Chromium-L-Methionine in pig feed: lean carcass and sow performance

By Mashilo Phosa (Chemuniqué RSA)

There is a strong interest in understanding the differences between chromium sources on the market today. New chromium research and the ban on beta-agonist in many countries have resulted in an increased use of organic chromium in animal feeds. Research with animals has confirmed that feeding certain organic forms of chromium will produce beneficial performance responses.

An interest in dietary chromium (Cr) for livestock production has increased due to reports of improved carcass quality of pigs, increased litter size in swine and improved performance and metabolic changes in young dairy calves. The biologically active form of Cr is an organometallic compound called glucose tolerance factor (GTF) and this compound has been proposed to consist of Cr3+, nicotinic acid and possibly the amino acids glycine, cysteine and glutamic acid. The presence of Cr3+ at the core is critical for GTF activity and is thought to facilitate interactions between insulin and insulin receptors on target tissue. Dietary inorganic Cr compounds are poorly absorbed in animals (0.4 to 3.0%) regardless of dose and dietary Cr status. The increased interest in the impact of Cr supplementation on production and evidence that inorganic forms are poorly absorbed has led to the introduction of organic Cr sources to provide a more bioavailable source of Cr that potentiate better performance.

Because Cr is associated with carbohydrate metabolism, the metabolic effects of Cr supplementation may be demonstrated by investigating glucose metabolism. The Cr3+ atom is thought to facilitate interactions between insulin and insulin receptors on target tissues such as muscle and fat. In this way, Cr potentiates anabolic activities of insulin. The main function of insulin is to regulate blood glucose levels. When bound to its receptor, insulin causes cellular uptake and use of glucose, thereby clearing it from the blood. Once acquired by cells, glucose is used as an energy source that, along with the anabolic actions of hormones such as growth hormone and insulin-like growth factor I, drives protein synthesis, growth of lean tissue and proper maintenance and function of other organs. Biologically active Cr also aids in the conversion of thyroxine (T4) to triiodothyronine (T3), the thyroid hormone that increases metabolic rate causing increased oxygen consumption, heat production, metabolism of fats, proteins and carbohydrates, cardiac output and RNA and protein synthesis. The improvements in carcass quality in pigs may be due to this potentiation of insulin function.

Chromium L-Methionine (CrMet): alters carbohydrate metabolism in pigs. During intravenous glucose tolerance test (IVGTT), clearance rate of plasma glucose increased as supplementation of CrMet increased. In addition, CrMet is an effective source of Cr for improving performance and carcass characteristics of swine. Growing-finishing pigs fed CrMet had improved feed conversion, decreased tenth rib backfat, increased loin eye area and increased lean meat percentage.

Grower/Finisher pigs

The most dramatic response to Cr supplementation for growing and finishing pigs has been the improvement of carcass composition. Research has shown decreased backfat thickness and/or increased loin muscle area. Other research has shown increased protein deposition and decreased fat deposition, as measured by whole-carcass composition, with little to no change in backfat thickness and loin muscle area. With the improvement in lean deposition that has been reported, an improvement in feed efficiency would be expected. Extensive research on chromium in swine diets suggests that feeding a bioavailable source of supplemental chromium can improve feed efficiency and lean gain in wean-to-finish pigs. The potential response of pigs to chromium supplementation depends on a number of variables, including animal genetics, environment, stress or health challenges, the amount of chromium already in the feed and bioavailability of the chromium supplement chosen. Research indicates producers feeding a bioavailable source of chromium could potentially expect the following response in wean-to-finish pigs:

- 2% improvement in feed efficiency;
- 1% increase in lean gain;
- 10% decrease in backfat thickness;
- 10% increase in average loin muscle area.

However, the research to date shows no consistent effect of Cr on growth or feed efficiency. Both negative and positive effects on growth performance have been reported; overall, the responses numerically favour Cr supplementation. The reasons for inconsistent responses are not clear.

Sow performance

Recent research with bioavailable sources of Cr has indicated that reproductive performance of sows could be improved with dietary supplementation. Reports in gilts consuming diets supplemented with 200 ppb Cr, the number of pigs born alive and weaned increased by 2.3 and 2.15 pigs per litter, respectively. As a result of increased pig numbers, 21 day litter weight improved in Cr supplemented

animals. In additional trials, gilts supplemented with 200 ppb Cr from the time of first breeding, with continued supplementation through three parities, slight improvements in pigs born alive were observed in the first parity (0.04 pigs per litter) and the magnitude of this effect increased with subsequent parities (0.7 pigs per litter and 2 pigs per litter in parity two and three, respectively).

Selecting an Organic Chromium Source

Selecting the correct organic chromium source is not an easy task. There are many forms of organic chromium available in the market. Science has not yet determined the metabolic uptake and utilization of any organic chromium source. There is little comparative performance data on organic chromium sources to help make your decision.

The best advice for selecting an organic chromium source is:

(1) Do your homework. Take time to understand the differences between each organic chromium source.

(2) Select a reputable supplier who has industry experience and proven technology.

(3) Use only research proven compounds. Make sure there is sufficient research to demonstrate the organic chromium source is effective. Avoid suppliers who have little or no research to support their own product, especially suppliers who use research from other organic chromium products to support their own product efficacy.

(4) When selecting a chromium supplier, remember that chromium products of the same form may be manufactured using different manufacturing processes. This may affect individual products' performances. Research for one product does not apply to different brands or forms of that same product.

(5) When selecting a chromium yeast source, determine if the product has chromium bound in the yeast or if the yeast is simply fortified with chromium.