

Optimising on Farm Feeding Strategies as a Means to Reduce Environmental Impact of Pig Pollution

Introduction

During the course of this project, I have been conducting research into how the methods of feeding pigs could be optimised to increase efficiency and reduce environmental impact and sustainability. Current methods are inefficient as they do not optimise the different phases of feeding, increasing environmental impact. The project has given me a chance to explore the scientific literature to enhance our understanding of alternative pig-feeding strategies, with the aim of recommending more environmentally friendly feeding strategies, while considering the capacity of farms to adapt to these suggested changes. The vision was to use scientific research to find the theoretically best option, while considering the logistics of implementing these changes in real life.

I have particularly focused on phase feeding, which is a feeding method designed to meet the nutritional needs of the pigs more closely at each stage of their development. By altering the nutritional contents of the feed at different stages during the grower-finisher period, it is predicted that the nutritional needs of the pigs will be more closely met which will allow sufficient growth, while also minimising waste. As well as optimising the growth performance of the pigs, it is expected that the improved nutrient conversion rate should minimise both the environmental impact and the cost of production. This is because, if the pigs are only fed as much nutrients as they require, less nutrients such as nitrogen and phosphorous will be excreted into the environment, and less nutrients need to be supplied in the feed. There are also other alternative methods such as daily multiphase feeding, blend feeding and single diet, which I also explored, in comparison with phase feeding.

Methods, Process

My journey in this project started with a visit to the local pig farm owned by the University of Leeds, where I had the opportunity to look around the different sections of the farm to see where the pigs go at different stages in their life. My supervisor led me around the indoor unit, starting from where the sows that had recently given birth were nursing the piglets, and then moved onto the nursery room, where the older piglets were kept. I was also able to see the unit where the pregnant sows were living. It was interesting to see how the pigs were grouped together with other pigs in the same growth stage, and the conditions were specifically controlled to meet their needs. I was also intrigued to learn that there was both an outdoor and an indoor unit, but that outdoor units are much less common in the UK compared to other pork-producing countries. Being able to see the pig production process in real life and discuss the concepts behind it with my supervisor was a real privilege and was a great way to start the project by firing my interest and giving me some perspective. During the rest of the project, I found that after having seen the farming system for myself, it was much easier to visualize the concepts and ideas being discussed in the literature.

My next steps were to start reading around the topic of phase feeding, to develop a better understanding of the science behind it, and to see what research had been done into it. Once I had a decent grasp of the subject area, I began to collect papers that I thought would be relevant to my review. I started my search by entering "phase feeding" AND "finishing pigs" into Web of Science, and looking through all the papers that came up. There were 70 results at this stage, so my next step was to look briefly through each of these papers to see which were relevant to my research. My aim was only to select papers looking specifically at the effect of phase feeding compared to a non-phase-feeding control. I found that many of the papers in my search, despite using phase-feeding methods in their studies, they were not actually investigating the effect of phase feeding, and instead were looking at the effect of other factors on the performance of the pigs, such as crude protein levels. I also was looking out for what observations were made, as I was only interested in the performance of the pigs, and any environmental impacts of the feeding method. Hence some articles that were investigating other impacts of phase feeding, such as gut microbes or feeding behaviour. I saved the relevant articles to End Note, as reference for later. I did the same search on Google Scholar to check that I hadn't missed any key papers, but I found there was a lot of crossover between the two search engines. I ended up with eight research papers, which I had saved in end note.

When looking over the literature I had collected, I found that there seemed to be quite a lot of contradiction in the research findings. I went into the project believing that feeding was an ideal feeding method compared to the alternatives. However, as I started to expose myself to more of the literature, I started to realise that there was actually lots of evidence to suggest that other methods might actually be advantageous over phase feeding. For example, there were studies that suggested daily multi-phase feeding was better for the environment, or that single diet is more practical and economical. I realised the starting point of my project might have been slightly biased, and that I would have to be open-minded going forwards and consider the validity of all the feeding methods in question.

Another issue I faced with the literature was that not a lot of the studies I found looking into phase feeding had looked into the effects on the environment, and were mainly focused instead on growth performance. While this was useful in providing me with plenty of evidence that there seems to be no difference in performance between most pig feeding methods, it became a problem when I realised I had barely any evidence for the environmental aspect of my review, which was a main focus. I decided to try to seek out any papers I could find relating to nitrogen and phosphorous excretion, using Google Scholar, and also following citations in the papers I had already read. While this did help to an extent, I realised that the issue was simply that there appears to be a lack of literature into this area. Hence I decided to do what I could with the evidence I had access to, and concluded that more research needs to be done into this area.

Another adjustment I made during the project was to add an extra column to my summary table where I could keep track of these extra factors, such as cost and practicality. This way I could consider not only the growth performance and environmental impact of the feeding methods, but also the practical difficulties of implicating these techniques in real life. Since the findings for the environmental aspect were not very conclusive, and the growth performance was neutral, this was a helpful addition to allow me to consider additional strengths and weaknesses for the different feeding methods.

Once I had collected all the relevant information, I used it to write a literature review to summarise my findings, which was then sent to the National Pig Centre to inform future decisions and research in this area.

Conclusions, Impacts

After having looked at the literature that compares phase feeding to alternative pig feeding methods, it appears that we currently do not know enough to declare one feeding method as definitively better than the others. The environmental impact of pig feeding is a complex topic that depends on various factors, from feed ingredients to the genetics of the individual pigs. There is evidence to support the notion that 3-phase feeding allows for the more precise matching of the nutrient requirements of the pigs at different growth stages, which can potentially reduce the over-supplementation and excretion of nutrients like nitrogen and phosphorous.

Other aspects such as cost and practicalities should also be taken into account before making decisions about which feeding strategies to implicate. Feeding pigs a single diet would be more practical, especially on smaller farms, as only feed needs to be made, and only one storage bin is required. However, if nutrient utilisation and environmental impact are compromised then the impracticalities of phase feeding might outweigh this in the long term. While there is evidence to suggest that phase feeding could be beneficial to the environment, much more research needs to be done to confirm that it does actually reduce nutrient excretion compared to other feeding methods.

Through working on this literature review, I have gained valuable insights into the existing research on pig feeding methods, enabling me to critically evaluate and compare the evidence supporting each alternative technique. By publishing my findings on the Laidlaw Scholars Network and making my research known to the Pig Foundation, I aimed to facilitate better-informed decision-making among scientists and farmers in this field.

I hope that my research raises awareness of the gaps in the literature, so that more studies can be done to come to better conclusions as to which feeding methods should be implemented going forwards. My aim is that the National Pig Centre uses my work as a motivation to fund further research into this area, so that further investigation can be done at the University of Leeds and globally. I hope that my work can raise awareness about the importance of sustainable and ethical pig farming practices. I am pleased that by sharing my findings, I will have contributed to the broader conversation on animal welfare and sustainable agriculture.

Reflections

This project has been an incredibly valuable learning experience for me, equipping me with essential skills ranging from understanding and interpreting scientific literature to honing time management and self-discipline. As a newcomer to conducting literature reviews, I found myself doing many things that I had never done before, such as using sites Web of Science and End Note and using excel to compare papers. These new challenges, though initially intimidating, served as character-building moments that pushed me beyond my comfort zone. Despite the initial struggle to access Web of Science and set up an account, seeking support from my supervisor and persisting through the obstacles allowed me to overcome these hurdles successfully.

One of the major difficulties I faced during the project was maintaining consistent motivation and adhering to self-imposed deadlines. Working independently required immense discipline, and I learned to set clear daily objectives to stay on track and prevent falling behind. The supportive network of fellow Laidlaw scholars played a crucial role in keeping me accountable and encouraged me to stay focused on my goals.

Beyond the skills I acquired, the research itself has been profoundly impactful on me. Prior to this project, I had little knowledge of the intricacies involved in the pig production system and animal nutrition. Delving into this field has been a fascinating journey, providing me with an intimate understanding of the complexities behind meat production—a process that is often taken for granted. Discovering the thought and consideration that goes into ensuring sustainable and ethical practices in pig farming has been an eye-opening privilege.

Skills and Future plans

While this project did not require traditional leadership involving managing a team, it provided me with numerous skills that are fundamental to becoming an effective leader. Throughout the literature review, I took the initiative to independently manage the research process and set clear objectives, ensuring I could achieve my goals without constant supervision. Decision-making was essential as I had to discern which papers to include in the review and which were less relevant, while also considering how to best summarize the current literature. My communication skills were put to the test as I effectively engaged with my supervisor, arranging weekly meetings, and keeping her informed of my progress. Seeking support and actively participating in discussions not only strengthened my research but also showcased my willingness to learn and grow as a researcher. These skills are crucial for leadership, and I am eager to apply them to my future endeavors in the scientific community and beyond.

All of the skills I have acquired and developed during this project, including self-discipline, time management and leadership, will undoubtedly prove invaluable as I progress through my university course and gain further experience in the science industry. The discipline and time management skills I honed will serve as a strong foundation for tackling the demanding challenges that lie ahead in my academic journey. As I plan to embark on a laboratory placement later this summer, where independent decision-making and facing novel situations will be essential, I am now better prepared after having gone through a similar process during this project. The experience will not only deepen my scientific knowledge but also strengthen my ability to work autonomously and adapt quickly to new environments.

Looking ahead, I am eager to take my skills to the next level during my year in industry, where I hope to secure a professional placement in a scientific research institution. The project has already fostered my curiosity and willingness to explore unfamiliar areas of science, and this experience will undoubtedly be enhanced through exposure to cutting-edge research during my industry placement.

With each opportunity and experience, I am dedicated to becoming a more resilient and inquisitive scientist capable of addressing complex questions and solving real-world problems. As I envision my future career as a research scientist, I see myself working diligently to improve people's lives through meaningful contributions to scientific knowledge. This research project has been an inspiring journey that has not only revealed the potential impact of my work but has also motivated me to become an ethical leader and advocate for positive change in the world. Witnessing how my findings can influence others encourages me to seek out further opportunities for personal and professional growth, continually building upon the foundation established through this project.

Overall, the skills cultivated during this research experience will be a driving force in shaping my future as a diligent and inquisitive scientist, committed to pushing the boundaries of knowledge and making a positive difference in the lives of others.

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Please comment on your scholar's research period, what you consider to be your scholars' strengths and which leadership attributes you feel your scholar has demonstrated and is particularly skilled in. You could also identify areas which your scholar can develop further.

Alice worked on the phase feeding review for six weeks. We met on a weekly basis to progress the work week by week. Alice was a very keen and enthusiastic student and took everything on board at the weekly meetings. She is a well organised and self-motivated student. Alice had to learn lots of new skills to complete the report which included; reading, and interpreting scientific papers, use of literature search engines (web of science, google scholar), use of refencing software (endnote) as well as having to understand the world of pig production. Each week Alice listened to my comments and suggestions and worked well independently for the rest of the week to get the work done showing great time management. The report was well written and shows clear understanding and interpretation of the literature. Well done Alice!