## Supplementary Figures

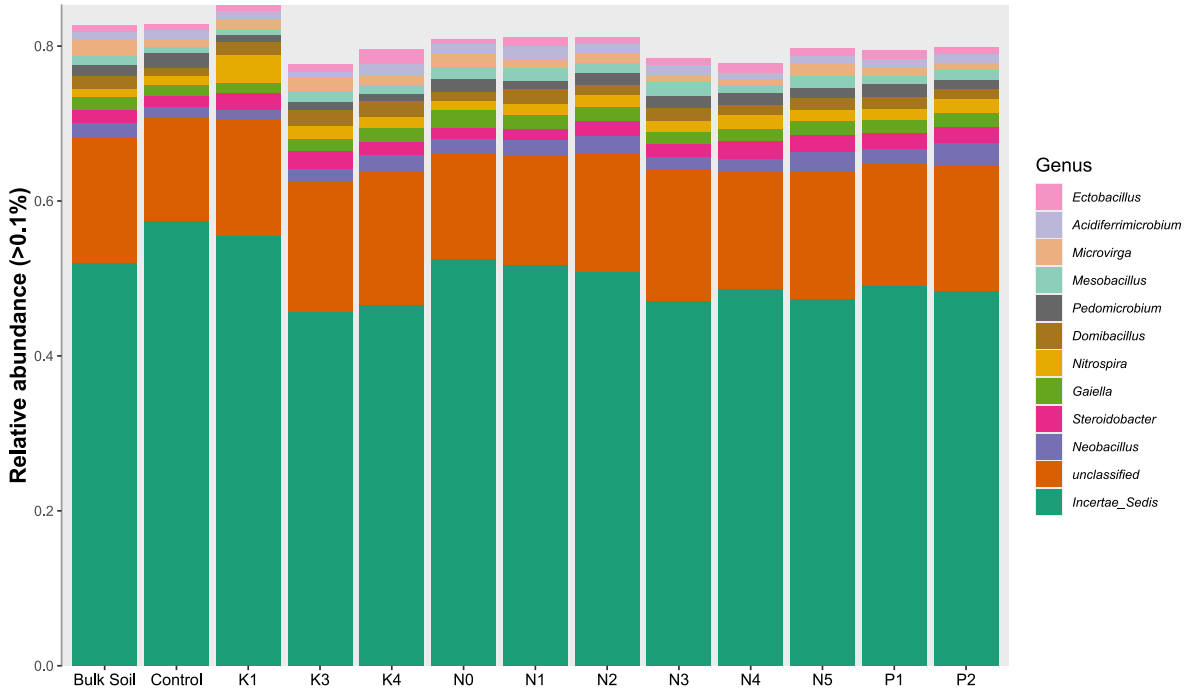


**Figure 1S.** Bacterial relative relative abundance at the genus level of all genera with relative abundance > 0.1% considering all unclassified and incertae sedis ASVs. Sample abbreviations: K1, medium potassium application; K3, high potassium application; K4, very high potassium application; N0, no nitrogen application; N1, low nitrogen application; N2, medium nitrogen application; N3, high nitrogen application; N4, very high nitrogen application; N5, low nitrogen application; P1, medium phosphorus application; P2, high phosphorus application.

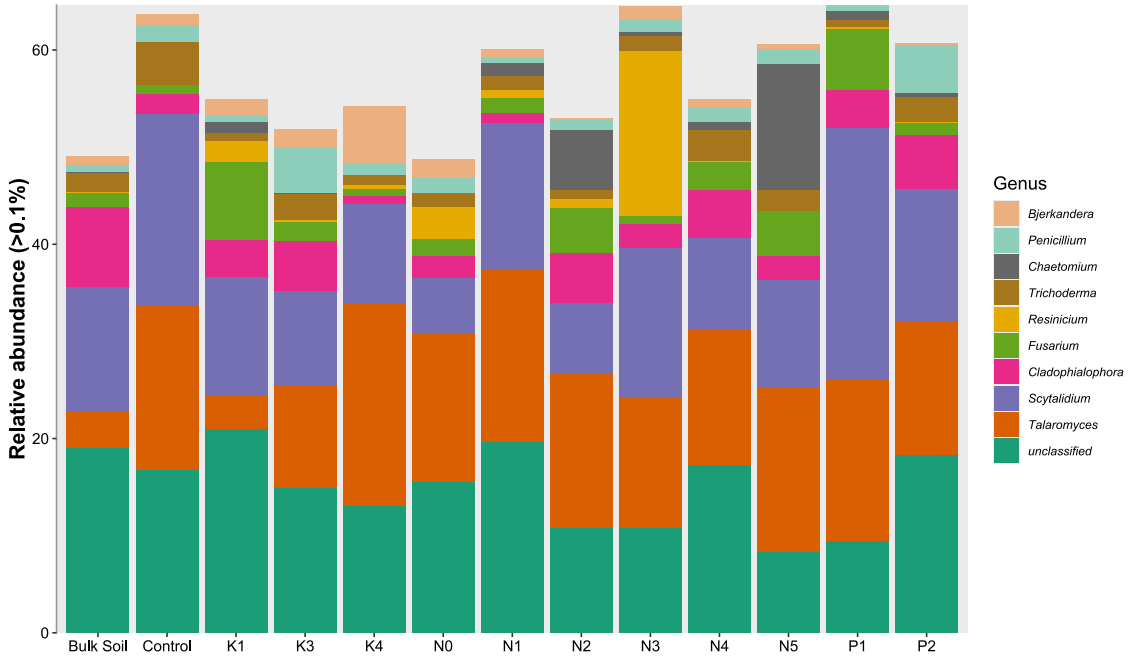


**Figure 2S.** Fungal relative relative abundance at the genus level of all genera with relative abundance > 0.1% considering all unclassified and incertae sedis ASVs. Sample abbreviations: K1, medium potassium application; K3, high potassium application; K4, very high potassium application; N0, no nitrogen application; N1, low nitrogen application; N2, medium nitrogen application; N3, high nitrogen application; N4, very high nitrogen application; N5, low nitrogen application; P1, medium phosphorus application; P2, high phosphorus application.

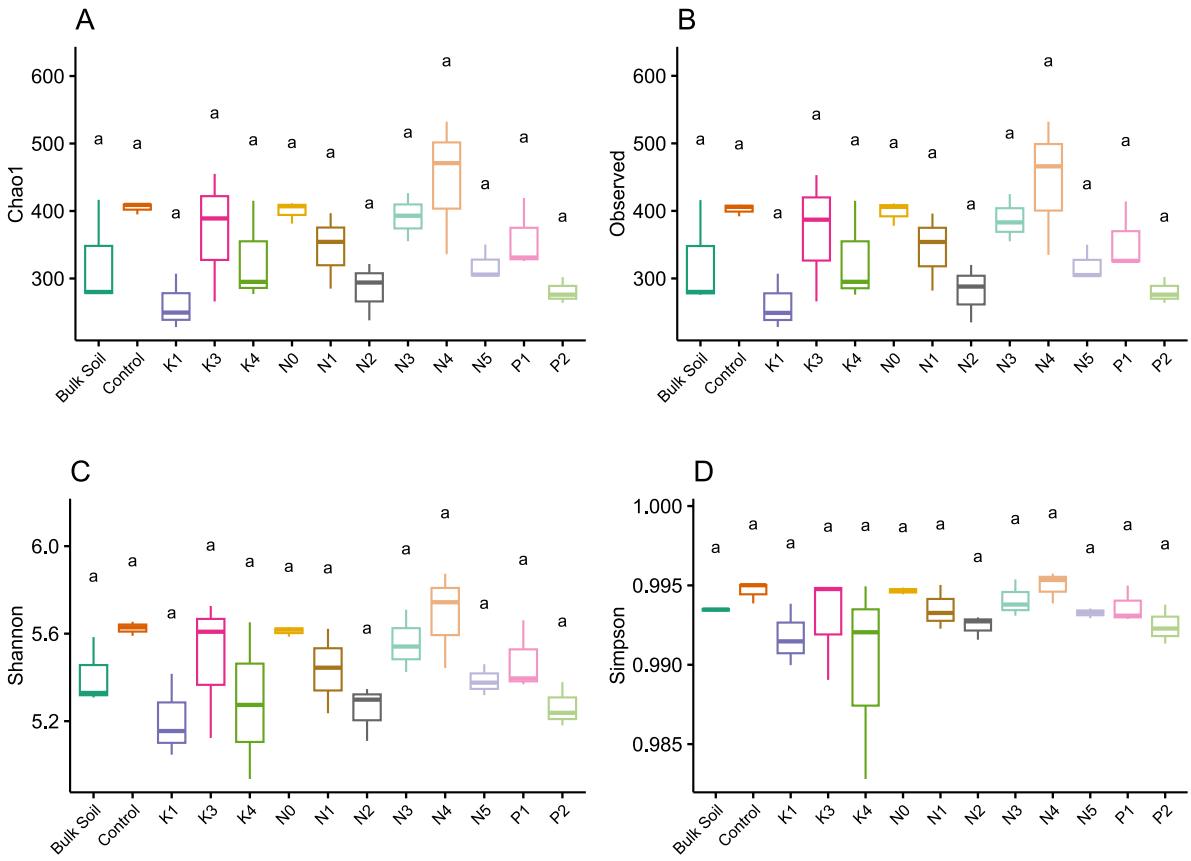


**Figure 3S.** Bacterial alpha diversity for rhizosphere and soil samples based on four indices (Chao1, A; Observed, B; Shannon, C; and Simpson, D). Kruskal–Wallis test, non-significant. Sample abbreviations: K1, medium potassium application; K3, high potassium application; K4, very high potassium application; N0, no nitrogen application; N1, low nitrogen application; N2, medium nitrogen application; N3, high nitrogen application; N4, very high N application; N5, low nitrogen application; P1, medium phosphorus application; P2, high phosphorus application.

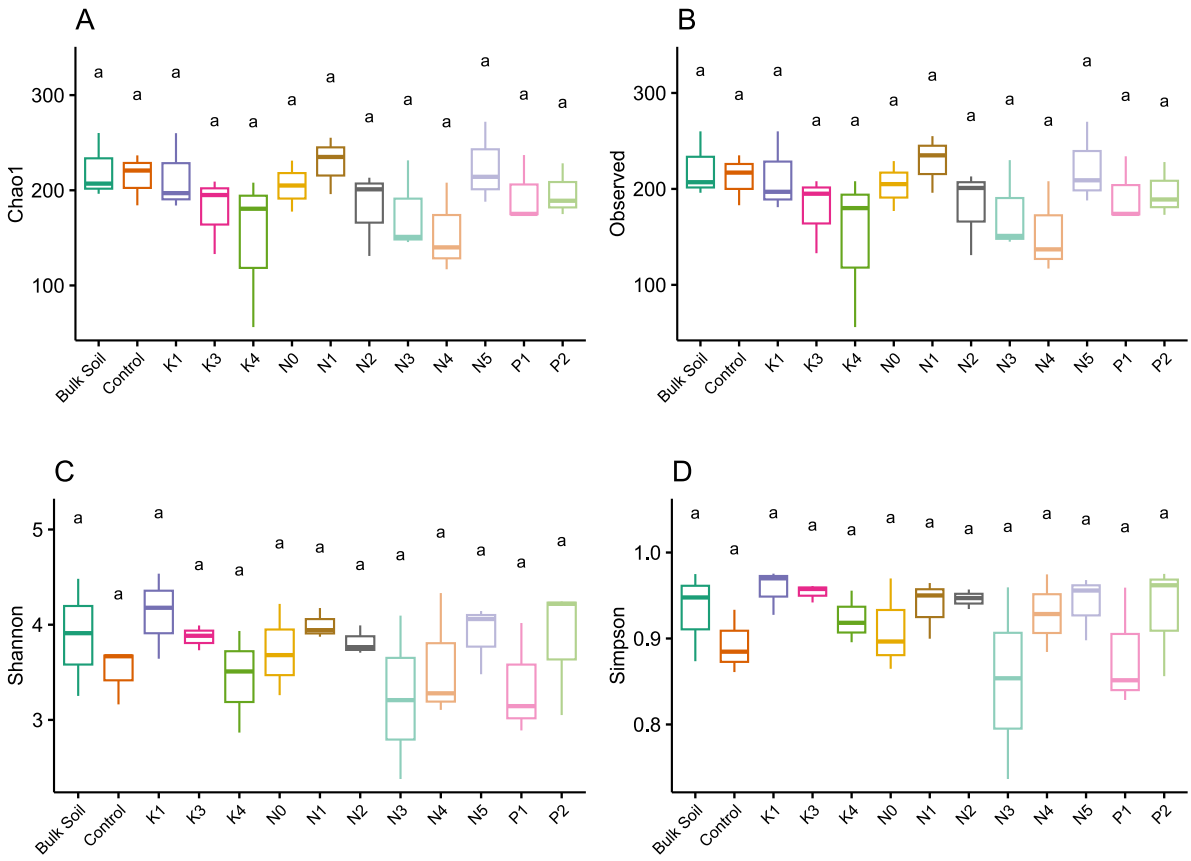


**Figure 4S.** Fungal alpha diversity for rhizosphere and soil samples based on four indices (Chao1, A; Observed, B; Shannon, C; and Simpson, D). Kruskal–Wallis test, non-significant. Sample abbreviations: K1, medium potassium application; K3, high potassium application; K4, very high potassium application; N0, no nitrogen application; N1, low nitrogen application; N2, medium nitrogen application; N3, high nitrogen application; N4, very high N application; N5, low nitrogen application; P1, medium phosphorus application; P2, high phosphorus application.


**Figure 5S**. Taxa roles on co-occurrence network of combined bacterial and fungal datasets. Upper panel, Among-module connectivity; lower panel, Within-module connectivity. Bigger figures represent higher relative abundance; shape represents taxa roles: Zi $\geq$ 2.5, module hubs; Pi $\geq$ 0.62, connectors; Zi and Pi $\geq$ 2.5, network hubs. Otherwise, they were classified as Peripheral nodes.

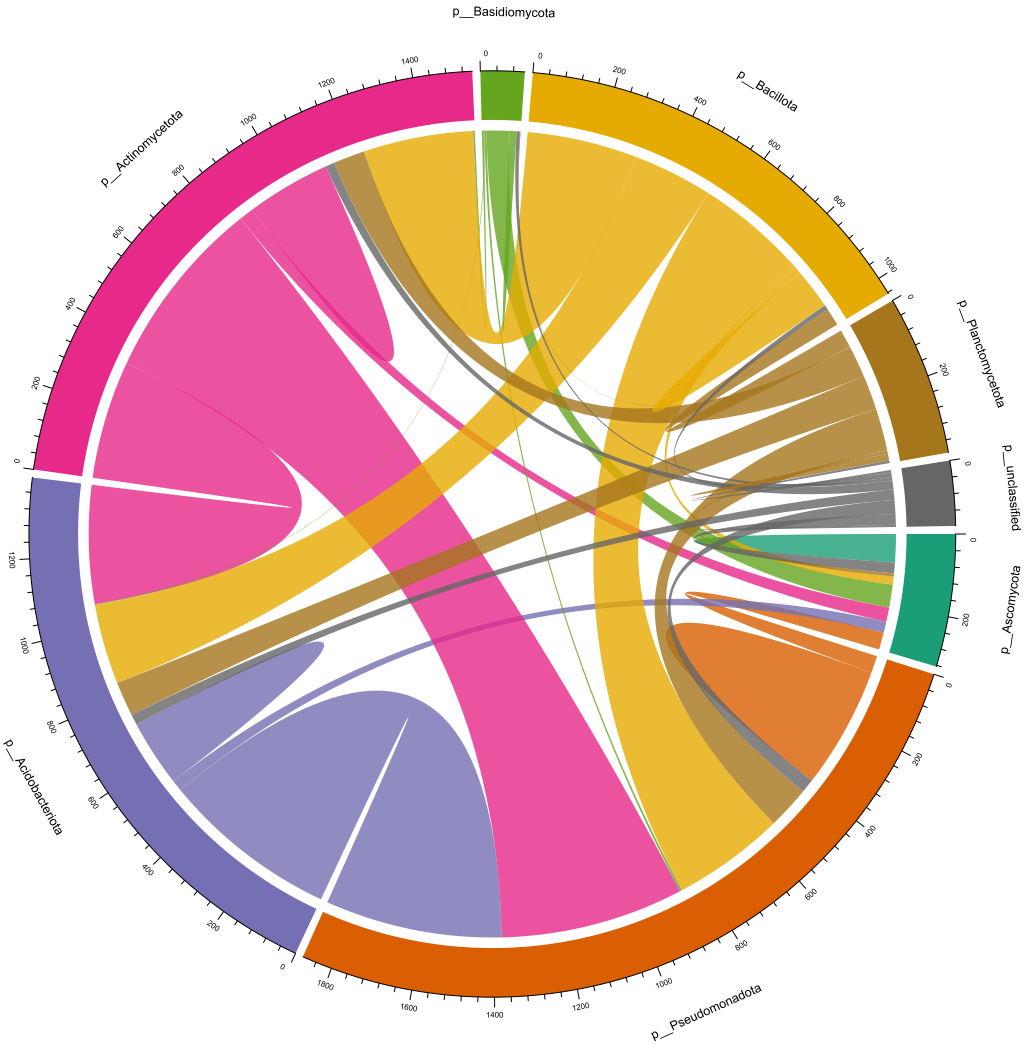


**Figure 6S.** Circular plot of connections between taxa at phylum level.

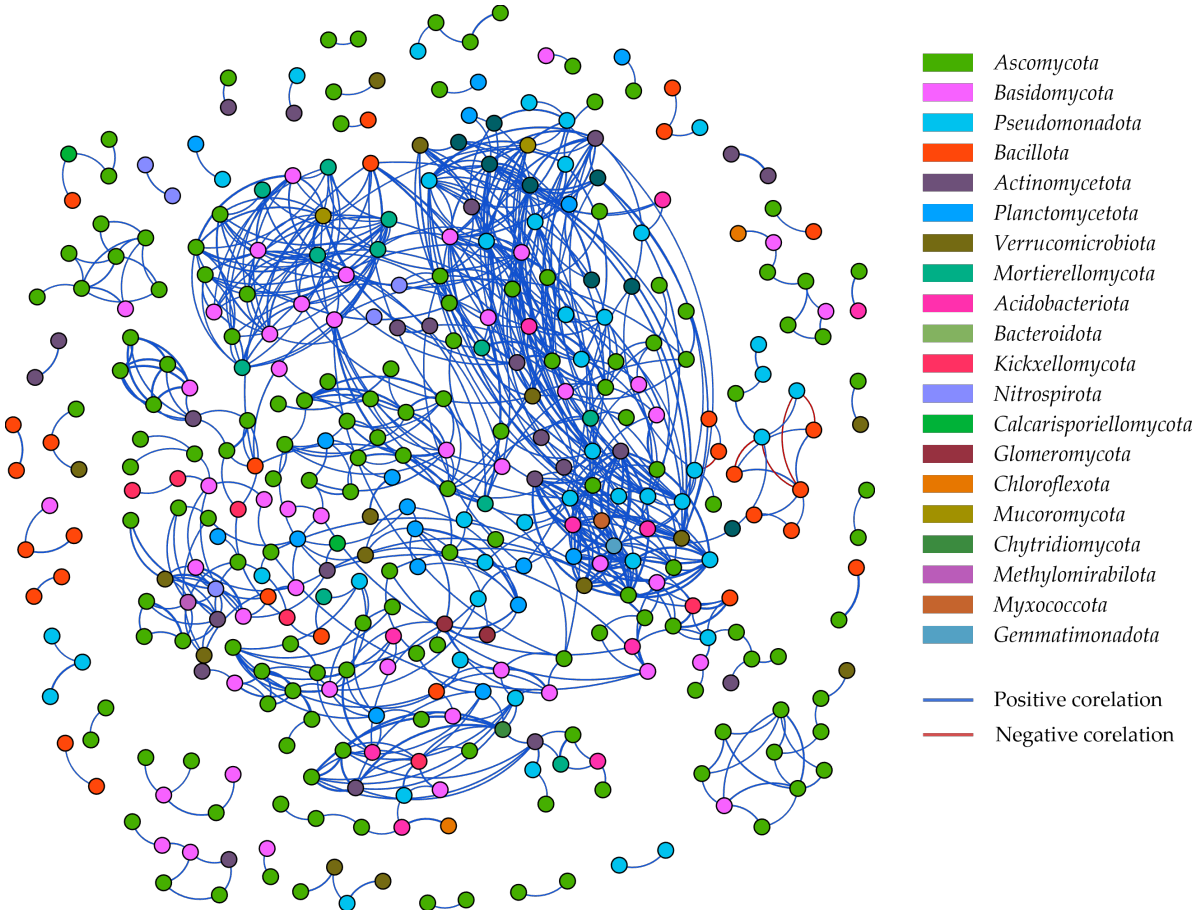


**Figure 7S. Microbial interaction network.** Bacterial and Fungal ASVs are graphed as nodes with node colors indicating the phylum, while the relationship between nodes is displayed as edges (positive relations, blue line; negative correlations, red). Significant positive Spearman correlations are graphed as edges ($\varrho > 0.6$, false discovery rate adjusted $P < 0.01$, two-sided).

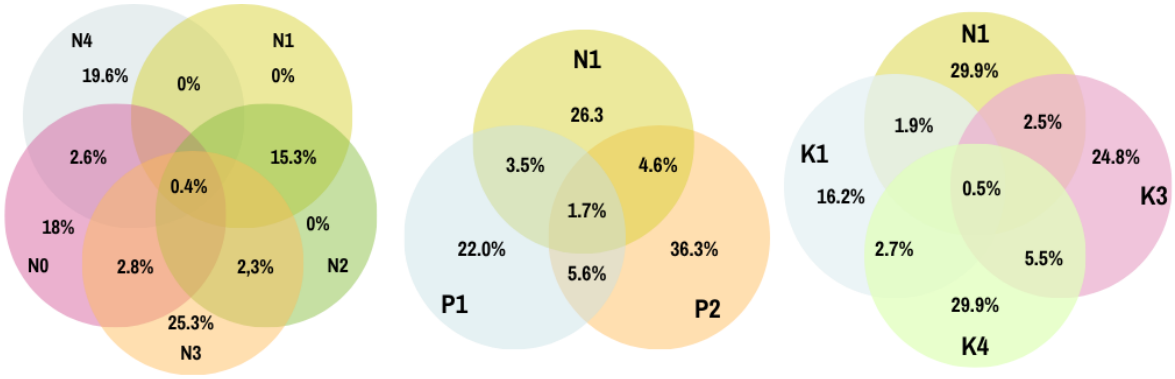


**Figure 8S.** Venn diagram of shared nodes from different fertilization regimes. Sample abbreviations: K1, medium potassium application; K3, high potassium application; K4, very high potassium application; N0, no nitrogen application; N1, low nitrogen application; N2, medium nitrogen application; N3, high nitrogen application; N4, very high N application; N5, low nitrogen application; P1, medium phosphorus application; P2, high phosphorus application.

Supplementary table 1. Yield of culture sites of long-term fertilization trial at the Sugar Cane Research Institute in Santiago de Cuba.

| **Site code** | **Fertilization regime** | **Yield of site (Ton/ha)** |
|---|---|---|
| Control | Bulk soil (no rhizosphere) | N/A |
| Blank | Rhizosphere (no fertilization) | 76.2 |
| N0 | $N_0P_{25}K_{50}$ | 95.9 |
| N1 | $N_{50}P_{25}K_{50}$ | 96.5 |
| N2 | $N_{100}P_{25}K_{50}$ | 95.3 |
| N3 | $N_{150}P_{25}K_{50}$ | 82.5 |
| N4 | $N_{200}P_{25}K_{50}$ | 83.5 |
| N5 | $N_{50}P_0K_0$ | 87.7 |
| P1 | $N_{50}P_{75}K_{50}$ | 97.4 |
| P2 | $N_{50}P_{10}K_{50}$ | 96.3 |
| K1 | $N_{50}P_{25}K_{100}$ | 98.2 |
| K3 | $N_{50}P_{25}K_{200}$ | 98.8 |
| K4 | $N_{50}P_{25}K_{300}$ | 99.6 |