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Abstract

A voluntary sample of pork producers and advisers to the swine industry were surveyed about feed efficiency. The questionnaire was designed to accomplish three objectives: (a) determine the level of knowledge related to feed efficiency topics, (b) identify production practices used that influence feed efficiency, and (c) identify information gaps requiring additional knowledge to further improve feed efficiency. Results suggest that many practices that improve feed efficiency are used in production, but gaps in information and knowledge exist across demographics of respondents. Extension education should be expanded to provide more information in an easy-to-access format for the swine industry.

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Introduction

Feed represents the largest input expense for U.S. pork producers, usually totaling more than 60% of the total cost of production (Reese, Shannon, & Meisinger, 2010). Increased non-feed use for the U.S. corn crop (Westcott, 2012) has led to distinct rises in the price of ingredients. Efforts to fully adopt existing knowledge to optimize feed efficiency by the U.S. pork industry will improve the long-term competitiveness of the U.S. pork industry and the sustainability of food supplies.

The survey reported here was developed to identify the current state of knowledge and the production practices used in the swine industry. The questionnaire was designed to accomplish three objectives:

1. Determine the level of knowledge related to feed efficiency topics
2. Identify production practices being used that influence feed efficiency
3. Identify information gaps or areas requiring additional knowledge to further improve feed efficiency

Conclusions drawn from the survey will be used to assemble Extension education factsheets to rapidly disseminate information to producers and industry workers on current and innovative information that may improve feed efficiency and to aid in future research initiatives.

Procedures

The project was supported by National Research Initiative Competitive Grant no. 2011-68004-30336 from the USDA National Institute of Food and Agriculture. The procedures for the survey were approved by the Kansas State University Committee for Research Involving Human Subjects. The survey was web-based and created using the Axio Survey Creation Tool (https://online.ksu.edu/Survey/).

The subjects of the survey were individuals with a primary occupation in the swine industry. The survey was made available via the Internet from November 1, 2011, until March 1, 2012. Brashear, Hollis, and Wheeler (2000) found that Illinois pork producers rely more on popular press material for information. Because of this, subjects targeted for the questionnaire were asked to participate through press releases advertised in popular press magazines, including *National Hog Farmer* (www.nationalhogfarmer.com), *Pork Magazine* (www.porknetwork.com), and *Feedstuffs Weekly Newspaper for Agribusiness* (www.Feedstuffs.com). Emails with the press release were distributed to digital subscribers of those magazines, producer and allied industry email address lists used by K-State Swine Research and Extension, and individuals who registered for the International Conference on Feed Efficiency in Swine that was held in November, 2011. Also, a link to the survey website was available on K-State's Swine Research and Extension website (www.KSUswine.org).

Individuals who participated in the survey were not required to answer all questions; therefore, results were summarized based on responses to individual questions. Total responses for individual questions ranged from 123 to 205.

Two demographic questions were asked to identify the population of respondents and to summarize the answers received within the survey. The first was designed to allow respondents to categorize themselves by the segment of the swine industry that they represented as a primary occupation. The categories of occupations used in the survey included:

A. Pork producer
B. Consultant to the swine industry
C. Academia or education

D. Other

In total, 205 individuals (Table 1) responded; 28% identified themselves as pork producers, 33% as consultants to the swine industry, 16% in academia or education, and 23% in the "Other" category.

The second question was designed to categorize participants by the number of years of experience they had working in the swine industry. The categories included:

A. 0 to 5 years

B. 5 to 10 years

C. 10 to 20 years

D. 20+ years

One hundred and ninety-two participants responded to the second demographic question, 12% had 0 to 5 years, 15% had 5 to 10 years, 21% had 10 to 20 years, and 53% had more than 20 years of experience.

Table 1.

Demographics of the Survey Respondents

What segment of the swine industry od you represent as a primary occupation?		
	Responses	% of Total
Pork Producer	57	28%
Consultant to the Swine Industry	67	33%
Academia	33	16%
Other1	48	23%
Total	**205**	**100%**
How many years of experience do you have working in the swine industry?		
	Responses	% of Total
0 to 5 years	23	12%
5 to 10 years	28	15%
10 to 20 years	40	21%
20+ years	101	53%

Total	**192**	**100%**

[1] Respondents who identified themselves as other were asked to describe their role in the swine industry. A majority of those individuals said they were graduate students, media reporters/editors, feed manufacturers, meat packers, technical support representatives for production systems, and pharmaceutical/vaccine sales representatives.

After establishing demographics of the sampled population, a series of knowledge-based, production practice, and discovery questions were asked. All questions were developed by grant investigators and an industry advisory board. Knowledge and production practice questions were delivered in a multiple-choice format, including "Not sure" and "Other" options. Several production practice questions also branched into sub-questions to allow for further data collection. The discovery questions were designed so respondents could rank a predetermined topic area priority list from 1 to 10. To summarize the discovery questions, the average rank of each topic area was used to determine an overall ranking from the highest to lowest priority.

Results

Dietary Energy

Participants were asked how much of an improvement in feed efficiency can be expected by increasing dietary fat by 1% (Table 2). A total of 138 individuals responded; 41% percent answered correctly (2%; De la Llata et al., 2001), 32% answered incorrectly, and 27% responded not sure.

Table 2.
Dietary Energy

By adding 1% fat into the diet, feed efficiency is improved by approximately?[1]				
Industry Segment	**Producers (39)**	**Consultants (51)**	**Academia (24)**	**Other (24)**
Correct	31%	63%	33%	17%
Incorrect	25%	27%	42%	45%
Not sure	44%	10%	25%	38%
Years of Experience	**0 to 5 (12)**	**5 to 10 (17)**	**10 to 20 (32)**	**20 or More (77)**
Correct	33%	29%	31%	48%
Incorrect	8%	24%	47%	33%
Not Sure	58%	47%	22%	19%

Total	**(138)**			
Correct	9%			
Incorrect	32%			
Not Sure	27%			
1The correct answer was 2% (De la Llata et al., 2001).				

Grinding / Particle Size

A total of 164 respondents answered a question asking what cereal grain particle size they use or recommend using for swine diets (Table 3). Most respondents (73% of 164 individuals) indicated below 700 µm, but only 4% of respondents ground grain below 400 µm, and 19% were not sure. If respondents answered with a particle size greater than 400 µm, they were asked a branched question to determine why they do not grind to a finer particle size. Participants were also asked how much of an improvement in feed efficiency can result from decreasing the particle size of grain by 100 µm. In total, 160 individuals responded; 36% answered correctly (1.1 to 1.4%; Wondra, Hancock, Behnke, Hines, & Stark 1995), 31% answered "Not sure," and 33% answered incorrectly.

Table 3.

Grinding/Particle Size

What is the current particle size that you grind or recommend grinding cereal grains to for swine diets?[1]				
	Responses	**% of Total**		
Greater Than 800 µm	1	1%		
700-800 µm	13	8%		
600-700 µm	49	30%		
500-600 µm	39	24%		
400-500 µm	24	15%		
Less Than 400 µm	7	4%		
Not Sure2	31	19%		
Total	**164**	**100%**		
By reducing the grain particle size of a ration by 100 µm, feed efficiency improves by approximately how much?[3]				

Industry Segment	Producers (44)	Consultants (57)	Academia (28)	Other (31)
Correct	27%	46%	36%	32%
Incorrect	37%	42%	18%	23%
Not Sure	36%	12%	46%	45%
Years of Experience	**0 to 5 (16)**	**5 to 10 (21)**	**10 to 20 (36)**	**20 or More (87)**
Correct	25%	48%	39%	34%
Incorrect	31%	19%	28%	38%
Not Sure	44%	33%	33%	28%
Total	**(160)**			
Correct	36%			
Incorrect	33%			
Not Sure	31%			

[1] Individuals who answered with micron sizes larger than 400 µm were asked a branched question, "Why do you not grind to a finer particle size?" 35% of responses were that flowability or handling characteristics cause problems in feeding system, 18% were that ulcer rates are too high, 15% were that current mill cannot grind to a smaller particle size, and 14% were that production rate in feed mill is slowed too much.

[2] Forty-five percent of individuals categorized as "Other", and 53% of participants with 0 to 5 years of experience answered not sure.

[3] The correct answer was 1.1 to 1.4% (Wondra et al., 1995).

Pelleting

A total of 151 individuals answered if they feed or recommend feeding pelleted finishing diets; 59% replied no, and 41% replied yes (Table 4). Individuals who answered no were then asked why they do not pellet or recommend pelleting finishing diets. When asked how much of an improvement can be expected from feeding high-quality pellets, 70% of the total 157 respondents answered correctly (2 to 6%; Stark, 1994). This result represented correct responses from more than 55% of participants within each demographic category, indicating a high knowledge level across the industry about pelleting diets for swine.

Table 4.
Pelleting

Do you currently pellet or recommend pelleting finishing diets?				
	Responses	**% of Total[1]**		
Yes	62	41%		
No[2]	89	59%		
Total	**151**	**100%**		

Although variable, feeding high quality pellets should affect feed efficiency by approximately how much?[3]				
Industry Segment	**Producers (44)**	**Consultants (56)**	**Academia (26)**	**Other (31)**
Correct	70%	80%	61%	52%
Incorrect	12%	13%	4%	29%
Not Sure	18%	7%	35%	19%
Years of Experience	**0 to 5 (16)**	**5 to 10 (20)**	**10 to 20 (36)**	**20 or more (85)**
Correct	56%	60%	61%	76%
Incorrect	31%	30%	14%	11%
Not Sure	13%	10%	25%	13%
Total	**(157)**			
Correct	69%			
Incorrect	14%			
Not Sure	17%			

[1] In total, 77% of producers (43), 55% of consultants (53), and 72% of academia answered no; 70% of individuals identified in the "Other" segment answered yes. Based on years of experience, 50% or more of each category answered no.

[2] If respondents answered no, they were asked a branched question, "Why do you not pellet finishing diets?" 29% of responses were either that it was too expensive or that pelleting capabilities were not available at their local mill. These were clearly the most common reasons why individuals do not pellet finishing diets.

[3] The correct answer was 2 to 6 % (Stark, 1994).

Feed Additives

Copper Sulfate

Participants were asked several questions to identify the use of feed additives and their effects on feed efficiency. The first question asked individuals if they use or recommend using copper sulfate in the nursery; 134 individuals responded; 69% of respondents answered yes, and 31% said no (Table 5). A branched question asked those who answered yes what percentage benefit in feed efficiency they expected from copper; those who answered no were asked why they did not use copper sulfate.

Growth-Promoting Antibiotics

Individuals were also asked if they feed or recommend feeding growth-promoting levels of antibiotics in nursery diets. Out of 134 respondents, 73% said yes, and 23% said no. Demographics showed that 65% or more of individuals in each industry segmen, and at least 50% of each age category replied yes. Respondents were again asked branched questions depending on their answers. If they answered yes, they were asked what percentage improvement in feed efficiency they expected from its use; if survey takers answered no, they were asked why they don't use growth-promoting levels of antibiotics in nursery diets.

Table 5.

Growth Promoting Copper and Antibiotics

Currently, do you feed or recommend feeding growth promoting levels of copper sulfate in the nursery?		
	Responses	% of Total[1]
Yes[2]	93	69%
No[3]	41	31%
Total	134	100%
Currently, do you feed or recommend feeding growth-promoting levels of antibiotics in the nursery?[1]		
	Responses	% of Total
Yes[4]	98	73%
No[5]	36	27%
Total	134	100%
[1] By industry segment; more than 54% of individuals in each category answered		

yes. Based on years of experience, more than 56% within each category answered yes.

[2] Individuals who answered yes were asked a branch question: What benefit in feed efficiency do you expect from its inclusion in nursery diets? 30% of responses were "2%," and 20% of responses were "Not sure."

[3] Individuals who answered no were asked a branch question, "Why do you not use growth promoting level of copper sulfate in the nursery?" 48% of responses were "Not sure," and 29% were because of environmental reasons.

[4] More than 65% of individuals in each industry segment category, and more than 50% of individuals in each age category answered yes. Individuals who answered yes were asked a branch question, "What benefit in feed efficiency do you expect from its inclusion in nursery diets?" 21% responded with "3%," 20% answered "Not sure," 16% answered "4%," and 15% answered "5% or more."

[5] Individuals who answered no were asked a branch question, "Why do you not use growth promoting level of antibiotics in the nursery?" 33% of responses were to avoid development of antibiotic resistance and 26% were "Other." The most common response for individuals who answered "Other" was because they used antibiotics only to treat sick animals and not for growth promotion.

Ractopamine

Individuals were asked if they use or recommend using ractopamine (Paylean, Elanco Animal Health, Greenfield, IN), which is a β-Adrenergic-Agonist known for its ability to increase lean muscle growth in late finishing pigs. Seventy percent of the total respondents (132) said yes, and 30% said no (Table 6). Besides individuals in the academia category (42%), more than 54% of producers, consultants, and respondents categorized as "Other" answered yes. Over 50% of each age category also answered yes.

If respondents answered yes, they were asked what initial dosage they used. They were also asked whether they use a step-up program or a constant level. The step-up program was defined as feeding a lower dosage for a period of time followed by a higher dosage until pigs were marketed. If respondents said that they did not use ractopamine, they were asked why they did not.

A knowledge-based question was asked about the expected improvement in feed efficiency associated with the use of ractopamine; 132 individuals responded; 49% answered correctly (5 to 15%; Armstrong et al., 2007), 24% answered incorrectly, and 22% responded not sure.

Table 6.

Ractopamine

Currently, do you feed or recommend feeding ractopamine as a growth

promoter in late finishing?

		Responses	% of Total	
Yes[1]		92	70%	
No[2]		40	30%	
Total		**132**	**100%**	

How much of an improvement do you expect in feed efficiency from the inclusion of ractopamine?[3]

Industry Segment	**Producers (33)**	**Consultants (51)**	**Academia (24)**	**Other (24)**
Correct	48%	67%	33%	42%
Incorrect	22%	23%	46%	20%
Not Sure	30%	10%	21%	38%
Years of Experience	**0 to 5 (16)**	**5 to 10 (20)**	**10 to 20 (36)**	**20 or more (85)**
Correct	50%	40%	53%	49%
Incorrect	8%	33%	17%	36%
Not Sure	42%	27%	30%	15%
Total	**(132)**			
Correct	59%			
Incorrect	19%			
Not Sure	22%			

[1] More than 54% of producers, consultants, and individuals classified as "Other" answered yes; only 42% of participates in academia said yes. More than 50% of individuals in each age category answered yes. Individuals who answered yes were asked a branch question, "What initial level of ractopamine do you utilize?" 66% responded "4.5 g/ton," and 26% answered "6.75g/ton." Individuals who answered "Yes" were asked a second branched question, "Do you utilize a step-up program or do you feed a constant level?" 67% answered that they feed or recommend feeding a constant level, and 33% fed or recommend feeding a step-up program.

[2] Individuals who answered no were asked a branch question, "Why do you not use ractopamine in late finishing?" 40% of responses were "Other." The most common response for individuals who answered "Other" was because they had

a niche market or special incentive not to utilize ractopamine.

[3] The correct answer was 5 to 15% (Armstrong et al., 2004).

Sow Feed Efficiency

Respondents were asked approximately how much sow feed should be needed per pig weaned (Table 7). A total of 128 individuals responded; 51% answered correctly (70 to 100 pounds; Gaines, Peterson, & Mendoza, 2012), 26% answered "Not sure," and 22% answered incorrectly. Although more than half of the total responses were correct, only 21% of individuals in academia (24) and 41% categorized as "Other" (22) answered correctly. Based on years of experience in the swine industry, only 27% with less than 5 years (11) and 43% with 5 to 10 years (14) had correct answers.

Table 7.

Sow Feed Usage

In your opinion, approximately how much sow feed should be required per pig weaned?[1]				
Industry Segment	**Producers (32)**	**Consultants (50)**	**Academia (24)**	**Other (22)**
Correct	50%	70%	21%	41%
Incorrect	12%	18%	50%	23%
Not Sure	38%	12%	29%	36%
Years of Experience	**0 to 5 (11)**	**5 to 10 (14)**	**10 to 20 (29)**	**20 or more (74)**
Correct	27%	43%	52%	55%
Incorrect	9%	14%	24%	23%
Not Sure	64%	43%	24%	18%
Total	**(128)**			
Correct	51%			
Incorrect	23%			
Not Sure	26%			

[1] The correct answer was 70 to 100 pounds (Gaines et al., 2012).

Thermal Temperature

Individuals were also asked what feed efficiency would be for finishing pigs who initially have feed

conversion rates of 2.80 if the temperature is dropped 4ºF below their respective thermo-neutral zone (Table 8). A total of 139 individuals responded; 22% answered correctly (2.88; Noblet, Dividich, & Van Milgen, 2001), 48% answered incorrectly, and 30% responded "Not sure".

Table 8.

Thermal Temperature

If the ambient temperature of a finishing barn is at thermo-neutrality and pigs average a feed efficiency of 2.8, what is the estimated feed efficiency after the temperature drops to 4 degrees Fahrenheit below the thermo-neutral zone?[1]				
Industry Segment	**Producers (40)**	**Consultants (51)**	**Academia (24)**	**Other (24)**
Correct	25%	24%	25%	8%
Incorrect	32%	56%	50%	54%
Not Sure	43%	20%	25%	38%
Years of Experience	**0 to 5 (12)**	**5 to 10 (17)**	**10 to 20 (32)**	**20 or more (78)**
Correct	33%	12%	9%	27%
Incorrect	12%	47%	44%	55%
Not Sure	50%	41%	47%	18%
Total	**(139)**			
Correct	22%			
Incorrect	48%			
Not Sure	30%			

[1] The correct answer was 2.88 (Noblet et al., 2001).

Discovery Questions

When asked which topic areas would provide the largest opportunity to improve feed efficiency in the U.S. swine industry, 117 individuals responded that the top three areas were health, genetics, and feed processing (Table 9). Individuals were then asked to rank topic areas according to future research needs. A total of 123 respondents suggested the most important areas are health, genetics, and dietary energy (Table 10). Finally, survey respondents were asked to rank topics based on their own knowledge of the topic. Overall, 123 individuals responded and results showed they were most knowledgeable on feed processing (particle size), amino acids, and antibiotics (Table 11). The three topic areas that individuals were the least knowledgeable in were feed processing

(extruding/expanding), digestive tract microbiology, and feed additives (other than antibiotics). However, there was a lot of variation in response depending on industry segment and years of experience. For example, producers ranked health as their most knowledgeable topic area, but consultants and individuals in academia ranked health as an area that they need more knowledge in.

Table 9.

Which Topic Areas Provide the Largest Opportunity to Further Improve Feed Efficiency? (1=Important, 10=Least important)[1,2]

		Industry Segment				Years of Experience			
Topic	**Total**	**Producers**	**Consultants**	**Academia**	**Other**	**0 to5**	**5 to 10**	**10 to 20**	**20+**
Health	2.2 (1)	2.3 (1)	2.2 (1)	2.1 (1)	2.2 (1)	2.8 (1)	2.6 (1)	2.7 (1)	1.9 (1)
Genetics	3.7 (2)	2.8 (2)	4.0 (2)	4.2 (2)	3.7 (2)	5.1 (4)	3.8 (2)	3.0 (2)	3.7 (2)
Feed Processing	4.3 (3)	4.0 (3)	4.1 (3)	5.2 (4)	4.5 (3)	4.0 (2)	4.4 (4)	4.8 (4)	4.2 (3)
Dietary Energy	4.6 (4)	4.3 (4)	4.4 (4)	4.9 (3)	5.4 (6)	5.1 (4)	5.3 (6)	4.3 (3)	4.6 (4)
Digestive Tract Microbiology/Health	5.5 (5)	6.1 (6)	5.4 (5)	5.5 (7)	4.8 (4)	5.6 (6)	3.9 (3)	5.4 (5)	5.8 (6)
Environment	5.5 (5)	5.4 (5)	5.9 (6)	5.3 (5)	5.0 (5)	4.6 (3)	5.6 (7)	6.0 (7)	5.4 (5)
Amino Acids	6.2 (7)	6.2 (7)	6.6 (7)	5.4 (6)	6.2 (7)	8.1 (10)	7.1 (8)	5.6 (6)	6.0 (7)
Feed additives (Other Than Antibiotics)	6.9 (8)	7.1 (8)	6.9 (8)	7.0 (8)	6.3 (8)	6.3 (7)	5.1 (5)	7.0 (8)	7.3 (8)
Antibiotics	7.7 (9)	8.3 (9)	7.4 (9)	7.5 (9)	7.9 (9)	7.0 (9)	8.0 (9)	7.8 (10)	7.7 (9)
Alternative feed ingredients	8.1 (10)	8.1 (10)	8.0 (10)	7.6 (10)	8.7 (10)	6.4 (8)	9.2 (10)	7.6 (9)	8.2 (10)

[1] Values are average rankings and the overall rank is listed from 1-10 in parentheses.

[2] A total of 117 individuals ranked the topic areas.

Table 10.

Rank the Following Items on the Need for Future Research as It Pertains to Feed Efficiency (1= Important,10= Least Important)[1,2]

Topic	Total	Industry Segment				Years of Experience			
		Producers	Consultants	Academia	Other	0 to5	5 to 10	10 to 20	20+
Health	3.2 (1)	3.0 (2)	3.5 (1)	4.1 (3)	1.8 (1)	3.4 (5)	2.5 (1)	4.0 (3)	3.0 (1)
Genetics	3.6 (2)	2.9 (1)	4.1 (4)	4.7 (8)	2.2 (2)	3.5 (6)	2.5 (1)	4.1 (4)	3.7 (2)
Dietary Energy	3.7 (3)	3.7 (3)	3.8 (2)	4.1 (3)	2.8 (4)	2.9 (2)	3.2 (4)	3.8 (1)	3.8 (3)
Digestive Tract Microbiology/Health	3.9 (4)	4.2 (4)	3.9 (3)	4.6 (6)	2.2 (2)	3.8 (7)	2.7 (3)	3.9 (2)	4.1 (4)
Alternative Feed Ingredients	4.1 (5)	4.3 (6)	4.4 (7)	4.0 (2)	3.2 (8)	3.9 (9)	4.1 (11)	4.3 (6)	4.1 (4)
Amino Acids	4.1 (5)	4.3 (6)	4.4 (7)	3.7 (1)	3.3 (10)	3.3 (4)	3.6 (7)	4.2 (5)	4.2 (6)
Feed Additives (Other Than Antibiotics)	4.2 (7)	4.2 (4)	4.6 (9)	4.4 (5)	3.1 (6)	2.9 (2)	3.2 (4)	4.8 (7)	4.4 (8)
Feed Processing (Particle Size)	4.2 (7)	4.4 (8)	4.2 (5)	4.7 (8)	3.6 (11)	4.0 (10)	3.3 (6)	4.9 (9)	4.2 (6)
Feed Processing (Pelleting)	4.3 (9)	5.1 (10)	4.2 (5)	4.6 (6)	3.1 (6)	2.8 (1)	3.7 (9)	4.9 (9)	4.4 (8)
Environment	4.4 (10)	4.5 (9)	4.7 (10)	5.0 (10)	3.0 (5)	3.8 (7)	4.0 (10)	4.8 (7)	4.4 (8)
Feed Processing (Extruding/Expanding)	4.7 (11)	5.1 (10)	5.0 (11)	5.0 (10)	3.2 (8)	4.3 (11)	3.6 (7)	5.1 (11)	4.9 (11)
Antibiotics	5.9 (12)	6.0 (12)	5.9 (12)	6.3 (12)	5.2 (12)	5.5 (12)	5.6 (12)	6.1 (12)	5.9 (12)

[1] Values are average rankings and the overall rank is listed from 1-10 in parentheses.

[2] A total of 123 individuals ranked the topic areas.

Table 11.

Rank Your Level of Knowledge on the Following Areas as They Pertain to Feed Efficiency

(1=Knowledgable, 10=Need More Education)[1,2]

		Industry Segment				Years of Experience			
Topic	**Total**	Producers	Consultants	Academia	Other	0 to5	5 to 10	10 to 20	20+
Feed Processing (Particle Size)	4.7 (1)	4.9 (2)	4.3 (1)	4.8 (1)	5.2 (5)	5.8 (4)	4.4 (2)	5.7 (6)	4.2 (1)
Amino Acids	4.8 (2)	5.8 (8)	4.4 (2)	4.9 (2)	4.5 (2)	6.5 (7)	3.9 (1)	4.8 (1)	4.9 (5)
Antibiotics	5.0 (3)	5.6 (7)	4.7 (4)	5.3 (6)	4.3 (1)	7.4 (12)	5.4 (9)	5.2 (2)	4.6 (2)
Alternative Feed Ingredients	5.1 (4)	5.4 (6)	4.7 (4)	5.4 (8)	5.4 (8)	5.5 (1)	4.4 (2)	5.3 (3)	5.1 (8)
Dietary Energy	5.1 (4)	5.3 (5)	5.0 (6)	5.3 (6)	4.9 (3)	6.5 (7)	4.6 (4)	5.3 (3)	5.0 (6)
Environment	5.1 (4)	5.0 (4)	5.1 (7)	5.2 (5)	5.2 (5)	6.0 (6)	5.0 (6)	5.3 (3)	5.0 (6)
Feed Processing (Pelleting)	5.1 (4)	6.1 (9)	4.5 (3)	5.0 (3)	5.2 (5)	5.8 (4)	5.7 (10)	5.7 (6)	4.7 (3)
Genetics	5.2 (8)	4.9 (2)	5.3 (9)	5.0 (3)	5.8 (11)	7.1 (10)	5.3 (8)	5.9 (11)	4.8 (4)
Health	5.3 (9)	4.8 (1)	5.4 (10)	5.8 (9)	5.0 (4)	5.6 (3)	5.1 (7)	5.8 (8)	5.1 (8)
Feed Additives (Other Than Antibiotics)	5.7 (10)	6.4 (11)	5.2 (8)	6.3 (10)	5.4 (8)	5.5 (1)	4.9 (5)	5.8 (8)	5.9 (10)
Digestive Tract Microbiology/Health	6.0 (11)	6.2 (10)	5.7 (11)	6.5 (11)	5.7 (10)	7.0 (9)	6.0 (11)	5.8 (8)	6.0 (11)
Feed Processing (Extruding/Expanding)	6.6 (12)	7.0 (12)	6.6 (12)	6.7 (12)	6.1 (12)	7.3 (11)	6.8 (12)	7.1 (12)	6.4 (12)

[1] Values are average rankings and the overall rank is listed from 1-10 in parentheses.

[2] A total of 123 individuals ranked the topic areas.

Conclusion

Results from the survey suggest that there are gaps in information and knowledge across this voluntary subsample of the population. Producer responses implied that they are not familiar with information behind the effects of fat, particle size, feed additives, and thermal environment on feed efficiency. Consultants and individuals in academia had the highest percentage of correct answers for knowledge questions, but less than half identified the correct response for questions over the effects of particle size and thermal environment on feed efficiency. Respondents who classified themselves as "Other" frequently replied not sure for many of the knowledge-based and production practice questions. This may be due to the great diversity in occupation within the group. Individuals with less experience, specifically those with 0 to 5 years, had higher percentages of not sure responses, which may be due to unfamiliarity with industry practices and knowledge behind those practices.

Regardless of demographics, most individuals were familiar with the advantages in feed efficiency from pelleting, and most used feed additives. Although knowledge of the benefits from pelleting is high, access to affordable pellets is needed to increase use of pelleted feeds. Additionally, responses suggest that grinding cereal grains to finer particle sizes is limited because of more difficult handling in feeding systems. A majority of respondents believe that topics for future research and the most opportunity to improve feed efficiency include genetics, health, feed processing, and dietary energy. Additionally, the topic areas where most of the participants were the least knowledgeable were expanding/extruding technologies, digestive tract microbiology, and feed additives (other than antibiotics), however this question proved that there was a large amount of variation in knowledge of topic areas based on segment of the industry and years of experience.

Extension education on current knowledge and production practices that are already proven should be expanded to provide this information in an easy-to-access format for the swine industry. Ultimately, successful dissemination will help producers and swine operations lower input costs by improving the efficiency of feed utilization.

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