SEGES Danish Pig Research Centre

SUPPORTED BY
Danish Pig Levy Fund

WEANING WITHOUT ZINC OXIDE – FIELD EXPERIENCES

REPORT NO. 1905

Hygiene, water and feed intake post-weaning, protein level in weaning feed and experienced staff were identified as key factors in weaning pigs without the use of in-feed zinc oxide on 12 farms.

INSTITUTION: SEGES DANISH PIG RESEARCH CENTRE
AUTHORS: NICOLAI ROSAGER WEBER, TINA SØRENSEN, POUL BÆKBO
PUBLISHED: 30 APRIL 2019

Abstract

Reports from 12 pig farms with weaned pigs and their veterinarians revealed that successful weaning without the use of in-feed zinc oxide requires multiple interventions. Common for all farms in the study was focus on biosecurity (a high level of hygiene) and on water and feed intake around weaning. The weaner diets were generally low in digestible protein, and the content of digestible lysine complied with the recommended levels. Furthermore, the employees working in the weaner unit were all experienced staff.

In connection with the European Commission's decision to ban the use of high levels of in-feed zinc oxide, SEGES Pig Research Centre launched an action plan presenting a range of specific interventions aimed at identifying alternatives to zinc oxide.

The action plan included, among other things, an analysis of field experiences from pig producers weaning pigs without the use of zinc oxide. The aim was to compile experiences that, combined with existing knowledge, can assist and guide pig producers wishing to stop using zinc oxide.

In 2018, an electronic questionnaire was sent to 12 Danish pig producers who have been weaning pigs without the use of zinc oxide for a long or short period of time.

Background

In June 2017, the European Commission decided to ban the use of zinc oxide for control of post-weaning diarrhoea in weaned pigs. All member states, incl. Denmark, were given a maximum of five years to phase out the use of zinc oxide [1-2].

Post-weaning diarrhoea is a multifactorial disease occurring in the first two weeks post-weaning. Outbreaks are triggered by interaction between pathogen *E. coli* bacteria, environmental factors and traits in the newly weaned pigs [3-4]. The consequences of a high prevalence of post-weaning diarrhoea include increased infection pressure, low productivity, increased mortality and increased antibiotic use [5].

Pig producers have been using in-feed zinc oxide for 30 years as an efficient measure for control of post-weaning diarrhoea [6-7].

A wide range of alternative products and management measures are marketed as alternatives to zinc oxide and antibiotics for prevention of post-weaning diarrhoea. However, the effect is rarely documented on commercial farms, and currently no alternative has been established to have a positive effect under practical conditions [5].

In connection with the European Commission's decision to ban the use of high levels of in-feed zinc oxide, SEGES Pig Research Centre launched an action plan containing specific intervention aimed at finding alternatives to zinc oxide to reduce zinc emissions to the environment [8].

The action plan included, among other things, an analysis of field experiences from pig producers weaning pigs without the use of zinc oxide. The aim was to compile experiences that, combined with existing knowledge, can assist and guide pig producers wishing to stop using zinc oxide.

Materials and method

A project group was established including seven pig veterinary practitioners and SEGES Pig Research Centre representatives. This group exchanged knowledge on potential alternatives to zinc oxide and shared their own experiences based on clinical pig practices. The seven veterinarians nominated a group of pig producers that had been weaning pigs without the use of zinc oxide for a short or long period of time, and of these 12 were selected for the study.

The conclusion of the study is primarily based on a questionnaire completed by these 12 pig producers. Additional information on productivity and feed was obtained via efficiency reports from Q1 and Q2, 2018, and specifications on the weaner feed used at the time. Information on antibiotic use in the period January-September 2018 was obtained from the VetStat database.

The electronic questionnaire comprised roughly 50 questions as listed in the Appendix.

Results and discussion

The results are divided into descriptive data and explanatory data. Descriptive data include physical framework, health status, productivity and antibiotic use. Explanatory data describe interventions made on the farms that may explain how they manage to wean pigs without the use of zinc oxide.

Descriptive data

The results include experiences from 12 farms, and descriptive data for each farm are shown in table 1.

General conditions and physical framework

The farms were largely representative of Danish farms in terms of production scope and health status: herd size ranged from 275 to 1,300 sows/year and an annual production of 7,500-47,000 30 kg pigs. Ten in 12 farms had SPF status, of which two were Red SPF. Three farms were declared free of all SPF diseases, and the remaining nine were positive of various SPF diseases. None of the farms were declared positive for PRRS type 2, rhinitis, dysentery, lice or mange.

Table 1. Farm characteristics

Farm	Sows/year	SPF status As of November 16, 2018	Period of weaning without zinc oxide	Feed, weaned pigs	Pigs weaned/sow/year	Daily gain, weaned pigs, gram	FCR, weaned pigs, FU/kg gain	Mortality, weaned pigs, %	AB use weaned pigs, as of Sept. 30 2018, ADD/100 head
A	625	Unknown	2 years	Liquid feed mixed on-farm	34.1	403	1.99	3	9.46
B	530	Blue SPF +Myc +Ap6 +Ap12	8 months	Dry feed purchased	33.7	473	1.60	2.5	8.87
C	440	Blue SPF +Myc	3 years	Dry feed mixed on-farm	30.4	485	1.80	1.4	17.48
D	235	Blue SPF +Myc +Ap12	3 years	Dry feed mixed on-farm	31.2	491	2.00	1.4	14.16
E	700	PRRS decl. (negative)	2 years	Dry feed mixed on-farm	35.5	399	1.77	1.7	6.5
F	500	Blue SPF +Myc	2 years	Dry feed purchased	-	-	-	-	3.02
G	540	Blue SPF +Ap2 +Ap6 +Ap12	8 months	Dry feed purchased	31.2	G1* 475	1.89	1.1	4.03
						G2 549	1.85	1.8	4.77
H	275	Blue SPF+ Myc+ Ap12 +PRRS1	9 years	Dry feed mixed on-farm	29.5	456	1.87	1.1	0.68
I	1300	Blue SPF	6 months	Dry feed purchased	37.0	I1* 450	1.80	2.5	12.09
						I2 450	1.80	2.5	11.52
J	700	Blue SPF +Ap6 +Ap12	3 years	Dry feed mixed on-farm	35.1	470	1,74	4.0	15.71
K	600	Red SPF	1 year	Dry feed purchased	-	430	-	1.0	1.35
L	550	Red SPF	7 months	Dry feed purchased					8.84

Based on interviews, efficiency reports and VetStat database extracts.

*Farms G and I have 2 weaner units, in this table listed as G1 & G2 and I1 & I2. Productivity separate for G1 & G2, but pooled for I1 & I2

These pig producers had been weaning pigs without the use of zinc oxide for a short or long period of time.

- Four pig producers had less than a year's experience and four had between one and three years of experience. Four pig producers had been weaning pigs without the use of zinc oxide for more than three years.
- On 11 in 12 farms, the weaned pigs originated from the same site, and on one farm they were moved from another site.
- On 11 in 12 farms, the weaned pigs were fed dry feed - evenly distributed between purchased feed and home-mixed.

The answers to questions concerning buildings revealed that the farms were representative of all Danish pig farms: on 7 in 12 farms, the farrowing units had not been renovated in the last ten years (figure 1), which was also the case for the weaner units (figure 2).

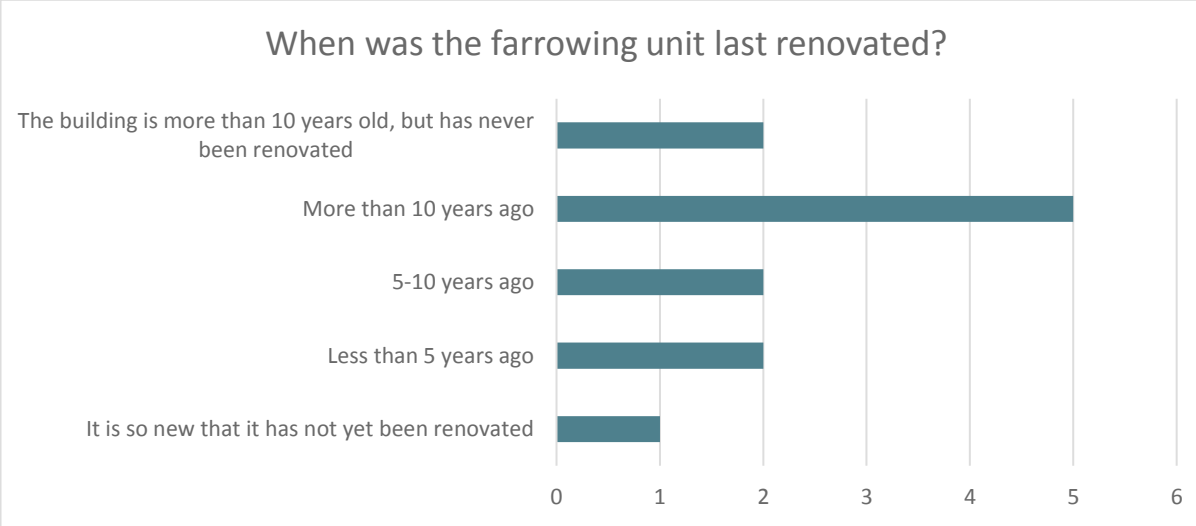

Figure 1: Age of farrowing units.

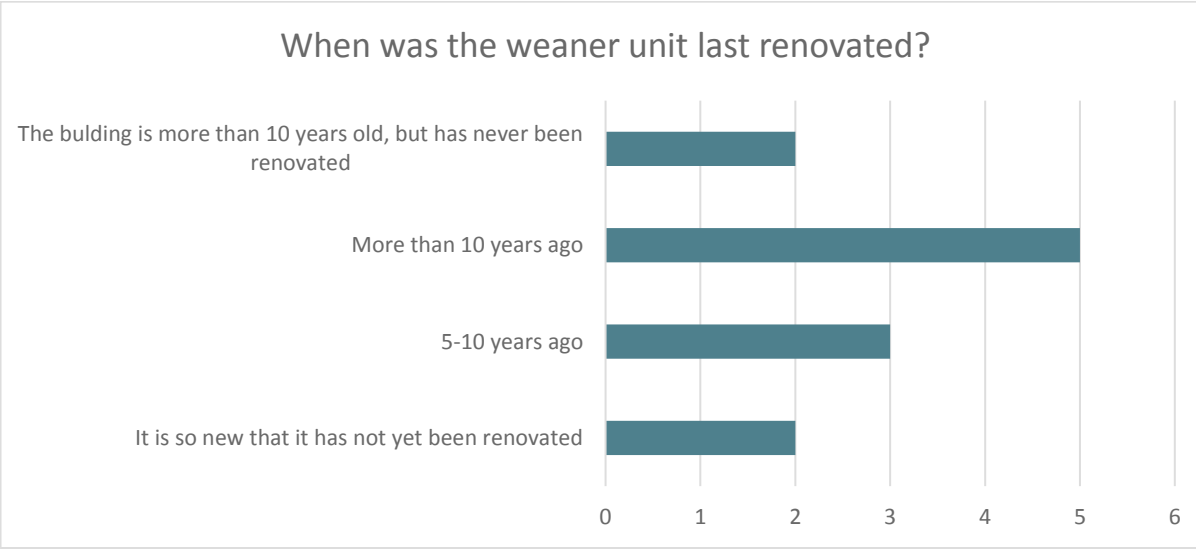

Figure 2: Age of weaner units.

Seven in 12 farms had a nursery unit, where the smallest pigs are housed in an optimum environment. On one farm, all pigs were weaned to a nursery unit where they stayed for a couple of weeks. On the other six farms, the nursery units were used for nurse pigs and pigs that are very small at weaning.

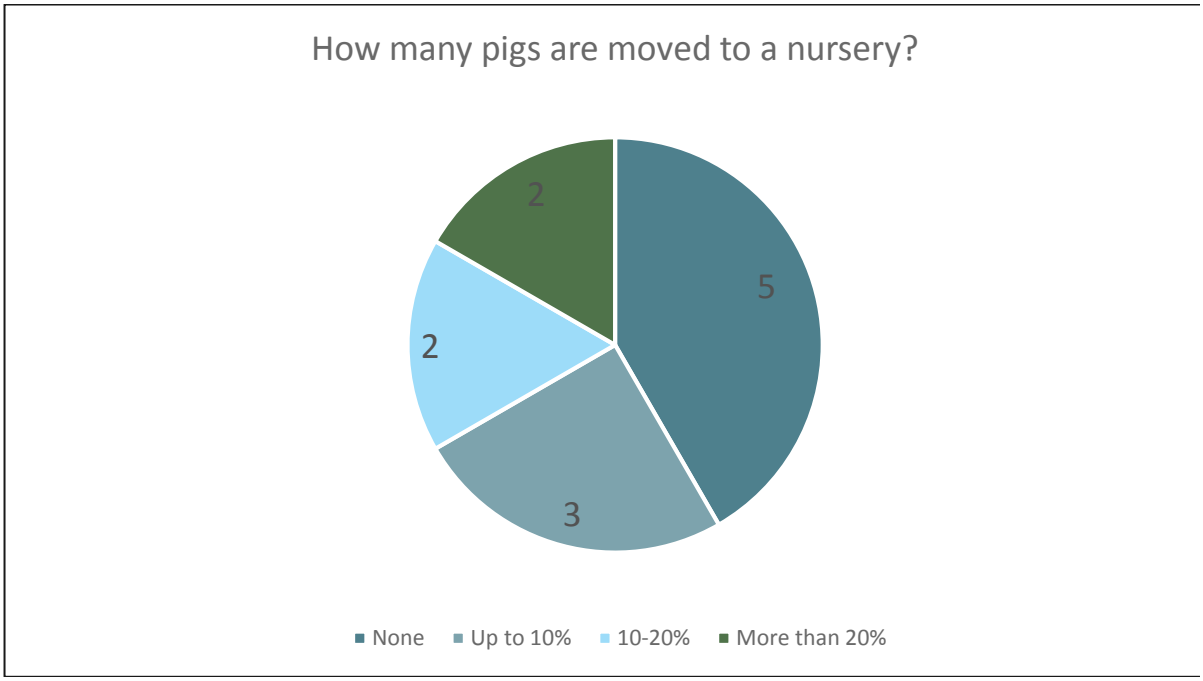

Figure 3: Pigs weaned to a nusery unit on the 12 farms, %.

Productivity

On all 12 farms, sow productivity, defined as pigs weaned/sow/year, was level with the 2017 national average. Weaner productivity, defined as daily gain and FCR, was identical with the 2017 national average.

However, data revealed that weaner mortality was lower than the 2017 national average on all 12 farms. Overall, this indicates good management routines and efficient biosecurity protocols on all 12 farms.

Table 2: Productivity on the 12 farms.

	Pigs weaned/sow/year	Daily gain, weaned pigs, g	FCR, weaned pigs, FU/kg gain	Mortality, weaned pigs, %
Average for the 12 farms in the study	33.1	461	1.83	2.0
National average 2017	33.3	453	1.87	3.1

Antibiotic use

Antibiotic use on the 12 farms is calculated as Animal Daily Doses (ADD) per 100 animals and as a 9-month rolling average. Data cover the first nine months of 2018.

Records show large variations in antibiotic use between the 12 farms; consumption averaged 8.5 ADD/100 animals, which is lower than the 2017 national average for weaners at roughly 10 ADD/100 animals.

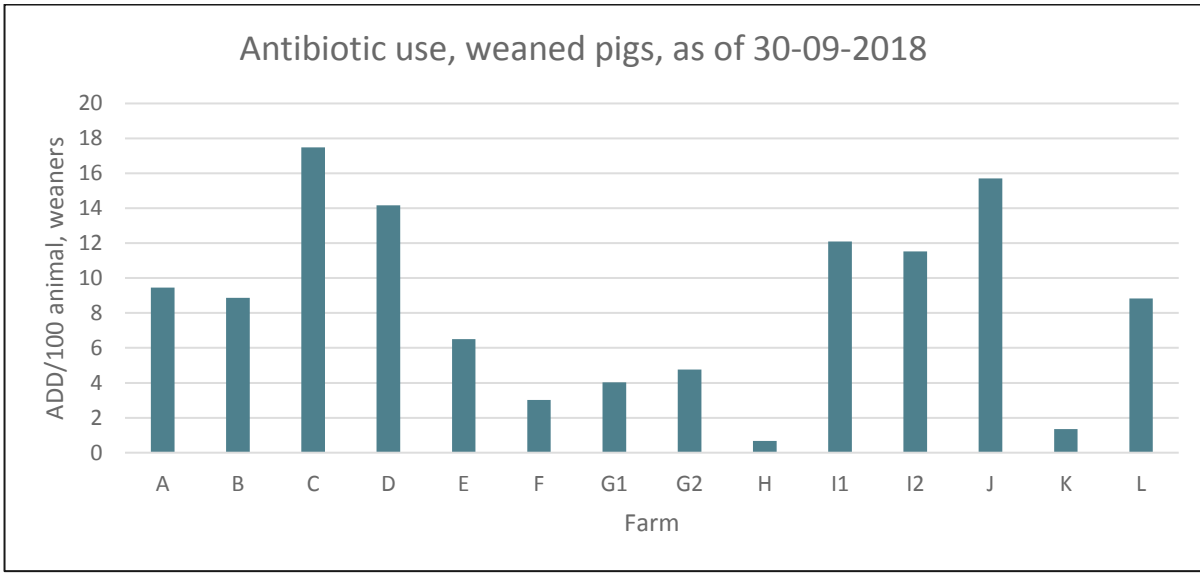

Figure 4: Antibiotic use, weaned pigs on the 12 farms in the study. Source: VetStat

Six pig producers responded that they applied flock-treatment with antibiotics against diarrhoea the first 14 days post-weaning, whereas the remaining six farms had no need for flock-treatments.

Explanatory data

Feed composition and feeding strategy

The pig producers also submitted information on the composition of feed, and table 3 shows the content of digestible protein and lysine in the weaner diets used on the 12 farms.

The weaner diets all contained 132 g to 146 g digestible protein per feed unit. The current recommended level in feed for 6-9 kg pigs and in protective diets (for pigs with diarrhoea problems) the recommendation is 140-152 g and 134-145 g digestible protein per feed unit, respectively [9]. On all farms, the feed's protein content was below or within the recommendation for protective diets. The diets contained 10.0-12.0 g digestible lysine per feed unit, which is the first limiting amino acid. The current recommendation in feed for 6-9 kg pigs is 10.6 g, and in protective diets the recommendation is 10.0 g [9]. On 11 in 12 farms, the feed was level with or above the recommendation.

Ingredients and feed composition are essential to successful weaning of pigs without the use of zinc oxide. Protein content has been proven to affect the prevalence of post-weaning diarrhoea [10], but low protein levels may cause daily gain to drop. On all 12 farms, the protein content of the feed was successfully lowered without daily gain dropping to below the national average.

Table 3: Protein and lysine content in weaning diets used

Farm	Standard dig. crude protein, g/FU	Standard dig. lysine, g/FU
A	143	10.6
B	132	12.0
C	144	10.0
D	135	11.0
E	142	11.7
F	137	11.0
G	132	12.0
H	113	6.7
I	140	10.6
J	146	11.0
K	140	12.0
L	132	10.6
Mean	136	10.8
Protective diets	134-145	10

Based on feed inserts

A high feed intake immediately post-weaning is crucial to protect pigs against post-weaning diarrhoea [5]. On all 12 farms, feeding strategy generally focused on ensuring a high feed intake up to and around the time of weaning. On six of the 12 farms, piglets were offered feed earlier than the recommended ten days. Furthermore, on four farms piglets were offered gruel feed and/or milk replacer before weaning.

Nine farms used the same feed before and after weaning, ie. the pigs were introduced to the feed in the farrowing unit.

Post-weaning, interventions were made on 10 in 12 farms aimed specifically at intake of and access to feed and water. This included extra water in troughs the first days, in some cases in combination with allocation of gruel feed several times a day. Furthermore, on many farms milk or feed was supplied in troughs, often several times a day. Switching from one diet to another was gradual: on six farms the transition took place over more than two days, while the remaining switched over 1-2 days.

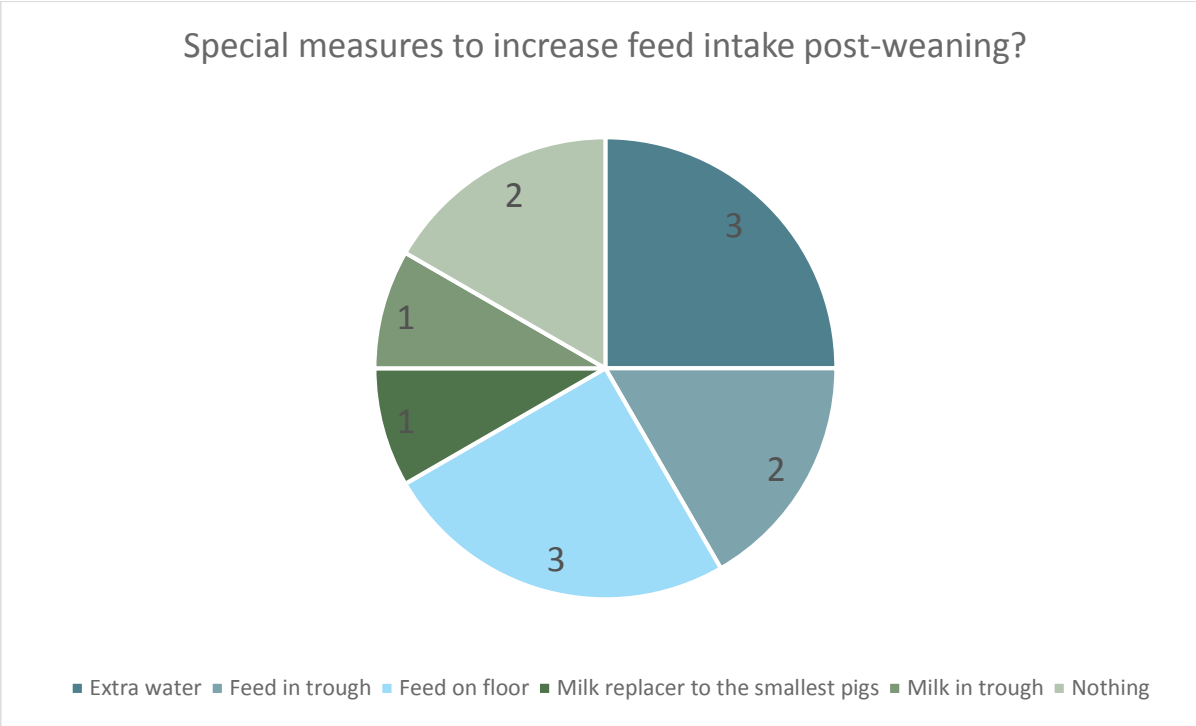

Figure 5: Interventions made to increase post-weaning feed intake.

Management

The pig producers were also asked about specific management routines in the farrowing unit and weaner unit. All farms applied several of the procedures recommended in Guidelines for Farrowing Units and in Guidelines for Growing Pigs, both published by SEGES Pig Research Centre.

In the farrowing unit, sows started out with 14-15 piglets and weaned 12-13 pigs (own weaning). Lactation period averaged 29.4 days, which is close to the 2017 national average of 31 [11]. Weaning weight ranged from 5.7 to 8.5 kg.

Before transfer of weaned pigs

All pig producers were asked about routines before pigs were transferred to the weaner unit. Hot and cold water are equally efficient for cleaning pens provided soap is used, which 9 in 12 farms did. Nine in 12 farms subsequently disinfected the pens. The importance of ensuring the pens are dry was also reflected in the answers, as on all 12 farms the pens were dried before pigs were transferred. However, only on 7 in 12 farms room temperature was recorded to ensure the pens were dry and warm before transfer of pigs.

To reduce the infection pressure in the weaner unit, correct cleaning and preparation of the pens is essential. Drying is particularly important: quick drying is essential to avoid that vaporization of liquid is attributed to the heat production of the weaned pigs. If the pen environment is not dry when a batch of pigs is transferred, it will slow the drying process as the pigs' heat production is limited. Ventilation capacity will be low, and humidity will evaporate slowly, which leads to a poor air quality and optimum

growth conditions for bacteria. Disinfection lowers the infection pressure provided it is performed correctly after cleaning.

Biosecurity

Procedures for transferring pigs to the weaner unit varied greatly between the 12 farms: On seven farms, pigs were sorted according to size; on two farms pigs were weaned litter-wise to the extent possible. On one farm, all nurse pigs were kept in one group and the rest of the pigs were mixed, and on one farm all pigs were mixed. One farm operated on a wean-to-finish basis, ie. the pigs stayed in the same pen from weaning to slaughter.

Biosecurity measures between sections and pens were not implemented on all 12 farms. On four farms, boots were changed between sections. On two farms, different tools were used in each section to minimise transmission of infection between sections.

Biosecurity also covers a range of precautions aimed at protecting the pigs against pathogen bacteria.

E.coli bacteria that trigger post-weaning diarrhoea may, like other gut bacteria and viruses, transmit via faeces to the animals. This happens partly when pigs are transferred to pens contaminated with faeces and partly when faeces from infected sections is transmitted to non-infected sections via boots and tools. Infection may also transmit between pens when pigs are mixed at weaning.

Staff

Part of the questionnaire concerned the staff working in the weaner units. On seven in 12 farms, the person in charge in the weaner unit had been employed for more than a year. On eight in 12 farms, this person had more than a year’s experience in tending to weaned pigs. This indicates that experienced staff is a key element when weaning pigs without the use of zinc oxide.

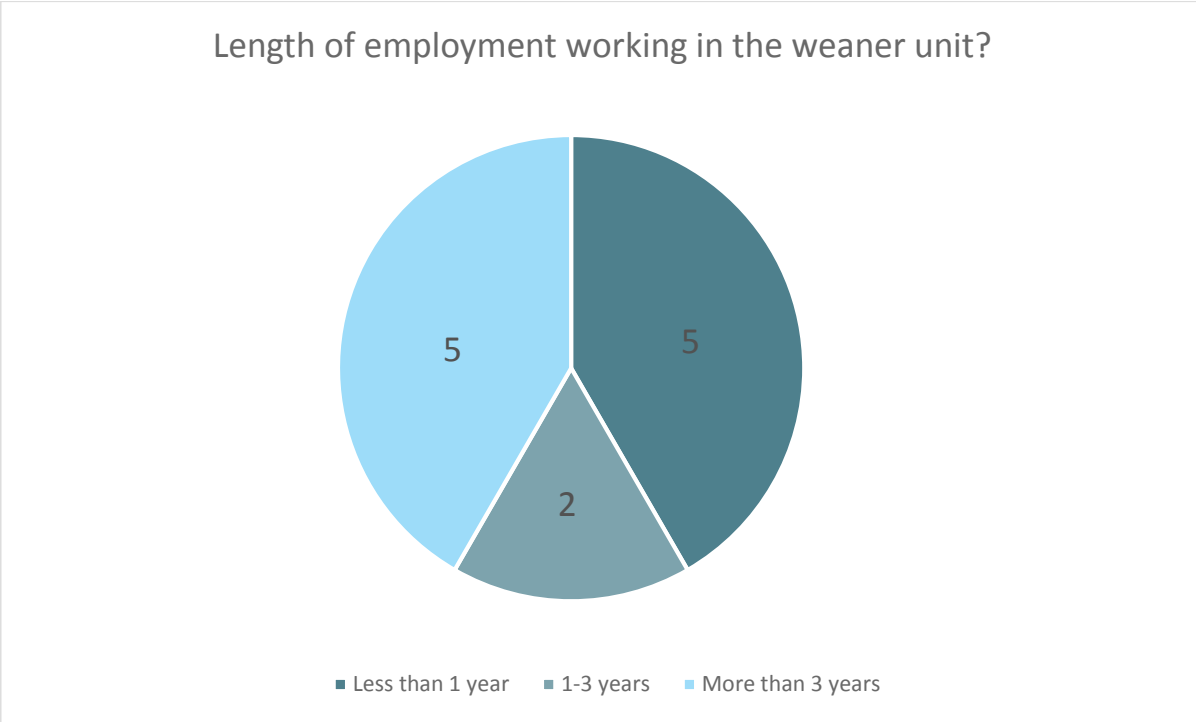

Figure 6: Length of employment of the person in charge of the weaner unit.

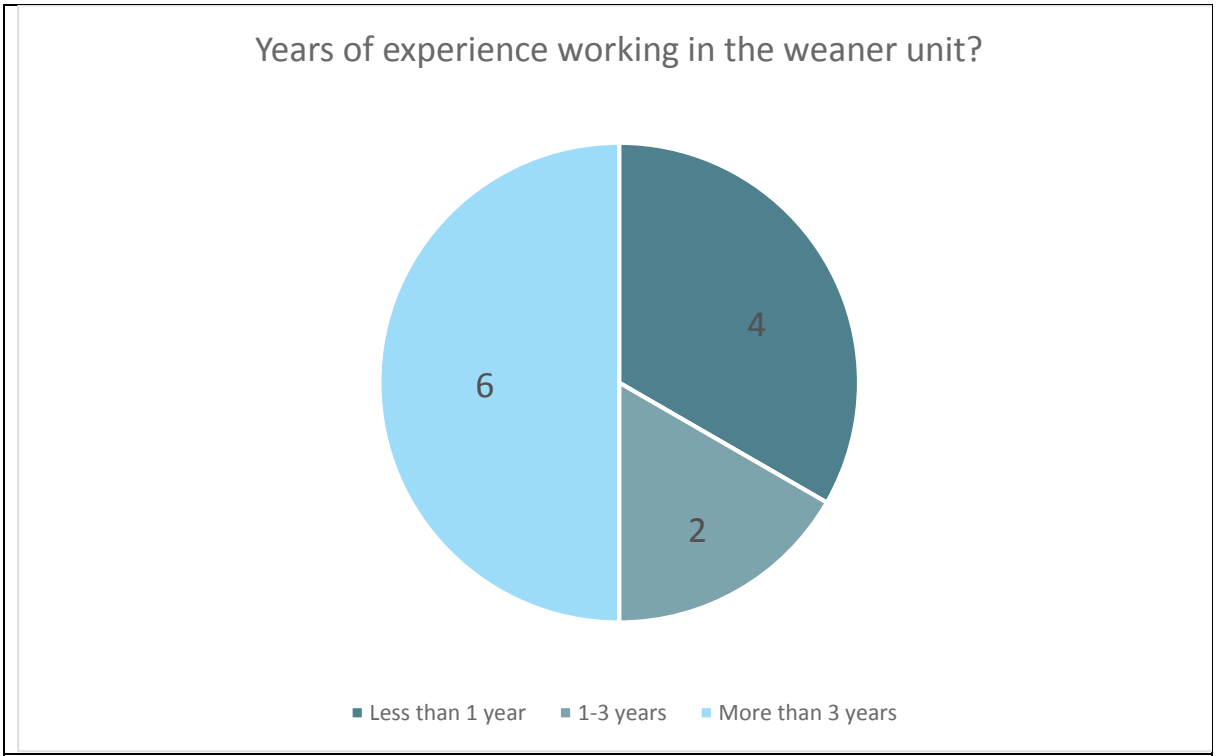

Figure 7: Degree of experience with tending to weaned pigs of the person in charge of the weaner unit.

Specific interventions that made it possible to wean pigs without using zinc oxide?

Finally, the pig producers were asked about specific interventions made on their farm that made it possible to phase out zinc oxide. Seven pig producers responded that they had done nothing in particular. The remaining five listed the below interventions:

1. ”Two daily feedings of newly weaned pigs where the pigs eat ad lib”.
2. ”Stable flow of weaned pigs. Wean a fixed number on a weekly basis – have extra capacity in the farrowing unit.”
3. ”Extra low cover of the creep and feed supplied in long troughs with milk for minimum one week”.
4. ”Focus on more water and high-quality feed. Supply of gruel feed three times a day in throughs.”
5. ”All in-all out production”.
6. ”Weaning of robust pigs that have learned to eat in the farrowing pen”.

Conclusion

Experience from 12 pig producers and their veterinarians confirm that successful weaning of pigs without the use of zinc oxide requires an effort in several areas. These pig producers named focus on biosecurity (a high level of hygiene) and on feed intake around weaning among the key elements. Furthermore, they used weaner diets with a low content of digestible protein and a content of digestible lysine that complied with the recommendations. Finally, the staff working in the weaner unit all have a certain degree of experience.

The outcome of this study, combined with existing knowledge, will form the basis of a concept designed to facilitate weaning of healthy and robust pigs without using zinc oxide. This concept will be tested on a number of commercial farms during 2020.

References

[1] https://www.ema.europa.eu/en/medicines/veterinary/referrals/zinc-oxide

[2] https://laegemiddelstyrelsen.dk/en/news/2017/the-european-commissions-decision-concerning-veterinary-medicinal-products-containing-zinc-oxide/

[3] Fairbrother, J. M., Nadeau, E., Gyles, C. L. (2005): Escherichia coli in postweaning diarrhea in pigs: an update on bacterial types, pathogenesis, and prevention strategies, Animal Health Research Reviews 6(1): 17–39

[4] Luppi, A. (2017): Swine enteric colibacillosis: diagnosis, therapy and antimicrobial resistance, Porcine Health Manag. 3:16

[5] Rhouma, M., Fairbrother, J. M, Beaudry, F., Letellier, A. (2017): Post weaning diarrhea in pigs: risk factors and non-colistin-based control strategies, Acta Vet. Scand. 59: 31-50

[6] Jensen, H.M. (2006): Health Management with reduced antibiotic use – Experiences of a Danish pig vet. Animal Biotechology 17, 189-194

[7] Pedersen, K. S. (2012): Smågrisediarré. Dansk Veterinær Tidsskrift, 18-22

[8] Hansen, B. I. & L. Shooter (2018): 2. handlingsplan for udfasning af medicinsk zink, februar 2018. Notat nr. 1806, SEGES Svineproduktion

[9] Normer for næringsstoffer, 28. udgave. SEGES Svineproduktion. https://svineproduktion.dk/Viden/I-stalden/Foder/Indhold_foder/Naeringsstoffer

[10] Callesen, J. & M. Johansen (2006): Betydning af foderets proteinindhold og sammensætning for tilvækst og fravænningsdiarré. Meddelelse nr. 740, Landsudvalget for Svin.

[11] Hansen, C. (2018): Landsgennemsnit for produktivitet i svineproduktionen 2017. Notat nr. 1819, SEGES Svineproduktion.

//CSK//

Appendix 1

Questionnaire used for compiling experiences from 12 study farms.

Experiences zinc – farm characteristics

Description of farms included in the study on weaning without zinc oxide

1. **E-mail**

2. **CHR no.**

3. **Herd size (sows/year)?**

4. **Production scope (annual production of 30 kg pigs)?**

5. **Do the pigs originate from the same site?** *Tick only one field.*

Yes

No, from another site (same owner)

No, we buy them

6. **Do you purchase gilts?** *Tick only one field.*

Yes

No, we produce our own gilts

7. **Are you currently using zinc oxide?** *Tick only one field.*

Yes

No

8. **If you do not use zinc oxide, for how long have you been weaning pigs without?**

Buildings and framework *Description of physical framework*

9. When was the farrowing unit last renovated? *Tick only one field.*

Less than 5 years ago

5-10 years ago

More than 10 years ago

The building is so new that it has never been renovated

The building is more than 10 years old, but has never been renovated

10. How many sections are there in the farrowing unit?

11. How many farrowing pens in total?

12. When was the weaner unit last renovated? *Tick only one field.*

Less than 5 years ago

5-10 years ago

More than 10 years ago

The building is so new that it has never been renovated

The building is more than 10 years old, but has never been renovated

13. How many sections are there in the weaner unit?

14. How many pig places in each pen (weaner unit)?

15. How many pens in each section (weaner unit)?

16. Have you installed floor heat in the weaner unit? *Tick only one field.*

Yes

No

17. Do you have a nursery/buffer unit? *Tick all relevant.*

Nursery

Buffer (extra farrowing pens)

Neither

Feed *Description of feeding strategy/feeding regimen*

18. Home-mixed or purchased (weaner unit)? *Tick all relevant.*

Home-mixed

Purchased

19. Liquid feed or dry feed (weaner unit)? *Tick all relevant.*

Liquid feed

Dry feed

20. When do you start feeding piglets (age in days)?

21. Which type(s) of feed do you offer the piglets? *Tick all relevant.*

Gruel feed

Milk in trough
Milk in milk cup system
Dry feed
Liquid feed
Other

22. Do you use the same feed for the piglets in the farrowing pen and at first in the weaner pen? *Tick only one field.*
Yes
No

23. Do you do anything special to increase the feed intake after weaning? *Tick only one field.*
Floor feeding
Feed in trough
Special feeders, eg first feeder
Extra water
Other:

24. How many diets do you use in the weaner unit?

25. Over how many days do you switch from one diet to another? *Tick only one field.*
From day to day
Over 1-2 days
More than 2 days

26. Do you use additives in the feed aimed at improving gut health? (if yes, which ones?)

27. Do you use additives in the water aimed at improving gut health? (if yes, which ones?)

Management *Description of management routines*

28. Routines for assuring all pigs of colostrum? *Tick all relevant.*
Split-suckling
Nurse sows for the smallest pigs
Colostrum bank
Other:

29. How many pigs do the sows start out with?

30. Where do you place pigs from nurse sows? *Tick only one field.*

Weaner unit
Nursery
Stay in the farrowing unit
Other:

31. What is own weaning?

32. Average lactation period, days?

33. Average weaning weight? Estimated or weighed?

34. Do the pigs stay in the farrowing pen at weaning or are they moved directly to the weaner unit?
Tick only one field.
They stay in the farrowing pen
They are moved directly to the weaner unit

35. How many pigs are moved to a nursery? *Tick only one field.*
None
Up to 10%
10-20%
More than 20%

36. For how long, averagely, are the pigs housed in the nursery?

37. How do you move the pigs from the nursery to the weaner unit? *Tick only one field.*
They are transferred with the batch they were born with (same age)
They are moved to a newly weaned batch (same size)
They are housed separately until 30 kg

38. How are the pigs sorted/mixed and transferred to the weaner unit? *Tick all relevant.*
According to size
X farrowing pens are moved to one pen in the weaner unit
Gender
Other:

Health *Description of health status and treatments*

39. For how long have you had your current health status?

40. Do you perform routine antibiotic treatments the first 14 days post-weaning? *Tick all relevant.*

Yes

No

For periods

41. How do you apply flock-treatment (diarrhoea)? *Tick all relevant.*

At fixed times

At clinical outbreaks

42. Do you observe diarrhoea problems among the piglets in the farrowing unit? *Tick only one field.*

Yes – for periods of time

Yes - mostly

No

Hygiene *Description of cleaning and hygiene routines*

43. Which of the below elements do you use when cleaning sections (weaner unit)? *Tick all relevant.*

Cold water

Hot water

Soap

Disinfection

Drying

Other:

44. **Do you check temperature/drying at transfer of pigs?** *Tick only one field.*

Yes

No

45. Do you apply one or more of the below routines to prevent transmission of infection between sections? *Tick all relevant.*

Change of footwear

Wash of footwear

Separate tools for each section

Change of coveralls between sections

Other:

46. Do you monitor water quality (analyses)? *Tick only one field.*

Yes, systematically

Yes, when needed

No

47. Do you clean the water pipes? *Tick only one field.*

Yes, systematically

Yes, when needed

No

Staff *Description of staff and their work experience*

48. How many people work in the weaner unit on a daily basis? *Tick only one field.*

1

2-4

5 or more

49. How many people work in the weaner unit during weekends/holidays? *Tick only one field.*

1

2-4

5 or more

50. For how many years has the person in charge of the weaner unit been employed? *Tick only one field.*

Less than a year

1-3 years

More than 3 years

51. How many years of experience does the person in charge of the weaner unit have with tending to weaned pigs? *Tick only one field.*

Less than a year

1-3 years

More than 3 years

Other proposals

52. Do you have any other ideas, proposals or steps related to weaning without zinc oxide? Something you are already doing, have considered doing or think we should look into?

Tlf.: 33 39 45 00
svineproduktion@seges.dk