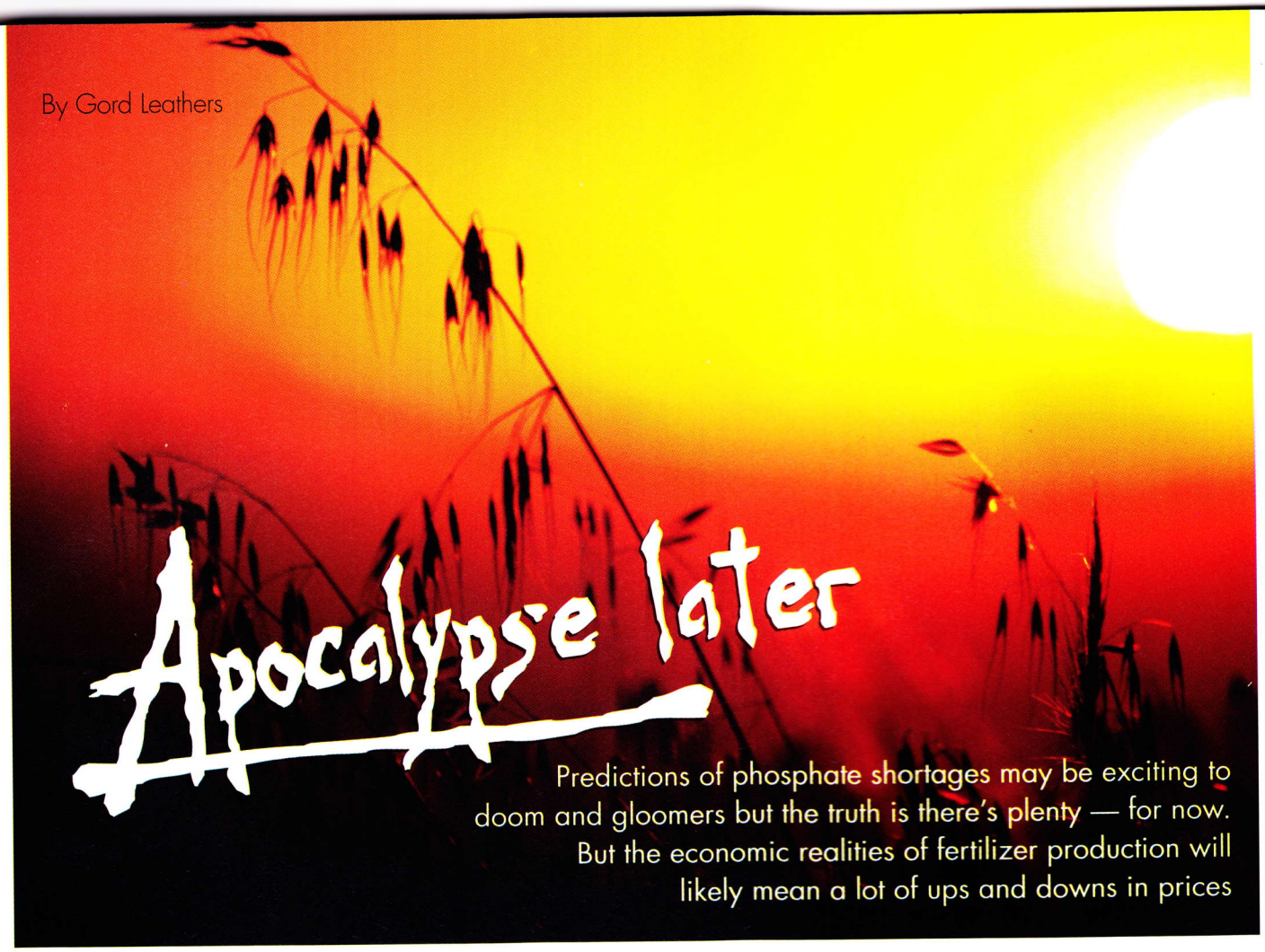

By Gord Leathers

Apocalypse later

Predictions of phosphate shortages may be exciting to doom and gloomers but the truth is there's plenty — for now. But the economic realities of fertilizer production will likely mean a lot of ups and downs in prices

"Dammit! The earth has run out of phosphorus!?" roared the President. "We've got to do something." He banged his fist on the table and it popped like a ripe tomato. "What!?" he roared again.

"It's your cell membranes sir. With no phosphorus they're coming apart," cried his chief science advisor, just as his DNA collapsed like a tower of Tinker Toys. The rest of the panel began to chatter but stopped dead as their energy reserves froze and they all collapsed in piles of limp ooze.

Hollywood hasn't discovered phosphorus yet but they might once it's finished with global warming and genetic modification and from there it will only be a matter of time until the next string of apocalyptic blockbusters stars this major macronutrient.

With headlines proclaiming that we're running out phosphorus we should ask ourselves — should we be concerned?

"I never thought there would be a time in my career that the worldwide supply of phosphorus would be getting as much attention as it is right now," says Dr. Paul Fixen of the International Plant Nutrition Institute. "These headlines are all saying the same thing, suggesting that this could be a huge problem for us and it's sneaking up on society as a whole."

The fundamental problem with phosphorus is keeping it where it belongs. It moves downhill to the ocean and, under natural circumstances, it's a long, slow, one-way trip. In a natural system, plants die and the phosphorus tied up in tissue is slowly released back into the soil. If the plant is eaten, the animal returns up to 80 percent of the phosphorus through the manure but, no matter how it's used, it's recycled on land up to 46 times. Then it finds its way into a watercourse, where it may be recycled upwards of 800 times before it comes to rest in ocean sediments. A little of it goes a long way.

Agriculture really puts the jets to this process by opening up the ground to erosion and freeing large amounts of mineral phosphorus for the downhill trip. In addition to that, phosphorus in crops is harvested, exported, processed and consumed in places far away from point of origin and then literally flushed out to sea.

Since the native phosphorus is depleted we have to replace it with fertilizer so it's common practice for farmers to run a hopper-full of commercial phosphate behind the seeding rig and put it into the ground alongside the awakening seeds.

As the embryonic shoots start to probe the soil they draw in the available phosphorus compounds where it's really put to work. It's a crucial component of adenosine triphosphate (ATP), the fuel formulation that powers living cells. It's built into

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phospholipids, an important building block of cell membranes. The support structure of the DNA molecule itself is constructed from phosphate molecules bolted to sugars in long spiral chains.

It's one of six very important elements that life can't do without, so if we deplete the local supply we have to top it up with a fertilizer. This fertilizer comes from phosphate rock and it's not renewable. Like any non-renewable resource, the more we use the less we have — and world production of phosphate rock has ranged from 120 million tons to 165 million tons per year since 1980. If the question is "How long do we have?" the answer is "We really don't know."

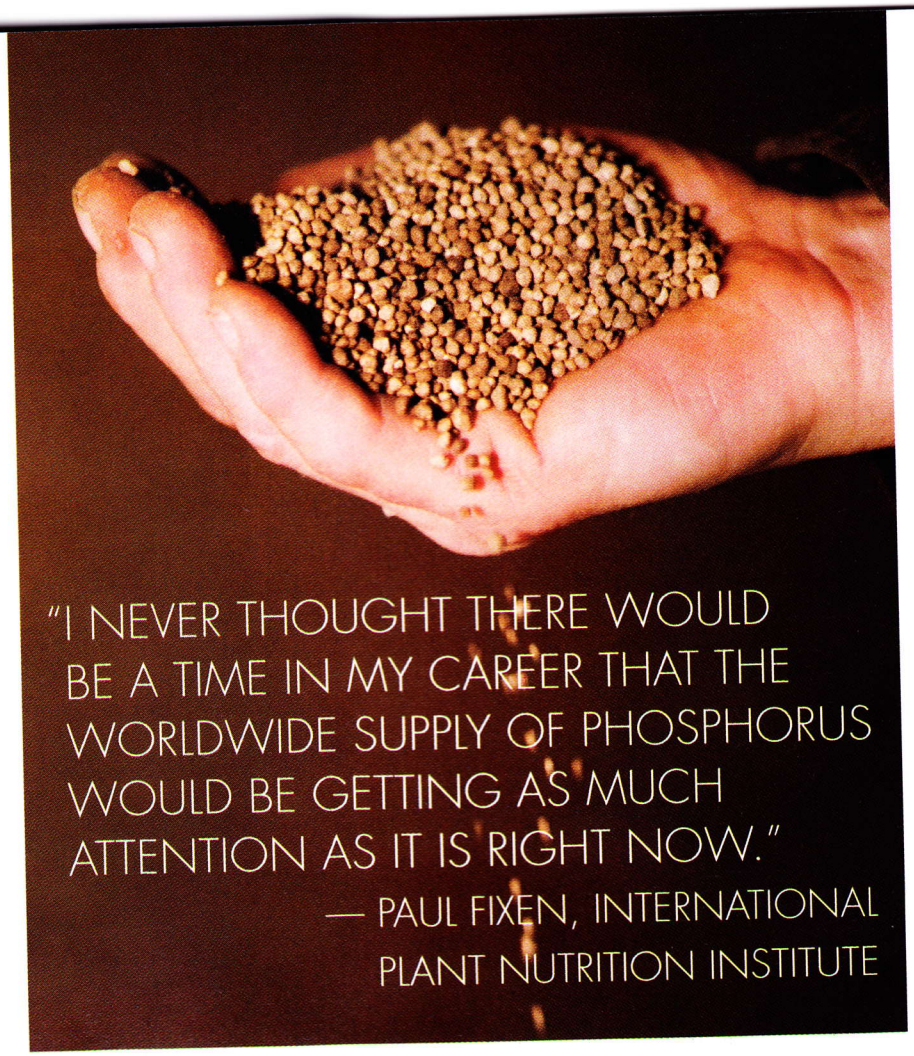
"Estimates of reserves are plagued with uncertainty because producers consider reserve information to be confidential." Fixen says. "Those that know aren't telling because if your business is to produce fertilizer from phosphate rock, it's probably not to your advantage to let the competition know just where you're sitting as far as reserves are concerned."

The U.S. Geological Survey (USGS) estimated world reserves at 15 billion tons and world reserve base at close to 50 billion tons. These are two very different numbers because reserve and reserve base are two different things.

When miners carve out rock for valuable minerals they're mining ore and ore is an economic term.

Suppose you're mining gold and it's worth $300 an ounce. Big mining operations don't just dig and find nuggets. They sink a shaft into an ore body, a large formation of underground rock that they know contains gold. They bring the ore to the surface where it's crushed and the gold is extracted. If the operation costs you $500 per ton of ore and that yields five ounces then you've made $1,000. If the price of gold drops to $50 an ounce then you're going to lose $250.

When you slip below this economic threshold, what you're talking about is no longer ore — its plain old rock, because processing it is no longer economically viable. Under those circumstances a mining company closes the mine and waits for the price of gold to go back up. It's still the same material but a number on a commodity exchange can transform ore into common rock and back into ore — frequently again and again.



Reserves refer to the phosphate ore that we can mine profitably. Reserve base is the rock that we know contains phosphate but, at the moment, mining it simply isn't economical. Several factors can change that such as higher fertilizer prices, discovery of new reserves or new extraction technology that lowers production costs. According to current USGS estimates we could have enough phosphate rock to last between 100 to 300 years at current use rates, assuming these estimates are accurate.

"Right now we really don't know what it is." Fixen says. "But from the data that are available, and they're really conservative data, the world is not on the verge of running out of phosphorus. Still, rock phosphate is a non-renewable natural resource of immense importance to food production and when we run out we run out."

That means we have some time to think about it, but future spot shortages will cause price spikes, caused by the inevitable lag time in bring what had been previously uneconomic sources on line and producing.

What's truly ironic is that for every headline about shortages there are equal headlines about excessive phosphorus in water supplies, in lakes and in rivers. If there's too much there and a looming shortage on the land then it's up to us to practice better conservation. If phosphorus is no longer being recycled its requisite 46 times before it hits the water then we, as a society, aren't really getting our money's worth out of that rock phosphate, and farmers aren't entirely to blame for that.

"The standard approaches to conservation apply to phosphorus as well: reduce, recycle and reuse," according to David Vaccari in SCIENTIFIC AMERICAN. "Our modern society separates food production and consumption, which limits our ability to return nutrients to the land. Instead we use them once and then flush them away."

We're going to have to find ways to keep phosphorus where we really need it and, instead of flushing it, recycle it. We need better wastewater treatment at the municipal level. We have some time but it's important that we find effective ways to put it back where we got it.

"That's just where we're headed." Fixen says. "So for a number of reasons it would be smart for us to be good stewards of phosphorus." ⊕