Fertoz

Composted Manures and Rock Phosphate

Crops will receive a high dose of accessible P from rock phosphate and the help of composted manure. Composted manure microbes break down insoluble forms of phosphate into plant available forms.

Studies Show the Added Benefits of Composted Manures when Blended with Rock Phosphate. With high priced commercial fertilizers and uncertainty in the supply chain, it is the best way to utilize cost effective solutions that encourage soil health and plant growth.

Add Fertoz rock phosphate, a mineral fertilizer, to manure during the composting process to create a cost effective, value added soil amendment that wont go to waste. Composted manure is easier to transport. It extends the range from the feedlot to be more commercially viable. Fertoz' powdered rock phosphate can be added to the windrow and be incorporated into the composting pile when turning. Fertoz rock phosphate contains high analysis P (>20%), which increases the phosphate content of the compost. Compost, with naturally present microbes and other organic materials undergo biological reactions which ensures the short and long-term soluble phosphate release and availability. The blended product is more efficient at supplying nutrients to the plant. Research shows higher yields compared to conventional fertility plans. Composted manure offers high analysis of macronutrients, plus a diversity of micronutrients, free microbes, and organic matter which are all essential for soil health and crop productivity.

Fertoz sedimentary rock phosphate and composted manure are approved for use in organic production systems, are encouraged in regenerative agriculture, assist in the transition phases to organic crop production, and are recognized as natural sustainable fertility options that are environmentally safe and build the soil for future generations.

*Researchers and agronomists have seen tremendous agronomic potential for blending rock phosphate and manure. Numerous research studies have been done on various soil types and crops. Some **additional benefits** of the blend;*

- Improves crop production and yields.
- Most studies demonstrate increased performance from rock phosphate and manure blends compared to conventional fertilizers. The blend reduces the need to use conventional fertilizers, lowering the cost of production and reducing greenhouse gas emissions from fertilizer production.
- Stimulates P mineralization while supplying, maintaining and enhancing solubility of phosphorus in plant available form for optimal uptake throughout the growing season.
- Provide direct and residual nutrients to the soil (NPKS, Ca, Mg, micros) to improve soil fertility status.
- Adds organic matter to the soil, which increases soil phosphate availability through decomposing organic matter releasing humates.
- Manure prevents P tie-up when applied to the soil due to formation of organic anions that compete with P for adsorption sites.
- Alleviate P, Ca, Mg deficiencies, as well as Aluminum toxicity in acidic soils.
- Soil pH balancing effect, improve soil physical and chemical properties.
- Promotes nutrient recycling, and a closed loop system where there is constant supply of essential nutrients.
- Provides an environmentally friendly alternative in saline environments.
- Economical, with good return on investment.

Specific crops are responding positively to blended Rock Phosphate and Manure

Canola – Enhanced growth, nutrient status, total oil, protein and yield gains
Chickpea – Increased nodulation, biomass, growth, seed output, and yield (grain and stover)
Corn – Showed significant increases in height, tissue leaf content of P, soil available P, high grain yields, better uptake of N, P, K, Fe, Mn, Zn
Lettuce – Significant growth performance, higher soil nutrient composition
Wheat – Increased grain and stover yield, total dry matter, straw yield and 1000 grains weight, increase in N and P uptake

Nutrient levels in composted manure are extremely variable based on animal source (beef, dairy, swine, poultry) and diet and feedlot management practices. Variability is also common within the same "lot stockpile". Good mixing is very important. Some typical NPK levels are present in the following ranges.

Nitrogen: 10-50 lbs/ton   Phosphate: 4-40 lbs/ton   Potassium : 8-40 lbs/ton

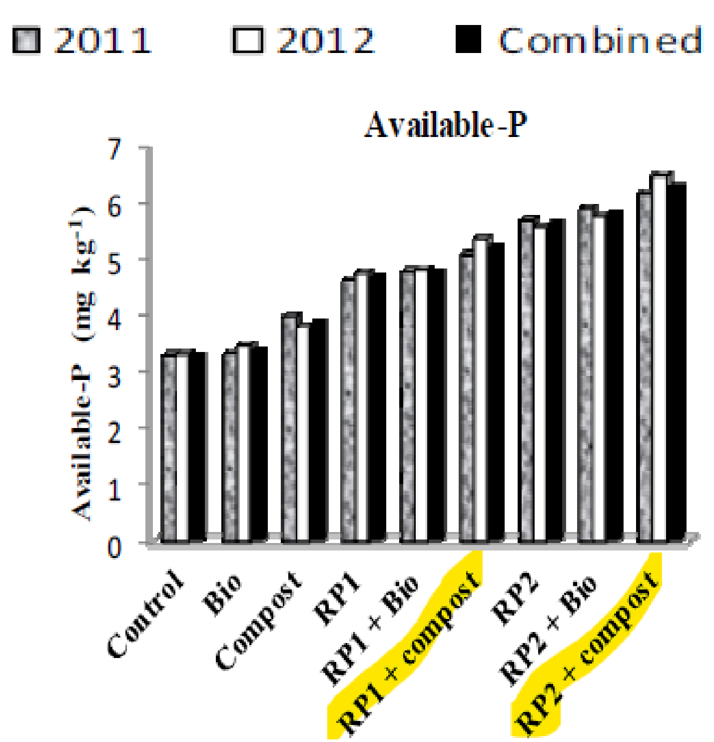
Application rates are determined based on compost nutrient levels and soil test requirements. Based on average soil P requirements, expect to apply 2-6 tons per acre of composted manure. Approximately 200-300 lbs of rock phosphate can be added for every 3 tons of composted manure.

Net return from use of Rock phosphate and manure. Yield values from Wahid et al., 2015.

Treatment	Yield (kg/ha)	Increased Yield (kg/ha)	Increased Yield Value ($/ha)	Cost of Fertilizers ($/ha)	Net Return ($/ha)
Control (N,K)	2756	-	-	-	-
FYM + RP	5244	2488	1141.99	127.40	$1014.59/ha

*Wheat price 12.50/bu (.459/kg)

Figure from Helmy et al., 2013. Two source of rock phosphate were blended with compost and biologicals.



Study Details (pH, crop, parameters)	Results (Yield, P uptake, P concentration in tissue, soil available P)			
	Control	Manure	Manure + RP	Manure + RP + microbes
Abassi et al., 2015, pH 6.89, Chili, poultry manure, P release over 60 days	5.25 mg/kg	14.97 mg/kg	14.21 mg/kg	16.47 mg/kg
Abassi et al., 2015, pH 6.89, Chili, poultry manure, yield over 60 days	3.5 g/plant	9.9 g/plant	6.4 g/plant	10.4 g/plant
Akande et al., 2005, pH 6.1, Maize and Cowpea, average residual soil P after 2,3,4 cropping	2.6 mg/kg		7.87 mg/kg*	
Akande et al., 2005, pH 6.1, Maize, average yield from 2000 and 2001 (1T/ha poultry manure, 100 kg P2O5/ha)	2.75 t/ha		3.15 t/ha	
Akande et al., 2005, pH 6.1, Cowpea, average yield from 2000 and 2001 (1T/ha poultry manure, 100 kg P2O5/ha)	1.8 t/ha		4.55 t/ha	
Ali et al., 2014, pH 7.6, Berseem, yield from cuts 1 and 2	2167, 1800 kg/ha		3167*, 2967* kg/ha	
Ali et al., 2014, pH 7.6, Berseem, plant P uptake from cuts 1 and 2	2.17, 2.58 kg/ha		8.23*, 7.95* kg/ha	
Alloush, 2003, pH, soil incubation and switchgrass, available P, North Carolina rock phos	4, 6.2, 3, 5.3 mg/kg	38.8, 33, 58, 49.2 mg/kg	67.7, 66.6, 116.8 109.3 mg/kg	
Alloush, 2003, pH 4.2, soil incubation and switchgrass, available P, Syrian rock phos	4, 6.2, 3, 5.3 mg/kg	38.8, 33, 58, 49.2 mg/kg	66.9, 61.6, 110.8, 108.9 mg/kg	
Alloush, 2003, pH 4.2, switchgrass P concentration, N. Carolina and Syrian rock phos	0.5 mg/g dry	1.8 mg/g dry	2.9, 2.8 mg/g dry	
Al-oud, 2011, pH 7.87, incubation, 30 kg/ha P from rock phos, 6% manure, available P average from 0-30 cm column	4.16 mg/kg	8.94 mg/kg	14.14 mg/kg	
Awaad et al., 2009, pH 7.5, canola, yield	463.21	581.86	910	1052.79
Awaad et al., 2009, pH 7.5, canola, P uptake	0.12 kg/fed	0.36 kg/fed	0.38 kg/fed	0.723 kg/fed
Ditta et al., 2017, pH 7.6, chickpea, 50 :50 Rock phos : compost yield		6.23 g/pot	11.37g/pot*	
Ditta et al., 2017, pH 7.6, chickpea, 50 :50 Rock phos : compost P in straw		1.4 g/kg	2.8 g/kg*	
Helmy et al., 2013, pH 7.5, corn, 2011 and 2012 from 2 rock phos sources, yield	4.93, 5.10 Mg/ha	6.33, 6.67 Mg/ha	6.48, 6.67, 6.62, 6.74 Mg/ha	
Khalil, 2013, pH 7.5, broad bean, yield	4730.29 kg/ha (RP only)		6484.57 kg/ha	7528.38 kg/ha
Khalil, 2013, pH 7.5, broad bean, total P in seed and straw	17.45 kg/ha (RP only)		42.29 kg/ha	56.17 kg/ha
Sanni et al. 2016, pH 6.5, lettuce, poultry manure, post crop P in soil 1	26.49 mg/kg	29.10 mg/kg*	47.7 mg/kg*	
Sanni et al. 2016, pH 6.5, lettuce, pig manure, post crop P in soil 1	26.49 mg/kg	39.42 mg/kg*	52.53 mg/kg*	
Sanni et al. 2016, pH 6.5, lettuce, cattle manure, post crop P in soil 1	26.49 mg/kg	49.25 mg/kg*	30.12 mg/kg*	
Sanni et al. 2016, pH 5.5, lettuce, poultry manure, post crop P in soil 2	9.7 mg/kg	11.83 mg/kg*	48.91 mg/kg*	
Sanni et al. 2016, pH 5.5, lettuce, pig manure, post crop P in soil 2	9.7 mg/kg	19.7 mg/kg*	23.97 mg/kg*	
Sanni et al. 2016, pH 5.5, lettuce, cattle manure, post crop P in soil 2	9.7 mg/kg	17.11 mg/kg	17.23 mg/kg	
Sekhar and Aery, 2001, pH 7.6, chickpea, FYM at 1,2,3 t/ha, seed output	160 g	162, 190, 250 g	255, 265, 273 g	
Sekhar and Aery, 2001, pH 8.3, wheat, FYM at 4 t/ha, seed output	49 kg	50 kg	57 kg	
Waheed et al., 2015, pH 7.8, wheat, grain yield	3.7 t/ha		4.9 t/ha*	5.2 t/ha*
Waheed et al., 2015, pH 7.8, wheat, available P in soil after harvest	1.52 mg/kg		5.68 mg/kg*	5.88 mg/kg*
Waheed et al., 2015, pH 7.8, wheat, P concentration in leaf tissue	0.191%		0.235%	0.228%
Wahid et al., 2015, pH 7.74, wheat, farmyard manure, grain yield	2756 kg/ha		5244 kg/ha*	
Wahid et al., 2015, pH 7.74, wheat, poultry manure, grain yield	2756 kg/ha		4409 kg/ha*	
Wahid et al., 2015, pH 7.74, wheat, farmyard and poultry manure, grain yield	2756 kg/ha		4853 kg/ha*	
Wahid et al., 2015, pH 7.74, wheat, farmyard manure, soil available P	3.2 mg/ha		13.5 mg/ha*	
Wahid et al., 2015, pH 7.74, wheat, poultry manure, soil available P	3.2 mg/ha		3.87 mg/ha*	
Wahid et al., 2015, pH 7.74, wheat, farmyard and poultry manure, soil available P	3.2 mg/ha		20.9 mg/ha*	
Wahid et al., 2015, pH 7.74, wheat, farmyard manure, plant P uptake	5.1		16.1 kg/ha*	
Wahid et al., 2015, pH 7.74, wheat, poultry manure, plant P uptake	5.1		23.2 kg/ha*	
Wahid et al., 2015, pH 7.74, wheat, farmyard and poultry manure, plant P uptake	5.1		16.4 kg/ha*	

*Significantly different from control

REFERENCES

Sekhar, D.M.R., N.C. Aery, 2001. Phosphate Rock with Farmyard Manure as P fertilizer in Neutral and Weakly Alkaline Soils, Current Science, Vol 80, No. 9, 1113-1115.

Waheed, M., M. A. Khan, T. Naseem, D. Muhammad, M Mussarat, 2015. Improving Effectiveness of Rock Phosphate through Mixing with Farmyard Manure, Humic Acid and Effective Microbes to Enhance Yield and Phosphorus Uptake by Wheat. Pure Appl. Biol., 4(4) 480-490.

Awaad, M.S., A. A. Rashad, M.A., Bayoumi, 2009. Effect of Farmyard Manure Combined with some Phosphate Sources on the Productivity of Canola Plants Grown on a Sandy Soil. Research Journal of Agriculture and Biological Sciences, 5(6): 1176-1181.

Khan, K., M. Sharif, I. Azeem, Ibadullah, A.A. Khan, S. Ali, I. Khan, A. Khan, 2017. Phosphorus Solubility from Rock Phosphate Mixed Compost with Sulphur Application and Its Effect on Yield and Phosphorus Uptake of Wheat Crop. Open Journal of Soil Science, 7, 401-429.

Ditta, A, J. Muhammad, M. Imtiaz, S. Mehmood, Z.Qian, S.Tu, 2017. Application of Rock Phosphate Enriched composts increases Nodulation, Growth and Yield of Chickpea. International Journal of Recycling of Organic Waste in Agriculture, 33-40

M. K. Abbasi, N. Musa, and M. Manzoor. 2015. Phosphorus release capacity of soluble P fertilizers and insoluble rock phosphate in response to phosphate solubilizing bacteria and poultry manure and their effect on plant growth promotion and P utilization efficiency of chilli (Capsicum annuum L.). Biogeosciences Discuss., 12, 1839–1873, 2015

Fazli Wahid1, Muhammad Sharif, Muhammad A. Khan., Amjad Ali, Abdul M. Khattak and Ahmad R. Saljoqi. 2015. ADDITION OF ROCK PHOSPHATE TO DIFFERENT ORGANIC FERTILIZERS INFLUENCES PHOSPHORUS UPTAKE AND WHEAT YIELD. The University of Agriculture Peshawar, 30 (n. 3, 2015)

Akande, M.O*, Adediran J.A, and F.I. Oluwatoyinbo. 2005. Effects of rock phosphate amended with poultry manure on soil available p and yield of maize and cowpea. African Journal of Biotechnology Vol. 4 (5), pp. 444-448, May 2005

Amjad Ali1*, Muhammad Sharif2, Fazli Wahid2, Zengqiang Zhang1, Syed Noor Muhammad Shah3,4, Rafiullah2, Sajjad Zaheer5, armanullah Khan2, Fazlur Rehman. 2014. Effect of Composted Rock Phosphate with Organic Materials on Yield and Phosphorus Uptake of Berseem and Maize. American Journal of Plant Sciences, 2014, 5, 975-984

Ghiath A. Alloush. 2003. Dissolution and effectiveness of phosphate rock in acidic soil amended with cattle manure. Plant and Soil 251: 37–46, 2003.

AL-OUD S. S. 2011. IMPROVING PHOSPHORUS AVAILABILITY FROM PHOSPHATE ROCK IN CALCAREOUS SOILS BY AMENDING WITH: ORGANIC ACID, SULFUR, AND/ OR ORGANIC MANURE. Ozean Journal of Applied Sciences 4(3), 2011.

Awaad M.S., Azza A. Rashad and Bayoumi M.A.2009. Effect of Farmyard Manure Combined with Some Phosphate Sources on the Productivity of Canola Plants Grown on a Sandy Soil. Research Journal of Agriculture and Biological Sciences, 5(6): 1176-1181, 2009.

Allah Ditta, Juma Muhammad, Muhammad Imtiaz, Sajid Mehmood, Zheng Qian & Shuxin Tu. Application of rock phosphate enriched composts increases nodulation, growth and yield of chickpea. International Journal of Recycling of Organic Waste in Agriculture.

Helmy, A. M.1 ; KH. A. Shaban2 and Mona G. Abd EL-Kader. 2013. ENHANCING THE EFFICENCY OF ROCK PHOSPHATE IN SALINE SOIL AS AN ENVIRONMENTAL FRIENDLY ALTERNATIVE FOR P- MANUFACTURED FERTILIZERS AND ITS EFFECT ON MAIZE QUALITY AND PRODUCTIVITY. J.Soil Sci. and Agric. Eng., Mansoura Univ., Vol. 4 (10): 1053 - 1071, 2013

Ahmed A. Khalil. 2013. Significance of Some Soil Amendments and Phosphate Dissolving Bacteria to Enhance the Availability of Phosphate in Calcareous Soil. Hindawi Publishing Corporation ISRN Soil Science Volume 2013, Article ID 438949, 7 pages

Sanni, K. O., 2Ewulo, B. S. and 3-4Adesina, J. M. 2016. EFFECTS OF PHOSPHORUS AND ORGANIC FERTILIZERS ON THE GROWTH OF LETTUCE (LECTUCA SATIVA) AND SOIL NUTRIENT CONTENT IN SOUTHWESTERN NIGERIA. Research Journal of Agricultural and Environmental Sciences.

D. M. R. SEKHAR*,† N. C. AERY. 2001. Phosphate rock with farmyard manure as P fertilizer in neutral and weakly alkaline soils. CURRENT SCIENCE, VOL. 80, NO. 9, 10 MAY 2001.

Muhammad Waheed, Muhammad Arshad Khan*,Taimur Naseem, Dost Muhammad and Maria Mussarat. 2015. Improving effectiveness of rock Phosphate through mixing with Farmyard manure, Humic acid and Effective microbes to enhance yield and Phosphorus uptake by wheat. Pure Appl. Biol., 4(4): 480-490, December- 2015.