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ONTARIO PORK

OPIC
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Contents

20 YEARS LATER....WHAT HAS CHANGED?

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EVERYTHING HAS CHANGED

Last February (2020) when I first prepared this presentation I was going to say that remarkably little has changed with respect to the London Swine Conference over the past 20 years. For the first 19 years, it remained a 2-day event held in London in the spring each year at almost the same location. Throughout those 19 years, the conference was organized by a small dedicated group of volunteers (some of the committee members participating every year from the very start). The founding organizations (Ontario Pork, Ontario Ministry of Agriculture, Food and Rural Affairs, and the University of Guelph) plus more recently the Ontario Pork Industry Council remained heavily involved each year. The conference continued to be loyally sponsored by the swine industry, through good and bad times. Each year the program featured an array of speakers presenting cutting edge science, opinions on social issues affecting pork producers, and very practical on-farm experiences. Even the registration cost remained the same!

But, of course, last year everything changed and the event was cancelled. This year, as the conference moves to a virtual format, it is still true that the conference is organized by the same hard-working and dedicated organizing committee, with the same loyal sponsors, and the program once again features a wonderful array of speakers. However, in each of the first 19 years of the LSC, some of the most important take-home information came from the discussions in the hallways and around the coffee stations. Sadly, that aspect of the conference will be missing this year and will be the most important motivating factor for the return of the in-person format in the years to come.

SOME THINGS HAVEN`T REALLY CHANGED

If we compare some of the big issues on the minds of pork producers in the spring of 2001, it is surprising how similar they are to the concerns today. One of the biggest topics of discussion in the hallways in 2001 was the outbreak of a foreign animal disease in Britain and news articles predicting the inevitable spread to Canada. The cause of border closing and mass destruction of swine herds in Britain in 2001 was Foot and Mouth Disease. There was not enough time from when the outbreak occurred in February until the first LSC to have a speaker on the program deal with this subject, but in the following year, Dr Terry Whiting from Manitoba presented a very sobering talk on the consequences of an exotic disease outbreak in Canada. Pointing out how vulnerable the Canadian pork industry is to any situation that might close borders to export. If you read Whiting`s paper in the LSC 2002 proceedings and substitute African Swine Fever, instead of Foot and Mouth Disease, it will seem very relevant. At that same conference in 2002, Dr Scott Dee presented a very thorough description of handling endemic Porcine Reproductive and Respiratory Syndrome (PRRS) virus. In 2021, PRRSv is still the biggest health issue facing the Ontario swine industry, and although that won`t be the subject that Dr Dee will address, he is once more on the program. It's interesting that PRRS has persisted as a problem but over the past 20 years Ontario has seen an outbreak of Porcine Circovirus come and go, as a result of vaccine development, and outbreaks of Porcine Epidemic Diarrhea that have been for the most part kept in check by enhanced monitoring and biosecurity. The emergence of new diseases seems to be a constant, and LSC proceedings of the past 20 years reflect this aspect of pork production.

There are many other issues faced by the swine industry that remain priorities and find a place on the program almost every year. For example, in the 2001 proceedings you can read a paper by John Deen discussing the problem of growth rate variability and another paper by Kees de Lange and Mike Tokach discussing on-farm tips for feeding grower-finisher pigs. There is a timeless quality about these papers dealing with a subject that is just as important today as it was 20 years ago. Feed is still the biggest input cost and adjusting feeding programs to achieve the best performance at the lowest cost remains as important now as it did in 2001.

SOME THINGS HAVE CHANGED

Since the spring of 2001, there have been monumental events in the world that have resulted in massive changes. For example in April 2001, the skyline of New York City was dominated by the giant twin towers of the World Trade Center and 6 months later they were gone and we are still experiencing the aftermath. In the last 20 years, there has been the introduction of disruptive technologies that have completely altered our way of life and destroyed some industries almost overnight. For example in 2001 buying Kodak stock still looked like a safe investment. In the Canadian swine world in the past 20 years, there have been major changes but nothing quite as earth shattering as the introduction of digital photography and the smart phone and the disappearance of Kodak. I use Kodak as an example of how fast change can occur and how very smart people who are experts in their field can miss the implications of disruptive technology.

Changes have certainly occurred in pork production. Change has occurred at such a fast and steady rate that maybe the tremendous progress made in pork production is not appreciated unless you stop and reflect back at the last 20 years. In every aspect of production including; growth rate, feed efficiency, reproductive performance, carcass quality and meat safety, improvement has been made. This is probably one of the most compelling arguments as to why forums like the London Swine Conference are necessary, because to stay competitive producers have to continually innovate. The LSC has been an annual forum to exchange ideas and to be inspired. In the 2005 proceedings there is a paper by Rob Knox describing the possibility of some day achieving 30 weaned pigs per sow per year. To me that seemed out of reach in 2005 but in less than 10 years I was visiting farms that were achieving it, and it is starting to be commonplace.

The London Swine Conference has had speakers that have looked back at the changes and summarized the progress helping us realize the value of the application of science to the business of raising pigs. An example of such a presentation was the 2017 CFM de Lange Memorial Lecture presented by Mike Tokach, who summarized some of the key advances in swine nutrition in the previous 20 years and at the same time he credited the tremendous contributions of Dr de Lange, who was one of the founding organizers of the LSC and a major contributor over the years.

In reviewing the proceedings from the early conferences I noticed in 2003, Peter Brooks from the UK was on the program to discuss group housing of sows, long before the Code of Practice was changed to make group housing mandatory. At that same conference Jens Peter Nielsen from Denmark spoke about the Danish experience of banning antibiotics in feed if they were used for the sole purpose of promoting growth, another topic that was not a pressing issue at the time but has become a reality. I think there are many examples of presentations at the London Swine Conference on topics that were ahead of where the industry was at the time but were included to stimulate discussion and get people thinking of future decisions the industry would need to make. And no doubt the pork industry will be facing many more changes in the years to come.

AND SOME THINGS CHANGE BUT STAY THE SAME

The Chair's Message in the proceedings of the first London Swine Conference states that on April of 1999 in a conference room in Guelph 6 people (Kees de Lange, Gary Koebel, Jim Morris, Andrew Pharazyn, Doug Richards and Janice Murphy) gathered to discuss starting a "world-class annual swine conference in Ontario". Their intention was to provide a platform to speed up the implementation of new technologies in commercial pork production in Ontario and to facilitate the exchange of ideas within the swine industry. In subsequent meetings the committee grew, a date was picked, a location chosen and committees were formed to organize, promote, raise-funding, create a program and make it happen. And on April 5th and 6th 2001, the first London Swine Conference took place, and continued to take place annually until 2020. This year`s virtual conference has been organized in order to continue that tradition.

The Past, Present and Future of Technology

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ABSTRACT

In the current globalized world and in a context of increased competition, adequate management of the supply chain is of paramount importance. Swine production is in a process of consolidation through a vertical integration model that secures a consistent flow of information and data from the sales stage back to the product development, manufacturing and logistics stages. Quality and flexibility can be increased, and costs reduced, by means of: (i) optimal connection of manufacturing systems, (ii) the prevention of system failures and (iii) better analytical abilities.

Moreover, the agri-food sector faces multiple challenges in the coming years that affect the society at large. Public health, including responsible use of antibiotics and the eradication and control of diseases, is in fact at the centre of the debate. Several strategies are available to tackle existing deficiencies in the production process and to increase value creation (in a broad sense). For instance, the environmental footprint can be reduced by using manure as an agricultural fertilizer (instead of regarding it as livestock waste). This will help farmers to cut down on the use of chemical fertilizers. Increasing animal welfare not only benefits animals themselves, but also improves sanitary and food guarantees, and conveys a better image of the agri-food sector to society. Given the public consequences of measures taken by agri-food businesses, management of swine production should balance the interests of all stakeholders involved in the process. Better distribution of production nucleuses in isolated areas and the pursuit of higher efficiency in production need to be reconciled with the development of production strategies that ensure income generation and satisfaction to consumers, while simultaneously ensuring sustainability of the environment and prosperity of healthy communities.

HARMFUL HITCH-HIKERS: SURVIVAL OF VIRAL PATHOGENS IN FEED INGREDIENTS

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INTRODUCTION

Effective biosecurity protocols are essential towards protecting the health status of swine farms. In the US, tremendous resources have been invested to reduce the risk of viral pathogens, such as porcine reproductive and respiratory virus entry into susceptible populations. Protocols including shower in-shower out, transport sanitation, quarantine and testing of incoming genetics and the filtration of incoming air are commonplace throughout the US swine industry, particularly at the level of the sow farm. In contrast, prior to the entry of porcine epidemic diarrhea virus (PEDV) in the US swine population during May 2013, the role of feed as a vehicle for pathogen transport and transmission had not been considered, despite the fact that feed is delivered to swine farms on a daily basis in the absence of any biosecurity protocols. Since the identification of this novel risk factor, scientists across North America have conducted numerous studies to understand its relevance. Based on the proactive response by the CFIA and the CPC, Canada clearly understands the risk of feed. I applaud each and every one of you for the marvellous national program that has set the standard for global agriculture. Therefore, I am hesitant to spend too much time re-hashing what may be "old news" to many of you. Therefore, I have tried to balance this lecture with a brief review of the science of feed risk, provide an update on what's happening in the US as we try to follow your lead, as well as share some exciting new data, still focusing on the risk of feed, but doing so via a novel approach called the "Demonstration Project".

ESSENTIAL LEARNING

Here is a general introduction to are the topics for the lecture:

1. **The Science**
    a. Survival of viruses in feed and feed ingredients.
        i. What are the "high risk combinations" of virus and ingredient?
    b. Transmission and oral infectious dose of PEDV and ASFV in feed.
        i. Can pigs become infected through consumption of contaminated feed?
    c. Half-life of ASFV in feed ingredients.
        i. How long does ASFV actually live in feed?
2. **The Response**
    a. Seaport analysis
        i. Where does the soy come from?
    b. Industry: Responsible imports and feed additives.
        i. What is the US swine industry doing to mitigate risk in the absence of a national program?

ii. Do feed additives effectively reduce the risk of contaminated feed?

c. Governance activity.

i. Can science effectively influence policy?

3. The Latest

a. Using demonstration projects to validate laboratory-based viral survival in feed.

i. What is this all about?

CONCLUSIONS AND TAKE HOME MESSAGES

1. Contaminated feed is a well-documented risk factor for the domestic and transboundary movement of viral pathogens.
2. Viruses which can survive and be transmitted in feed ingredients include PEDV, ASFV, SVA, PRV, CSFV, PRRSV 174, with FMDV in process.
3. Across all ingredients tested, soy-based products appear to be the most protective.
4. The 3 primary countries supplying soy imports to the US are China, Russia and the Ukraine.
5. The ports of San Francisco, Oakland and Seattle is where the majority of these products enter the US.
6. Responsible Imports is a science-based approach to safely introduce essential ingredients from high-risk countries.
7. A variety of feed additives tested appear to have some anti-viral effect and positively impact swine health and performance.
8. The US industry is actively attempting to influence imports from high risk countries though policy and specific requests to the Secretary of Agriculture.
9. Demonstration projects support laboratory data.

RECOMMENDED READING

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PRODUCTIVITY MONITORING FOR SOW FARMS

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1. Know how many weaned pigs per week a sow farm should be producing.

There is a simple formula:

Sow Inventory * Index = Weaned Pigs per Week

2,500 sows (average sow inventory) * 0.50 = 1,250 weaned pigs per week

The Index (0.50) in this case corresponds to a sow farm with average productivity levels. In other words, a 2,500-sow farm with average productivity (26 PWSY, 22-day average weaning age) should be producing 1,250 weaned pigs each week.

This formula works for all weekly breeding-weekly farrowing sow farms, no matter how many sows they have.

600 sows * (0.50) = 300 weaned pigs per week

5,600 sows * (0.50) = 2,800 weaned pigs per week

The Index is a single number that contains all the information having to do with sow farm productivity. It's the combination of biological performance measured by pigs weaned/sow/year and throughput performance measured by pigs weaned/crate/year. The worst sow farms are below 0.35, the best are above 0.62. Here's a table that shows the index compared with PWSY.

PWSY	Maximus Index
32	0.61
31	0.59
30	0.57
29	0.55
28	0.54
27	0.52
26	0.50
25	0.48
24	0.46
23	0.44
22	0.42
21	0.40
20	0.38

When you are doing a quick analysis, you find out the number of pigs being weaned each week and the sow inventory, then reverse the formula and calculate the Index.

Pigs weaned per week / Average sow inventory = Index

450 pigs weaned per week / 1,200 sows = 0.375 (not very good)

3,000 pigs weaned per week / 5,200 sows = 0.577 (excellent)

2. Know how many sows should farrow each week, and what the weekly breeding targets should be.

   A. How many sows are needed to farrow each week? It's determined by a farm's Pigs Weaned/Sow and the Farrowing Rate:

      Target is 1,250 pigs weaned/week. 12.0 pigs weaned/sow. Formula: (Pigs Weaned/Week) / (Pigs Weaned/Sow) = 1,250/12 = 104 sows farrowed each week.

This target will be somewhere between 8% to 9% of the target for pigs weaned/week, depending on the average pigs weaned/sow. (1,250)(.08) = 100 or (1,250)(.09) = 113 so in this example the target for sows farrowed each week would be somewhere between 100 and 113. The actual target would be set based on the farm's historic average for pigs weaned/sow.

   B. How many sows (plus gilts) are needed to breed each week? That is determined by a farm's historic Farrowing Rate, adjusted for seasonal effects on fertility.

      Target is 1,250 pigs weaned/week. 12.0 pigs weaned/sow. 85% farrowing rate. Formula: (Pigs Weaned/Week / Pigs Weaned/Sow) / Farrowing Rate = (1,250/12)/0.85 = 123 sows (plus gilts) to breed each week.

      It's about 10% of the target for pigs weaned/week, which is a rough but quick estimate for weekly breeding targets.

You need to adjust the weekly breeding targets for seasonal improvements or depressions in fertility (farrowing rate). It should be farm-specific and based on the farm's historic data by week of farrowing. Use this data to back-calculate (lagged 17 weeks) the breeding targets for each week.

Not meeting the weekly target for sows farrowed is the number one reason for not producing enough pigs weaned each week. The key point is you want the number of sows farrowed each week to be consistently similar or stable over time, no matter how much seasonality affects farrowing rates.

Likewise, not meeting the weekly target for breedings is the number one reason a farm won't meet its farrowing targets and therefore its target for pigs weaned/week. Like the point earlier about sows farrowed each week, you want the number of sows (plus gilts) bred each week to be consistently similar or stable over time, no matter how much seasonality affects farrowing rates.

If a breeding herd manager tells you "My breeding target is 125, I breed 125 each week", then you have a problem. What she should say is "My average is 125 each week but we target 135 in the hot months and 115 the rest of the year." The details will depend on how big the seasonal effect on fertility is for that particular farm. The farm's historic farrowing rate data provides the answer.

3. Have software that helps you plan and set targets using the farm's historic performance.

Here's an example of how we've done it in our Maximus Sow software.

Maximus Target entry and calculation sheet

Calculate targets based on | Weaned pigs (Weaned pigs / Farrowings / Breedings) | Calculate Targets

Target		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
# of females bred	Weekly	115	115	115	115	115	115	115	115	115	115
Repeat services %	Single	10.0									
Farrowing rate %	Single	88.0									
Total born	Single	15.2									
Liveborn pigs	Single	14.1									
Stillborns	Single	0.9									
Mummies	Single	0.2									
Weaned pigs/sow	Single	11.2									
Pre-Wean Mortality %	Single	15.0									
Annual Cull rate %	Single	52.0									
Annual Death + Euthanized rate %	Single	10.0									
Sows farrowed/week	Weekly	101	96	96	96	96	96	96	96	96	96
Weaned pigs/week	Weekly	1131	1131	1131	1131	1075	1075	1075	1075	1075	1075

We set it up so a producer can set their targets based on three different (mutually exclusive) starting points: Either (1) Start with the desired number of breedings each week; Or, (2) Start with desired number of farrowings each week; Or, (3) Start with the desired number of weaned pigs each week.

If you start with the Weaned Pigs, the software will back-calculate the weekly breeding and weekly farrowing targets based on the underlying performance numbers (pigs weaned/sow and farrowing rate). For example, starting with a target of say, 1,200 weaned pigs in 2017 Week 4, the software will automatically calculate the breeding target for 2016 Week 36.

For each target you're setting, you can choose 'Single' to set a single number which is then posted across all production weeks. For items not affected by season, this is fine. Or, you can choose 'Weekly-Manual' and enter the numbers manually for every week of the year (a lot of work!). Or you can choose 'Weekly-Historic' where you can have the software analyze the farm's database and fill the weeks automatically with the calculated data (much easier!).

Of course, you have to be able to manually edit the targets that are automatically filled in by the software because there may be times in the past that were affected by a disease or other problems, for example an acute PRRS problem. You don't want to have past events bias the targets you want for the future.

4. Have a report that quickly shows how a sow farm is performing against the key targets.

For our Maximus Sow software, we created a simple yet comprehensive production monitoring report (Figure 1). We call it the Weekly Breed/Farrow/Wean report. It highlights the three key items essential for running a sow farm, showing actual performance against targets. To hit your target for pigs weaned/week, you must hit your weekly targets for sows farrowed and sows+gilts served. The example report is from a 2,250-sow farm in the US (Midwest, Iowa).

Figure 1. Breed-Farrow-Wean report (Maximus Sow™ software)

Breeding Actual v Targets

CV	4.1%
SD	4.9
Target	122
Actual	120

Week No.	Week Begin	Services Actual	Target	Actual v Target	Net Ahead/ Behind
36	4-Sep-2016	128	125	3	3
37	11-Sep-2016	129	125	4	7
38	18-Sep-2016	119	125	(6)	1
39	25-Sep-2016	123	125	(2)	(1)
40	2-Oct-2016	118	122	(4)	(5)
41	9-Oct-2016	117	122	(5)	(10)
42	16-Oct-2016	131	122	9	(1)
43	23-Oct-2016	120	122	(2)	(3)
44	30-Oct-2016	121	122	(1)	(4)
45	6-Nov-2016	120	122	(2)	(6)
46	13-Nov-2016	122	122	0	(6)
47	20-Nov-2016	120	122	(2)	(8)
48	27-Nov-2016	108	122	(14)	(22)
49	4-Dec-2016	114	122	(8)	(30)
50	11-Dec-2016	121	122	(1)	(31)
51	18-Dec-2016	111	122	(11)	(42)
52	25-Dec-2016	115	122	(7)	(49)
1	1-Jan-2017	124	120	4	(45)
2	8-Jan-2017	121	120	1	(44)
3	15-Jan-2017	121	120	1	(43)
4	22-Jan-2017	118	120	(2)	(45)
5	29-Jan-2017	121	120	1	(44)
6	5-Feb-2017	122	120	2	(42)
7	12-Feb-2017	111	120	(9)	(51)
8	19-Feb-2017	122	120	2	(49)
9	26-Feb-2017	123	120	3	(46)
10	5-Mar-2017	125	120	5	(41)
11	12-Mar-2017	120	120	0	(41)
12	19-Mar-2017	116	120	(4)	(45)
13	26-Mar-2017	121	120	1	(44)
14	2-Apr-2017	120	122	(2)	(46)
15	9-Apr-2017	126	122	4	(42)
16	16-Apr-2017	123	122	1	(41)

Farowing Actual v Targets

Target Farrowing Rate	86.3%	
Actual Farrowing Rate	89.9%	
Target No. Farrowed	104	13.0
Actual Avg No. Farrowed	108	13.2

Week No.	Week Begin	Farrow Rate Actual	Actual Sows Farrow	Actual v Target	Net Ahead/ Behind	Avg Live Born Actual
1	1-Jan-2017	84.8%	109	5	5	13.8
2	8-Jan-2017	88.3%	114	10	14	12.3
3	15-Jan-2017	87.3%	104	(0)	14	13.4
4	22-Jan-2017	80.8%	99	(5)	10	12.9
5	29-Jan-2017	83.6%	99	(5)	4	12.9
6	5-Feb-2017	80.4%	94	(10)	(6)	13.4
7	12-Feb-2017	84.1%	110	6	1	12.5
8	19-Feb-2017	94.2%	113	9	10	13.2
9	26-Feb-2017	93.7%	113	9	19	13.1
10	5-Mar-2017	87.1%	105	1	20	12.7
11	12-Mar-2017	91.6%	112	8	27	13.8
12	19-Mar-2017	89.6%	108	4	31	12.9
13	26-Mar-2017	84.1%	91	(13)	18	14.1
14	2-Apr-2017	89.5%	102	(2)	16	13.5
15	9-Apr-2017	92.2%	112	8	23	13.4
16	16-Apr-2017	92.7%	103	(1)	22	13.6
17	23-Apr-2017	92.8%	107	3	25	13.5
18	30-Apr-2017	83.2%	103	(1)	24	13.9
19	7-May-2017	92.3%	112	8	32	13.2
20	14-May-2017	94.6%	114	10	42	13.2
21	21-May-2017	90.5%	107	3	45	13.2
22	28-May-2017	92.0%	111	7	52	13.5
23	4-Jun-2017	90.5%	110	6	59	13.2
24	11-Jun-2017	92.5%	103	(1)	57	13.0
25	18-Jun-2017	93.8%	114	10	68	12.7
26	25-Jun-2017	99.1%	122	18	86	12.9
27	2-Jul-2017	90.9%	114	10	95	13.1
28	9-Jul-2017	92.8%	111	7	103	12.9
29	16-Jul-2017	91.0%	106	2	104	12.6
30	23-Jul-2017	94.1%	114	10	114	12.9
31	30-Jul-2017	91.8%	110	6	120	13.0
32	6-Aug-2017	91.4%	115	11	131	12.8
33	13-Aug-2017	90.7%	112	8	139	12.9

Weaned Actual v Targets

CV	7.5%	
SD	92	
Target	1,203	11.6
Actual	1,234	11.4
Index	0.55	

Week No.	Week Begin	No. Pigs Weaned Actual	Avg Pigs Weaned per Sow Actual	Total Weaned Actual v Target	Net Ahead/ Behind
4	22-Jan-2017	1,248	11.5	45	45
5	29-Jan-2017	1,207	10.6	4	50
6	5-Feb-2017	1,236	11.9	33	83
7	12-Feb-2017	1,103	11.1	(100)	(17)
8	19-Feb-2017	1,115	11.3	(88)	(105)
9	26-Feb-2017	1,119	11.9	(84)	(189)
10	5-Mar-2017	1,333	12.1	130	(59)
11	12-Mar-2017	1,356	12.0	153	95
12	19-Mar-2017	1,236	10.9	33	128
13	26-Mar-2017	1,139	10.9	(64)	64
14	2-Apr-2017	1,307	11.7	104	168
15	9-Apr-2017	1,247	11.6	44	213
16	16-Apr-2017	1,081	11.9	(122)	90
17	23-Apr-2017	1,184	11.6	(19)	71
18	30-Apr-2017	1,316	11.8	113	184
19	7-May-2017	1,091	10.6	(112)	72
20	14-May-2017	1,153	10.8	(50)	22
21	21-May-2017	1,145	11.1	(58)	(36)
22	28-May-2017	1,262	11.3	59	23
23	4-Jun-2017	1,351	11.8	148	171
24	11-Jun-2017	1,303	12.2	100	270
25	18-Jun-2017	1,369	12.3	166	437
26	25-Jun-2017	1,270	11.5	67	503
27	2-Jul-2017	1,068	10.4	(135)	368
28	9-Jul-2017	1,270	11.1	67	435
29	16-Jul-2017	1,402	11.5	199	634
30	23-Jul-2017	1,341	11.8	138	772
31	30-Jul-2017	1,258	11.3	55	827
32	6-Aug-2017	1,193	11.3	(10)	817
33	13-Aug-2017	1,196	10.5	(7)	810
34	20-Aug-2017	1,201	10.9	(2)	807
35	27-Aug-2017	1,347	11.7	144	952
36	3-Sep-2017	1,283	11.5	80	1,032

This format is sometimes called a 'cohort' report because it tracks groups of sows forward from a event, in this case Breeding. The first row shows that 128 sows+gilts were served in Week 36. Seventeen weeks later, 109 farrowed (84.8%), and three-and-a-half weeks later, they weaned 1,248 pigs.

This sow farm should wean somewhere between 1,150 and 1,350 pigs per week (index 0.50 to 0.60). Given the farm's goals and historic performance (86% farrowing rate, 11.6 pigs weaned/sow), the manager set a target of 1,200 weaned pigs per week (index target 0.53).

On the report, you can see the actual number of pigs weaned each week (average 1,234) and pigs weaned/sow (11.4). The Net Ahead/Behind column is a cumulative sum. Although they did not hit their expected performance for pigs weaned/sow (11.4 v 11.6), they produced more weaned pigs each week than they targeted. In fact, the last row shows they were over 1,000 weaned pigs ahead.

That's because they farrowed more sows than they expected (90% actual v. 86% target) and had a higher average pig born live (13.2 actual v. 13.0 target). They were actually below the breeding target (120 actual v 122 target) and were Net Behind by 40 sows overall. They were 'saved' from missing the weaned pig target because the actual farrowing rate was much better than what they expected. They farrowed more sows and ended up far ahead of their weaned pig target.

They based their weaned pig target on an index of 0.53 and ended up better than expected at 0.55. This is a good example of over-performing against a set of reasonable targets based on the farm's historic performance as well as a thoughtful look into the future. Not only managers and barn staff but especially owners, investors, and lenders are all happy when it works out like that.

5. Remember that targets are the minimum numbers that must be hit.

Forward-looking targets are the assumptions used in budgeting and cash flow projections. Keep in mind that targets set a minimum threshold to be met. For example, a weekly breeding target of 140 sows/gilts served means that at a minimum the farm needs to breed 140 sows/gilts. And that means they will (should) always end up breeding more (but not too much more) than the target. This leads to the understanding that the average will (should) always be higher than the target. In this example, the target is 140 services/week, but the average should be more like 143 to 145. In my experience, many producers don't understand this concept and end up having to explain to owners, investors, and lenders why they didn't meet the budget and cash flow projections.

6. Create a steady and consistent weaned pig flow by reducing week-to-week variation.

In our Maximus Sow software, we created a KPI Variation report that provides analysis and feedback on three key performance indicators (KPI) focused on weaned pig consistency (Figure 2). The idea is that by reducing the variation in sows/gilts bred each week, you reduce variation in sows farrowed/week which in turn reduces the variation in pigs weaned/week. Our Weekly Breed/Farrow/Wean report (Figure 1) is used to manage and track the weekly results on the farm, and our KPI Variation report provides the bigger-picture feedback and results over a longer time period.

You can measure variability in weaned pigs/week and average weaning weight (and other items such as sows/gilts served or sows farrowed each week) by calculating a standard deviation and the coefficient of variation (CV = SD/Average). For any given year, you would have 52 (or 53) weaned pig data points, one for each week, and that's the data set that gives you the standard deviation. That's how it's done in the example KPI Variation report. On the Weekly Breed/Farrow/Wean report example (Figure 1), you can also see the SD and CV.

Figure 2. KPI Variation report

KPI Variation & Year-Over-Year Monitoring Report

Start Date: 1-Jan-2014
End Date: Dec 31 2017

Weaned Pigs/Week

	2014		2015		2016		2017	
Sow Farm	**Average**	**CV**	**Average**	**CV**	**Average**	**CV**	**Average**	**CV**
Farm 1	1,386	8.6%	1,468	6.3%	1,380	6.0%	1,367	2.7%
Farm 2	558	17.1%	489	18.8%	619	14.0%	676	6.9%
Farm 3	1,416	4.1%	1,404	4.9%	1,347	6.0%	1,372	5.0%
Farm 4	1,385	6.7%	1,415	6.6%	1,351	5.9%	1,389	3.2%
Farm 5	1,476	5.6%	1,489	5.9%	1,416	6.0%	1,362	5.5%
Total/Avg	6,221	7.2%	6,265	6.9%	6,113	6.8%	6,166	4.4%

Average Weaning Weight, kg

	2014		2015		2016		2017	
Sow Farm	**Average**	**CV**	**Average**	**CV**	**Average**	**CV**	**Average**	**CV**
Farm 1	6.18	10.0%	5.73	4.5%	6.26	5.5%	6.24	2.3%
Farm 2	5.69	9.3%	6.37	8.7%	6.17	8.2%	6.36	5.6%
Farm 3	5.31	3.2%	5.62	2.8%	5.88	3.1%	6.13	3.3%
Farm 4	5.38	3.6%	5.76	2.8%	6.28	2.3%	6.50	2.2%
Farm 5	5.71	6.7%	5.77	6.4%	6.35	3.2%	6.02	4.6%
Total/Avg	5.65	6.2%	5.77	4.5%	6.19	4.0%	6.24	3.4%

Pigs Weaned/Sow (YOY = Year-Over-Year Change)

	2014		2015		2016		2017	
Sow Farm	**Average**	**YOY**	**Average**	**YOY**	**Average**	**YOY**	**Average**	**YOY**
Farm 1	9.16	-	9.94	4.5%	10.46	5.2%	10.56	0.9%
Farm 2	9.16	-	9.49	8.7%	9.11	-3.9%	9.85	8.1%
Farm 3	9.70	-	9.52	2.8%	10.00	5.0%	10.26	2.6%
Farm 4	9.47	-	9.58	2.8%	9.97	4.0%	10.14	1.8%
Farm 5	9.27	-	9.57	6.4%	10.21	6.6%	10.20	-0.1%
Total/Avg	9.38	-	9.64	4.5%	10.06	4.3%	10.24	2.0%

Maximus Systems

Here's how the General Manager whose numbers I'm showing in the KPI Variation report explained how and why they use it (DK, personal communication):

> *"One of the first things we saw when we began using the Weekly Breed/Farrow/Wean Report was that our production was quite volatile. Volumes were frequently higher than our nursery capacity could ideally accommodate, and this had adverse effects on feeder pig (and downstream market hog quality). In the sow barn, we were finding variable wean weights*

and age as capacity was being pushed. This led to uneven flow of hogs to market, and more mixed source fills (poorer results). We created a bonus program for the sow barns to help manage wean numbers to create even filling of nursery rooms. We established breeding target monitoring and used the weekly report to provide feedback.

The KPI Variation report shows the results of our efforts to reduce production variation in the sow barn. Variability in our weekly wean numbers [measured by Coefficient of Variation, CV] dropped over four years from 7.2% to 4.4% This means consistency of weekly wean number volume is almost 40% better. CV for wean weight dropped from 6.2% to 3.4%, meaning consistency of weekly wean weights is 45% better. Weights also increased 0.6 kg or 10.6%. Pigs weaned/sow farrowed is 9% better (10.24 v 9.38).

These flow consistency changes have made a significant difference in light hog volumes, feeder pig place *weights, age at market and wean to finish mortality."*

7. Use Top v Bottom (point-in-time) sow farm benchmarking to understand how a farm ranks against others.

Figure 3 shows recent sow farm performance benchmarks from an analysis of over 400 sow farms representing over 1.2 million sows for the US (Midwest, mainly) and Canada. Keep in mind how this ranking of performance by Top and Bottom was done. First, we rank all the sow farms from best to worst on pigs weaned/sow/year (or to be technical, pigs weaned/mated female/year). Next, in each category (like Top 33%, for example), we determine the averages for all the components of overall productivity (like pigs born alive, pre-weaning mortality, etc.). This approach tells you how sow farms, say, in the Top 33%, perform when looking at the farm as a whole.

This is not the same as Percentile Benchmarking, which we'll get to next.

8. Use Percentile Benchmarking to understand a farm's strengths and weaknesses relative to all other sow farms in the benchmarking database.

Figure 4 shows percentile distributions for sow farm key performance indicators. This is not the same as what we just talked about where you benchmark by ranking farms on overall productivity using PWSY. In percentile analysis, each item is ranked by itself from best to worst. That means you can look at a KPI on its own and say "How does this one KPI, say farrowing rate, on my farm compare with everyone else's farrowing rate. You can use percentiles to create report cards for sow farms, highlighting a farm's strengths and weaknesses (Figure 5).

Figure 3. Benchmarks for Sow Farm Performance

Sow Farms Ranked on Pigs Weaned/Mated Female/Year

Farms in the United States & Canada

	Bottom 10%	Bottom 33%	Avg	Top 33%	Top 10%
Maximus Production Index	0.37	0.41	0.45	0.49	0.55
Pigs weaned / mated female / yr (PWMFY)	19.0	21.1	24.0	26.9	28.3
Litters / mated female / yr (LMFY)	2.09	2.20	2.30	2.40	2.45
Non-Productive days (w/o gilt pool)	60.4	52.0	41.5	31.0	28.9
% Repeats	14.3%	11.4%	9.0%	5.9%	1.0%
% Abort	1.4%	1.5%	1.1%	1.0%	1.1%
Wean-1st service	9.0	8.3	7.5	6.7	6.0
Farrowing rate	79.9%	82.2%	85.2%	89.0%	89.2%
Average total born	13.1	13.3	13.5	14.0	14.1
Average live born	11.7	11.9	12.2	12.7	12.9
Average Stillborn	1.0	1.0	1.0	0.9	0.8
Stillborn %	7.8%	7.9%	7.4%	6.5%	5.9%
Average Mummified	0.3	0.3	0.3	0.3	0.3
Mummified %	2.1%	2.5%	2.3%	2.2%	2.4%
Pre-wean mortality %	19.0%	17.5%	14.7%	12.4%	11.4%
Pigs weaned / sow	9.3	9.5	10.2	10.9	11.1
Wean age	21.0	20.1	20.1	20.3	20.2
Wean weight (pig)	6.6	6.5	6.2	6.0	6.0
Culling %	42.2%	42.8%	43.4%	44.7%	45.7%
Death %	10.2%	10.8%	9.3%	8.0%	7.1%
Gilt arrival age (days)	233.0	236.6	219.5	204.0	198.4
Gilt arrival weight	131.5	133.9	132.5	129.5	128.7
Entry - 1st serv interval	38.5	37.0	36.1	36.2	34.5
Weight per day-of-age at arrival, g/day	565	566	604	635	649

9. Use Internal Benchmarking with Scorecard Ranking to compare all the sow farms owned by the same organization against each other. You should be able to rank the farms based on a criterion of your choice (such as Pigs Weaned/Sow/Year or Maximus Production Index). Or create an index yourself that takes into account the factors most important to your organization. For example, an index that uses both PWSY and Weaning Weight together, with each item being given a weight relative to its importance, i.e. (PWSY * .66) + (Weaning Weight * .34).

Figure 6 shows an example of a Scorecard Ranking report from the Maximus Sow software.

Notice that to be ranked highest, a sow farm doesn't necessarily have to be the best in each individual KPI. But to rank high, a farm needs to be very good in the most important items (Pigs Born Live, Pigs Weaned/Sow, and Farrowing Rate).

Figure 4.

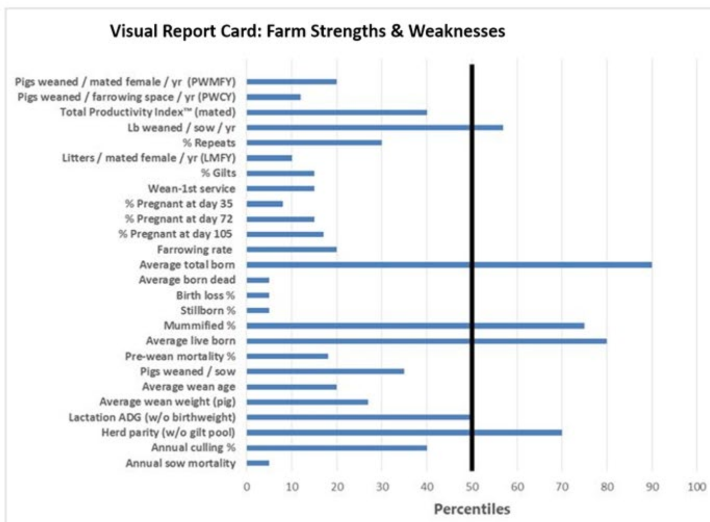
Percentile Distributions for Sow Farm Performance

	Percentiles								
	10	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**
Pigs weaned / mated female / yr (PWMFY)	20.1	21.9	22.8	23.5	24.0	24.9	25.6	26.4	27.3
Litters / mated female / yr (LMFY)	2.12	2.23	2.26	2.30	2.33	2.34	2.37	2.41	2.45
Non-Productive days (w/o gilt pool)	25.9	28.8	33.0	35.7	38.8	43.0	46.5	51.4	61.6
% Repeats	14%	12%	11%	10%	9%	8%	6%	5%	4%
% Abort	2.9%	1.9%	1.1%	0.9%	0.6%	0.5%	0.3%	0.1%	0.0%
Wean-1st service	9.7	8.7	8.0	7.5	7.1	6.7	6.4	6.1	5.7
Farrowing rate	79.0%	81.3%	83.1%	84.5%	85.4%	86.8%	88.1%	89.5%	91.3%
Average total born	12.5	12.9	13.1	13.3	13.6	13.8	13.9	14.1	14.5
Average live born	11.3	11.6	11.8	12.0	12.3	12.5	12.6	12.8	13.1
Stillborn %	10.5%	8.9%	7.9%	7.3%	7.0%	6.7%	6.3%	5.7%	4.5%
Mummified %	3.5%	3.1%	2.8%	2.5%	2.2%	2.0%	1.7%	1.3%	1.0%
Pre-wean mortality %	21.0%	18.5%	16.4%	15.3%	14.4%	13.3%	11.8%	10.4%	9.1%
Pigs weaned / sow	9.1	9.5	9.8	10.1	10.3	10.5	10.6	10.8	11.1
Wean age	18.2	18.9	19.3	19.6	20.0	20.4	20.7	21.2	21.8
Culling %	58.7%	50.7%	47.4%	45.4%	42.5%	41.1%	37.4%	34.3%	30.4%
Death %	14.0%	11.8%	10.6%	9.6%	8.9%	7.7%	7.2%	6.6%	5.2%

Figure 5. Using Percentiles to create a strengths/weaknesses report card of sow farm performance.

Sow Farm Report Card

	Average	Percentile
Pigs weaned / mated female / yr (PWMFY)	22.1	20
Pigs weaned / farrowing space / yr (PWCY)	124	12
Total Productivity Index™ (mated)	46.1	40
Lb weaned / sow / yr	344	57
% Repeats	10.1%	30
Litters / mated female / yr (LMFY)	2.11	10
% Gilts	22.0%	15
Wean-1st service	9.1	15
% Pregnant at day 35	86.2%	8
% Pregnant at day 72	84.3%	15
% Pregnant at day 105	83.0%	17
Farrowing rate	82.4%	20
Average total born	14.6	90
Average born dead	2.0	5
Birth loss %	13.3%	5
Stillborn %	11.8%	5
Mummified %	1.6%	75
Average live born	12.7	80
Pre-wean mortality %	17.2%	18
Pigs weaned / sow	10.0	35
Average wean age	19.1	20
Average wean weight (pig)	12.8	27
Lactation ADG (w/o birthweight)	0.621	50
Herd parity (w/o gilt pool)	3.0	70
Annual culling %	47.6%	40
Annual sow mortality	15.5%	5



10. Use Rate-of-Improvement Benchmarking to understand whether a farm or production system is keeping up with the rate of change in the industry.

For average sow farms, the annual rate of improvement overall productivity (PWSY) is 0.14 units/year. In other words, by 2025, an average farm will produce between 25 and 26 pigs weaned/sow/year. Sow farms ranked in the Top 10% are increasing PWSY by 1.0 pig/year. By 2025, a Top 10% farm will be close to 36 PWSY.

If you're not keeping up, you're falling behind. If you're falling behind, you're becoming less and less competitive against your peers. Not a happy ending.

Figure 6. Internal benchmarking using a Scorecard

Sow Farm Ranking -- Scoreboard

Maximus Sow

Start Year/Week:	**2017/1**
End Year/Week:	**2017/52**
Ranking By:	**Maximus Index**

	RANK								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Sow Farm	E2	B2	B3	A1	D1	E1	B1	F1	C1
Manager									
Sow Inventory	1,289	662	549	823	1,700	2,581	351	1,363	379
SCOREBOARD -- PERFORMANCE NUMBERS									
Pigs weaned/week	738	352	289	418	832	1,241	162	620	141
Maximus Index (index * 100)	57.3	53.2	52.7	50.8	48.9	48.1	46.1	45.5	37.2
Pigs weaned/sow/yr	29.0	28.5	28.8	26.8	27.4	25.2	22.1	24.8	19.5
Littters/sow/yr	2.37	2.50	2.51	2.38	2.36	2.31	2.11	2.29	1.71
% Repeat services	4.4%	8.6%	3.1%	10.1%	7.2%	9.0%	11.1%	6.1%	29.8%
Farrowing rate %	92.1%	83.4%	90.0%	84.3%	87.1%	84.7%	82.4%	86.0%	69.6%
Wean to 1st serv int	4.9	5.5	6.2	6.7	6.6	5.5	9.1	8.6	5.3
Average total born	15.3	14.6	14.1	14.2	14.1	14.2	14.6	14.0	14.6
Average born dead	2.05	1.48	1.36	1.56	1.43	1.67	1.95	1.25	2.16
Average live born	13.3	13.1	12.8	12.6	12.7	12.6	12.7	12.8	12.4
Pre-wean mortality %	8.1%	10.1%	10.2%	12.2%	10.5%	17.2%	17.2%	19.5%	15.8%
Pigs weaned/sow	11.9	11.7	11.5	11.1	11.3	10.4	10.5	10.3	10.5
Average wean age	16.5	19.7	18.5	17.5	20.8	20.1	19.1	21.0	23.1
Weaning weight, kg	6.6	5.8	5.6			7.8	5.8		6.6
Herd parity	2.9	2.7	3.1	2.6	3.0	3.7	3.0	2.6	2.8
Culling %	22.7%	40.9%	53.3%	40.9%	45.2%	30.3%	47.6%	49.2%	20.7%
Death %	2.8%	7.5%	7.3%	6.7%	8.1%	8.6%	15.5%	6.9%	5.2%

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Can eastern pigs be fed western diets?

Rebalancing rations in the era of corn root worm

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LSC

March 2021

University of Saskatchewan

Can eastern pigs be fed western diets?

Rebalancing rations in the era of corn root worm

Objective:

The following slides are designed to provide swine producers with information required to gain confidence in the utilization of alternate ingredients (especially wheat) in swine rations

The Problem

CORN ROOTWORM LARVAE ON CORN ROOTS. PHOTO COURTESY OF JOCELYN SMITH, UGRC.

https://ontariograinfarmer.ca/2020/11/01/bt-resistant-corn-root-worm/

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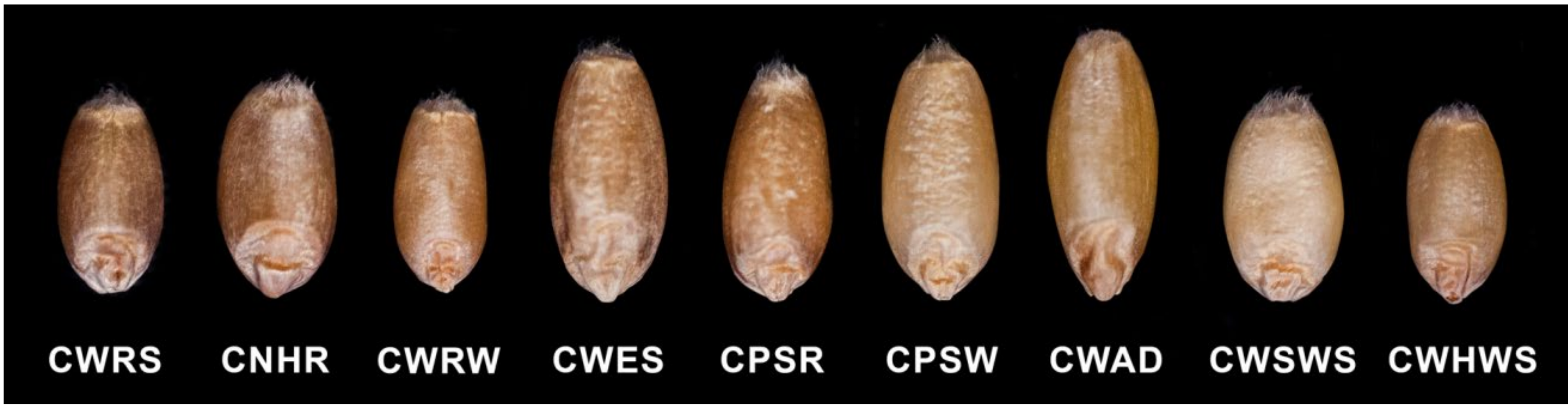
Solution?



Western Red Spring | Western Red Winter | Canadian Western Extra Strong | Prairie Spring Red and White | Western Amber Durum

https://grainscanada.gc.ca/en/grain-quality/grain-grading/wheat-classes.html

Wheat grown in Ontario is primarily Canada Eastern Soft Red Winter

https://goodineverygrain.ca/2018/07/19/what-type-of-wheat-is-grown-in-ontario/

2020 Summary Data, Ontario wheat quality

	Soft red winter wheat	Hard red winter wheat	Soft white winter wheat
Test weight kg/hL (13.5% moisture basis)	75-80	78-83	71-81
Protein	8.9-11.1	11.4-12.7	7.3-13.7
Moisture	13.2-14.7	13.0-14.8	14-16.2
Bushel weight *	62	65	61

*1 kg/hL = 0.802 lb/bu

What about feed wheat?

https://gfo.ca/market-development/exporters/ontario-wheat-quality/

Quality characteristics of feed wheat

	Canadian Eastern Feed	**Eastern Soft Red Winter No 1**
Minimum test weight, kg/hL	65	76
Variety	Any, excluding amber durum	CESRW
Degree of soundness	May be immature or weather damaged	Reasonably matured, reasonably free from damaged kernels
Ergot, %	**0.1**	**0.04**
Sclerotinia %	**0.25**	**0.04**
Fusarium damage, %	**5**	**1**
Total foreign material, %	**10**	0.8
Heated, mouldy, %	2.5	0.1
Shrunken, %	No limit	6
Broken, %	50	6
Sprouted, %	No limit	0.5

https://www.grainscanada.gc.ca/en/grain-quality/official-grain-grading-guide/04-wheat/classes-varieties.html

Wheat milling co-products

IFN #		
4-05-258	Hard red wheat	2.57 % CF
4-05-190	Wheat bran	(7.77 % CF, NRC 2012)
4-05-199	< 1% CF	“tail of the mill”
4-05-201	< 7% CF	Wheat middlings
4-05-205	< 9% CF	Wheat shorts
4-05-206	<9.5% CF	Wheat mill run

Wheat “red dog” comparable to middlings?

Does bushel weight indicate feed quality?

	Hectolitre weight		P value*
	Low	**High**	
ADG kg/d	0.54	0.66	0.001
ADFI, kg/d	1.13	1.14	0.69
G:F	0.46	0.58	0.001
F:G	2.17	1.72	
DE Mcal/kg	3.34	3.53	0.001
NE Mcal/kg	2.39	2.53	0.001

Low wheat 66.42 kg/hl (53.3 lb/bu)
High wheat 73.79 kg/hl (59.2 lb/bu)

Diets formulated with 50% wheat

Fed to 12 kg pigs

Discussion!

The low hectolitre wheat had reduced content of GE, CP and lysine

BUT also higher levels of mycotoxins

"Hectolitre weight combined with chemical and mycotoxin analyses can be useful as a predictor of wheat quality"

Clarke et al. 2019

Using Saskatchewan wheat samples

- 14 wheat samples (12/14 frost damage)
- 57.8 to 77.6 kg/hL

- Xylose content had the highest correlation with DE (**R^2 = 0.61)**
- Correlation of density (kg/hL) with DE, **R^2 = 0.43**

Density not a good correlation with energy content, but is an indication of other potential quality factors

Zijlstra et al. 1999

Recommended inclusion rates of small grains into swine diets

Table 1. Recommended maximum inclusion rates of cereal grains for pigs					
Grain	**Starter Pigs**	**Grow-Finish Pigs**	**Gestation**	**Lactation**	**Comparative Value vs. Corn**
Wheat	45%	95%	90%	40%	100-110
Barley	25%	95%	90%	85%	95-100
Rye	25%	35%	20%	10%	100-105
Triticale	25%	95%	25%	40%	95-105
Oats*	0-5%	40%	90%	0-15%	80-85

**high fibre content of oats means they have lower energy density. Small pigs and lactating sows already struggle to consume enough energy for their needs, so oat inclusion should be limited in these rations. If high test weight oats are used (greater than 36 lb/bu), inclusion rates of 5% for weaner pigs and 15% for lactating sows can be used*

https://fieldcropnews.com/wp-content/uploads/2020/10/Options-to-Replace-Grain-and-HMC-in-Swine-Rations.pdf

Nutrient composition of corn and wheat
(as is basis)*

		Corn	Hard red wheat
Kcal/kg	DE	3451	3313
	NE	2672	2472
%			
	CP, %	8.2	14.5
	NDF	9.1	10.6
	ADF	2.9	3.6
	P, total	0.26	0.39
	STTD P	0.09	0.22
	Ether Extract	3.5	1.8
% SID	Lysine	0.19	0.32
	Methionine	0.15	0.19
	Threonine	0.22	0.34
g/Mcal	Lys/NE	6.92	12.94

* 2012 NRC

Processing

		Wheat source and particle size, um						
Wheat		**Hard red winter wheat**				**Soft white winter wheat**		
	Screen size, mm	6.35	4.06	1.00		6.35	4.83	1.52
	Screen #	16	10	2		16	12	4
	Particle size, um	693	465	245		710	402	258

DeJong et al. 2016

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Processing

		Wheat source and particle size, um					
Wheat		**Hard red winter wheat**			**Soft white winter wheat**		
	Particle size, um	**693**	**465**	**245**	**710**	**402**	**258**
	Bulk Density, g/L	1,134	1,224	1,088	1,192	1,133	1,125
Diet[a]							
	Pellet durability index, %	74.2	81.2	88.5	48.7	50.9	54.5
	Pellet fines, %	26.9	22.9	24.0	24.1	27.2	22.2

[a]Diets contained 78 to 89% wheat

DeJong et al. 2016

	Feeding trial						
Performance , 43 kg BW to market							
	Hard red winter				Soft white winter		
Particle size, um	683	465	245		710	402	258

Summary

Improved ADG and ADFI, feeding hard red winter wheat, relative to soft white winter wheat

Reducing particle size of wheat included in **meal** diets improved ADG and G:F. However, reducing particle size of wheat in **pelleted** diets had no effect on growth or carcass traits

De Jong et al. 2016

Use of carbohydrases?

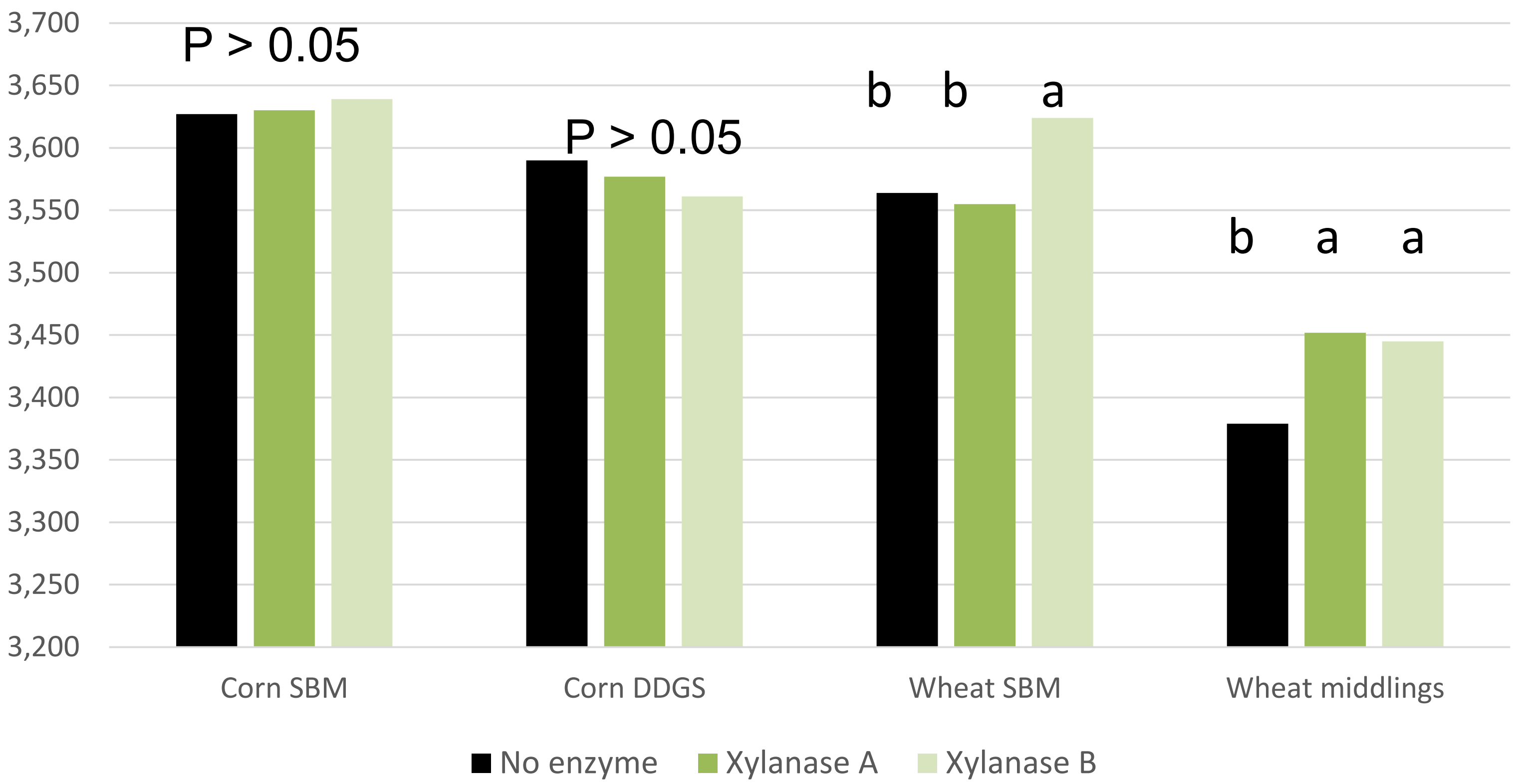
	Corn-SBM	Corn-SBM-DDGS	Wheat-SBM	Wheat-SBM-middlings
Corn	71.4	47.6		
DDGS		30.0		
Wheat			73.75	44.9
Wheat middlings				30.0
SBM	24.0	18.0	22.0	21.0
NE, kcal/kg	2,476	2,416	2,348	2,247
Total dietary fibre	11.1	18.4	13.9	23.5
Insoluble dietary fibre	10.5	17.4	12.9	21.9

Each of the diets was divided into 3 treatments:

- No enzyme, xylanase A or xylanase B
- Enzymes added at 4x suggested concentration
- Pigs, approximately 35 kg BW

Abelilla and Stein 2019

DE (kcal/kg) content of diets



Xylanase improved digestibility of dietary fibre in wheat, but not corn based diets
Action of xylanase a and b differed

Abelilla and Stein 2019

Use of carbohydrases?

Conclusion

Potential for carbohydrases to improve digestibility of wheat-based diets

Formulating diets based on wheat for growing swine

Table 1. Recommended maximum inclusion rates of cereal grains for pigs					
Grain	**Starter Pigs**	**Grow-Finish Pigs**	**Gestation**	**Lactation**	**Comparative Value vs. Corn**
Wheat	45%	95%	90%	40%	100-110
Barley	25%	95%	90%	85%	95-100
Rye	25%	35%	20%	10%	100-105
Triticale	25%	95%	25%	40%	95-105
Oats*	0-5%	40%	90%	0-15%	80-85

**high fibre content of oats means they have lower energy density. Small pigs and lactating sows already struggle to consume enough energy for their needs, so oat inclusion should be limited in these rations. If high test weight oats are used (greater than 36 lb/bu), inclusion rates of 5% for weaner pigs and 15% for lactating sows can be used*

https://fieldcropnews.com/wp-content/uploads/2020/10/Options-to-Replace-Grain-and-HMC-in-Swine-Rations.pdf

Examples of wheat based swine diets

	Ingredient cost, Ontario March 2021			
Corn	293			
Wheat	310			
SBM,	642			
Corn DDGS	372			
Wheat midds	310			
Barley	290			
Oat groats				
Tallow	1100			
Dical P				
Lysine				
Methionine				
Threonine				
Vit/Min/Salt				

Examples of wheat based swine diets

	10 to 25 kg BW			
DIET #	**1**	**2**	**3**	**4**
Corn	60.00			15.0
Wheat		55.45	45.0	46.0
SBM, 47% CP	26.4	20.4	20.5	21.5
Corn DDGS < 4% EE	8.94	10.0	10.0	10.0
Wheat midds		10.0	10.0	
Barley			10.4	
Oat groats				3.19
Tallow	1.97	1.89	1.88	1.50
Dical P	1.05	0.82	0.81	1.15
Lysine	0.50	0.50	0.50	0.57
Methionine	0.08	0.06	0.06	0.09
Threonine	0.12	0.08	0.08	0.14
Vit/Min/Salt	0.93	0.84	0.84	0.85

Examples of wheat based swine diets

	75 to 100 kg BW			
DIET #	**1**	**2**	**3**	**4**
Corn	65.0	63.5		
Wheat			87.1	72.8
SBM, 47% CP	4.56	34.8		16.2
Corn DDGS < 4% EE	27.2		10.0	10.0
Wheat midds				
Barley				
Oat groats				
Tallow	1.27	0.75		0.03
Dical P	0.78	0.54	0.71	0.61
Limestone			1.30	
Lysine	0.50		0.51	
Methionine				
Threonine	0.29		0.08	
Vit/Min/Salt	0.35	0.39	0.33	0.33

Examples of wheat based swine diets

30% millrun

	90 to 125 kg BW	
Wheat	45.7	18.4
Wheat millrun	0	30.0
Barley	43.0	42.3
Soybean meal	8.0	6.0
Canola oil	1.20	1.40
DE, Mcal/kg (measured)	3.50	3.32
NE, Mcal/kg (calculated)	2.46	2.34

Kpogo and Beaulieu unpublished

Performance response to 30% wheat millrun

Item	Millrun, % 0	Millrun, % 30	Enzyme No	Enzyme Yes	Pooled SEM	P-value Millrun	P-value Enzyme
BW, kg							
Initial	60.1	60.3	59.8	60.6	1.27	0.63	0.10
Final	120.6	118.9	119.6	120.0	0.72	0.10	0.69
ADG, kg d^{-1}							
d 0 to 56	**1.10**	**1.07**	1.09	1.08	0.02	**<0.05**	0.65
ADFI, kg d^{-1}							
d 0 to 56	2.85	2.90	2.85	2.90	0.05	0.41	0.51
G:F							
d 0 to 56	**0.39**	**0.37**	0.38	0.37	0.01	**0.01**	0.20

The millrun was substituted for the wheat, resulting in a reduction of ~ 150 kcal NE/kg

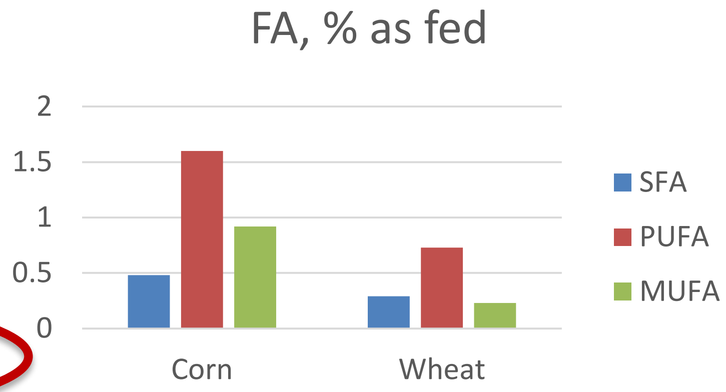
Reduction in gain:feed kg/kg, $$ per kg will depend on cost of millrun vs wheat

Kpogo and Beaulieu unpublished

What about pork quality?

		Corn	Hard red wheat
Kcal/kg	DE	3451	3313
	NE	2672	2472
%			
	CP, %	8.2	14.5
	NDF	9.1	10.6
	ADF	2.9	3.6
	P, total	0.26	0.39
	STTD P	0.09	0.22
	Ether Extract	3.5	1.8

Wikipedia.com



* 2012 NRC

Pork Quality?

	Wheat	Corn
Corn	0.00	80.45
Wheat	87.13	0.00
SBM	8.49	15.37
Tallow	0.46	0.00
Dical P	1.27	1.49
Limestone	0.95	1.08
Salt	0.50	0.50
Lysine	0.21	0.11
Vit/Min Premix	1.00	1.00

Diets fed throughout the finishing period.

Marketed at ~ 115 kg BW

No effect of diet on carcass characteristics, pork fat composition or colour,

Han et al. 2005

Formulating diets with wheat
(or decreasing corn content of swine diets)

- Use the net energy (NE) system, SID amino acids and STTD (or available) P
- Allow the NE content to decrease ?
- Formulate based on nutrient (ie LYS) to NE ratio
- Assume calorie intake will be maintained, thus feed efficiency will be reduced
  - Example from the NRC 2012 model, pigs growing from 100 to 135 kg BW
- Ensure adequate feeder space

	100 to 135 kg BW
Diet NE, kcal/kg	**2475**
Gain, kg	35
Feed intake, kg	112.5
G/F	**0.311**
Diet NE, kcal/kg	**2350**
Feed intake, kg	118.5 (constant NE intake)
G/F	0.295

Formulating diets with wheat (or decreasing corn content of swine diets)

Economics

- Use least-cost formulation
- Or – take advantage of on-line tools:
- Example: Stein, Pahm and Roth, Swine Focus #002 Feeding Wheat to Pigs 2010

Mycotoxins

- Monitor, specifically deoxynivalenol (DON)
- DON will concentrate in most wheat by-products
- Follow CFIA guidelines for purchasing, feeding contaminated feeds

Table 7. Maximum price ($/bushel) that can be paid for wheat at different costs of corn and soybean meal (SBM) without increasing cost of the complete diet [a,b,c]

	Corn, $/bushel			
SBM, $/ton	3.0	4.0	5.0	6.0
200	3.23	4.27	5.31	6.35
250	3.29	4.33	5.37	6.41
300	3.35	4.39	5.43	6.47
350	3.41	4.45	5.49	6.53
400	3.47	4.51	5.55	6.59

[a] Calculations based on soybean meal containing 47.5% crude protein.

[b] For each combination of costs for corn and soybean meal, the price indicated for wheat will result in identical diet costs for a corn-soybean meal diet and a wheat-soybean meal diet. Total diet costs will be reduced if wheat can be purchased at prices that are less than indicated in the table.

[c] One bushel of corn = 25.45 kg; one bushel of wheat = 27.22 kg; one ton of soybean meal = 907 kg.

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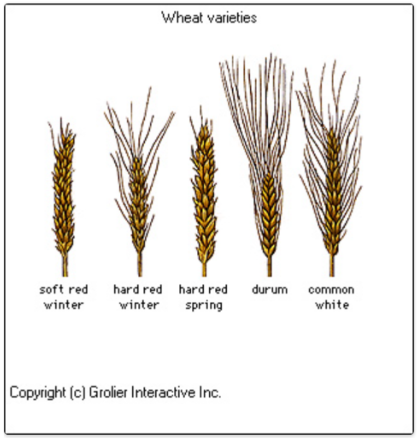
UNIVERSITY OF SASKATCHEWAN

Can eastern pigs be fed western diets?

Rebalancing rations in the era of corn root worm



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March 2021

Questions? Comments?

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Feed Grade

Grade #3

	Test Weight	% of Sprouts	% Max FDK
CEWW	69 kg/hl	8.00%	1.00%
CEHRW	69 kg/hl	8.00%	1.50%
CERS	69 kg/hl	8.00%	1.50%
CESRW	69 kg/hl	8.00%	1.50%
CER	69 kg/hl	8.00%	1.50%

CE: If graded Canada Feed only because of sprouts and test weight.

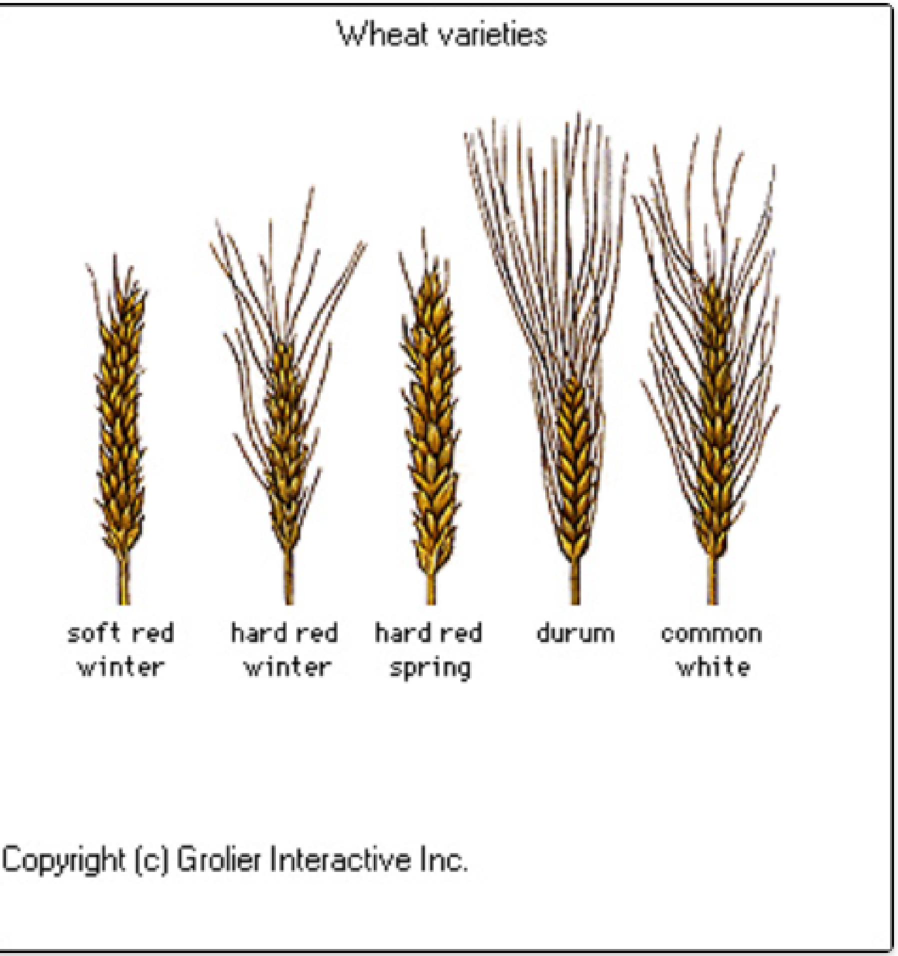
Grade Discounts

Feed discounts will apply at time of delivery. Grain Farmers of Ontario does not accept sample grade wheat.

Soft White Winter (Pool A)	Grade #3	$10/tonne
Hard Red Winter (Pool B)	Grade #3	$10/tonne – no protein payment
Hard Red Spring (Pool C)	Grade #3	$10/tonne – no protein payment
Soft Red Winter (Pool E)	Grade #3	$10/tonne
Hard Red (Pool F)	Grade #3	$10/tonne

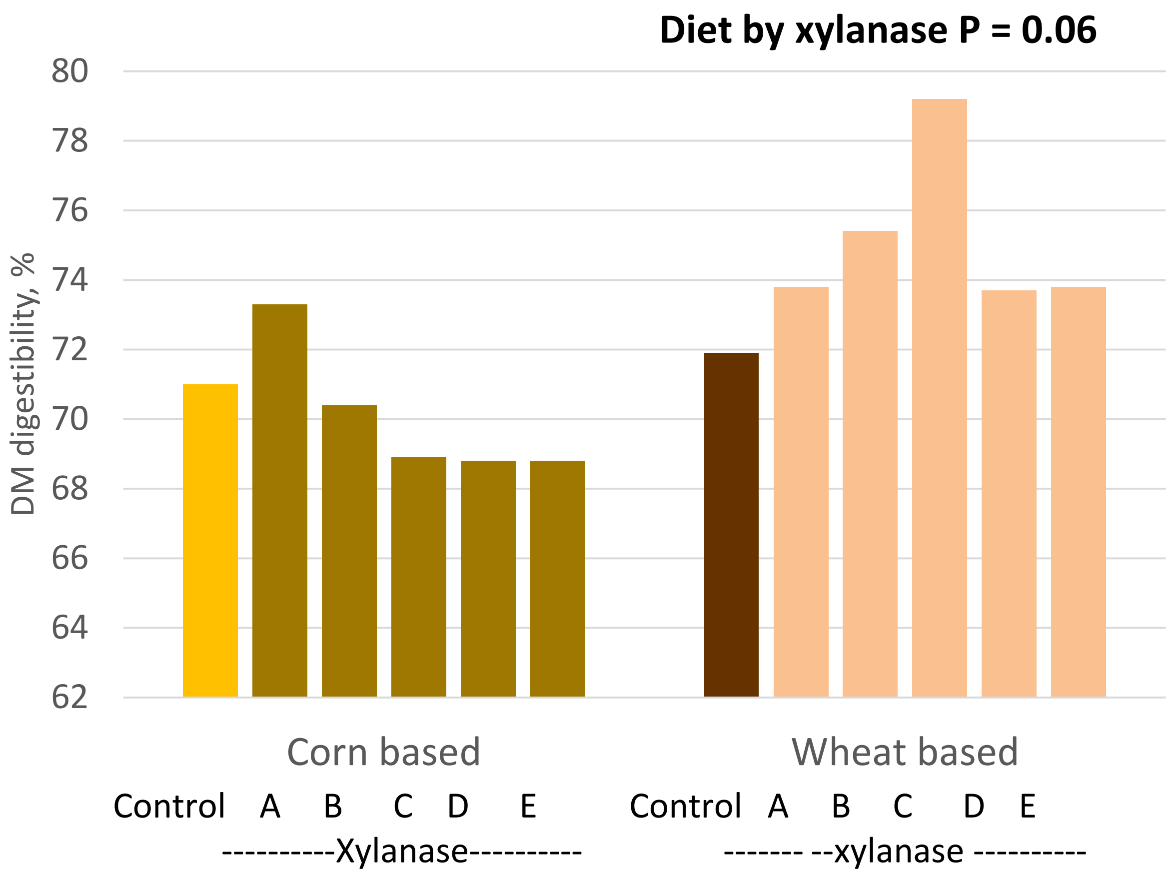
FDK = Fusarium damaged kernels

https://gfo.ca/marketing/wheat-marketing/grade-specifications/



Minnestota ag classroom.org

Xylanase and grain source

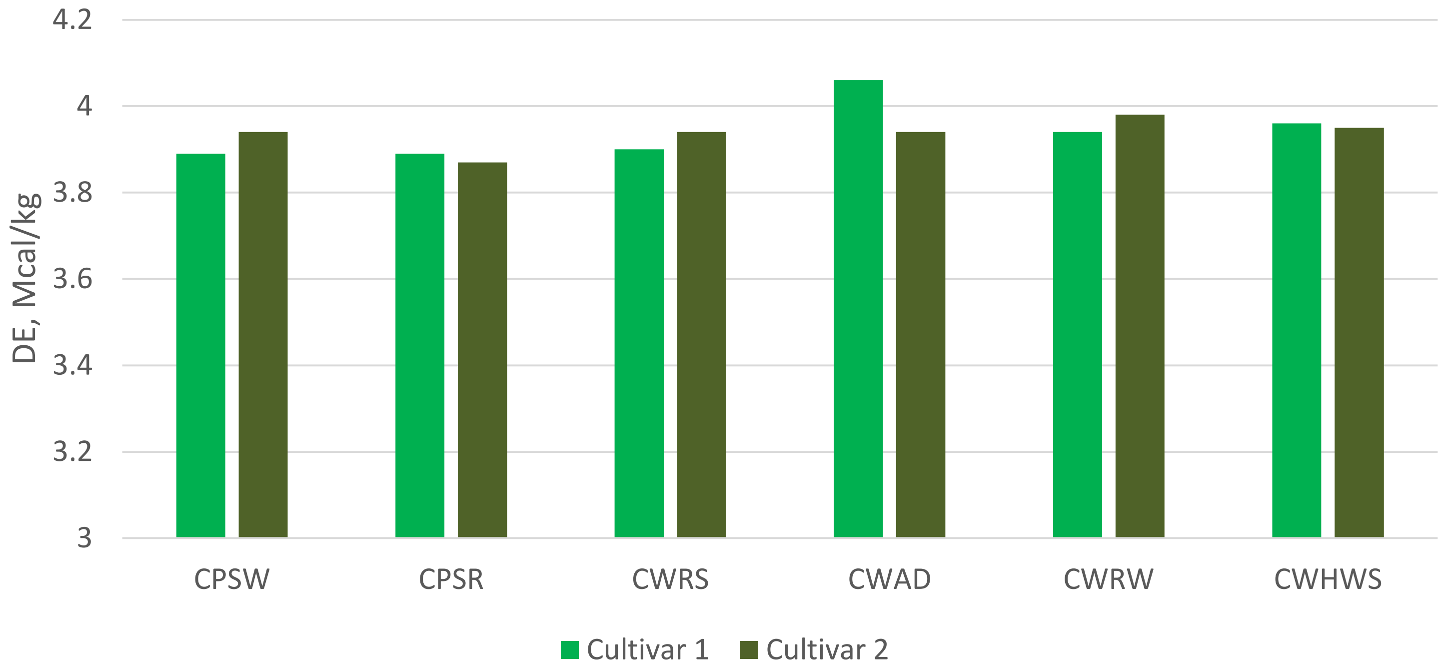


Differential effect of xylanase on **DM, energy and CP** digestibility depending on grain source.

This led to differential effects on diversity of piglet gut microbiota

Zhang et al. 2018

Research suggests that the DE content of wheat may differ among classes



In this study, the performance of weaned piglets was comparable when fed diets formulated with these wheat classes (~ 65% inclusion) for a 21 day trial.

Jha et al. 2011