Supplementary materials

Continuous Intercropping Increases the Depletion of Soil Available and Non-Labile Phosphorus

Jianyang He [1,†], Jun He [1,†], Haiye Li [1], Yumei Yu [1], Ling Qian [2], Li Tang [1], Yi Zheng [1,3] and Jingxiu Xiao [1,*]

[1] College of Resources and Environment, Yunnan Agricultural University, Kunming 650201, China; hejianyang115hjy@126.com (J.H.); hejunynau@gmail.com (J.H.); lhy19961228@sina.com (H.L.); yumeiyu615@163.com (Y.Y.); ltang@ynau.edu.cn (L.T.); yzheng@ynau.edu.cn (Y.Z.)
[2] Institute of Resources and Environment, Kunming Academy of Agricultural Sciences,
Kunming 650118, China; qianling427@126.com
[3] Yunnan Open University, Kunming 650599, China
* Correspondence: 2005023@ynau.edu.cn
† These authors contributed equally to this work.

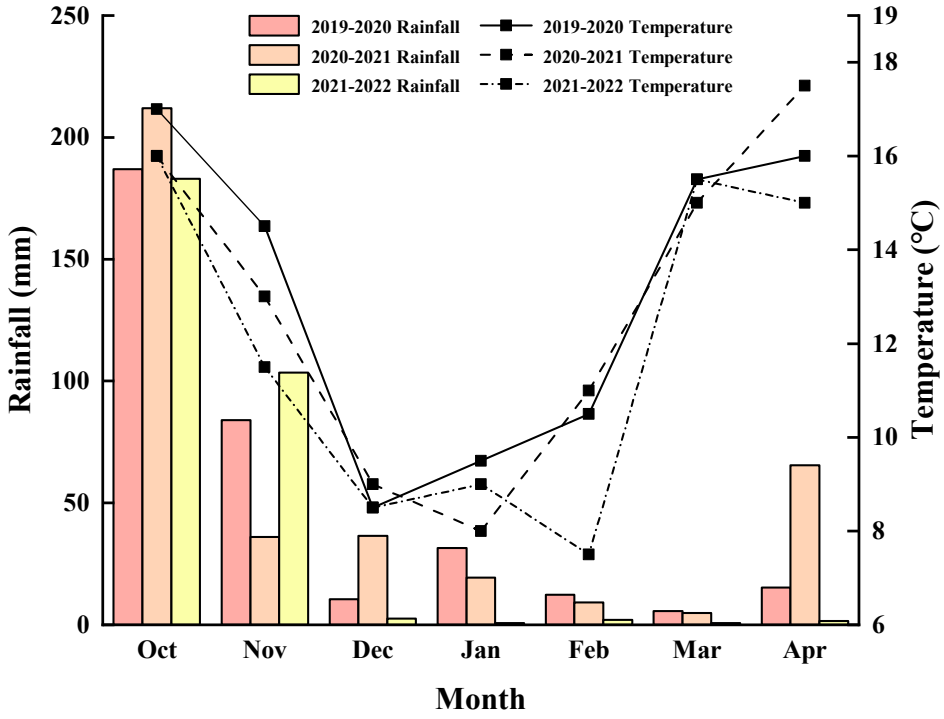

Figure S1 The monthly average temperature and rainfall during the field experiments in 2019 and 2022.

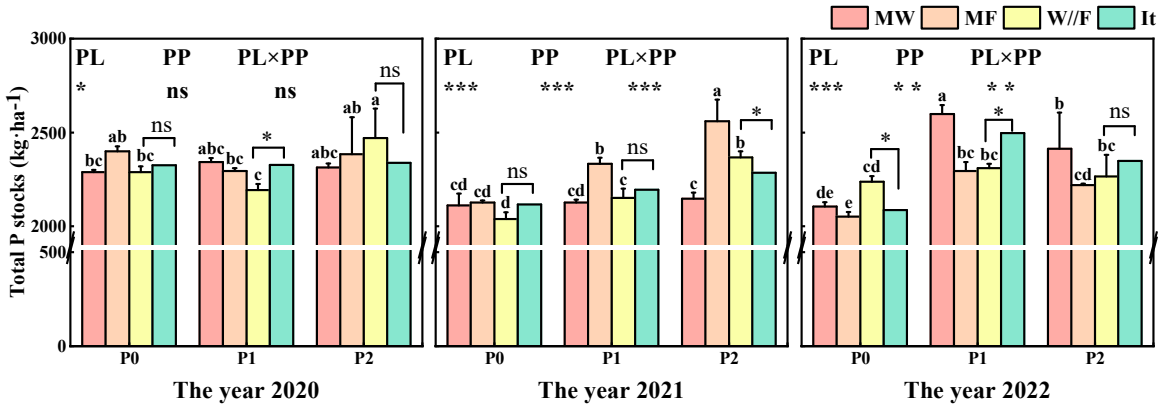

Figure S2 Soil total P stock under different planting patterns and P levels.

Note: PL and PP represented P levels and planting patterns, respectively; ***, **, and * indicated differences among treatments at 0.001, 0.01 and 0.05 levels, respectively; ns indicated no differences among treatments. MW, MF, W//F, and It represented monocropped faba bean, monocropped wheat, wheat and faba bean intercropping, and weighted average values of monocropped wheat and faba bean. ns on the bar chart indicated that there was no difference between W//F and It, and * meant there was difference between W//F and It; In the same year, different lowercase letters indicated significant difference in total P stock of wheat and faba bean under different P application levels ($P<0.05$).

Table S1: Contents of Various Phosphorus Fractions

P fractions	MW (mg kg^{-1})			MF (mg kg^{-1})			W//F (mg kg^{-1})		
	P0	P1	P2	P0	P1	P2	P0	P1	P2
2020 year									
Resin-P	13.5±0.7	22.3±2.3	21.1±0.4	12.7±0.3	23.3±3.0	21.3±0.4	12.9±0.6	17.3±1.5	20.7±0.3
NaHCO3-Pi	22.6±0.6	29.7±0.8	37.7±0.7	22.3±0.9	42.9±2.5	45.2±0.5	28.8±0.5	34.6±3.0	49.4±1.4
NaHCO3-Po	31.2±1.8	32.4±1.9	26.7±0.9	25.3±0.8	27.4±0.7	31.8±3.8	29.9±2.6	31.2±0.9	27.4±2.1
NaOH-Pi	92.8±1.7	110.4±0.8	122.6±9.0	97.7±0.9	124.0±3.1	117.2±3.3	96.5±1.6	108.3±5.2	118.1±2.0
NaOH-Po	30.2±0.1	30.7±0.1	31.2±0.1	31.8±0.1	32.3±0.1	32.8±0.1	33.3±0.1	33.9±0.1	34.4±0.1
Conc. HCl-Pi	153.4±10.1	166.4±4.0	146.3±10.3	155.3±3.6	175.3±2.9	189.7±28.6	156.0±7.6	166.4±1.5	175.0±2.2
Dil. HCl-P	553.8±9.2	582.3±6.1	558.5±5.1	560.7±8.4	565.1±3.6	544.6±1.0	550.0±23.4	604.9±10.0	559.7±8.9
Residual-P	109.2±5.1	115.3±4.8	107.8±18.1	101.7±11.4	123.1±3.4	91.0±6.9	127.3±5.3	168.2±13.2	140.9±17.1
2021year									
Resin-P	15.6±0.9	21.6±0.5	25.4±0.2	12.6±0.3	21.5±1.9	24.8±0.1	14.4±0.8	20.6±0.2	21.0±1.0
NaHCO3-Pi	19.1±0.8	25.4±1.9	32.0±1.3	14.4±0.6	19.9±0.8	44.5±1.0	21.7±2.5	33.5±0.7	32.2±1.1
NaHCO3-Po	20.8±1.3	27.1±0.4	25.1±0.9	19.4±2.4	21.2±2.4	20.5±2.1	19.4±1.3	21.9±0.6	24.5±3.7
NaOH-Pi	74.5±0.1	92.3±3.5	91.9±0.4	63.8±4.2	94.5±1.9	104.0±1.0	71.5±0.8	87.0±2.3	94.7±3.9
NaOH-Po	33.2±1.1	43.4±0.7	44.4±3.5	27.2±2.5	42.0±2.0	46.3±2.2	31.8±1.5	34.5±2.6	45.7±2.9
Conc. HCl-Pi	138.5±2.0	147.1±6.1	150.0±12.4	136.8±0.8	150.2±2.2	152.9±7.3	136.8±0.1	163.4±6.3	145.0±3.6
Dil. HCl-P	483.4±8.3	485.4±4.0	452.5±16.6	513.4±12.7	493.1±19.4	497.8±4.9	503.8±17.7	501.1±10.8	509.4±7.5
Residual-P	168.0±7.3	145.8±6.1	168.0±3.9	171.5±11.3	159.8±3.4	148.2±4.1	166.9±7.1	156.3±7.0	157.6±5.3
2022 year									
Resin-P	18.2±0.6	21.5±1.0	28.7±1.3	13.0±0.7	20.8±2.0	35.7±0.6	16.9±0.4	18.7±1.6	24.1±2.2
NaHCO3-Pi	29.9±0.9	39.0±0.9	47.3±1.4	25.5±0.8	50.3±3.6	69.0±0.5	28.4±1.4	35.6±1.3	52.8±8.8
NaHCO3-Po	21.8±0.5	29.5±1.3	24.9±1.0	23.5±0.9	21.0±0.4	24.9±0.7	25.5±2.1	33.5±1.9	21.5±0.4
NaOH-Pi	94.5±0.5	113.9±2.5	105.5±3.4	91.9±0.7	117.1±4.7	133.0±1.6	95.4±0.7	117.7±4.8	124.5±0.3
NaOH-Po	30.9±2.3	40.4±1.8	40.9±0.9	40.6±4.1	34.9±1.7	36.5±2.0	35.0±1.6	36.8±3.2	42.8±2.1
Conc. HCl-Pi	147.4±0.4	156.1±2.8	146.6±11.4	128.7±1.3	151.9±8.6	176.7±10.2	138.6±1.4	145.1±4.3	150.3±6.7
Dil. HCl-P	446.0±2.4	439.6±6.5	440.4±1.2	463.1±9.0	455.2±4.3	460.8±3.8	530.5±11.4	452.0±6.5	460.4±12.9
Residual-P	155.1±2.7	144.6±3.7	136.0±4.3	162.2±2.1	140.9±6.5	125.0±0.9	147.1±5.8	143.4±2.0	122.6±1.8

Note: MW, MF, and W//F meant monocropped wheat, monocropped faba bean, and wheat and faba bean intercropping, respectively. P0, P1, and P2 meant P application rate was 0, 45, and 90 kg P_2O_5 ha^{-1}, respectively.

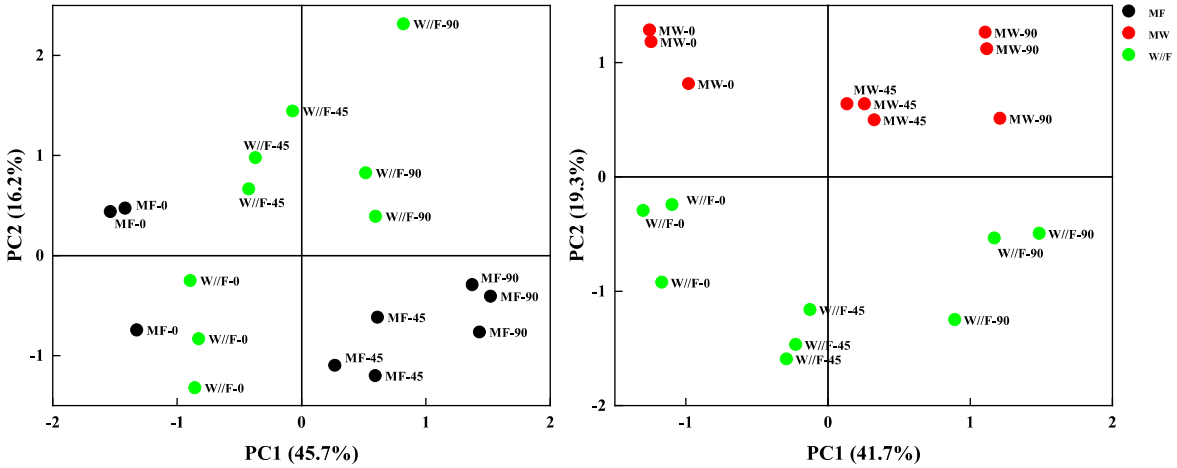

Figure S3 Principal component analysis of soil P fractions and crop P uptake under different planting patterns and P levels.

Note: MW, MF, and W//F meant monocropped wheat, monocropped faba bean, and wheat and faba bean intercropping, respectively. 0, 45, and 90 meant P application rate was 0, 45, and 90 kg P_2O_5 ha^{-1}, respectively.

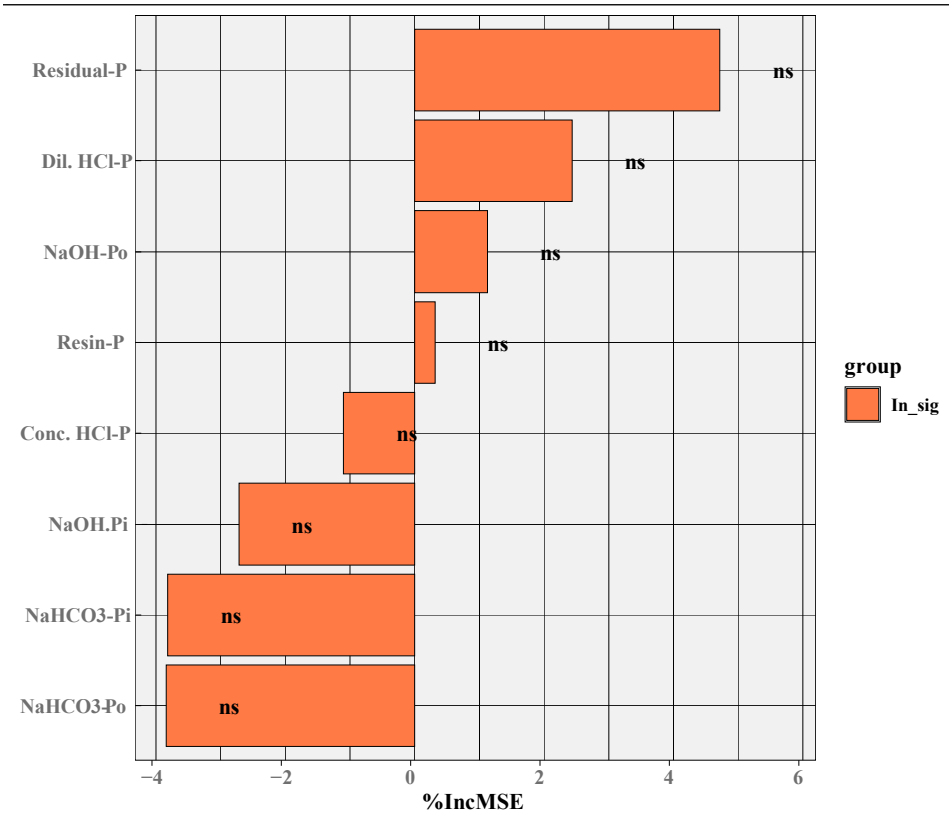

Figure S4 Depicts the random forest modeling of crop P uptake and soil P fractions under monocropped faba bean system.

Note: "ns" indicates no significant difference between crop P uptake and soil P fractions.