

Supplementary material

Insect pollination enhances faba bean yield more than weed removal or fungicide application

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Table S1 Results of the extraction of the random effects from the model estimating yield per hectare using the ranef function in R. Listed are Cage ID, Block ID and the intercepts for each cage.

ranef(yield.m)\$Cage:

| Cage ID | Block ID | Intercept |
|----------------|-----------------|------------------|
| 1 | 1 | 2.3050758 |
| 2 | 1 | 9.4241360 |
| 3 | 1 | 7.2169317 |
| 4 | 1 | -6.4443353 |
| 5 | 2 | -2.7288248 |
| 6 | 2 | -4.4752786 |
| 7 | 2 | -2.7520674 |
| 8 | 2 | -9.2650724 |
| 9 | 3 | 1.1519522 |
| 10 | 3 | 14.8694911 |
| 11 | 3 | 1.2250025 |
| 12 | 3 | -3.1238018 |
| 13 | 4 | 1.6169271 |
| 14 | 4 | - 22.9747936 |
| 15 | 4 | 3.3731548 |
| 16 | 4 | -4.9933970 |
| 17 | 5 | -0.4267767 |
| 18 | 5 | 2.7078427 |
| 19 | 5 | 16.7454132 |
| 20 | 5 | -4.0508891 |
| 21 | 6 | -2.5603894 |
| 22 | 6 | -4.0511986 |
| 23 | 6 | -4.1903052 |
| 24 | 6 | 3.0451846 |
| 25 | 7 | 4.0803843 |
| 26 | 7 | 11.1862813 |
| 27 | 7 | -4.9511273 |
| 28 | 7 | -1.9595201 |

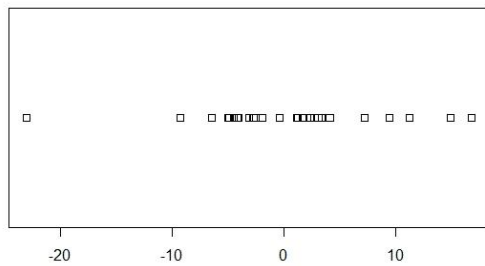


Figure S1 Figure plotting the intercepts of the extraction of the random effects from the model estimating yield per hectare using the ranef function in R

Table S2 List of weeds that spontaneously emerged in our weedy treatments, their biomass dry weight (g), and percentage biomass out of the total weed biomass of all weedy cages. NA = unidentified weed species.

| WeedID | Biomass (grams) | Percent |
|---------------------------------------|----------------------------|----------------|
| <i>Sinapis arvensis</i> | 922.37 | 59.91 |
| <i>Chemopodium album</i> | 549.39 | 35.68 |
| <i>Lamium purpureum</i> | 24.34 | 1.58 |
| <i>Sonchus arvensis/oleraceus</i> | 15.56 | 1.01 |
| <i>Fallopia convolvulus</i> | 10.09 | 0.66 |
| <i>Erodium cicutarium</i> | 8.17 | 0.53 |
| <i>Viola arvensis</i> | 5.9 | 0.38 |
| <i>Polygonium aviculare</i> | 1.01 | 0.07 |
| <i>Galeopsis speciosa</i> | 1 | 0.06 |
| <i>Myosotis arvensis</i> | 0.52 | 0.03 |
| <i>Lactuca sp.</i> | 0.4 | 0.03 |
| <i>Stellaria media</i> | 0.37 | 0.02 |
| <i>Galium aparine</i> | 0.08 | 0.01 |
| NA | 0.19 | 0.01 |
| <i>Trifolium repens</i> | 0.18 | 0.01 |
| "Grass"(unidentified) | 0.0001 | 0 |
| Total | 1539.57 | 100 |

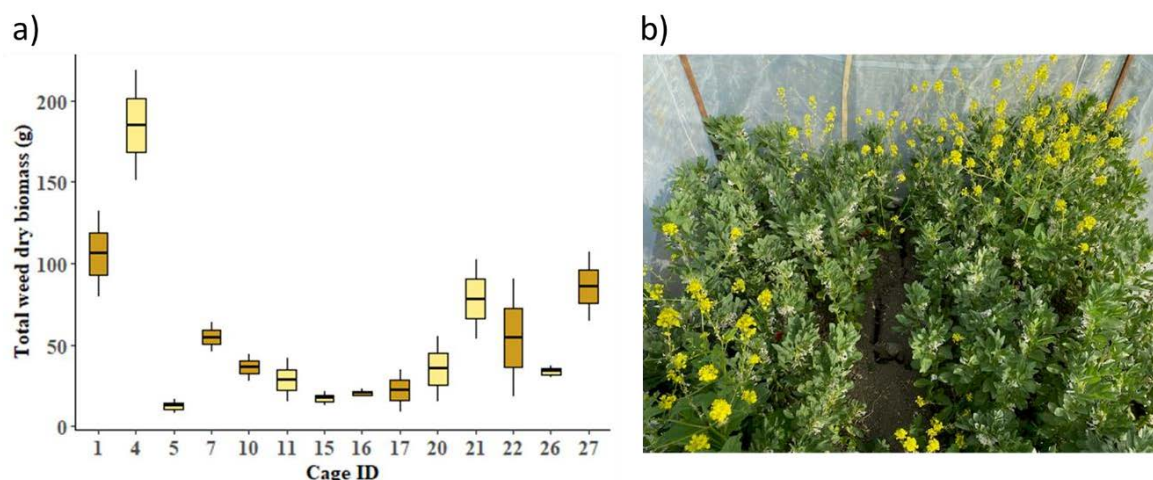


Figure S2 a) Boxplots of total weed dry biomass (g) in all weedy cages. Auto-pollinated treatment (light yellow), insect-pollinated treatment (dark yellow). Boxplots show the 25th, 50th (median) and 75th percentiles and whiskers extend 1.5 the interquartile range. b) Photograph of cage 4 with the yellow flowering weed *Sinapis arvensis* spontaneously growing.

Table S3 Results from (generalised) linear mixed effects models for weed biomass (g) and weed species richness with respect to the pollination (P) and fungicide (F) treatments and their two-way interaction. Shown are test statistics (F or χ^2), (denominator, d) degrees of freedom (Df) and *p*-values (p) for the respective treatments. Model error distributions (compois – Conway-Maxwell Poisson) are also listed.

| <i>Variable</i> | | <i>P</i> | <i>F</i> | <i>P*F</i> | <i>model</i> |
|-----------------|----------|----------|----------|------------|--------------|
| <i>Weed</i> | F | 0.36 | 0.13 | 2.37 | normal |
| | p | 0.57 | 0.72 | 0.15 | |
| | dDf | 6 | 12 | 12 | |
| <i>Weed</i> | χ^2 | 0.69 | 0.69 | 1.84 | compois |
| | p | 0.41 | 0.41 | 0.18 | |
| | DF | 1 | 1 | 1 | |

Table S4 Result from the linear mixed effects model for leaf area infestation of faba bean rust (%) with respect to the pollination (P), weed (W) and fungicide (F) treatments and their two-, and three-way interactions. Shown are test statistics (F), denominator degrees of freedom (dDf), and *p*-values (p) for the respective treatments. Marginal (Rm²) and conditional (Rc²) R-square values and model error distributions are also listed.

| <i>Variable</i> | | <i>P</i> | <i>W</i> | <i>F</i> | <i>P*W</i> | <i>P*F</i> | <i>W*F</i> | <i>P*W*F</i> | <i>model</i> |
|-----------------|-----|----------|----------|----------|------------|------------|------------|--------------|--------------|
| <i>Rust</i> | F | 0.29 | 0.61 | 3.20 | 0.10 | 3.00 | 0.061 | 0.32 | normal |
| | p | 0.60 | 0.44 | 0.087 | 0.75 | 0.10 | 0.81 | 0.31 | |
| | dDf | 18 | 18 | 23 | 18 | 23 | 23 | 23 | |

Table S5 Results from (generalised) linear mixed effects models including cage 14 for: Yield (kg per hectare), bean mass per plant (grams), individual bean weight (grams), the number of pods per plant, the number of beans per pod and aboveground crop biomass (grams) with respect to the pollination (P), weed (W) and fungicide (F) treatments and their two-, and three-way interaction. Shown are test (F) statistics, (denominator, d) degrees of freedom (DF) and *p*-values (p) for the respective treatments. Model error distributions (compois – Conway-Maxwell Poisson) are also listed. Values in bold indicate significance at an alpha-level of 0.05.

| <i>Variable</i> | | <i>P</i> | <i>W</i> | <i>F</i> | <i>P*W</i> | <i>P*F</i> | <i>W*F</i> | <i>P*W*F</i> | <i>model</i> |
|-----------------------------------|------|------------------|--------------|----------|--------------|------------|------------|--------------|--------------|
| <i>Yield (kg ha⁻¹)</i> | F | 9.98 | 1.80 | 0.35 | 1.60 | 0.16 | 0.040 | 0.80 | normal |
| | dDF | 18 | 18 | 24 | 18 | 24 | 24 | 24 | |
| | p | 0.0054 | 0.20 | 0.56 | 0.22 | 0.69 | 0.84 | 0.38 | |
| <i>Bean mass per plant</i> | F | 11.00 | 2.81 | 0.71 | 0.79 | 0.13 | 0.02 | 1.04 | normal |
| | dDF | 18 | 18 | 24 | 18 | 24 | 24 | 24 | |
| | p | 0.0038 | 0.11 | 0.41 | 0.39 | 0.72 | 0.89 | 0.32 | |
| <i>Ind. bean weight (g)</i> | F | 1.07 | 1.50 | 2.81 | 0.04 | 0.39 | 2.94 | 0.22 | normal |
| | dDF | 18 | 18 | 24 | 18 | 24 | 24 | 24 | |
| | p | 0.32 | 0.24 | 0.11 | 0.84 | 0.54 | 0.10 | 0.65 | |
| <i>Pods per plant</i> | Chi2 | 23.74 | 2.63 | 0.00 | 4.69 | <0.01 | 0.65 | 1.47 | compois |
| | DF | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| | p | <0.001 | 0.11 | 1.00 | 0.030 | 0.93 | 0.42 | 0.23 | |
| <i>Beans per pod</i> | Chi2 | 42.23 | 0.29 | 2.04 | 0.042 | 2.09 | <0.01 | 2.00 | compois |
| | DF | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| | p | <0.001 | 0.59 | 0.15 | 0.84 | 0.15 | 0.97 | 0.16 | |
| <i>Crop biomass (g)</i> | F | 0.65 | 5.18 | 1.66 | 2.39 | 0.71 | 2.77 | 0.71 | normal |
| | dDF | 18 | 18 | 24 | 18 | 24 | 24 | 24 | |
| | p | 0.43 | 0.035 | 0.21 | 0.14 | 0.41 | 0.11 | 0.41 | |

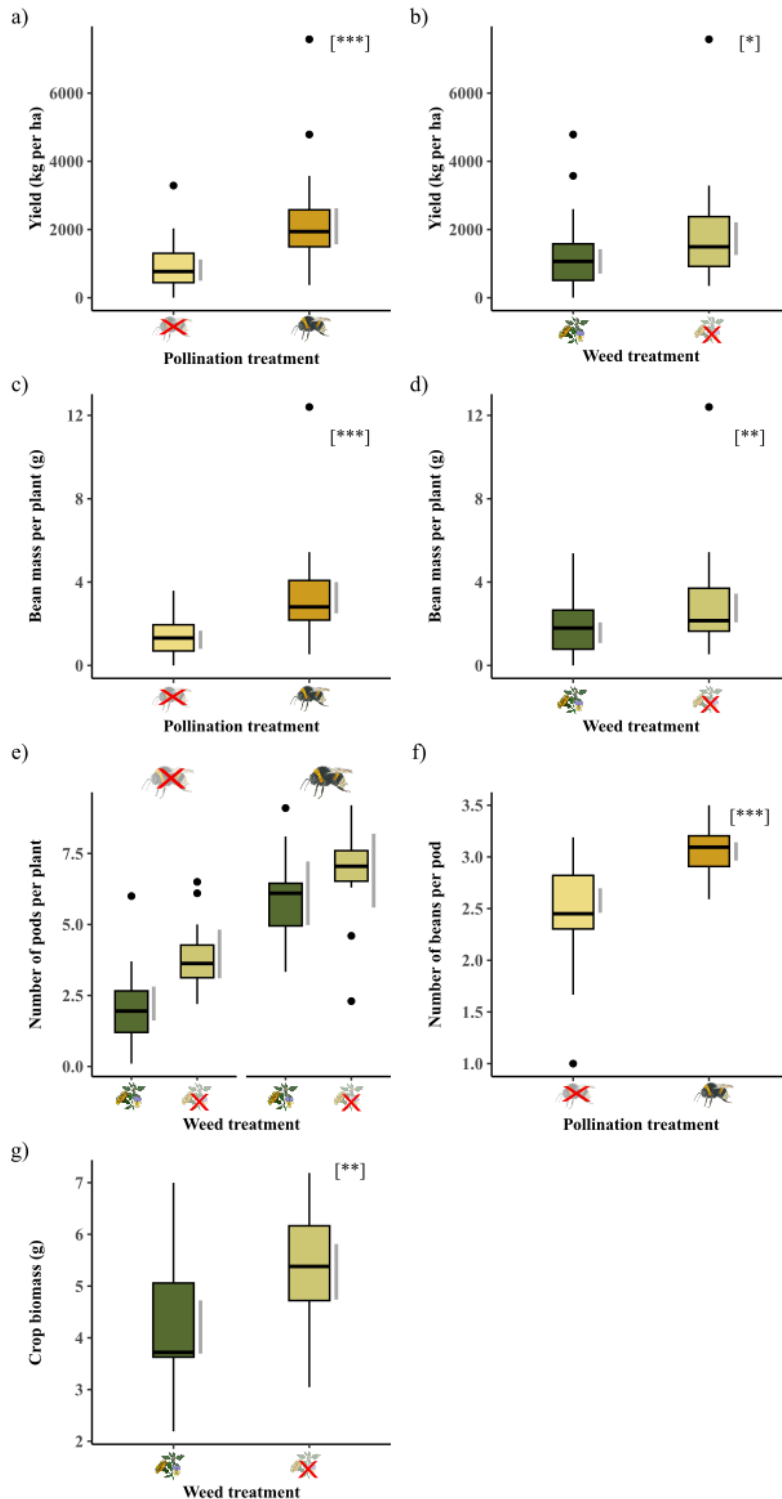


Figure S3 Boxplots showing a) yield (kilogram per hectare), b) bean mass (grams) per plant, c) number of pods per plant, d) number of beans per pod (grams) and e) aboveground crop biomass (grams) in respect to the pollination treatment or the weed treatments: auto-pollinated (crossed-out bumble bee icon, light yellow), insect-pollinated (bumble bee icon, dark yellow), weedy (dark green, plant icon), or weed-free (light green, crossed-out plant icon). Boxplots show the 25th, 50th (median) and 75th percentiles and whiskers extend 1.5 the interquartile range. Grey bars indicate 95% confidence intervals extracted from the models. Asterisks indicate alpha-levels of the p-values of main effects: [***] = p<0.0010, [**] = p<0.010, [*] = p<0.050.

