

NEWS & VIEWS

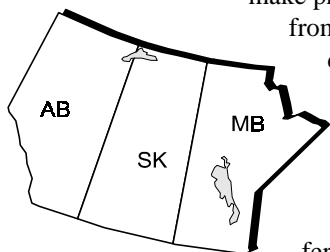
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Western Canada

Rock Phosphate... Should We Use It in the Prairies?

ROCK PHOSPHATE (RP) is the raw material used to make phosphate fertilizer. It is mined from commercial phosphate deposits in Florida, North Carolina, the western United States, Africa and several other places around the world. There is considerable interest in using RP as a fertilizer in western Canada. It's cheaper than manufactured phosphate fertilizers and has been successfully used in many other areas of the world.



But what about here—is RP a good phosphorus (P) fertilizer in our prairie soils? The answer is NO! And here's why.

Factors Affecting Rock Phosphate Availability

Rock phosphate is not available to plants under our soil conditions. In fact, prairie soils of western Canada already contain hundreds of pounds per acre of calcium phosphates that are similar chemicals to RP and also mostly unavailable to plants. That's why 70 to 85 percent of the soils in Alberta, Saskatchewan and Manitoba need P fertilizer.

Phosphate minerals in our soils are unavailable because they're insoluble. The phosphate (PO_4) ions are strongly bound to the calcium (Ca) ions, and need to be released to the soil solution before a plant can take them up. Similarly, RPs

are not available unless their solubilities can be increased either naturally by an acidic soil environment or artificially by treating with acid.

The P_2O_5 equivalent content of processed RP ranges from about 25 to 40 percent. None of this P is water-soluble. However, a small amount will dissolve in weak acids and become plant available. Treating the RP with strong acids (acidulation) makes the P much more available. This is the process used to make water-soluble P fertilizers like monoammonium phosphate (MAP) or triple superphosphate (TSP).

When added directly to soil, soil acidity helps dissolve the RP...gradually releasing Ca and PO_4 ions to the soil solution. The rate of this reaction is dependent on soil pH...the lower the pH the greater the dissolution of the mineral and the greater the availability of the P. Likewise, soil Ca affects the reaction. High amounts of Ca suppress the dissolution of RP, making the P less available.

Because most of our prairie soils have a neutral or higher pH, and because they're also rich in Ca, RP is a poor choice for P fertilizer here. However, its effectiveness can be improved by fine grinding. Finely ground particles have more surface area and that means a greater rate of dissolution. But, finely ground material is difficult to handle and spread and cannot be blended with other fertilizers. So, manufacturers granulate the RP to improve the ease of handling, but in so doing the granulation decreases the effectiveness of the product.

How Does Rock Phosphate Stack Up to Phosphate Fertilizer?

Granulated RP products were introduced to prairie farmers a few years ago and they've since generated a lot of interest. But good agronomic information on how well RP works under our soil conditions has been lacking.

About 15 years ago, Agriculture Canada researchers conducted greenhouse studies comparing 17 sources of RP to MAP and TSP on Alberta soils. The effectiveness of the various sources of RP differed considerably compared to the



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phosphate fertilizers. **Table 1** compares the most and least available RP with two common phosphate fertilizers.

Table 1. Phosphorus fertilizer source influences wheat dry matter yield and P uptake in a southern Alberta soil.

P source	P ₂ O ₅ Rate, mg/pot	Yield, g/pot	P uptake, mg
Control	0	0.89	1.50
MAP (11-48-0)	25	2.51	4.19
TSP (0-45-0)	25	2.78	4.21
RP (Christmas Island)	250	2.39	3.59
RP (Idaho)	250	1.08	2.22

Soil pH = 5.3 and soil test P = 0.5 ppm. Agriculture Canada Data

The RP from Christmas Island was almost as available as the phosphate fertilizers, but that from Idaho was less than half as available. This type of response is typical, as the mineral composition of the various RPs differ; some are more chemically reactive and more available than others. However, regardless of its reactivity, RP is still not as available as phosphate fertilizer and so needs to be applied at much higher rates.

The greenhouse work mentioned above has been confirmed in recent field studies in Alberta. Cereals fertilized with TSP and granulated RP are shown in **Figure 1**. A good yield response occurred up to the 27 lb/A rate for the TSP. However, RP did not increase yields, even when applied at a rate of 130 lb/A P₂O₅.

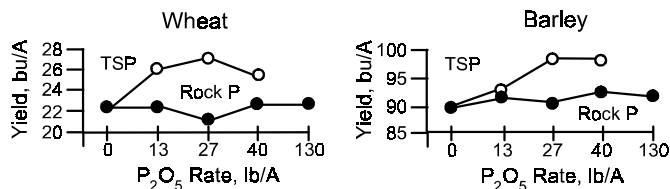


Figure 1. Influence of TSP (0-45-0) and rock phosphate on wheat (one site) and barley (average of two sites) yield in Alberta. Westco Data (1994)

Westco researchers obtained similar results comparing MAP with two RPs of differing particle size (**Figure 2**). Applied at the 40 lb/A rate, MAP increased barley yield by 21 bushels compared to 12 bushels for the 54 lb/A rate of the more finely divided RP. In other words, 35 percent more RP was needed to produce half the barley the MAP produced. The RP that contained a higher percentage of coarse particles did not produce any yield increase.

Researchers at Alberta Agriculture have also been evaluating RP in field trials with barley and canola. They compared low rates of MAP with low and high rates of RP (**Figure 3**). Fertilization with the higher rate of RP increased barley yields by 6 bushels per acre and tripled canola yields. But these yield increases were only a quarter of the increase that occurred using 75 percent less MAP.

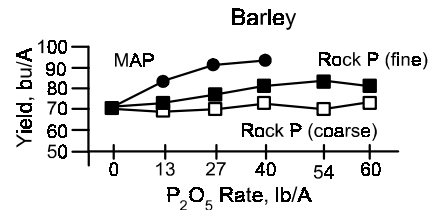


Figure 2. Influence of MAP (11-52-0) and rock phosphate on barley yield (one site) in Alberta. Westco Data (1995)

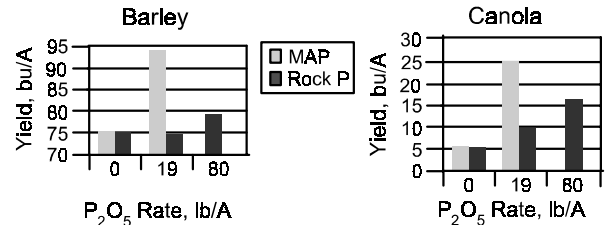


Figure 3. Influence of MAP and rock phosphate on yield of barley and canola at two locations in Alberta. Alberta Agriculture Data (1994)

Similar results were found in yet another study (**Figure 4**). Rock phosphate increased barley grain and silage yields, but increases were only a fraction of the increases that occurred with lower rates of MAP.

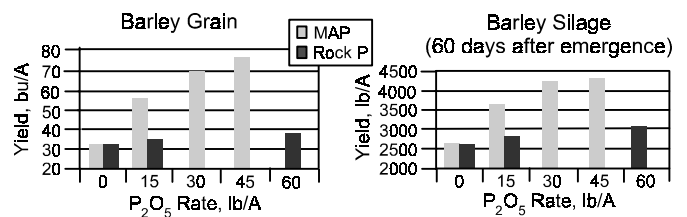


Figure 4. Influence of MAP and rock phosphate on barley grain yield and silage production in Alberta. Alberta Agriculture Data (1996)

Summary

Rock phosphate may improve crop yields for some soils, but the evidence clearly shows it's not as effective as commercial phosphate fertilizers on Prairie soils. The price makes RP attractive. But if it needs to be applied at 5 to 10 times the rate of manufactured phosphate...is it economical? And, even at much higher application rates, it is doubtful that RP can match the yields produced by much lower rates of phosphate fertilizers like MAP or TSP.

If you want to optimize crop production, and profits...the best source of P for our calcareous, high pH prairie soils is manufactured phosphate fertilizers. ■