

Botanicals for Pigs – Echinacea II

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Summary and Implications

Botanicals have been proposed as a substitute for antimicrobials in swine diets because of their natural antibacterial activity. Echinacea, a botanical grown in Iowa, was compared with an antibacterial nursery feeding program consisting of 50 g of Mecadox per ton. At the tested Echinacea levels (0, 0.10, 0.25, and 0.50%) in experiment I, Mecadox generally elicited a positive response for daily gain and feed efficiency over the Echinacea treatments during the nursery phase. In experiment II (Echinacea levels of 0, 1.5, and 3.0%), there were only minor or no differences between Mecadox and the various Echinacea additions, indicating a high level of pig health. The cumulative data were inconsistent, with the 3.0% Echinacea often showing improved feed efficiency and daily gain (weeks 0–3) and better daily gain (weeks 0–3 and 0–5) compared with 0.0 or 1.5% Echinacea. Periodic data (Table 5) numerically suggested that the 3% Echinacea supplement enhanced daily gain equal to the Mecadox diet.

Introduction

The historic use of herbal remedies to treat and prevent infectious disease has been supplanted with the emergence of specific man-made chemotherapeutic and antibacterial agents. However, selected herbs are known to possess natural antibacterial qualities as well as other characteristics that could be useful in value-added animal protein production. This area of investigation has not received substantive examination because of the relatively low costs, proven effectiveness, and ready availability of synthetic growth-promoting antibacterial products. The possibility of significant antibiotic-resistant bacteria development through the use of human drugs in animals and subsequent transfer of this resistance to human pathogens has caused concerns within the medical community. Inclusion of herbs in animal feeds as alternative growth promotion and efficiency stimulating strategies can address some of these concerns while producing a more holistically grown pork product.

An Echinacea study reported in the 1998 ISU Swine research noted that in weeks 0-3 and 0-4 the two high levels of Echinacea (0.5 and 2.0%) supplementation were significantly more efficient in feed efficiency ($P < 0.05$) but daily gain and feed intake were not statistically different. Total performance for the entire experiment, weeks 0-5, was not statistically different. These data suggested that in the experiment that higher levels of Echinacea enhanced feed efficiency compared to the 0% Echinacea during the first

two weeks and were greater than the positive control diet with Mecadox during the 0–3 and 0–4 week periods. Generally, performance was similar over all treatments, suggesting minimal subclinical stress during this experiment.

Materials and Methods

Two experiments were conducted at the ISU Swine Nutrition and Management Center starting in December 1999 and April 2000. Each five-week experiment measured gain, feed intake, and efficiency, plus an additional 12 weeks in the finisher where only gain was recorded. The Echinacea purpurea was purchased from Nature's Cathedral, 1995 78th St., Blairstown, IA 52209. Pigs were grown in 4 x 4-ft raised-deck pens with woven wire floors. Each pen had a 1 x 4 ft heat pad, a stainless steel self-feeder, and a nipple drinker. The heat pads supply supplemental heat for the first two weeks after which they are turned off and the feeders are placed on them. Room temperature is maintained at $75 \pm 5^\circ\text{F}$. Pigs were allotted to blocks of pens at random on the basis of initial weight and litter.

Pigs were weighed and feed disappearance was determined weekly. Data were analyzed using the GLM procedure of SAS with the pen as the experimental unit. After the five-week nursery trial pigs were placed on common grower-finisher diets and weighed every four weeks to evaluate post-treatment effects on average daily gain. The control diet contained 50 g of Mecadox (carbadox) per ton and the botanical treatments consisted of the same diet without Mecadox. The grower diet contained 40 grams/ton of Tylan to control ileitis and the finisher contained 30 grams/ton of BMD.

Experiment 1. This study evaluated lower levels of Echinacea (approximately \$6.00/lb) than were fed in the 1998 report in an attempt to reduce feed costs. One hundred pigs were weaned at an average of 18 days and 14.9 lb (6.75 kg) and immediately placed on the experimental diets. Twenty pens of five pigs each provided four replications of five dietary treatments. Each pen of five pigs received 100 lb (45 kg) of the prestarter treatment and then was switched to the starter treatment diet for the remainder of the nursery study (Table 1). The Echinacea additions were 0.00, 0.10, 0.25, and 0.50%.

Average final weight in the nursery was 46.3 lb (21.0 kg) and 213.2 lb (96.7 kg) in the finishing phase.

Experiment 2. This experiment was initiated because of the minimal effects of the lower levels of Echinacea in experiment 1. Higher levels of Echinacea were fed along with the positive and negative control diets. One hundred twenty pigs were weaned at an average age of 18 days and 14.5 lb (6.59 kg) and immediately placed on the

experimental diets. Twenty-four pens of five pigs each provided six replications of four dietary treatments. Each pen of five pigs received 100 lb (45 kg) of the prestarter treatment and then was switched to the starter treatment diet for the remainder of the nursery study (Table 1). The Echinacea additions were 0.0, 1.5, and 3.0%.

Average final weight in the nursery was 41.9 lb (19.0 kg) and 200.6 lb (91.2 kg) in the finishing phase.

Results and Discussion

Experiment 1 (9915B). One pig was removed from treatment 1 during the nursery phase and one from treatment 4 during the finishing phase. Reported data (least square means) are cumulative from the start of the experiment (Table 2) and periodic data (Table 3). In week 1 there were no statistical differences indicating similar performance among the treatments. Subsequent performance showed no advantage for feeding Echinacea, with the exception of weeks 0–2 and 0–3 when a significant quadratic observation was observed for the Echinacea levels for feed/gain. Generally the Mecadox diet had significantly better performance figures than the treatment levels of Echinacea in weeks 0–2, 0–3, 0–4, and 0–5. Growth rate during the post-nursery phase was not affected by nursery treatments.

Table 1. Basal diet composition, experiments 1 and 2.

	Prestarter	Starter
Corn, yellow	36.43	51.57
Whey, dried	25.00	10.00
Plasma protein	5.00	0.00
Soybean meal, dehulled	29.20	33.50
Dicalcium phosphate	1.65	2.19
Limestone	0.90	0.78
Salt	0.00	0.25
L Lysine HCl	0.20	0.20
Methionine, DL	0.10	0.10
Vitamins, trace minerals	0.52	0.41
Animal fat, stabilized	1.00	1.00
Additive	-	-
Total	100.00	100.00

Calculated analyses of dontrrol diets (%).

	Prestarter	Starter
Lysine	1.46	1.28
Methionine + cystine	0.88	0.66
Calcium	0.79	0.79
Phosphorus, total	0.72	0.70
Phosphorus, available	0.48	0.41

Experiment 1	Experiment 2
Treatment	Treatment
1 Mecadox, 50 g/ton	1 Mecadox, 50 g/ton
2 Echinacea, 0.0%	2 Echinacea, 0.0%
3 Echinacea, 0.10%	3 Echinacea, 1.50%
4 Echinacea, 0.25%	4 Echinacea, 3.00%
5 Echinacea, 0.50%	

Experiment 2 (9915D). No pigs were removed during the nursery phase. During the grow-finish phase one poorly performing pig was removed from treatment 1 and a ruptured pig was removed from treatment 4. Reported data (least square means) are cumulative from the start of the experiment (Table 4) and periodic data (Table 5).

Cumulative data indicate few treatment differences.

Mecadox generally increased daily gain in weeks 0–3 and 0–5 (P<.01). Echinacea additions depressed feed/gain in weeks 0–2 and 0–3. However, 3% Echinacea enhanced overall gain in the week 0–5 nursery period compared with 0 and 1.5% Echinacea and supported gains equal to the Mecadox treatment. No significant cumulative responses were observed in the post-nursery gains, although the highest level of Echinacea fed during the nursery phase numerically supported gains equal to the Mecadox-fed pigs in the nursery. Note that no Mecadox or Echinacea was fed after the five-week nursery period.

Periodic data (Table 5) indicated only a significant quadratic effect for Echinacea during the third week of testing. Again, numerically the highest level of Echinacea-supported performance was similar to the Mecadox diet.

Table 2. Cumulative effect of Echinacea on pig performance (9915B).

	Mecadox	Echinacea levels, %			
		0.00	0.10	0.25	0.50
Week 1					
ADG, lb	0.26	0.31	0.24	0.26	0.22
ADF, lb	0.40	0.48	0.42	0.40	0.37
F/G	1.59	1.52	1.67	1.64	1.64
Weeks 0–2					
ADG, lb ^a	0.37	0.35	0.26	0.33	0.35
ADF, lb	0.53	0.53	0.53	0.51	0.51
F/G ^{bc}	1.39	1.52	2.08	1.59	1.49
Weeks 0–3					
ADG, lb ^b	0.66	0.60	0.51	0.57	0.60
ADF, lb	0.86	0.82	0.79	0.79	0.79
F/G ^c	1.32	1.35	1.52	1.39	1.33
Weeks 0–4					
ADG, lb ^d	0.84	0.71	0.68	0.73	0.71
ADF, lb	1.17	1.06	1.06	1.06	1.01
F/G ^b	1.39	1.49	1.52	1.43	1.47
Weeks 0–5					
ADG, lb ^b	0.99	0.90	0.88	0.88	0.86
ADF, lb	1.43	1.32	1.32	1.30	1.28
F/G ^b	1.45	1.45	1.52	1.49	1.49
ADG, lb					
Weeks 0–9	1.32	1.30	1.28	1.19	1.20
Weeks 0–13	1.50	1.43	1.48	1.45	1.43
Weeks 0–17	1.70	1.65	1.70	1.65	1.61

^a Mecadox vs 3,4,5, P < .05.

^b Mecadox vs all, P < .05.

^c Echinacea Quadratic, P < .02.

^d Mecadox vs all, P < .01.

Table 3. Periodic effect of Echinacea on pig performance (9915B).

	Mecadox	Echinacea levels, %			
		0.00	0.10	0.25	0.50
Week 1–2					
ADG, lb	0.50	0.40	0.26	0.40	0.46
ADF, lb	0.64	0.59	0.65	0.62	0.65
F/G ^{ab}	1.29	1.50	2.43	1.62	1.41
Week 2–3					
ADG, lb	1.21	1.12	1.04	1.08	1.09
ADF, lb ^c	1.54	1.39	1.28	1.37	1.33
F/G	1.27	1.25	1.23	1.27	1.23
Week 3–4					
ADG, lb ^{bd}	1.39	1.05	1.21	1.22	1.02
ADF, lb ^d	2.05	1.82	1.86	1.83	1.73
F/G ^{be}	1.47	1.74	1.53	1.50	1.72
Week 4–5					
ADG, lb	1.56	1.64	1.62	1.42	1.51
ADF, lb ^a	2.48	2.31	2.40	2.30	2.33
F/G ^f	1.58	1.39	1.48	1.61	1.54
ADG, lb					
Weeks 5–9	1.76	1.78	1.79	1.60	1.64
Weeks 9–13	1.92	1.75	1.90	2.01	1.92
<u>Weeks 13–17</u>	<u>2.32</u>	<u>2.39</u>	<u>2.46</u>	<u>2.36</u>	<u>2.20</u>

^a Mecadox vs all, P < .05.^b Echinacea Quadratic, P < .05.^c Mecadox vs all, P < .01.^d Mecadox vs all, P < .005.^e Mecadox vs 2, P < .05.^f Echinacea Linear, P < .04.**Table 4. Cumulative effect of Echinacea on pig performance (9915D).**

	Mecadox	Echinacea levels, %		
		0	1.5	3.0
Week 0–1				
ADG, lb	0.20	0.20	0.13	0.15
ADF, lb	0.33	0.35	0.33	0.33
F/G	1.82	1.82	2.70	2.22
Weeks 0–2				
ADG, lb	0.35	0.33	0.31	0.29
ADF, lb	0.48	0.51	0.48	0.48
F/G ^a	1.41	1.56	1.61	1.64
Weeks 0–3				
ADG, lb ^b	0.55	0.51	0.48	0.53
ADF, lb	0.75	0.75	0.71	0.73
F/G ^{bc}	1.33	1.43	1.47	1.39
Weeks 0–4				
ADG, lb	0.66	0.64	0.60	0.64
ADF, lb	0.95	0.93	0.90	0.93
F/G	1.39	1.45	1.52	1.43
Weeks 0–5				

ADG, lb ^d	0.82	0.77	0.75	0.82
ADF, lb	1.17	1.17	1.10	1.19
F/G	1.45	1.52	1.47	1.47
Weeks 0–9				
ADG, lb	1.19	1.17	1.15	1.23
Weeks 0–13				
ADG, lb	1.39	1.34	1.32	1.43
Weeks 0–17				
<u>ADG, lb</u>	<u>1.61</u>	<u>1.56</u>	<u>1.56</u>	<u>1.65</u>

^a Echinacea linear, P < .01.^b Mecadox vs all, P < .01.^c Echinacea quadratic, P < .01.^d Echinacea quadratic, P < .05.**Table 5. Periodic effect of Echinacea on pig performance (9915D).**

	Mecadox	Echinacea levels, %		
		0	1.5	3.0
Week 1–2				
ADG, lb	0.48	0.44	0.48	0.44
ADF, lb	0.62	0.66	0.64	0.62
F/G	1.27	1.45	1.35	1.45
Week 2–3				
ADG, lb ^a	0.99	0.90	0.84	0.99
ADF, lb	1.28	1.23	1.17	1.23
F/G	1.28	1.35	1.37	1.27
Week 3–4				
ADG, lb	0.99	0.99	0.93	1.01
ADF, lb	1.52	1.48	1.45	1.52
F/G	1.49	1.47	1.59	1.52
Week 4–5				
ADG, lb	1.34	1.30	1.39	1.45
ADF, lb	2.09	2.09	1.96	2.18
F/G	1.56	1.59	1.43	1.49
Weeks 5–9				
ADG, lb	1.65	1.65	1.61	1.79
Weeks 9–13				
ADG, lb	1.85	1.76	1.74	1.87
Weeks 13–17				
<u>ADG, lb</u>	<u>2.29</u>	<u>2.29</u>	<u>2.34</u>	<u>2.34</u>

^a Echinacea quadratic, P < .03.**Reference**

1. Holden, P., et al. 1998. Botanicals for pigs – Echinacea (ASL-R1560). 1998 ISU Swine Research Report, AS-640. Pp. 27-30. Iowa State University, Ames, IA 50011.

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