**Supplementary Tables and Figures**

**Supplementary Tables**

**Table S1.** Results of the ANOVA test for the effects of AMF (with and without inoculation), plant species (maize and faba bean), planting patterns (intercropping and monoculture, the difference indicates overyielding effect), water treatments (well-watered, alternative well-watered and droughted, and droughted), and their synergistic effects on average total biomass of maize and faba bean at low P and high P levels. Significant effects are noted with bold font and factors that interacted with planting patterns are noted with italic.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Factors |  | Low P | | High P | |
| Df | F | *P* | F | *P* |
| AMF | 1 | 1235 | **< 0.0001** | 37.8 | **< 0.0001** |
| Plant species | 1 | 692 | **< 0.0001** | 14911 | **< 0.0001** |
| Planting patterns | 1 | 26.5 | **< 0.0001** | 69.7 | **< 0.0001** |
| Water | 2 | 680 | **< 0.0001** | 1538 | **< 0.0001** |
| AMF \* Plant species | 1 | 1212 | **< 0.0001** | 0.19 | 0.67 |
| *AMF \* Planting patterns* | 1 | 7.12 | ***0.009*** | 0.089 | 0.77 |
| AMF \* Water | 2 | 13.5 | **< 0.0001** | 1.98 | 0.14 |
| *Plant species \* Planting patterns* | 1 | 3.27 | 0.073 | 224 | ***< 0.0001*** |
| Plant species \* Water | 2 | 32.7 | **< 0.0001** | 83.9 | **< 0.0001** |
| Planting patterns \* Water | 2 | 0.60 | 0.55 | 1.52 | 0.22 |
| *AMF \* Plant species \* Planting patterns* | 1 | 48.8 | ***< 0.0001*** | **0.002** | 0.96 |
| AMF \* Plant species \* Water | 2 | 8.17 | **< 0.0001** | 6.40 | **0.002** |
| *AMF \* Planting patterns \* Water* | 2 | 5.32 | **0.006** | 0.53 | 0.59 |
| *Plant species \* Planting patterns \* Water* | 2 | 2.80 | 0.065 | 10.1 | ***< 0.0001*** |
| *AMF \* Plant species \* Planting patterns \* Water* | 2 | 0.26 | 0.77 | 0.56 | 0.57 |

**Table S2.** Results of the ANOVA test for the effects of planting patterns (intercropping and monoculture), AMF (with and without inoculation), P levels (low and high) and water treatments (well-watered, alternative well-watered and droughted, and droughted) and their synergistic effects on total biomass of maize and faba bean. Significant effects are noted with bold font.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Factors | Df | Maize | | Faba bean | |
|  |  | F | *P* | F | *P* |
| P | 1 | 3678 | **<0.0001** | 1.78 | 0.19 |
| Planting patterns | 1 | 123.0 | **<0.0001** | 0.45 | 0.51 |
| AMF | 1 | 1576 | **<0.0001** | 1.04 | 0.31 |
| Water | 2 | 1094 | **<0.0001** | 628 | **<0.0001** |
| P \* Planting patterns | 1 | 22.36 | **<0.0001** | 22.8 | **<0.0001** |
| P \* AMF | 1 | 1330 | **<0.0001** | 0.49 | 0.49 |
| P \* Water | 2 | 1.86 | 0.16 | 0.38 | 0.68 |
| Planting patterns \* AMF | 1 | 34.0 | **<0.0001** | 1.05 | 0.31 |
| Planting patterns \* Water | 2 | 2.33 | 0.102 | 6.3 | **0.003** |
| AMF \* Water | 2 | 1.67 | 0.193 | 1.24 | 0.29 |
| P\* Planting patterns \* AMF | 1 | 19.0 | **<0.0001** | 17.1 | **<0.0001** |
| P\* Planting patterns \* Water | 2 | 1.53 | 0.22 | 1.38 | 0.26 |
| P \* AMF \* Water | 2 | 8.51 | **<0.0001** | 0.59 | 0.56 |
| Planting patterns \* AMF \* Water | 2 | 1.18 | 0.31 | 1.38 | 0.26 |
| P \* Planting patterns \* AMF \* Water | 2 | 4.07 | **0.02** | 8.88 | **<0.0001** |

**Table S3.** Results of the ANOVA test for the effects of AMF (with and without inoculation), P levels (low and high) and water treatments (well-watered, alternative well-watered and droughted, and droughted) and their synergistic effects on water use efficiency of maize, faba bean and maize/faba bean intercropping. Significant effects are noted with bold font.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Factors | Df | Maize | | Faba bean | | Mazie/faba bean | |
|  |  | F | *P* | F | *P* | F | *P* |
| AMF | 1 | 923 | **<0.0001** | 18.3 | **<0.0001** | 500 | **<0.0001** |
| P | 1 | 2220 | **<0.0001** | 1.73 | 0.19 | 41.6 | **<0.0001** |
| Water | 2 | 115 | **<0.0001** | 1.62 | 0.21 | 854 | **<0.0001** |
| AMF\*P | 1 | 664 | **<0.0001** | 0.021 | 0.88 | 186 | **<0.0001** |
| AMF\* Water | 2 | 0.70 | 0.50 | 0.11 | 0.89 | 0.81 | 0.45 |
| P\* Water | 2 | 2.60 | 0.08 | 0.92 | 0.40 | 5.87 | **0.005** |
| AMF\*P\*Water | 2 | 26.6 | **<0.0001** | 0.32 | 0.73 | 0.10 | 0.06 |

**Table S4.** Direct, indirect and total effect coefficients of each variable on crop biomass.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Low P | | |  | High P | | |
|  | Direct effect | Indirect effect | Total effect |  | Direct effect | Indirect effect | Total effect |
| P uptake | 0.452 | 0.362 | 0.814 |  | 0.751 | 0.111 | 0.862 |
| WUE | 0.606 | 0 | 0.606 |  | 0.379 | 0 | 0.379 |
| Photosynthesis rate | -0.054 | 0 | -0.054 |  | -0.023 | 0 | -0.023 |
| Stomatal conductance | 0 | -0.027 | -0.027 |  | 0 | -0.006 | -0.006 |
| Respiration rate | 0 | -0.040 | -0.040 |  | 0 | 0.018 | 0.018 |

**Supplementary Figures**



**Figure S1.** Averaged shoot and root biomass (mean + SE, n = 6) of maize and faba bean in monoculture (Mono) and intercropping (Inter) at low P (A, C) and high P (B, D) treatments. W, W-D and D represent well-watered (W), alternative well-watered and droughted (W-D) and droughted treatments (D) respectively. The same lowercase and uppercase letters indicate that faba bean and maize biomass (shoot or root) do not differ significantly among different planting patterns with and without AMF inoculation in each water according to Tukey’s HSD test at *P* < 0.05.



**Figure S2.** Root: shoot ratio (mean + SE, n = 6) of maize and faba bean grown in monoculture (Mono) and intercropping (Inter) at low P (A, C) and high P (B, D) supply levels. W, W-D and D represent well-watered (W), alternative well-watered and droughted (W-D) and droughted treatments (D) respectively. Bars topped by the same uppercase letters do not differ significantly among averaged root: shoot ratio of monoculture and intercropping in different AMF and water treatments according to Tukey’s HSD test at *P* < 0.05. Bars topped by the same lowercase letters do not differ significantly among different planting patterns with and without AMF inoculation in each water treatment at *P* < 0.05 according to Tukey’s HSD test.



**Figure S3.** Transpiration rate (mean + SE, n = 4) of maize and faba bean in monoculture (Mono) and intercropping (Inter) at low P (A, C) and high P (B, D) supply levels. W, W-D and D represent well-watered (W), alternative well-watered and droughted (W-D) and droughted treatments (D) respectively. Bars topped by the same uppercase letters do not differ significantly among average transpiration rate of monoculture and intercropping under different AMF and water treatments according to Tukey’s HSD test at *P* < 0.05. Bars topped by the same lowercase letters do not differ significantly among different planting patterns with and without AMF inoculation in each water treatment at *P* < 0.05 according to Tukey’s HSD test.



**Figure S4.** AMF colonization (mean + SE, n = 6) of maize and faba bean roots in monoculture (Mono) and intercropping (Inter) at low P (A, C) and high P (B, D) supply levels. W, W-D and D represent well-watered (W), alternative well-watered and droughted (W-D) and droughted treatments (D) respectively. Bars topped by the same lowercase letters do not differ significantly in different water and planting pattern treatments according to Tukey’s HSD test at *P* < 0.05.



**Figure S5.** Hyphal length density (HLD) (mean + SE, n = 6) of maize (M), faba bean (F) and maize/faba bean intercropping (M/F) in low P (A) and high P (B) treatments. W, W-D and D represent well-watered (W), alternative well-watered and droughted (W-D) and droughted treatments (D) respectively. Bars topped by the same uppercase letters do not differ significantly among average HLD of three water treatments in different cropping systems according to Tukey’s HSD test at *P* < 0.05. Bars topped by same lowercase letters do not differ significantly among different water treatments in each cropping system at *P* < 0.05 according to Tukey’s HSD test.



**Figure S6.** Proportion of soil macroaggregates (mean + SE, n = 6) of maize (M), faba bean (F) and maize/faba bean intercropping (M/F) in low P (A) and high P (B) treatments. W, W-D and D represent well-watered (W), alternative well-watered and droughted (W-D) and droughted treatments (D) respectively. Bars topped by the same uppercase letters in panel (A) do not differ significantly among average proportion of soil macroaggregates of three water treatments in different AMF and cropping systems according to Tukey’s HSD test at *P* < 0.05. Bars topped by the same lowercase letters in panel (A) do not differ significantly among different water treatments with and without AMF inoculation under each cropping system at *P* < 0.05 according to Tukey’s HSD test. “NS” in panel (B) means no significant difference among different treatments.