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Sponsor's study No EIDS ANI-DEN 022	Trace Company Study V-Lars 022	Confidential Information

The effect of EIDS treated water on the performance of weanling pigs.

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A. Executive Summary.

In response to consumer demands the EU Pig Industry have decided to remove growth promoters from feeds causing difficulties for the farmer to maintain profitability with the ever-growing cost of industrial production.

The present controlled study deals with a novel alternative to maintain high levels of animal growth without the addition of chemicals or biological products.

The physical changes to water and colloid suspensions generated by the Radio Frequency (RF) EIDS technology are known to increase solubility, reduce surface tension and change the gas/liquid interface in favour of reactive oxygen forms.

A total of 2,929 weaning pigs were divided in two groups of five batches each (five treated and five controls) and fed EIDS treated wet feed and drinking water for a period of 54 days. As a result of the consumption of a more soluble diet, the treated group has shown a superior ADG of 97.84 grams over controls (502.59g Vs. 404.75g) resulting in a 19.47 % significant different ($p < 0.05$) weight gain.

In turn, this superior ADG resulted in a total final weight at the end of the 54 days of treatment of 6.18 Kg/pig (19.22 %) heavier than the controls ($p < 0.05$).

The current technology has been demonstrated to be a feasible “green” approach to the pig farming industry compatible with modern consumer demands and EU regulations.

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B. INTRODUCTION

The current changes in the European Food production sector have persuaded producers to restrict the use of antibiotics and growth promoters.

In the absence of growth promoters, pig production has shown, as in the case of Denmark, a significant increase in the incidence of post weaning diarrhea infections with consequent loss of income. This new scenario is of concern, not only to Food Safety Authorities, but also to producers, as average daily gain ADG is affected across the industry.

Radio Frequency (RF) technology is known to induce a reduction of Zeta Potential and increase the dilution of suspensions. The increase in solubility is accompanied by changes in the liquid /gas phase of water enhancing the production of Oxides, peroxides and super oxides (Colic and Morse 1998)

The scientific literature has reported the growth promoting effect of farm animals exposed to RE treated drinking water (Klassien R.I 1982)

In view of the ability of the EIDS (R.F. Electromagnetic Generator) technology to increase cation exchange in soil, resulting in enhanced growth in plants and crops it seems logical for ZPM Europe to investigate the benefits of this treatment in animal nutrition.

The current study constitutes a controlled clinical trial to investigate the impact of R F treated drinking water and wet feed on the overall production performance of young pigs.

It is the objective of ZPM Europe that EIDS treated water would become a viable contribution to substitute growth promoters for a safer and more natural food production.

D. STUDY OBJECTIVES

D.1. To evaluate the efficacy of EIDS treated water to promote growth in young pigs.

D.2 To assess the impact of EIDS in overall animal safety and animal welfare.

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E. MATERIAL AND METHODS.

E.1.STUDY SITE

Mr. Lars Valloe Hansen's Pig ~Farm at Hvalsoe- 50 Km northwest of Copenhagen- was selected based on the availability of animals, record keeping and the experience of this farm in dealing with animal studies.

This farm was of average disease status and growth performance, in line with the national pig health and production statistics of Denmark.

The trial was a controlled study treating five batches of approximately 300 pigs per batch and using five other similar batches as controls. The nature of the water supply and buildings at this farm did not allow keeping a simultaneous control group during the trial.

This was not a blind study and the Investigator, Monitor, farmer and all farm staff were aware when the equipment was functioning.

E.2.ANIMALS

All animals were produced by the same commercial hybrid (LandraceYorkshire- duroc) sow herd at Mr. Hansen's Farm. The sow herd did not have any physical contact with the supply of EIDS treated water or feed.

At 25 days of age and averaging 6 Kilos of weight all piglets were transferred to the weaning barn and allocated in 8 pens per batch of approximately 40 piglets per pen. Each pen measuring 5.0 X 2.2 meters on slatted floors covering 2/3 of the pen (2/3 slatted floor, 1/3 concrete) was provided with one water drinker only, as much of the water was supplied with the wet feed.

F. TREATMENT

F.1.EQUIPMENT

A single EIDS unit was fitted to treat "on line" the main water supply of the farm drinking water and the supply of water to the wet feed equipment. (see installation in Appendix I)

This unit generates a Radio Frequency of 27MHz and electromagnetic forces known to modify the Zeta Potential of fluids thereby enhancing the solubility of colloids. Studies conducted at the University of Limerick in Ireland have shown the EIDS technology to significantly reduce the Zeta Potential of colloids while temporarily altering the gas/liquid phase of water (Leahy J.J. 2000). This effect is proven to last at least 12 hours before reversing to normality (Coil & Morse 1998). The same phenomenon can be obtained by adding, already "activated water" to an existing solution.

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This phenomenon is known as “secondary emissions” and it is important in the overall understanding of the present study. The EIDS unit was switched on continuously and supplied the wet feed equipment with fresh treated water at an average of 6 hour interval. This allowed the wet feed to be continuously “activated” during the fermentation process. In addition to this, the drinking water was continuously treated.

F.2. TREATED ANIMALS

All piglets in this group consumed EIDS treated water from the day after weaning at 25 days old weighing approximately 6 Kilos until leaving the barn at around 80 days old and weighing approximately 34 Kilos (54 +1- 7 days of treatment on average). During the first weeks at the barn, all piglets were fed dry creep feed only and gradually introduced to the wet feed from the following week. From the third week they were fed treated wet feed until leaving the barn at 80 days of age.

A total of 5 batches of on average 271 pigs were subjected to treatment while a second group of 5 batches of on average 314 pigs served as control.

A period of at least two weeks was observed between the last control batch leaving the farm and the first treated group. On Day 1 of the trial all pigs were examined, identified, and allocated to each of the pens. On days 1 and 54 all pigs were weighed and the following parameters were determined:

1. Initial batch average weight in Kilos on day 1.
2. Final batch average weight in Kilos leaving the barn on day 54.
3. Average weight gain in kilos during the 54 days study.
4. Average Daily Gain in grams from day 1 to day 54.

F.3. WET FEED AND DRINKING WATER.

Water was supplied *Ad Jib* and feed at semi *Jib*, as feeder bowls were refilled when emptied. Wet feed was prepared at a rate of 2,5 part of water to 1,0 part of feed.

The starter diet used was “Organic mini add” containing corn, grain, fish meal, grinded wheat, fat and skim milk powder supplied by DLG Danish Coop.

The wet feed equipment consists of two Skiold Echberg units.

Unit “A” with a total capacity of 4.500 Kgs was permanently kept at 50% capacity with the feed-stuff other ingredients of the final diet fermenting in treated water. Unit B of a total capacity of 3.000 Kg was maintained at 50% with the wheat also in treated water.

From early morning and four times daily 1.600 Kg of liquid feed composed of

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“A” plus “B” mix was fed to the animals (20 to 25% of A and 80 to 75% of B) After feeding, each of the containers was refilled with wheat, other ingredients and treated water to allow further fermentation for the next feed 6 hours later. This six hour water re-filling frequency allowed for an efficient “reactivation” of the treatment of the feed by the physical phenomenon known as “secondary emissions “. This reactivation frequency assures an interrupted activation of the feed and fermentation process. .

It is estimated that the piping system for the feed distribution at this farm had a capacity of holding approx. 250 kg of “stored” feed between feeding schedules.

G. ASSESSMENT OF EFFICACY

- 1. ADG between day 1 and 54.**
- 2. Average total gain during the 54 days treatment.**
- 3. Safety of the treatment.**

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H. RESULTS

A total of five batches of pigs were successfully treated while another five remain as control.

Table 1 EIDS treated liquid feed and its impact in pig production

	Control pigs non treated					EIDS treated pigs				
Batch No.	1	2	3	4	5	1	2	3	4	5
initial number of pigs	308	319	300	327	320	260	302	276	258	259
Starting week No.	25	26	28	30	31	40 /	41 /	42	43	44
Average Initial weight Kg.	6.3	7.1	5.8	5.8	6.5	6.7	6.5	6.8	6.7	7.1
Average initial age in days	25	25	25	25	25	25	25	25	25	25
Number of deaths	12	6	5	6	6	4	12	6	4	5
Final number of pigs	296	313	295	321	314	256	290	270	254	254
Finished on week	33	33	35	36	37	48	49	50	51	52
Days of treatment	54	47	54	54	56	54	54	54	54	54
Average final weight in kg.	30	25.8	29	25	29	34	31.9	33	35.3	35.5
Average final age in days	79	72	79	79	81	79	79	79	79	79
Average total gain/Kg./Pigs	23.7	18.7	23.2	19.2	22.5	27.3	25.4	26.2	28.6	28.4
Average daily gain grams	439	400	430	360	400	505	453	485	529	525

Results:	Control	EIDS		Average Difference
ADG in grams (LSM)	404.75	502.59	P < 0.05	97.84 g
Average weight (Kg/pig)				
Initial weight LSM	6.30	6.76		
Finishing weight LSM	27.76	33.90	P < 0.05	6.18 Kg
Average total gain/pig	21.46	27.14		5.9 Kg

The treated group has shown a statistically significantly superior ADG per pig/ day (502.59g Vs. 404.75g; (p<0.05)) resulting in a 19.47 % larger gain. This superior ADG resulted in a total final weight of 33.90 Kg/pig (19.22 %) heavier than the controls (p<0.05) for the 54 days of treatment.

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The initial weights have no effect on these results as were very similar in both groups. Considering that this study only recorded average weights within groups, these levels of significance are even more relevant.

Figure 1 represents the average daily weight gain for both groups.

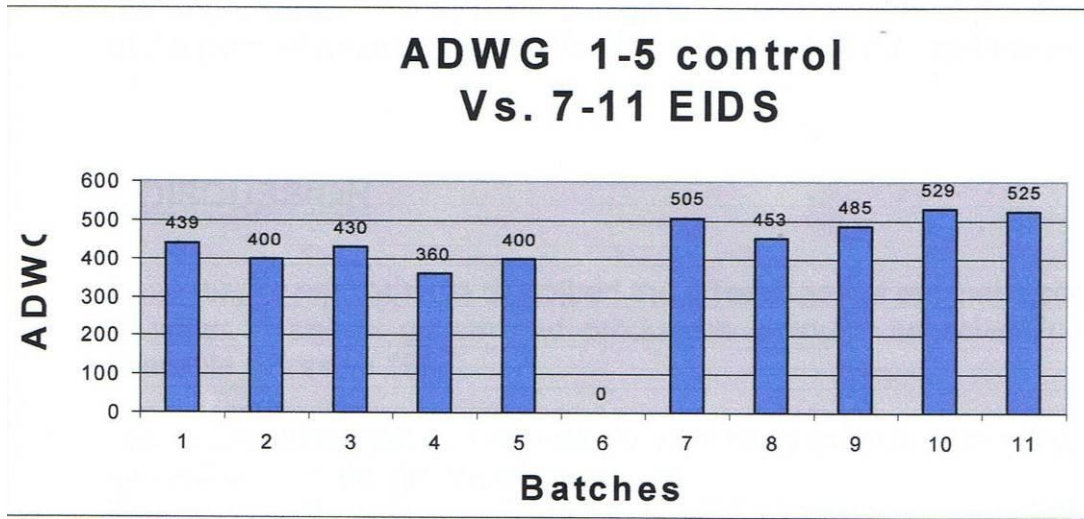
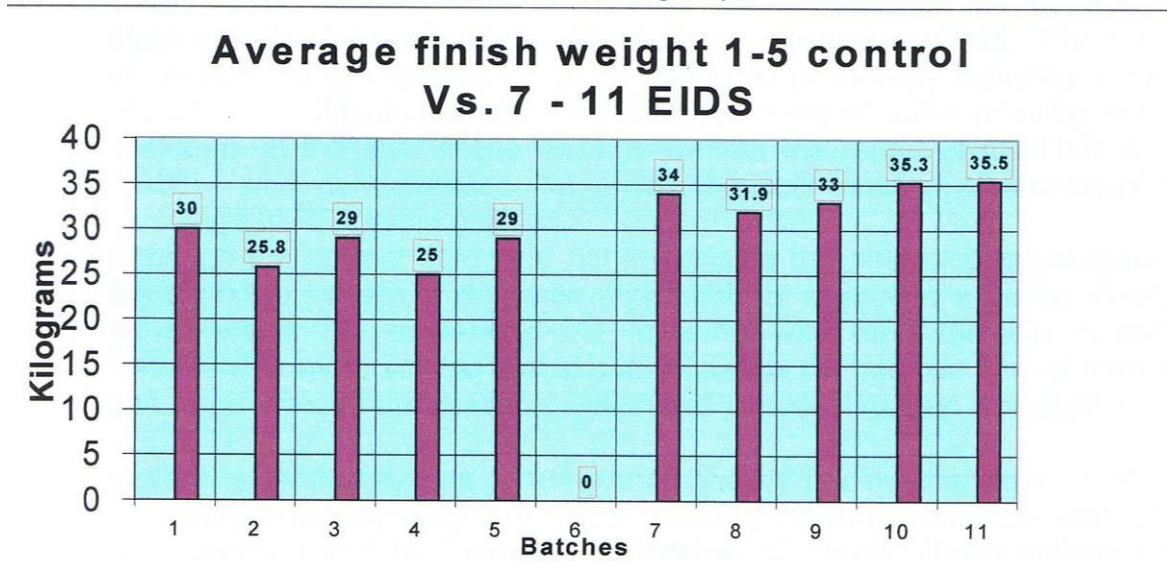


Figure 2 represents the final weights for both groups.



This study also provides safety data showing no difference in the number of dead piglets in both groups 35/1.574 (2.22%) for the control group and 31/1.355 (2.28 %) for the treated group.

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Although blood analysis is not available Mr. Hansen has reported an estimated 65% reduction in the incidence of Lawsonia among the treated pigs.

Although the treatment did not affect the macroscopic quality of the wet feed it was noticeable that less water was required to achieve the same degree of mix and texture. This obvious change led to a change from the original ratio of 2.5 parts of water to 1 part of feed to a final one of 2.2 to 1 respectively.

DISCUSSION

A number of reports have described the advantages of magnetic conditioning of water in animal growth and production although no scientific data are available (Klassien 1982)

This study attempted to evaluate through basic science, the effect of EIDS treated water in the growth of young pigs.

The growth difference found of 19.47% ADG of treated over control ($p < 0.05$) resulted in a superior final total weight of 19.22%. This result exceeds the investigators expectations.

These results are consistent with those reported applying the EIDS unit to plant growth obtaining up to 30% superior vegetable yields. The current understanding of the effect of EIDS and plant physiology indicates a better utilization of nutrients through a significant increase of water solubility and ion exchange in the soil. These findings confirm the report of Oshitiani et. al. (1998) who demonstrated the physiochemical kinetics of increased ion exchange of RF treated colloids.

Although the current study did not investigate the physiological changes in the digestive system, it would be acceptable to speculate a similar situation as in plants i.e. presenting the intestine with more soluble nutrients. Therefore, a more soluble diet should enhance the osmotic flow of nutrients and water through the intestinal wall thereby increasing feed conversion.

Several scientific reports indicate that one of the mechanisms of RE for increasing solubility is by reducing the size of the water molecule from 10 to 13 monomers to 5 to 6 monomers (Aoki et. al. 1994). These authors have found that the dissolution of silica increased significantly in treated water with smaller clusters being able to diffuse more quickly.

The preparation of wet feed, it's fermentation, posterior ingestion and digestion, provides a gas rich colloid environment particularly favourable for the actions of RF. RF and magnetic forces are reported to target primarily

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the liquid/gas interface and bubble surface of colloids enhancing solubility and other physical changes (Shira et. al 1997, and Colic & Morse 1998).

On the other hand, the same authors found that degassing solutions would dissipate the effects of RF. The process of fermentation and digestion are an ideal environment for RF to maximise its effect. Furthermore, these authors have demonstrated the electron kinetics of this process, which can be beneficial to the enzymatic processes during fermentation and digestibility. The donation of temporary unstable hydrogen electrons would induce a more effective enzymatic action during fermentation and further digestibility of nutrients. Prof. Tino Rives (2003) has observed this biological phenomenon while working on plant chlorophyll and EIDS treated water.

The EIDS unit delivers High Frequency RF, which is known to perturb colloids for at least 18 hrs after treatment has ceased (Colic and Morse 1998). This aspect of the technology and particularly the effect of secondary emissions are of significant advantage in treating wet feed. Furthermore the drinking water would have a longer term contributing activating effect in the digestive system of the pigs.

During the fermentation process EIDS increases the amounts of reactive oxides and rearranges the hydroxyl groups causing a reduction of pH as reported by Colic and Morse (1998).

A lower pH in wet feed helps to eliminate deleterious microbes, such as E. coli and Salmonella, from the digestive tract as reported by Mikkelsen and Jensen (1998) A low pH in the feed will also help to promote protein digestion in the stomach by facilitating pepsin activity (Longland, 1991).

Both factors can help prevent diarrhoea in the early post-weaning period.

RE treated water is also reported to increase the production of small amounts of Hypochlorous acid and Oxygen peroxide up to .3 ppm (Colic & Morse 1998). Both are well known disinfectant agent, which may be a contributing factor to control the growth of pathogenic bacteria.

The fact that the water ratio in the feed was changed from 2.5/1, to 2.2 /1 may reflect the way carbohydrates were hydrated by smaller clusters of water molecules with considerable advantages in nutritional value and absorption.

At equal volumes of feed consumption, piglets were able to ingest more solids more readily dissolved. This in turn can increase overall feed intake as observed by Mr. Lars Hansen and promote better feed conversion.

Mr. Lars Hansen has reported a different abdominal shape in the treated pigs indicative of a major intake of feed. This observation together with increased intake post-weaning, as achieved by liquid feeding, has been found to help maintain gut integrity (which normally deteriorates with weaning), and in particular, villous height (Deprez et al., 1987; Pluske et al., 1996). Maintenance of gut-integrity would serve to maintain the digestive capacity of

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the pig, and thus prevent the post-weaning "growth lag" often experienced at this time.

A more soluble wet feed may lead to using smaller calibre pipes in the distribution of feed thereby avoiding the storage of large amounts in the system between feeds , which is responsible for the breakdown of aminoacid.

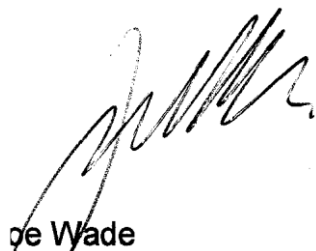
Liquid feeding has been reported to stimulate increased intake post-weaning, and thus increase post-weaning growth-rates (Brooks et al, 1996; Jensen and Mikkelsen, 1998). These authors summarized the results of ten studies on wet feeding of first-stage pigs, and found that ADG was increased by 12% when compared with dry feeding. They also reported that ADG of fermented wet-fed pigs was 13% higher than that found with fresh wet feeding.

A further ADG increase of over 19% on conventional wet feeding values, without growth promoters, is undoubtedly an attractive opportunity for pig producers and manufacturers of wet feed equipment.

Further research is needed to elucidate food conversion and absorption, the behaviour of enzymes and nutrients during fermentation and the effect of EIDS treated feed in the control of Lawsonia and other pathogens.

A more effective fermentation process and availability of nutrients may allow the future utilization of more economical resources of feed for pig nutrition.

End of report



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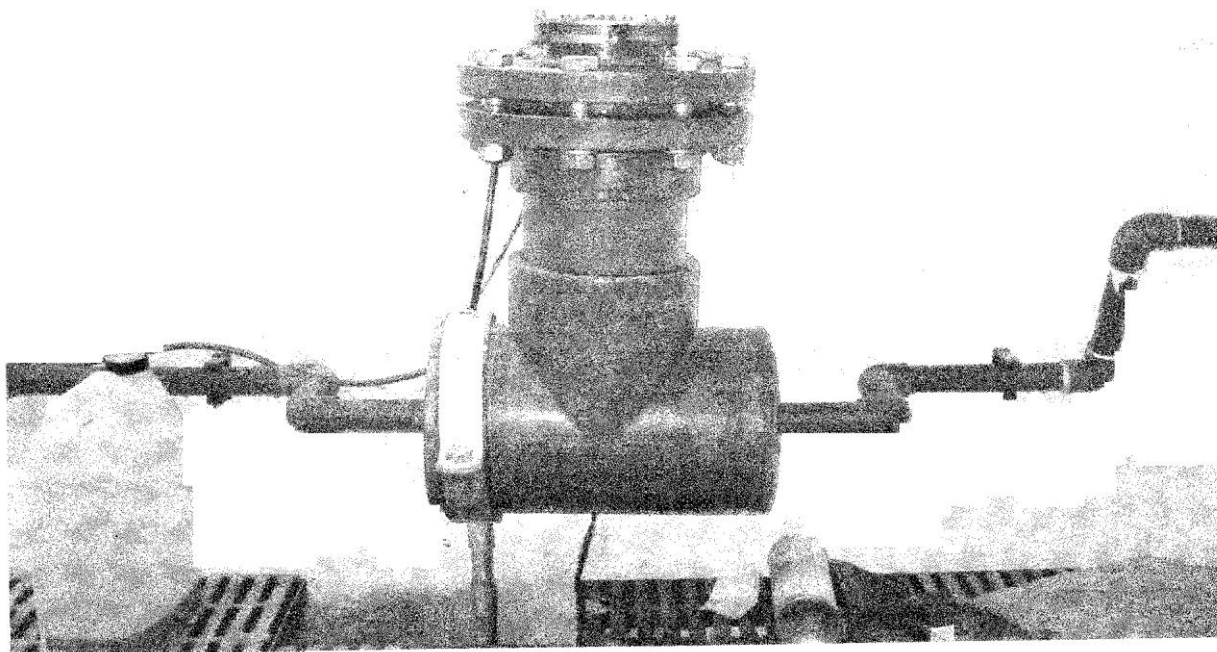
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APPENDIX 1 EIDS INSTALAT1ON



This picture shows the installation of an EIDS unit at the water pipe entrance to the farm.

The EIDS unit is easily installed and current models allow up to 10 bar pressure.

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APPENDIX II STATISTICAL REPORT

Study: EIDS versus Control

Average weight (Kg/pig) 110
16:53 Saturday, June 28, 2003

----- trt=EIDS -----

The Mixed Procedure

Covariance Parameter Estimates

Cov Parm	Estimate
batch*trt	0.03875
Residual	1.8152

Fit Statistics

-2 Res Log Likelihood	61.7
AIC (smaller is better)	65.7
AICC (smaller is better)	66.6
BIC (smaller is better)	66.3

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
trt	1	8	28.77	0.0007
week	1	8	1626.47	<.0001
week*trt	1	8	22.22	0.0015

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Average weight (Kg/pig). Least Square Means 113
16:53 Saturday, June 28, 2003

tr1	Treatment	Week	Least Square Means	Standard Error	Upper* 95%CI	Lower*
EIDS	Control	-	17.0300	0.4351	18.0332	16.0268
EIDS	EIDS	-	20.3300	0.4351	21.3332	19.3268
EIDS	-	0	6.5300	0.4306	7.4428	5.6172
EIDS	-	8	30.8300	0.4306	31.7428	29.9172
EIDS	Control	0	6.3000	0.6089	7.5909	5.0091
EIDS	EIDS	0	6.7600	0.6089	8.0509	5.4691
EIDS	Control	8	27.7600	0.6089	29.0509	26.4691
EIDS	EIDS	8	33.9000	0.6089	35.1909	32.6091

Week	Contrast	df	t	Pr > t	(1)
-	Control vs EIDS	8	-5.36	0.0007	*
0	Control vs EIDS	16	-0.53	0.6006	ns
8	Control vs EIDS	16	-7.13	<.0001	*

(1): ns = no significant difference, * = significant difference ($P \leq 0.05$).

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Average Daily Weight Gain 114

16:53 Saturday, June 28, 2003

----- EIDS=EIDS -----

Class Level Information

Class	Levels	Values
trl	1	EIDS
batch	5	1 2 3 4 5
trt	2	Control EIDS

Average Daily Weight Gain (gr/pig) 115
16:53

Saturday, June 28, 2003

----- EIDS=EIDS -----

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
trt	1	4	28.46	0.0059

Average Weight Daily Gain (gr/pig)

Effect	Treatment	Least Square Means	Standard Error	DF	t value	Pr> t	Alpha
trt	Control	404.75	12.9683	4	31.21	<.0001	0.05
trt	EIDS	502.59	12.9683	4	38.76	<.0001	0.05

Least Squares Means

Effect	Treatment	Estimate	Lower	Upper
trt	Control	404.75	368.74	440.75
trt	EIDS	502.59	466.59	538.60