coming from so that they don't just seem like numbers pulled out of a book somewhere.

(Slide 10) You have a diet, and this diet is going to supply the energy and amino acids. When a sow consumes it, the first thing she does is meets her own needs for maintenance. Maintenance is her keeping herself alive and well without any net gain or loss. But it's not the same for every animal. Maintenance is affected by body weight, so a larger sow has a larger maintenance requirement. It's also affected by genetics. Sows from different lines aren't all going to have the same maintenance requirements.

Maintenance is also impacted by things we can control, like the environment. If a sow is cold, or if she's hot, or if she's above or below her critical temperatures, she's going to need more energy to maintain her internal temperature, which is costly. And then there's housing systems. If a sow is running around or if she's lying because she doesn't want to run around it changes her requirements. The more active a sow the more nutrients she requires just to achieve maintenance. And maintenance is the largest determinant of sow requirements. And it's important to remember that it's not the same for each individual sow.

(Slide 11) Once she's achieved maintenance she's then got to worry about her conceptus. She wants to make sure everything is alive and well and growing until farrowing. But her needs for that conceptus aren't the same at day one and day 114. At the beginning they're rather low, and it's just the small embryos that are implanting and the beginning of placenta formation. Then around day 20 to day 70 of gestation that placenta really begins to develop. And the placenta is developing to create a place for those piglets to grow and thrive, and that requires nutrients from the diet. And that's also the time when the muscle fibres start developing in the pigs. But this is where nutrient requirements really start to ramp up. Around day 50 there's an exponential increase in the growth of those fetuses. So really in the last month of gestation is two-thirds of the growth of that entire conceptus. As you can see on this graph here, it just takes off.

So that's what I really want to point out is she doesn't need the same thing all along. She needs those nutrients at the end when the fetuses are really growing.

(Slide 12) Once she's met the needs for the conceptus, she now worries about herself. Any amino acids left over are used for protein deposition and then any leftover energy after that is used for lipid deposition. These are the nutrients left over for the sow to continue growing her body towards maturity. And this is what’s left over so that she can recover any losses. Both of these contribute to the total body weight and body condition of the sow.

But, under certain circumstances, in late gestation when those needs are really high, if the sow is not getting everything she needs from the diet, she may go into a negative balance before she farrows, which means she's going to be mobilizing her lipid stores, and to a certain extent her protein stores to meet the needs of maintenance and of the conceptus, because those are more important to her.

(Slide 13) So far I haven’t told you what her requirements are. Using this flow diagram, researchers use complex math and generate the NRC sow model. This NRC sow model is used to then give the requirements for sows. And it's used by researchers and nutritionists alike. You can put in the amount of feed you give the sow, some anticipated measure of the sow performance, such as litter size and parity, and it gives you how much she's going to grow and her requirements for amino acids, calcium and phosphorus amongst other things.

(Slide 14) Now that you understand these requirements I want to talk about them a little further. At first I'd like to look at lysine, which is a good indicator of protein because it's often the first limiting amino acid. I've broken it into early and late gestation, parity one, two and four plus. For early to late gestation in a first parity sow you can see that there's a 30% increase in lysine requirements. And then from early to early, first parity to four plus parity you can see that there's a 40% reduction in lysine requirements. What this means is if you're feeding one gestation diet, you're actually missing out on a near 70% reduction in requirements. It's a good first thought when you're thinking about moving

towards phase or blend feeding of sows, feeding individual sows within parity or groups of sows across parities.

(Slide 15) Now we add energy into the equation. This graph comes from a modified NRC model that was created during my thesis work where we made lipid deposition constant. Because if there's constant lipid deposition to achieve an ideal body condition, it means she's meeting her requirements for everything else before that. The green line represents the energy, and you can see that from day 1 to day 114 in a first parity gilt there's a 45% increase in energy requirements. But now if you look at lysine broken down to individual day of gestation you can see that from day one to day 114 there's a near 200% increase in requirements. The take-home message of this slide is that energy and protein requirements do not change at the same rate throughout gestation. So simply increasing the same feed by a different amount may not be satisfactory in meeting the ideal requirements of each sow.

(Slide 16 and 17) There are multiple different ways of feeding sows. I want to talk about electronic sow feeders. Technology is evolving. I hear a lot of stories about how ESFs won't work, about how producers put them in 20 years ago and ripped them all out because they were garbage. Well 20 years ago I didn't have a phone in my pocket that could FaceTime someone in Korea in 10 seconds. Technology is evolving. And I think that we are moving towards real-time linking of individual sow performance to her feeding strategy. This is already being done in other industries, such as the dairy industry, where the cow comes in through the milking robot and she receives a different amount of concentrate depending on where she is in her lactation. In some instances they even have scales right there. This could be the future we're moving to in a dream world a few years from now.

But what do we know? If we meet the nutrient requirements more closely for individual sows over time, we know we can reduce feed costs and nutrient losses into environment. The literature has proven this. But we don't know the effects on long-term sow productivity and longevity, or on sow welfare.

(Slide 18) ESFs are not the only way. Simple group sow housing can also work. You need to match your group housing system to your management style and to what your barn staff wants to work with, because your management is what's going to make everything work at the end of the day. Simple group housing systems can work as long as you respect the amount and quality of space and plan and manage your grouping size. When you do that you lose the opportunity to feed and manage individual sows, but you can adjust the amount of feed to individual pens which is still better than nothing. Eventually you could even have multiple diets and feed certain pens the diet matching their stage of gestation.

(Slide 19) There are lots of different feeding strategies, and I'm not going to go through them in detail because they're written down here and you already probably know them.

(Slide 20) I do want to talk about bump feeding a little bit, because it's very common and it's very simple to do. All it is, is increasing the amount of feed. But you're then increasing the amount of amino acids and energy at the same ratio. And as I showed, this might not be ideal and can lead to over conditioning of animals. I think it's just something to consider closely and to give some thought to because there's lots of people that show that it does have effects and lots of people say that it doesn't have effects. But it always comes at a cost. But it usually does show increases in body weight gain in those sows.

(Slide 21) Now I'm going to take a brief moment to talk about what I did for my thesis. What we did was we blended two feeds directly at ESF station. We had one really high protein feed and one really low protein feed, and we could blend them at varying rates on each individual day of gestation for each individual sow based on her body weight and what the model predicted she needed.

So that's what you see here. Those two shaded areas represent the blend of high and low protein feeds in comparison to her requirements. This is cutting edge, meeting her requirements exactly. We found that sows that were precision fed grew faster in late gestation when the needs of the conceptus were higher.

Unfortunately we only did it for gilts as I had to finish my master's and graduate at some point, and leave school unfortunately. The validation of this concept requires more work. There is talk at the university to hopefully continue this work and do the multi-parity approach to see the long-term effects on each sow.

(Slide 22) So, this is the end of my part, and just to summarize so far. Our goal, if we want to increase sow lifetime productivity, we have to remember that requirements of sows change with size, parity and stage of gestation. And these variations between sows can be rather large. Energy requirements can vary by half a kilogram for each sow and then when we consider protein we've got to remember there's high protein requirements in late gestation and lower protein requirements in higher parity sows.

I just wanted to stimulate some thought and have you consider the benefit of phase and parity segregated feeding and the use of electronic sows feeders precision feeding.

Thank you.

Laura: So, I have a little bit of a different component in this presentation. So I'm going to talk about some important considerations for group housing systems and some key nutritional aspects that we need to consider. And then I'm going to talk about some ways that you can actually try and capture some added potential in your feeding systems.

(Slide 23) The consumer perspective is that the shift to group sow housing will improve sow welfare. And that may be the case, but we also know that the improved welfare from the increased freedom of movement can be quickly

erased by aggression that we know may happen. Aggression at or around feeding can lead to injury, lameness, and decreased performance of these animals. So we want to try and avoid that as much as possible, which is an area I'm going to talk about. It's also important to note that group housed sows have increased activity levels when they're out and they're moving around. So that may alter their actual nutritional requirements as well.

So for this talk, the key nutritional aspects that I'm going to go through include reducing aggression, feed allowance and bone development and strength, because it's important for these sows that are out and walking around a lot more.

(Slide 24) Sows typically are hungry. We know that. Over feeding of gestating sows is an issue regardless of the system they're in, whether it's stalls or groups. Over feeding sows reduces productivity and longevity, this is something we've known for a long time, and because of that we restrict the feed of our sows. Feed restriction can lead to abnormal or stereotypic behaviour and this is also an animal welfare concern. In stalls we may not see it to the same extent on the aggression side of things that we would see in the group settings. Trying to make the sows feel like they're not hungry anymore could help reduce aggression.

So how do we increase satiety? How do we make them feel more full and decrease these abnormal behaviours? The key is fibre. There are three different aspects we need to look at with fibre; the amount of fibre in the diet, the type of fibre in the diet and the physical characteristics of the fibre in the diet.

(Slide 25) In the EU a typical gestation ration will contain between 9 and 12% crude fibre, and in some cases as high as 20%. Or they take their regular gestation diets and supplement them with additional fibre sources. But there are two things that are more important than the crude fibre content of the diet, than the total fibre content. The first one is the physical size. The size of the particle will actually affect her feeling of satiety. More coarsely ground material is going to make her feel more full than a really fine particle of the same fibre would.

The second point is that the balance between fermentable fibre and crude fibre is important. You might have heard of non-starch polysaccharides (or fermentable fibre). These provide a slow consistent release of energy throughout the day and they help with a longer term satiation. So instead of the sows getting ups and downs in their blood glucose levels, it's more of a plateau and it helps them feel less hungry for a longer period of time. In order to account for fermentable fibre we need to formulate diets using the net energy system.

(Slide 26) This table here shows some common pig feed ingredients. We've got corn, soybean meal, barley, wheat shorts, DDGS, sugar beet pulp, soybean hulls and alfalfa meal. The three bottom ones here are very high fibre ingredients. So I've got the crude fibre content, you can see the corn is about two percent crude fibre. Some of these more fibrous ingredients are 20 or above in terms of their crude fibre content. I'm not going to talk about the ADF and the NDF just in

terms of time, but those are lab measures of fibre content. I am going to talk about this NSP, the non-starch polysaccharide fraction. This is basically the fermentable fibre portion of the ingredient and it's what the gut microbes are going to actually ferment and turn into an energy source for the animal. You can see as we go lower on this list, our NSP fraction gets higher. Sugar beet pulp, soybean hulls and alfalfa meal contain 60 to 70 percent of their fibre fraction as a non-starch polysaccharide.

The reason that I have sugar beet pulp highlighted is because of its fermentability, the ability of the microbes to ferment that product. Although soybean hulls and alfalfa meal have higher levels of NSP, they're not as fermentable. For sugar beet pulp, 85% of the 70% NSP fraction is fermentable and available as an energy source to the animals, which makes it a very good ingredient to help the animals feel full.

(Slide 27) These are results from a study in 2003 where they fed a control diet and a diet containing about 38% sugar beet pulp. The diets were formulated to have the same energy content. There was no difference in the feed intake values, and the data was collected over two parities. A couple of interesting things to note; in both parity one and parity two the live-born piglets were higher in the sows that were fed the sugar beet pulp in their gestation diets. Non-feeding oral activities and sham chewing, evidence of abnormal behaviours, were very much reduced in the sows that were fed the sugar beet pulp diet. There was no effect on the number of stillbirths or litter birth weights or any of those other factors. So it does work.

(Slide 28) So how do we feed fibre practically in our barns? Well fibre can be included in multiple ways. It can be included straight into the diet. You can make pellets out of the sugar beet pulp, things like alfalfa meal can also go into the diet, and straw or hay can be fed directly to the animals, which can be done using the hay racks or straw racks, or in the form of cubes.

(Slide 29) So that's enough about feeling full, let’s talk about increasing feed allowance. Group housed sows potentially have an increased energy requirement because their exercise and activity levels may be higher. I can't give you an exact value to say your barn is going to need to increase your feed allowance by 10 or 20%. It's very hard to predict because not every sow and not every system is the same. It's going to depend on the body condition of the animals. It's going to be dependent on the expected performance of the animals. It's going to be dependent on the animals' temperament, on housing conditions. The layout of your barn is going to have a big effect. How much walking are they going to have to do to get around to the feeders and to the drinkers? The thermal environment and the overall management of your system play a role too. What I can say is if you have over conditioned sows, putting them into a group setting, the exercise will help them and you will be able to get their body condition under control a little bit better.

The best thing you can do is monitor your daily feed allowance and monitor your body condition scores on a regular basis. The more frequently you do this, the more accurately you're going to be able to determine how much feed those sows need. Because every sow is going to be different.

(Slide 30) Do group housed sows have increased requirements for calcium and phosphorous for bone development and strength compared to stall housed sows? Do they need more calcium and phosphorous because they are out and walking around?

Recently, a research study at the Prairie Swine Centre was conducted to determine whether or not the NRC values that we have, the book values that all the nutritionists use, are adequate for group housed sows? Without going into all of the details due to time, the researchers found that yes, the current NRC values are adequate for group housed sows. One interesting thing to note was that regardless of their diet, the sows that were in groups had an increase in the number of piglets born alive versus the ones in stalls. Based on this information, there may be some evidence for increased performance potential with increased calcium and phosphorus, but there needs to be more research to be able to determine that. It's just something to keep in mind that yes, our NRC values are good, but there may be some added potential there down the road.

Slide 31: How are we going to capture potential through nutrition? Well, the first thing to do is remember the importance of your body condition scoring system. In your manuals you all have this picture (can be found in the Code of Practice for the Care and Handling of Pigs, 2014). Make sure you use it. Have it in your barn and make sure your staff are aware of it. Aim for a condition score of 3.

Don't just consider feeding requirements for productivity and longevity. Also consider feeding requirements for animal welfare. Find ways to help reduce that abnormal behaviour. There are also some studies out there that show that full feeding for that first 24 to 48 hours from the time of mixing may also help reduce aggression during that critical period. There are ways that you can use diet to help reduce potential negative effects of group housing at critical times.

Slide 32: Let’s talk quickly about competitive feeding systems such as open stall, floor and trough feeding. These animals compete for feed when feed is dropped. Your main goal here is to reduce feeding competition as much as possible. Space your feed drops as much as you can or your feeding stations. Spread feed out around the pen as much as possible so you have less sows in one spot.

Sort your pens as best you can. You can sort based on several different things, find what works best for you barn and flow of pigs. For example, you can sort based on eating speed. If you have a bunch of slow eaters maybe you want to put them together. Or you can sort on body condition, on size, or by parity.

You can also sort pens to improve your feeding accuracy. This is something that Quincy talked about. Sort your pens based on their gestation stage so you can actually change their diet and phase feed them where you wouldn't have been able to do that before.

Slide 33: In ESF systems your competition is not actually at the time of feeding, but it's typically before the time of feeding when the animals are waiting to get in line for their feed. So make sure your pens are designed well to try and reduce that backup in front of the feeding pens.

With ESF's, you can have access to multiple feed lines for precision feeding. Plan ahead and have the ability to run 2 or 3 feed lines into the gestation barn, in order to blend diets to make a more accurate, precise feed for the sows.

You can also use the ESF to identify any sows that are needing special attention. You can pick them up really quickly and notice that they're not eating using your computer system. So take advantage of that. Move those sows if you need to and get them eating as soon as you can.

Slide 34: This slide presents the potential of an additional opportunity when group housing sows that might be something of interest. Quincy talked about the lower critical temperature and the upper critical temperature for sows. Outside of these upper and lower limits, sows have to start using more of their own energy to maintain their body's homeostasis and meet their maintenance requirements. The lower critical temperature for stall-housed sows is about 16^{o}C. This is roughly what we try and aim for in our gestation sow rooms.

In a study conducted in Saskatchewan in the winter, sows were given the opportunity to pick their own room temperature. They had two rooms. One room was held constant at 16^{o}C, and in the other room the sows were allowed to turn the heater on whenever they wanted to. Those sows preferred a temperature between 9 and 12^{o}C, versus the 16^{o}C in the control room. These sows were given a diet that was high in fibre, which generates some body heat for them through digestive process. Also, group housed sows have the ability to express thermo-regulatory behaviours such as huddling and moving around. In that study for a six-week period during the winter there was a 78% savings in natural gas consumption between those two rooms. So using your diet (by providing a high heat increment diet), a high fibre diet may also give you some added opportunities in your barn to capture potential for nutrition.

I'm going to stop there and open it up to any questions.

Facilitator: Questions for Laura or Quincy?

Male: Just in that last slide there. That study that took place out west, did the sows have straw bedding?

Laura: No.

Male: Okay. So based on what you see, could you extrapolate that if they had straw bedding they would be able to have even a lower room temperature

Laura: It's possible, yes. It would provide an additional source of heat for the sows. But that wasn't part of this study.

Male: Okay. Thanks.

Male: Quincy. One of your last slides there you said in your precision feeding that the sows grew rapidly in their late gestation. Is that a typo or were you really meaning the sows grew rapidly. Is it supposed to be litters? Like the piglets? Or was it the sows?

Quincy: No, the sows grew faster in late gestation compared to the other ones. We weighed the sows every week and they grew more in late gestation compared to the ones we fed with one diet all the time.

Female: How many times are these sows fed a day? Or were they?

Quincy: Once a day.

Female: Okay. Have you ever tried feeding them, say, six times a day in the spring as though to give their bodies enough time to, say, process what their putting into their bodies?

Quincy: Yes, I've looked into that, and I agree. You'll get better digestibility of nutrients if they're fed at a more constant rate and that it slows the passage rate down. But in systems like a ESF you're going to have those sows going through more often in a day, so then they're up, there's more chances of aggression because they're up and around, and it increases the wear and tear on your equipment.

Female: How about floor feedings where they don't have to really get up, there's no aggression. Have you tried that?

Quincy: They still have to get up and they still have to go and eat. I haven't tried it personally, but I haven't found any literature that says that there's better performance from feeding more times a day.

Female: What I'm trying to say is if we're forcing these pigs to grow on whatever they're getting once in a 24 hour period. Wouldn't it be better to spread it out and take that stress off and let their bodies absorb what they're receiving?

Quincy: Yes. I agree with you. I'm not disagreeing with you. But from the other side of this, what if I'm a small timid sow and now I only get half my feed for whatever the feeding station and I have to get up and have to go through that crowd of animals more often in a day. In a system like an ESF they don't have to eat it all at once. They could eat half of it now and it would stop delivering feed if they walked out and they could come back and get it. I have seen too many sows do that. They eat it, they go and they lie down. Sorry, I'm not disagreeing with you but that's what I've seen so far.

Laura: And it's possible that providing things like hay or straw out in the pen for them to consume outside of their meal would help with that as well, because it would give them something that they can consume whenever they feel like it.

Facilitator: Other questions?

Male: I'm just wondering if it might be prudent to throw out a disclaimer with fibre use in manure pit management. I'd hate to everyone go home and put a straw rack up and then wonder why they can't pump their manure come spring.

Laura: A lot of the research with the straw racks has shown that it's actually not as bad as we think it's going to be. If it's small enough particles, the sows will consume it and very little is actually dropped into the pits. But yes, it is a potential risk.

Male: But even what they digest isn't fully digested.

Laura: Yes. There's still going to be an increase in fibre content in the manure.

Transcription services provided by TranscriptHeroes