



UPDATE

Kansas State University Agricultural Experiment Station
and Cooperative Extension Service

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UPCOMING EVENTS

Colorado Swine Day
April 7th

Limon Community Center
Limon, Colorado



see page 3 for program details

L-carnitine Influences the Number of Pigs Born Alive Per Litter

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L-carnitine is a naturally occurring nutrient that is thought to be synthesized by the pig in amounts sufficient to meet its requirements. Carnitine has been traditionally associated with the transportation of fatty acids across the mitochondria membrane where they are metabolized to produce energy. For the past 10 years, research has focused on the effects of added L-carnitine on growing-finishing pigs. In general, these studies have observed improvements in carcass leanness in pigs fed added L-carnitine, but with current market conditions, the improved carcass leanness does not offset the cost of the added L-carnitine. However, a growing research base has found that adding L-carnitine to gestation and lactation diets improves reproductive performance.

The use of L-carnitine in sow diets was initially investigated in Europe, where sows supplemented with added L-carnitine had increased litter weaning weights and greater pig survivability. These experiments demonstrated improvements with litters weaned at 28 to 35 days. Therefore, the next logical question was whether similar effects could be observed with shorter lactation lengths (14 to 21 days) more typical of U.S. production systems. This led to a series of experiments investigating the effects of addi-

tional L-carnitine in both lactation and gestation diets on sow and litter performance. As follows is a brief summary of 6 experiments conducted at 4 research facilities by 3 different research groups.

Experiment #1

This experiment was a pilot study conducted at K-State with 50 sows (PIC). The sows were fed 50 ppm of added L-carnitine from d 108 of gestation until weaning (d 22). No differences were observed on litter weaning weight or number of pigs weaned. However, when sows were monitored for subsequent farrowing performance, a numerical increase in subsequent litter size was observed for L-carnitine supplemented sows (10.8 vs 12.3 pigs born alive). This experiment led us to further investigate the influence of L-carnitine on the number of pigs born alive per litter.

Experiment #2

This experiment used 307 (PIC) sows on a commercial swine operation in NE Kansas. Sows were fed 50 ppm of added L-carnitine in gestation and/or lactation. Sow weight and last rib fat depth gain were increased in sows fed added L-carnitine during gestation. Also, sows fed added L-carnitine had heavier pig weights at birth and at weaning than those pigs from control sows. When sows were monitored for subsequent

reproductive performance, the number of pigs born alive was increased similar to that in the first experiment. Sows fed added L-carnitine in either gestation or lactation had more pigs born alive compared to control litters (10.2 vs 11.2 pigs). Sows fed added L-carnitine in both gestation and lactation produced litters with even higher number pigs born alive compared to controls (10.2 vs 12.0 pigs). This experiment supported the increase in subsequent number of pigs born alive that was observed in the first experiment.

Experiment #3

This experiment was conducted at the same facility and time as Experiment 2. It evaluated the effects of adding 50 ppm of L-carnitine only in lactation on performance of first-litter gilts. No differences in litter performance were observed. Unlike the first two studies, when gilts were monitored for subsequent number of pigs born alive, no differences were observed.

Experiment #4

This experiment was conducted on a commercial swine facility in NE Kansas. Eighty sows (PIC) were used to evaluate the effects of added L-carnitine (0, 50, 100, or 200 ppm) fed during gestation (d 1 to 110 of gestation) on sow and litter performance. In this experiment, an increase in the number of pigs born alive was observed (control, 10.7 pigs mean of added L-carnitine, 11.4 pigs). No differences were observed in sow or litter lactation performance. The subsequent litter size was not recorded in this experiment.

Table 1. Determining the Annual Benefit of Extra Pigs per Litter^a

| Increased pigs/litter | Value of a Newborn Pig | | | | | |
|-----------------------|------------------------|---------|---------|---------|---------|---------|
| | \$10.00 | \$15.00 | \$20.00 | \$25.00 | \$30.00 | \$35.00 |
| 0.3 | \$ 7.20 | \$10.80 | \$14.40 | \$18.00 | \$21.60 | \$25.20 |
| 0.4 | \$ 9.60 | \$14.40 | \$19.20 | \$24.00 | \$28.80 | \$33.60 |
| 0.5 | \$12.00 | \$18.00 | \$24.00 | \$30.00 | \$36.00 | \$42.00 |
| 0.6 | \$14.40 | \$21.60 | \$28.80 | \$36.00 | \$43.20 | \$50.40 |
| 0.7 | \$16.80 | \$25.20 | \$33.60 | \$42.00 | \$50.40 | \$58.80 |
| 0.8 | \$19.20 | \$28.80 | \$38.40 | \$48.00 | \$57.60 | \$67.20 |

^a This table assumes 2.4 litters per sow per year and does not take into account the added input cost (i.e., L-carnitine) to increase litter size.

Experiment #5

This study was conducted by a large integrated swine business. Sows (450) were fed a lactation diet with or without 50 ppm of added L-carnitine. At weaning, sows were switched to their respective gestation diets with or without 50 ppm of added L-carnitine until day 110 of gestation. At this time, all sows were fed a lactation diet without added L-carnitine. An increase in both total born (10.86 vs 11.62 pigs) and number of pigs born alive (9.74 vs 10.50 pigs) per litter was observed in sows fed added L-carnitine compared to control sows.

Experiment #6

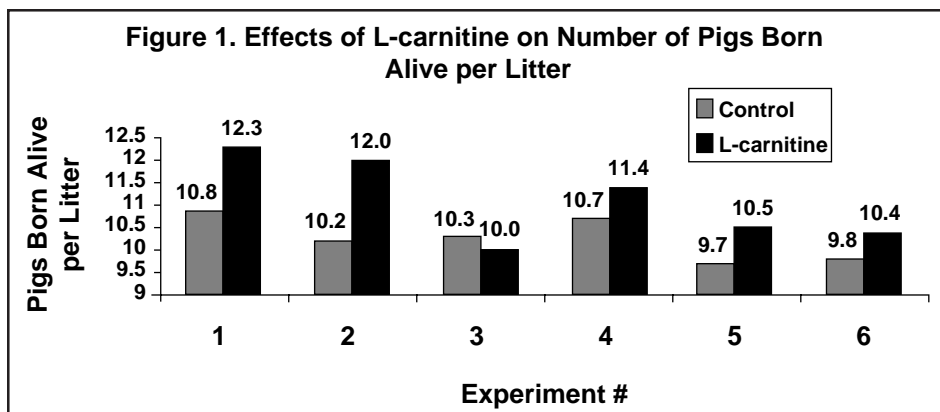
A second independent study conducted by another large integrated swine business investigated the effects of L-carnitine fed only during lactation. They observed that sows fed added L-carnitine during lactation had an increase in the number of pigs born alive in the subsequent farrowing (9.8 vs 10.4 pigs) compared to control sows.

Summary

To summarize results of the six experiments evaluating added L-carnitine fed during gestation and/or lactation, with the exception of Exp. 2, no differences in litter weaning weights have been observed when L-carnitine has been fed compared with control sows. However, in five out of the six experiments, increases in subsequent litter size have been observed in sows fed L-carnitine in gestation and/or lactation (Figure 1). The range in increased number of pigs born alive ranged from 0 to 1.8 and averaged between .7 and .9 pigs per litter. Based on these findings, the use of L-carnitine in gestation and lactation may be economically feasible based on its cost and the value of weaned pigs in your production system.

Economic Review

Currently, it costs approximately \$4.50 to add 50 ppm of L-carnitine in a ton of sow feed (price may vary based on quantity of L-carnitine purchased). While gestation and lactation feed intake, and number of litters per sow per year may vary from farm to farm, on average a sow will consume approximately one ton of combined gestation and lactation feed each year. To justify the increased cost of \$4.50 per sow per year, it is necessary to determine the expected increase and value in pigs born alive for your specific operation. In Table 1, we have calculated the potential benefits with added L-carnitine based on a range of extra pigs born alive per litter and the value



of that extra pig. This table assumes 2.4 litters/sow/year and does not subtract the cost of the L-carnitine. For example, with 2.4 litters per sow per year and \$20 value for a newborn pig, if the number of pigs born alive increased by .5, gross revenue would increase \$24 per sow per year. Subtracting the amount paid for added L-carnitine (\$4.50 per sow) would give a net increase in value of \$19.50. This revenue sheet is based on the calculation: Revenue = (Increase in Pigs Born Alive per Sow per Litter (P/S/L)* Litters per Sow per Year * Value of a Newborn Pig).

Other Potential Benefits

At this time we are unsure of the exact mechanism that added L-carnitine increases the number of pigs born alive. However, preliminary results from two

recent studies suggest that the beneficial effects of added L-carnitine may result from an increase in the number of eggs ovulated and(or) increased embryo survival. Therefore, it may be necessary to provide added L-carnitine in the diet for a period of time before breeding to see the greatest response in litter size.

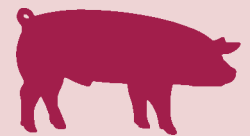
In addition to the effects of L-carnitine on the number of pigs born live, we have also observed increases in insulin and IGF-I concentrations of sows. Increased IGF-I during specific windows of gestation (days 30 to 50) has been associated with changes in fetal muscle fiber development, resulting in leaner, faster growing offspring. Results for initial field studies appear to confirm this possibility in pigs raised from sows fed L-carnitine during gestation. In one study, finishing pigs from sows fed 50 ppm of L-carnitine during gestation

had an increase in percentage lean compared with pigs from control sows (53.4 vs 51.9%, respectively). Further research is needed to confirm this effect on fetal muscle fiber development from feeding L-carnitine during gestation.

In conclusion, adding L-carnitine in gestation and lactation diets increases the number of pigs born alive. The reason for the improvements in the number of pigs born alive are not known at this time. Additional research is being conducted to determine how L-carnitine affects litter size, and if there are any possible effects on fetal muscle fiber development, and carcass characteristics of the offspring. It is essential to determine the overall cost-effectiveness of L-carnitine for your specific operation.



Colorado Swine Day April 7th Limon Community Center Limon, Colorado



- 10:00 to 10:30 Registration
- 10:30 to 11:15 Diet and Feed Management Strategies to Reduce Nutrient Excretion, Bob Goodband
- 11:15 to 11:45 PRRS Update, Steve Dritz
- 11:45 to 12:30 Lunch
- 12:45 to 1:30 1999 Price Update and Outlook, Jim Mintert
- 1:30 to 2:15 Managing Pig Variation and Weaning and Marketing, Steve Dritz
- 2:15 to 2:45 New Developments in Swine Nutrition for 1999, Bob Goodband

For further information and registration please contact Brad Gillmore (970-332-4151)
or

Elena Moreskonich-Metro (303-637-9200).

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