

Phytase Facts

What forms of phosphorus are present in feedstuffs? What is phytate-bound phosphorus?

The phosphorus (P) that is contained within feedstuffs is present in both free and phytate-bound forms. Phytate is a naturally occurring complex molecule formed by plants that is capable of binding a number of different minerals, the most nutritionally important of which is P. The free (non-phytate-bound) P that is present within feedstuffs is digested and absorbed by swine at nearly 100% efficiency. However, the phytate-bound P is unavailable to the pig. Approximately 60% to 75% of the total P present in feedstuffs commonly used in swine diets (e.g. corn, soybeans, wheat, milo and barley) is bound by phytate molecules. Because of this, pigs are able to utilize only about 14% of the total P in corn, about 25% of the total P present in dehulled soybean meal, and about 35% of the total P present in 44% soybean meal (with hulls).

What is phytase? How is phytase activity measured?

Phytase is a natural enzyme that breaks down phytate molecules. This liberates the minerals (including P) that are bound by phytate, thereby making them available to the pig. Since pigs and other mammals do not naturally possess their own phytase enzyme, supplemental phytase from microbial sources is used to free some of the phytate-bound P that is present in swine diets.

Phytase activity is measured by phytase units (FTUs or FYTs). FTUs and FYTs are equivalent units of phytase activity. One FTU or FYT is the amount of phytase that is able to liberate one micromole of P from sodium phytate at 37° C and at a pH of 5.5.

How is phytase used in swine diets? What are the economics?

Swine research has demonstrated that the addition of 500 FTUs or FYTs/kilogram (227 FTUs or FYTs/lb) of diet liberates an amount of P equivalent to .10% of the diet (see Table 1). This is equivalent to the contribution of approximately 10 lb/ton of 21% Dicalcium Phosphate, or about 11 lb/ton of 18.5% Dicalcium Phosphate. Therefore, the economics of phytase use are determined primarily by the costs of phytase and the dical that it can replace in the diet formula.

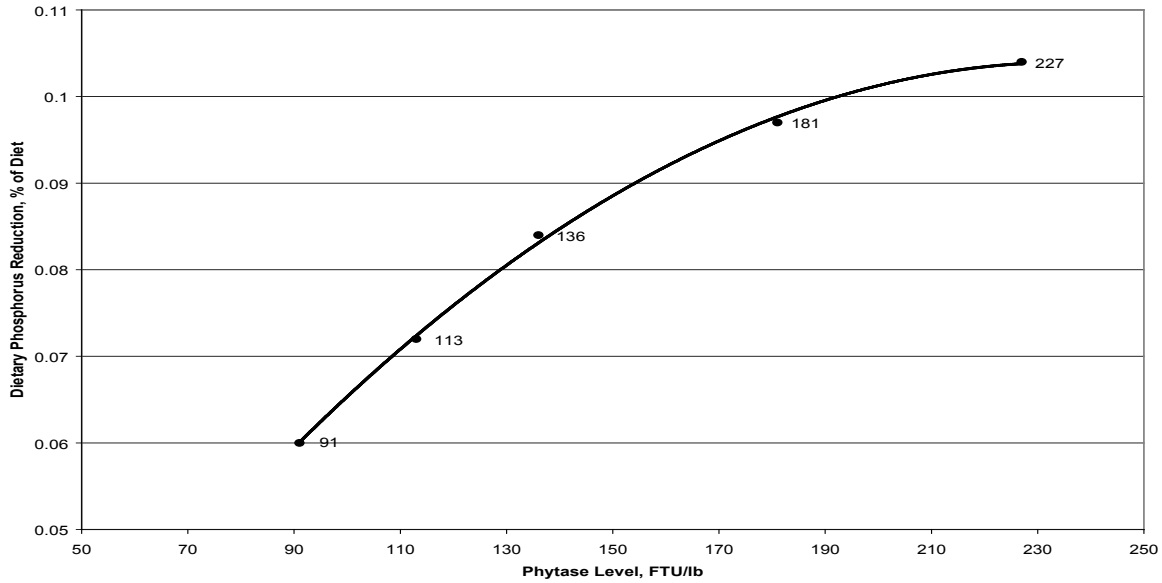
Lower amounts of supplemental phytase will release lesser amounts of P equivalents from the diet. The P liberating activity of phytase acts in a curvilinear function (as illustrated in Figure 1). For example using a half level of phytase 250 FTUs or FYTs/kilogram or 113 FTUs or FYTs/lb) will release an amount of P equivalent to approximately .07% of the diet.

Table 1. Effect of Phytase on Phosphorus Liberation

	Phytase Level in Diet				
FTUs or FYTs/lb	227	181	136	113	91
FTUs or FYTs/kg	500	400	300	250	200
Reduction in Total Phosphorus due to phytase addition, % of diet	0.10	0.09	0.08	0.07	0.06
Dietary adjustments if using Dical, 21% P					
Dical, 21% reduction, lb/ton	9.6	8.7	7.7	6.8	5.8
Limestone reduction, lb/ton	1.9	1.7	1.6	1.4	1.2
Dietary adjustments if using Dical, 18.5% P					
Dical, 18.5% reduction, lb/ton	10.9	9.8	8.8	7.7	6.6
Limestone reduction, lb/ton	0	0	0	0	0



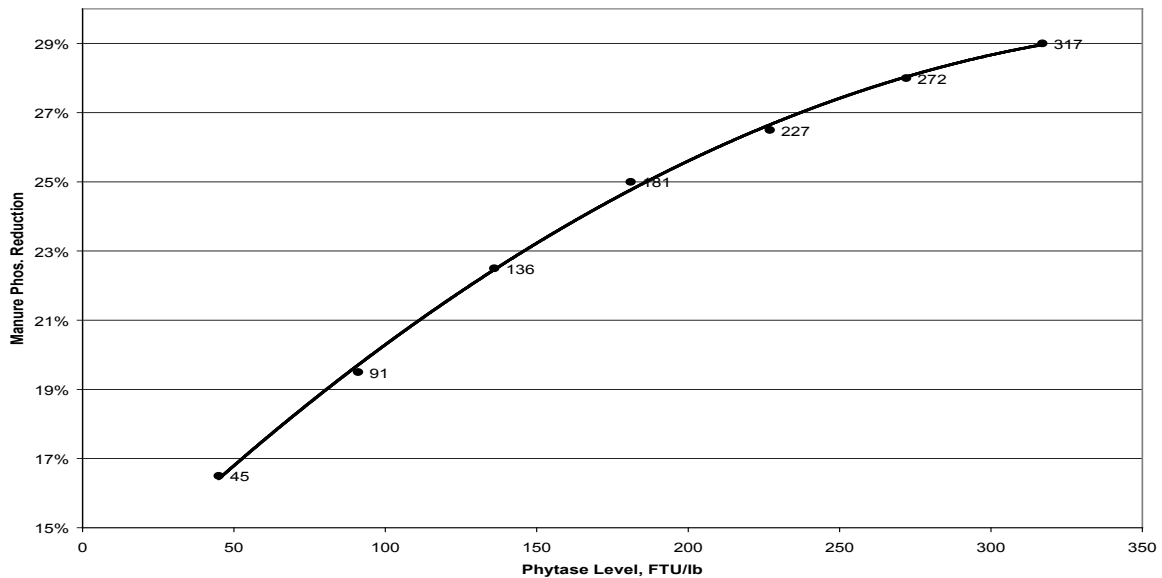
Figure 1. Phosphorus Activity of Phytase



What is the impact of phytase on manure P levels?

Research has shown that P content of swine manure can be reduced by approximately 30% by adding 227 FTUs or FYTs/lb of diet, while simultaneously reducing the total P of the formulation by .10% (due to the lower Dicalcium Phosphate inclusion levels). Use of phytase at lower levels results in decreased manure P reductions (see Figure 2). The reduction in manure P levels due to phytase use is especially important in areas where swine wastes have been applied to the same farm fields year after year, and in areas where manure application is regulated by the rate of P application.

Figure 2. Effect of Phytase on Reduction of Phosphorus in Manure



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