Pork Prose

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LIMESTONE

Rumors are flying that a company (the same one that brought us Aerogen) is promoting a vitamin-mineral premix in Pennsylvania on the basis of high nutrient content and bioavailability.

Well, that's nothing new. But this premix is reportedly special because it contains midwestern limestone, unlike many of the premixes and feeds manufactured in the Northeast.

The midwestern limestone reportedly has lower levels of impurities, especially aluminum and magnesium, which might interfere with the uptake of other important nutrients.

Does midwestern limestone really have fewer impurities? Are the levels of impurities high enough in eastern limestone to limit performance in pigs? Read on.

All Limestones Are Not Created Equal

Limestone is composed of a mineral called calcium carbonate ($CaCO_3$). This is basically the same material found in sea shells, marble, and the white deposits found in your sink if you have hard water.

The type of crystal and the amount of impurities will dictate what the final product looks like and how it can best be used.

The Association of American Feed Control Officials (AAFCO) categorizes limestone based on calcium content. Limestone sources high in calcium (38-40 percent) qualify as calcium carbonate. If the limestone contains 33-37 percent calcium, then it's called ground limestone.

Two other types of limestone are popular for agronomic use, but less practical for swine diets. One is dolomitic limestone which contains 20-23 percent calcium and at least 10 percent magnesium. The other is high magnesium limestone, and contains about 30 percent calcium and 5-6 percent magnesium.

Both calcium level and magnesium level are important aspects of limestone quality. Another concept that's just as important is bioavailability. This term characterizes how well an animal digests and absorbs nutrients.

A nutrient bioavailability of 100 percent is ideal. Research clearly shows that the higher the calcium level in the mineral source, the higher the bioavailability:

Table 1: Bioavailability of Calcium Sources

Source	Calcium Level	Bioavailability
Ground limestone	33-37%	70-90%
Marble dust	39%	98%
Oyster shell flour	38%	98%
Aragonite	39%	98%
High magnesium limestone	30%	82%
Dolomitic limestone	23%	51-73%

Impurities

Magnesium. Impurities such as heavy metals can affect the value of limestone sources, but no element has more impact on calcium availability than magnesium.

When magnesium replaces calcium in the limestone, the result is a much tighter crystal, one that is more resistant to attack from digestive acids. In high-calcium limestones, magnesium levels range from .1-1.0 percent. Incidentally, the magnesium in limestone has a low bioavailability.

Aluminum. This element, when in the right form, can limit phosphorus absorption. But the form that we find in soil and in limestone cannot be digested by the pig. So, yes, aluminum is a contaminant of limestone. But because it's in an undigestible form, it's of little consequence. In high-calcium limestones, aluminum levels range from 50-1,000 parts per million (ppm).

Iron. Another major impurity, iron, can be found at levels of 1,000-2,000 ppm in high calcium limestone. But it is only about 50 percent available. So it's also of little concern.

Northeastern Limestone

I recently contacted an individual involved in marketing the premix mentioned in the first paragraph. And he confirmed that the product uses a "unique combination of minerals because of low aluminum and magnesium in midwestern limestone." I then asked if our limestone was really that different from what is mined in the midwest. He told me that midwestern limestone generally contains about .1 percent magnesium and a similar amount of aluminum, while limestone from our area typically has 5-8 percent of both magnesium and aluminum.

Then I called four major feed companies in Pennsylvania to find out where they buy their limestone and learned that nearly all of it originates from the Bellefonte region, parts of the Shenandoah Valley in Virginia, and the York area. The limestone deposits in all of these regions contain 95-98 percent calcium carbonate, which make them high-quality deposits. After contacting the limestone suppliers I learned that they sell a variety of products or "grades" depending on calcium level, etc. The names of the grades don't necessarily conform to the terms used Table 1, so I've simply grouped them into high calcium and low calcium limestone in Table 2:

Midwestern Limestone

Having talked with the Iowa Limestone Company, and an individual in the east that's familiar with those deposits I have found that it's almost identical to ours:

One exception to this is a deposit near St. Genevieve, Mo. which contains about 99 percent calcium carbonate. That's a percent or two higher than what we have in the Northeast.

The purest calcium carbonate deposit in North America is apparently found in the Bahamas, and is called Aragonite. But if you check Table 1, you'll see that the bioavailability of Aragonite is no better than that of high calcium limestone (listed as calcium carbonate in the table).

Table 2: Average Composition Feedgrade Limestone from Northeast U.S.

	Calcium	Magensium	Aluminum
High calcium limestone	38-39%	.40-1.5%	1-3700 ppm
Low calcium limestone	34%	3.6%	?

Nearly all of the limestone fed to pigs (and livestock) is of the high calcium variety. But you can see that even the low calcium limestone (based on one product that I could locate) contains far less magnesium than what our premix marketer claims.

Particle Size

Particle sizes for feedgrade limestone range from 5-5,600 microns. The optimum size for swine appears to be in the 300-1,000 micron range.

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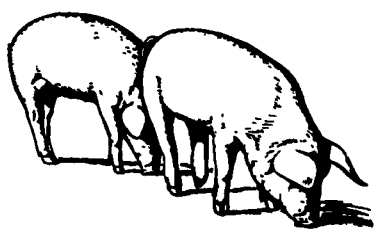
Table 3: Average Composition Feedgrade Limestone from from Midwestern U.S.

	Calcium	Magnesium	Aluminum
High calcium limestone	38-39%	.1-.4%	1000 ppm



ANIMAL SCIENCE 406 SWINE PRODUCTION AND MANAGEMENT FALL, 1992

DATE	TOPIC
28-Aug	Course overview, industry structure
31-Aug	Facility design and animal welfare
2-Sep	Lab - Field trip
4-Sep	Ventilation systems
7-Sep	Labor Day Holiday
9-Sep	Lab - Ventilation demonstration Basement of Ag Engineering Bldg
11-Sep	Pit and polytube ventilation
14-Sep	Manure Handling
16-Sep	Lab - Field Trip
18-Sep	QUIZ. Mgt during farrowing
21-Sep	Baby pig management
23-Sep	Lab - Baby pig processing Swine Center
25-Sep	Nursery, grower, finisher mgt
28-Sep	Breeding and gestation mgt
30-Sep	Lab - Heat detection; AI Swine Center
2-Oct	Artificial Insemination
5-Oct	Feeding the breeding herd
7-Oct	Lab - Castration/SPI Swine Center
9-Oct	Feeding the growing pig
12-Oct	Exam
14-Oct	Lab - Feeds and Feeding Swine Center
16-Oct	Nutritional problems, feed additives
19-Oct	Feed Processing
21-Oct	Lab - Allot pigs to research trial Swine Center
23-Oct	QUIZ Breeds, important traits
26-Oct	Testing programs

DATE	TOPIC
28-Oct	Lab - Gilt/boar selection Swine Center
30-Oct	Breeding systems
2-Nov	Biosecurity programs
4-Nov	Lab - Neoropsy Animal Disease Laboratory
6-Nov	Respiratory problems
9-Nov	Diarrhea and parasite control
11-Nov	Lab - Trouble Shooting Animal Disease Laboratory
13-Nov	Selling feeder pigs & market hogs
16-Nov	QUIZ Grading programs
18-Nov	Lab - Marketing alternatives 109 Ag Sciences and Ind Bldg
20-Nov	EXAM
23-Nov	Selling cull sows & boars, seedstock; Packers & Stockyards regs
25-Nov	Lab - Finish research trial Swine Center
27-Nov	Thanksgiving Holiday
30-Nov	Using records
2-Dec	Lab - Budgets and cash flow 109 Ag Sciences and Ind Bldg.
4-Dec	Budgets and cash flow
7-Dec	Review of records, goals
9-Dec	Contracts, hedging forward contracts (Meet in 110 C O B)
11-Dec	QUIZ

Lectures and laboratories may be attended free of charge, by calling one week in advance.
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