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Precision Feeding in Pigs

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Introduction

Precision livestock farming is an innovative production system approach based on the intensive and integrated use of advances in animal sciences and in the new technologies of information and communication. Its main objective is to optimize animal production and the management of the productive processes; Precision livestock farming can be defined as the management of livestock using the principles and technologies of process engineering. Precision animal nutrition or precision feeding is part of the precision livestock farming approach and involves the use of feeding techniques that allow the proper amount of feed with the suitable composition to be supplied in a timely manner to a group of animals. Precision feeding allows animals to be fed with diets tailored daily to requirements. It is now evolving in animals such as, pigs. It is also known as information intensive nutrition or personalized nutrition. Swine production systems have dramatically changed in the last three decades. Today main challenges for the pig industry are to maximize feed efficiency while minimizing production costs and environmental impacts. The high relevance of environmental load has forced swine producers and nutritionists around the world to re-assess the nutritional and feeding programmes in use. Excretion of nutrients can be reduced by providing an individual pig with its required dietary levels through precision feeding system. This practice also improves nutrient efficiency and reduces production costs.

Objectives of Precision Feeding in Pigs

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1. Effective utilization of nutrients and feeds and optimizing productivity
2. Reduction of feed cost
3. Increasing profitability
4. Reduction of environmental pollution

Nutrient Requirements of Pigs

1) Dietary nutrient requirements of growing pigs (90% dry matter basis) (NRC, 2012)

Sl. No.	Nutrients	Nutrient requirements for different body weight (kg)						
		5 – 7	7 – 11	11 – 25	25 – 50	50 – 75	75 – 100	100 – 135
1	NE content of diet (kcal/kg)	2448	2448	2412	2475	2475	2475	2475
2	DE content of diet (kcal/kg)	3542	3542	3490	3402	3402	3402	3402
3	ME content of diet (kcal/kg)	3400	3400	3350	3300	3300	3300	3300
4	Estimated ME intake (kcal/kg)	904	1592	3033	4959	6989	8265	9196
5	Body weight gain (gram/day)	210	335	585	758	900	917	867

2) Nutrient requirements of pigs (BIS, 1986) (reaffirmed in 2001)

Sl. No.	Nutrients	Nutrient requirements for different body weight (kg)		
		Pig starter/ Creep feed (upto 20 kg live weight)	Pig grower meal (weaning to 35 kg live weight)	Pig finishing/ breeding meal (over 35 kg live weight)
1.	Moisture content (max, %)	11	11	11
2	Crude protein (min, %)	20	18	16
3	Crude fat/ether extract (%)	2	2	2
4	Crude fibre (%)	5	6	8

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5	Total ash (%)	8	8	8
6	Acid insoluble ash (%)	4	4	4
7	ME (kcal/kg)	3360	3170	3170
8	Calcium (%)	0.6	0.6	0.6
9	Phosphorus (%)	0.6	0.4	0.5
10	Iron (mg/kg)	100	90	80
11	Copper (mg/kg)	8	6	6
12	Vitamin A (IU/kg)	1700	1300	1300
13	Vitamin D (IU/kg)	190	180	130

Implementation of Precision Feeding

Precision feeding concerns the use of feeding techniques that provide animals with diets tailored according to the production. Objectives are to address environmental impact and animal welfare issues. Precision feeding is presented in this document as the practice of feeding individual animals while accounting for the changes in nutrient requirements that occur over time and the variation in nutrient requirements that exists among animals. Implementation of precision feeding systems in commercial farms requires the integration of three types of activities:

1. Automatic collection of data
2. Data processing according to established control strategy
3. Action concerning control of system

Application of precision feeding at the individual level is only possible where measurements and data collection, data processing, and control actions can be applied to the individual animal.

Data collection:

Measurements of the animal, the feeds, and the environment are essential for precision feeding and these parameters have to be measured directly and frequently. Essential measurements for precision feeding in growing pig operations include feed intake and body weight. The availability and the rapid development of new devices and emerging sensor technologies offer great potential for other measurements (e.g., body composition, physical activity, interactions among animals) RFID (radio frequency identification device)ear tags in

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monitoring pig movement that will allow more precise estimation of requirements and real-time animal monitoring.

Data processing:

Collected data has to be processed according to the farm production objectives .In animals offered feed *ad libitum*, the only way to control nutrient intake is by varying the composition of the feed to be served. . Mathematical models developed for precision feeding, however, have to be designed to operate in real-time using real-time system measurements. Therefore, they are structurally different from traditional nutrition models, which are developed to work in a retrospective manner and to stimulate known production situations.

Control of system:

The information collected and processed is used to control the production system. In the context of precision feeding, automatic precision feeders are used to provide individual pigs with the right amount and composition of the feed at a given time. Plastic button tags inserted in the ear contain passive transponders (RFID**)** that are used for pig identification.

Impacts of Precision Feeding

Precision feeding programme for growing-finishing pigs is the largest source of environmental impact in the pig production. Switching from a conventional feeding system to precision feeding programme during the growing-finishing phase would have the potential environmental impact of pig production. Environmental impacts were evaluated according to the LCA standards using the approach described based on four interrelated steps: goal and scope definition; life-cycle inventory; life-cycle impact assessment, and interpretation.

Precision feeding programmes cause minimization of nutrient excretion as well as odour and gas emissions from confinement pork production facilities ,Environmental cost of grain production used for pig diets is also minimized in precision feeding. Improvements of precision feeding models which are currently in use will further reduce the environmental foot print of the swine industry with estimated reductions of feed cost of more than 12%, nitrogen and phosphorus excretion of more than 60%, and greenhouse gas emissions of over 12% .

Conclusion

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To further develop precision feeding systems, it is necessary to improve our actual understanding of several animal metabolic processes. Precision feeding is still based on mathematical models and nutritional concepts developed for average population responses. Individual pigs are able to modulate growth and the composition of growth according to the level of available amino acids Advances in precision feeding rely on the development of sound nutritional concepts and comprehensive biological models to more precisely estimate individual real-time nutrient requirements. The new understanding of individual metabolism and nutrition will allow animal science to move forward, opening up new opportunities for individualized nutrition. Further developments will also include new knowledge concerning the genetic capability of pigs to efficiently use nutrients and integrate in the daily estimation of individual pigs' optimal nutrient requirements, the interaction between feeding patterns, diet composition, and the digestive and metabolic dynamic availability of dietary nutrients. These will ultimately enhance efficiency, profitability and sustainability of the overall pig farming and pork production system.