

## **Spray Dried Plasma can be an Effective Alternative to Zinc Oxide and Perform better than Other Alternative Specialty Proteins in Diets for Weaned Pigs**

**J. Polo, J.D. Crenshaw, and J.M. Campbell, APC Inc., Ankeny, IA**

Swine producers know how critical it is to provide the best nutrition, environment, health and management practices to help the pig transition through the multiple stressors associated with weaning. Pigs with no weight gain compared to pigs with > 227 g/d (0.5 lb/d) weight gain during the initial week after weaning took 10 more days to get to market weight [Tokach et al., 1992]. Season of birth, birth weight, weaning weight and body weight at 6 weeks of age explained 60-70% of the variation in body weight at the end of the nursery (63-64 days of age) and body weight at the end of the nursery explained more than 30% of the variation in slaughter weight at 110 kg (242 lb) [Paredes et al., 2013]. The importance of growth rate during the initial 1 to 3 weeks after weaning clearly has a long term impact on how the pig performs to market weight.

Growth rate of the weaned pig is driven by feed intake. Feed intake, especially during the initial 1 to 3 weeks after weaning, is affected by environmental conditions, health and production management practices and provision of highly digestible diets. Spray-dried plasma (SDP) is widely used as a protein source in nursery pig diets because the enhanced nutrition it provides has well-documented and published beneficial effects on post-weaning growth and feed intake [Torrallardona, 2010]. The improvement in post-weaning performance of pigs fed diets with SDP may be related to immunomodulatory effects of SDP [Campbell et al., 2010] that minimize intestinal dysfunctions associated with weaning stress [Peace et al., 2011] and helps the pig to be more resilient to subsequent stress later in life [Boyer et al., 2015].

Studies comparing dietary SDP versus growth promoting antibiotics in-feed consistently show equivalent and sometimes better results for SDP (Coffey and Cromwell, 1995; Owusu-Asiedu et al., 2002, 2003; Torrallardona et al., 2002, 2003 and 2007; Bikker et al., 2004; Bosi et al., 2004; Conde, 2005; Pierce et al., 2005; Nofrarias et al., 2006; Polo et al., 2014). The nutrition provided by starter pig diets with plasma generally improves live weight (LW), average daily gain (ADG), average daily feed intake (ADFI), feed efficiency (gain to feed ratio; G:F), and morphology of the intestinal epithelium, and it reduces clinical disease and level of pro-inflammatory cytokines in response to infectious challenge.

The use of ZnO at high doses around 2,500 ppm in weaning pig diets has been very common in some EU member states, like Denmark, Spain and others due to the beneficial effects associated to increase daily gain and feed conversion, and reduce mortality and diarrhea treatment in weaners. However, the use of zinc oxide has other important counterpart related with the risk of environmental and potential body (physiological) accumulation and, in addition, development of bacterial resistant to high doses of ZnO. It has been observed that when an intensive usage of zinc is practiced in intensive areas of animal production, multi-resistance *E. coli* was significantly associated with pig manure. In addition, Zinc resistance of *Staphylococcus aureus* of animal origin has been strongly associated with methicillin resistance, suggesting that it may be partly implicated in the emergence of some MRSA (Durosoy, 2015).

A study conducted in cooperation between Danish Pig production and a Danish plasma producer in 2009 was designed to compare the performance of ZnO at 2,500 ppm or the inclusion of 5% SDP of porcine origin in the diets of weaning pigs. A total of 364 weaning pigs of initial 7.1 kg body weight per treatment was used in this study. There were 4 treatments, a control group, a control group supplemented with 2,500 ppm ZnO, a group supplemented with 5% SDP and a combined group of 2,500 ppm + 5% SDP. All diets were balanced for energy and same nutrient composition. These diets were provided during first 14 days of age and after that, all pigs were fed a common diet until animals achieve 30 kg of body weight. Pigs were weighed at day 0, 10 (intermediate weight) and at the end of the study. The results from this study indicated that the addition of SDP or 2,500 ppm zinc significantly increased the pigs' production value. The highest production value (+9%) was obtained by adding both SDP and 2,500 ppm zinc to diet 1 (the diet given the first 14 days post-weaning). A significant positive effect was obtained on daily gain and feed intake before intermediate weighing (10 days post-weaning) when spray dried plasma was added, regardless of whether 2,500 ppm zinc was added. After intermediate weighing, when all the pigs were given the control feed, a significant positive effect was obtained on feed intake when plasma had been added to diet 1. Regardless of the addition of SDP, the addition of 2,500 ppm zinc to the feed had a significant positive effect on daily gain, feed conversion and feed intake before

intermediate weighing and a significant positive effect on feed intake and feed conversion after intermediate weighing. From this study, it was concluded that both, ZnO and SDP reported positive performance at weaning and SDP can replace ZnO in these diets.

A new recent study (Exp 1) was conducted at an US research institution to determine if alternative specialty proteins, including an US-specific blood base product (BBP), an enzymatically hydrolyzed soy protein with yeast (Hamlet 800; HP), spray dried whole egg from hyper-immunized hens (ProtiMax; PM) or a combination of BBP, HP and fish meal affected performance of weaned pigs compared to a diet containing SDP. Pigs were weaned at 21 days of age (6.3 kg average initial BW) and randomly allotted to pens to provide 10 replications per dietary treatment. As in Exp 1, pens were not cleaned and sanitized prior to placement of pigs and all diets were non-pelleted and non-medicated and formulated to contain 3.4 Mcal ME/kg and 1.60% lysine. Specialty proteins (BBP, HP, PM, SDP) replaced soy protein concentrate on an equal lysine basis. Diets were fed from weaning to 14 days after weaning.

Results of Exp 1 are presented in Table 1. No pigs died during experiment 2. Pigs fed dietary treatment 6 with SDP had greater final BW, ADG, ADFI and gain:feed compared to all other diets. Pigs fed diets with any of the other specialty proteins (diets 2-5) did not differ in performance compared to soy protein concentrate (diet 1).

Table 1. Performance results for Experiment 2.*						
Dietary Treatment	1	2	3	4	5	6
Soy protein concentrate, %	8.04	7.49	0.00	0.00	7.71	0.00
BBP, %	0.00	0.40	0.00	0.40	0.00	0.00
Hamlet 800, %	0.00	0.00	10.66	6.36	0.00	0.00
Fish meal, %	0.00	0.00	0.00	2.50	0.00	0.00
ProtiMax, %	0.00	0.00	0.00	0.00	0.44	0.00
Spray dried plasma, %	0.00	0.00	0.00	0.00	0.00	5.00
Final BW, kg	8.17 <sup>b</sup>	7.83 <sup>b</sup>	8.07 <sup>b</sup>	7.90 <sup>b</sup>	8.19 <sup>b</sup>	9.01 <sup>a</sup>
ADG, g/d	133 <sup>b</sup>	109 <sup>b</sup>	127 <sup>b</sup>	114 <sup>b</sup>	135 <sup>b</sup>	193 <sup>a</sup>
ADFI, g/d	205 <sup>b</sup>	186 <sup>b</sup>	186 <sup>b</sup>	182 <sup>b</sup>	207 <sup>b</sup>	245 <sup>a</sup>
Gain:feed	0.65 <sup>b</sup>	0.58 <sup>b</sup>	0.68 <sup>b</sup>	0.63 <sup>b</sup>	0.65 <sup>b</sup>	0.79 <sup>a</sup>
* Values are least squares means of 10 pens per diet. Means within row with uncommon superscripts differ ( $P < 0.05$ ).						

Under the conditions of Exp 1, weaned pigs fed diets containing spray dried plasma had superior performance compared to all of the other specialty proteins evaluated. In fact, performance of pigs fed diets containing the alternative specialty proteins was not different from that of pigs fed a diet containing traditional soy protein concentrate.

In conclusion, spray dried plasma has been used in starter diets for weaned pigs for over 30 years because it is well researched and has consistently been highly effective for improving post-weaning growth and feed intake compared to other specialty proteins. Our studies confirmed past research showing that starter diets with spray dried plasma were consistently more effective than all of the other alternatives studied and can replace ZnO in weaning diets to support nursery pig performance and help pigs thrive during periods of stress.

References available upon request