

# Effect of Spray-Dried Plasma and Dried Porcine Solubles on the Growth Performance of Weanling Pigs Raised in Different Health-Status Environments

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### Summary and Implications

Spray-dried plasma can advantageously replace whey on a protein basis in Phase I diets for early-weaned pigs, although less so in a 'clean' than in a 'dirty' environment. Contrary to previous trials, growth performance of weanling pigs was not affected when dried porcine solubles replaced whey protein.

### Introduction

Diets of weanling pigs often include spray-dried plasma (SDP) because of its content of immunoglobulins and high-quality protein. Another protein source called dried porcine solubles (DPS) has recently emerged. It is a by-product of the heparin extraction from pig intestines. The product is also a high-quality protein source and both SDP and DPS have been shown to result in improved growth performance of weanling pigs. Their modes of action, however, probably differ; in previous trials, SDP-fed pigs have shown an immediate response in increased feed intake and weight gain, whereas pigs fed DPS have shown a delayed response in feed intake and weight gain.

In this trial, dried whey protein was replaced by either SDP or DPS in Phase I diets to investigate possible growth performance responses to the ingredients. Furthermore, pigs were placed in different health-status environments to investigate possible interactions with responses to the feed ingredients.

Because the modes of action of the two protein sources are different, it was thought that their effects might be additive. Therefore, it was expected that pigs fed both SDP and DPS during Phase I would have an improved growth performance throughout the 5-week trial compared with pigs fed the control, SDP, or DPS diets. In addition, it was expected that pigs raised in a high-health environment would show a better growth performance than pigs raised in a low-health status environment and that the high-health pigs would respond less to SDP.

### Materials and Methods

The experiment was conducted in two environments: a 'dirty' environment in a previously used, on-site nursery room that was not cleaned and a 'clean' environment in an off-site nursery room that was cleaned and disinfected before the start of the trial. Sixty-four pigs were weaned at 11 to 14 days of age, placed in individual pens and fed Phase I diets containing 0 or 5% SDP and 0 or 5% DPS in a 2×2 factorial arrangement for 2 weeks. Additions replaced dried whey lysine and L-lysine-HCl. Diets were isolysin (1.60%) and had equal concentrations of lactose (Table 1). After 2 weeks, pigs in all treatment groups received a common Phase II diet for 3 weeks. Pigs were monitored daily and appearance of feces was subjectively scored for firmness as an indication of diarrhea. Feed disappearance and gain were measured weekly to calculate average daily feed intake (ADFI), average daily gain (ADG), and feed utilization (gain:feed ratio, G:F). In each environment, eight blocks of four littermate pigs were fed the four dietary treatments.

The data were analyzed as a split-plot design with health environments as main plot treatments and the 2×2 factorial arrangement of diets as subplot treatments by using the GLM procedure of SAS. Differences between treatments were separated into main effects of factors and the interaction using contrasts; significance was declared at  $P < .05$ .

### Results and Discussion

Averaged over environments, ADG ( $P < .008$ ) and ADFI ( $P < .006$ ) were increased by SDP but not by DPS during Phase I. Growth performance was not ( $P > .05$ ) affected by diet during Phase II, although, as in Phase I, ADG ( $P < .03$ ) and ADFI ( $P < .04$ ) were increased by SDP but not by DPS for the overall 5-week period (Table 2). Contrary to previous trials with DPS, we found no delayed effects on growth response when DPS was fed during Phase I.

The comparable ADG and ADFI between pigs fed control and DPS diets indicate that the protein in DPS is of comparable quality to that of dried whey and that 5% DPS can replace dried whey on a protein basis with no adverse effects on weight gain and feed intake. Furthermore, replacing dried whey protein with 5% SDP on a protein basis resulted in improved ( $P < .05$ ) growth performance during Phase I and the overall period (Phase I plus II). There were no additive effects ( $P > .05$ ) of DPS and SDP on growth performance.

Feed utilization was decreased ( $P < .04$ ) in Phase I after dietary inclusions of DPS. During Phase II, feed utilization improved ( $P < .05$ ) in DPS-fed pigs compared with SDP-fed pigs. This improvement may, however, be an effect of the lower body weight in Phase II of pigs not fed SDP, as they showed a lower ADG during Phase I (Table 2).

Throughout the trial, pigs grew faster ( $P < .05$ ) in the clean environment than in the dirty environment (Table 3). Also, in the dirty environment, feeding SDP increased ADG by 33.6% during Phase I, whereas in the clean environment, feeding SDP increased ADG by only 10.0% (data not shown), which corroborates the results of previous trials.

Pigs fed DPS utilized feed more efficiently (interaction,  $P < .01$ ) in the dirty environment than did DPS-fed pigs in the clean environment during Phase I plus II. No differences ( $P > .05$ ) in diarrhea scores were observed between the two environments.

In conclusion, responses to SDP were typical of previously published research. Pigs fed DPS plus lactose performed as well as pigs fed dried whey (the control diet), however, no delayed effects of DPS on growth performance were observed, as had been reported previously. The data indicate that a combination of DPS and lactose can replace dried whey with no adverse effects on growth performance.

**Table 1. Diet composition of Phase I and Phase II diets (as-fed basis).**

Ingredients, %	Phase I <sup>a)</sup>				Phase II <sup>a)</sup>
	Control	SDP <sup>b)</sup>	DPS <sup>c)</sup>	SDP and DPS	
Corn	32.67	32.67	30.13	31.19	53.92
Soybean meal (48%)	19.25	19.25	19.25	19.25	23.53
Dried whey	30.00	11.81	22.42	—	15.00
SDP <sup>b)</sup> (AP920)	—	5.00	—	5.00	—
DPS <sup>c)</sup>	—	—	5.00	5.00	—
Lactose	—	12.73	5.31	21.00	—
Dried skim milk	10.00	10.00	10.00	10.00	—
Blood cells (AP301)	2.50	2.50	2.50	2.50	2.00
Soy oil	2.00	2.00	2.00	2.00	2.00
L-Lysine-HCl	.43	.25	.39	.26	.18
DL-Methionine	.30	.22	.24	.17	.26
Dicalcium phosphate	.81	1.56	.28	1.16	1.08
Limestone	.70	.66	1.14	1.12	.67
Salt	.25	.25	.25	.25	.25
Vitamin premix <sup>d)</sup>	.20	.20	.20	.20	.20
Selenium premix <sup>e)</sup>	.05	.05	.05	.05	.05
Zinc oxide	.30	.30	.30	.30	.30
CSP 250	.50	.50	.50	.50	.50
Endox	.01	.01	.01	.01	.01
Calculated Analysis, %					
Crude protein	22.08	23.02	22.29	22.79	19.60
Lysine (total)	1.60	1.60	1.60	1.60	1.31
Sulfur amino acids	.88	.88	.88	.88	.83
Calcium	.90	.90	.90	.90	.70
Phosphorus (total)	.70	.71	.70	.70	.62

<sup>a)</sup>Phase I, week 1–2; Phase II, week 3–5.

<sup>b)</sup>SDP, spray-dried plasma.

<sup>c)</sup>DPS, dried porcine solubles.

<sup>d)</sup>Supplied 2,000 IU vitamin A; 500 IU vitamin D<sub>3</sub>; 3 mg riboflavin; 8 mg pantothenic acid; 15 mg niacin; and 10 µg vitamin B<sub>12</sub> per pound of diet.

<sup>e)</sup>Contributed 75 ppm Zn, 87.5 ppm Fe, 30 ppm Mn, 8.75 ppm Cu, and .1 ppm Iodine per pound of diet.

**Table 2. Effect of spray-dried plasma protein and dried porcine solubles on the growth performance of weanling pigs.**

Response	Period <sup>a)</sup>	Dietary Treatments			
		Control	SDP <sup>b)</sup>	DPS <sup>c)</sup>	SDP and DPS
ADG, lbs	Phase I	.44a	.57b	.46a	.52b
	Phase II	1.22	1.23	1.17	1.23
	Phase I plus II	.90a	.98b	.90a	.95b
ADFI, lbs	Phase I	.49a	.61b	.54a	.61b
	Phase II	1.83	1.79	1.65	1.81
	Phase I plus II	1.28a	1.35b	1.22a	1.35b
G:F	Phase I	.91a	.93a	.86b	.84b
	Phase II	.67a	.69a	.72b	.69b
	Phase I plus II	.71	.73	.75	.71

<sup>a)</sup>Phase I, week 1–2; Phase II, week 3–5; Phase I plus II, week 1–5

<sup>b)</sup>SDP, spray-dried plasma.

<sup>c)</sup>DPS, dried porcine solubles.

Means with different letters within rows differ ( $P < .05$ ).

**Table 3. Effect of environment on the growth performance of weanling pigs.**

Response	Period <sup>1)</sup>	Health Status	
		Clean Environment	Dirty Environment
ADG, lbs	Phase I plus II	.98a	.88b
ADFI, lbs	Phase I plus II	1.37a	1.21b
G:F	Phase I plus II	.72	.73

<sup>1)</sup>Phase I plus II, week 1–5.

Means with different letters within rows differ ( $P < .05$ ).