Supplementary information

S1 - Ashes description

SSA was produced as part of the ReNu2Farm project using the AshDec® process. The process aims to remove heavy metals from the sewage sludge ash and the conversion of non-plant available phosphate to plant-available calcium (Ca)-sodium (Na)/potassium (K) phosphates (Figure 1). The ash is thermally treated at high temperatures (~900°C) in a rotary kiln. Total P = 53-55 g/kg, K = 95-134 g/kg, S = 26-31 g/kg, Ca = 153-166 g/kg, Mg = 29-35 g/kg, Fe = 3.5-4.6 g/kg, Al = 4.9-7.5 g/kg (for more details, see [72]).

PLA was produced from 600 poultry manures through incineration at up to 1000ºC. The obtained ashes are used for export to EU countries and the UK. PLA has a high dry matter content, pH-water of 12-13 and a low electrical conductivity, is P-rich with considerable amounts of K, S, Ca and Mg, but negligible N content. Heavy metals are present below prescribed legal limits (EU FertilisingProduct Regulation 2019/1009). Total P = 65-84 g/kg, K = 10-13 g/kg, S = 30-50 g/kg, Ca = 76-103 g/kg, Mg = 15 g/kg, Fe = 43-60 g/kg, Al = 4.5-53 g/kg (for more details, see [72]).

Supplementary Tables

Table S1 Mean AMF colonization of the L. perenne *roots after cultivation in microcosms for 54 days in soil amended with P fertilizers SP, PLA and SSA a year prior to the experiment, arbuscular (AC), vesicular (VC) and hyphal (HC) colonization were recorded via microscopic investigation at 600x magnification after root staining with trypan blue [30], 100 observations per sample, ± represents standard error, n=6. Letter "a" within a column indicates that there is no statistically significant difference between the treatments (ANOVA with Tukey post-hoc test, P≤0.05).*

Treatment	AC (%)		VC (%)		HC (%)	
SP0	62.50[a]	±6.4	67.67[a]	±4.5	98.67[a]	±1.1
SP60	43.83[a]	±6.4	61.83[a]	±5.5	90.33[a]	±5.3
PLA60	62.83[a]	±3.2	76.00[a]	±3.9	99.83[a]	±0.2
SSA60	67.00[a]	±11.1	53.67[a]	±9.7	98.00[a]	±0.6

Table S2 Alpha diversity measures of 16S rRNA amplicon sequencing results of the microcosm trial, significance determined via Kruskal-Wallis test and Wilcoxon post-hoc analysis and Benjamini-Hochberg correction, different letters within a column indicate statistically significant difference, n=6.

Treatment	Observed Features		Chao1		ACE		Shannon		Simpson	
SP0	676.0[a]	± 76.5	676.0[a]	± 76.5	676.1[a]	± 76.5	6.15[a]	± 0.094	0.9965[a]	± 0.0002
SP60	527.5[a]	± 73.1	527.5[a]	± 73.1	527.5[a]	± 73.1	5.87[a]	± 0.170	0.9954[a]	± 0.0007
PLA60	611.2[a]	± 38.8	611.2[a]	± 38.8	611.2[a]	± 38.8	6.06[a]	± 0.060	0.9962[a]	± 0.0001
SSA60	590.0[a]	± 21.4	590.0[a]	± 21.4	590.0[a]	± 21.4	6.04[a]	± 0.033	0.9962[a]	± 0.0001

Table S3. Alpha diversity measures of phoD functional gene sequencing results of the microcosm trial, significance determined via Kruskal-Wallis test and Wilcoxon post-hoc analysis and Benjamini-Hochberg correction, different letters within a column indicate statistically significant difference, n=6.

Treatment	Observed Features		Chao1		ACE		Shannon		Simpson	
SP0	3071.2[a]	± 82.80	3648.3[a]	± 54.14	3704.8[a]	± 44.18	5.864[a]	± 0.0386	0.9888[a]	± 0.0005
SP60	3011.8[a]	± 99.07	3710.7[a]	± 62.39	3751.4[a]	± 53.65	5.893[a]	± 0.0257	0.9892[a]	± 0.0002
PLA60	2769.2[a]	± 151.51	3499.3[a]	± 135.04	3573.2[a]	± 120.18	5.805[a]	± 0.0223	0.9869[b]	± 0.0003
SSA60	3235.5[a]	± 61.91	3755.4[a]	± 57.27	3814.4[a]	± 56.24	5.891[a]	± 0.0229	0.9883[a]	± 0.0003

Supplementary Figures

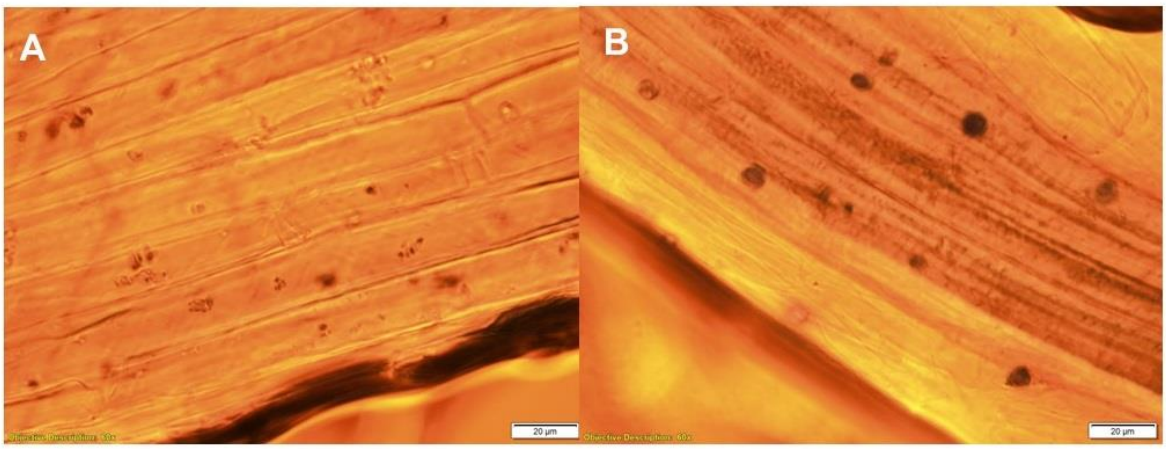

Figure S1. Example of arbuscules (A) and vesicles (B) in L. perenne *roots after cultivation in soils fertilized with ashes, visualised at 600X magnification (BX60, Olympus, Tokyo, Japan)*

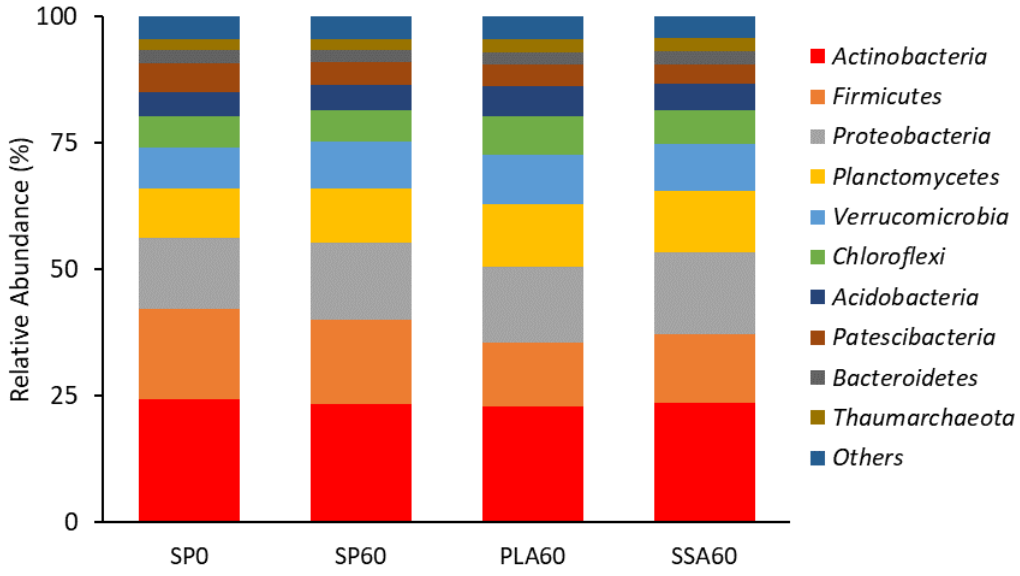

Figure S2. Mean relative abundance of the top 10 abundant phyla obtained from 16S rRNA amplicon sequencing of the microcosm trial, all other genera collapsed in "others", n=6.

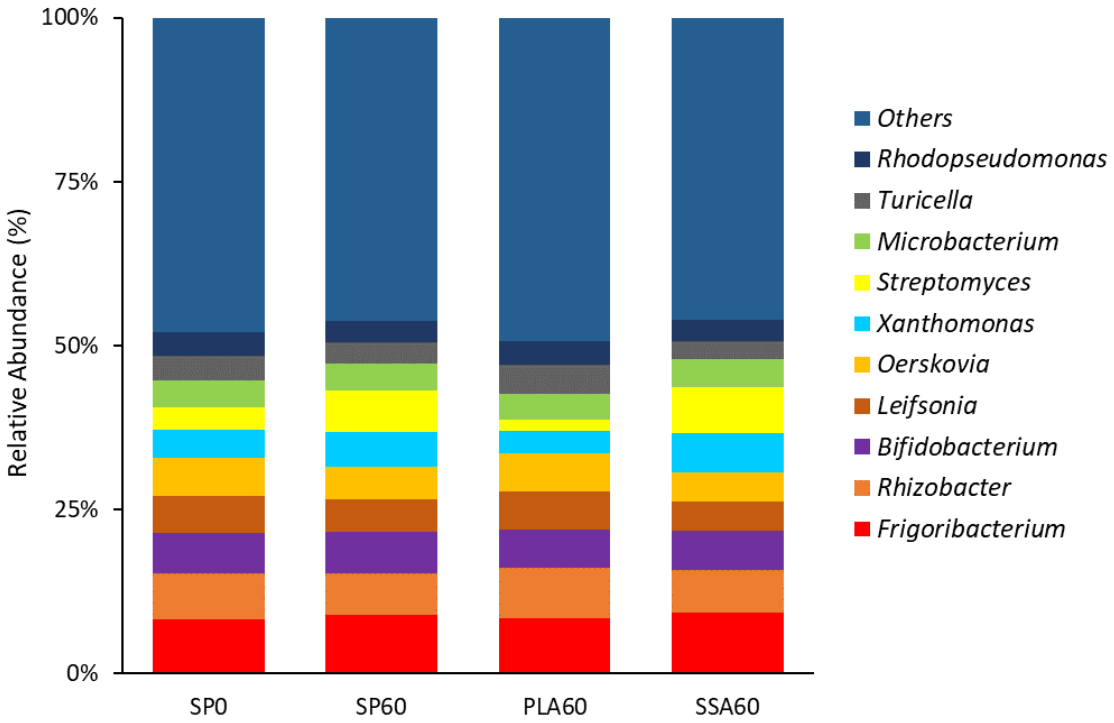

Figure S3. Mean relative abundance of the top 10 abundant genera obtained from phoD amplicon sequencing of the microcosm trial, all other genera collapsed in "others", n=6.