

Supporting Information

Table S1 Soil phosphorus activation coefficient in 40–45, 45–50, 50–55mm soil layer from fertilization layer.

Phosphate fertilizer	40–45 mm (%)	45–50 mm (%)	50–55 mm (%)
CP	47.86 ± 3.71 a	7.65 ± 0.62 d	2.20 ± 0.25 d
HAP0.1	48.41 ± 8.11 a	7.73 ± 0.58 d	2.31 ± 0.11 d
HAP0.5	40.86 ± 0.41 a	35.70 ± 1.50 c	3.60 ± 0.37 c
HAP1	46.52 ± 2.99 a	38.54 ± 0.81 bc	6.44 ± 0.38 b
HAP5	45.28 ± 4.38 a	43.60 ± 7.48 b	7.39 ± 0.51 a
HAP10	48.41 ± 0.85 a	58.67 ± 5.66 a	6.36 ± 0.16 b

Means with no letter in common were significantly different at $P < 0.05$, as indicated by the LSD test.

Table S2 Soil total PLFA, bacteria, gram-positive bacteria (Gm+), gram-negative bacteria (Gm-), fungi, and actinobacteria biomass, fungi:bacteria (F/B), and Gram-positive:Gram-negative (Gm+/Gm-) in the 0–40 mm soil layers around the P application site under NTC, CP, and HAP0.5 treatments.

Treatment	Total PLFA (nmol g ⁻¹)	Bacteria (nmol g ⁻¹)	Gm+ (nmol g ⁻¹)	Gm- (nmol g ⁻¹)	Fungi (nmol g ⁻¹)	Actinobacteria (nmol g ⁻¹)	F:B	Gm+/Gm-
NTC	11.5 ± 1.1 a	2.9 ± 0.4 a	0.6 ± 0.1 a	0.3 ± 0.0 a	1.4 ± 0.2 a	0.6 ± 0.1 a	0.4 ± 0.1 a	2.1 ± 0.1 a
CP	7.9 ± 0.6 b	2.1 ± 0.1 b	0.4 ± 0.0 b	0.2 ± 0.0 a	0.7 ± 0.1 b	0.5 ± 0.0 a	0.3 ± 0.0 b	1.7 ± 0.5 a
HAP0.5	8.2 ± 1.5 b	2.3 ± 0.4 ab	0.4 ± 0.1 b	0.3 ± 0.0 a	0.8 ± 0.1 b	0.5 ± 0.1 a	0.2 ± 0.0 b	1.6 ± 0.2 a

Means with no letter in common were significantly different at $P < 0.05$, as indicated by the LSD test.

Table S3 Correlation of soil total PLFA, bacteria, gram-positive bacteria (Gm+), gram-negative bacteria (Gm-), fungi, and actinobacteria biomass, fungi:bacteria (F/B), and Gram-positive:Gram-negative (Gm+/Gm-) in the 0–40 mm soil layers around the P application site with average TP and AP.

Parameter	Total PLFA	Bacteria	Gm+	Gm-	Fungi	Actinobacteria	F:B	Gm+/Gm-
TP	–0.863 **	–0.758 *	–0.796 *	–0.300	–0.900 ***	–0.572	–0.875 **	–0.640
AP	–0.880 **	–0.784 *	–0.820 **	–0.319	–0.907 ***	–0.606	–0.864 **	–0.651

Values represented correlation coefficients, * $P < 0.05$; ** $P < 0.01$, *** $P < 0.001$.