Supplementary Material

# Supplementary Tables

**Sup. Table 1.** Soil chemical attributes and granulometry in 0-0.20m depth before wheat sowing in 2016.

|  |  |  |
| --- | --- | --- |
| Soil chemical attributes | Unit | 0-0.20m layer |
| Total N | g kg-1 | 0.96 |
| P (resin) | mg kg-1 | 28 |
| S (SO4) | mg kg-1 | 4.8 |
| Organic matter | g kg-1 | 22 |
| pH (CaCl2) |  | 5.2 |
| K | mmolc kg-1 | 1.7 |
| Ca | mmolc kg-1 | 29 |
| Mg | mmolc kg-1 | 19.0 |
| H+Al | mmolc kg-1 | 34 |
| Al | mmolc kg-1 | 0.70 |
| B (hot water) | mg kg-1 | 0.20 |
| Cu (DTPA) | mg kg-1 | 3.5 |
| Fe (DTPA) | mg kg-1 | 25 |
| Mn (DTPA) | mg kg-1 | 44 |
| Zn (DTPA) | mg kg-1 | 1.3 |
| Cation exchange capacity (pH 7.0) | mmolc kg-1 | 84 |
| Base saturation | % | 55 |
| Granulometry |  | 0-0.20m layer |
| Sand | g kg-1 | 469 |
| Silt | g kg-1 | 90 |
| Clay | g kg-1 | 441 |

*n* = 20, DTPA = diethylenetriaminepentaacetic acid

**Sup. Table 2.** *Azospirillum* sp. most probably number (MPN) analyzed in semi-solid medium NFb without N addition at wheat full flowering.

|  |  |
| --- | --- |
| 2016 | MPN (CFU g-1 soil) |
| Without | 3.2 × 104 |
| With | 2.1 × 106 |
| 2017 |  |
| Without | 4.8 × 104 |
| With | 1.2 × 107 |

Without and With refers to absence and presence of *A. brasilense* inoculation; *n* = 10.

**Sup Table 3.** Summary of statistical analysis (*P*-values) for wheat root and shoot dry mass, grain yield, agronomic efficiency (AE), apparent N-fertilizer recovery (AFR), ammonium (NH4+), nitrate (NO3-) and total N concentration in leaf tissue, NH4+, NO3- and total N accumulated in root and shoot and total N accumulated in grains affected by *A. brasilense* inoculation, N level, year and their interactions.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variable | Root dry mass | Shoot dry mass | Grain yield | AE | AFR | Leaf NH4+ | Leaf NO3- | Leaf N |
| Inoculation (I) | 0.001 | 0.0332 | 0.007 | 0.049 | 0.001 | 0.001 | 0.001 | 0.008 |
| N level (N) | 0.001 | 0.0034 | 0.001 | 0.001 | 0.001 | 0.001 | 0.002 | 0.001 |
| Year (Y) | 0.001 | 0.0004 | 0.438 | 0.127 | 0.160 | 0.001 | 0.311 | 0.001 |
| I × N | 0.001 | 0.1860 | 0.999 | 0.564 | 0.121 | 0.057 | 0.107 | 0.073 |
| I × Y | 0.845 | 0.1120 | 0.094 | 0.558 | 0.099 | 0.124 | 0.109 | 0.004 |
| N × Y | 0.207 | 0.1158 | 0.005 | 0.012 | 0.001 | 0.284 | 0.057 | 0.025 |
| I × N × Y | 0.134 | 0.2178 | 0.699 | 0.840 | 0.074 | 0.241 | 0.098 | 0.585 |
| Variable | Root NH4+ | Root NO3- | Root N | Shoot NH4+ | Shoot NO3- | Shoot N | Grain N | |
| Inoculation (I) | 0.044 | 0.730 | 0.042 | 0.001 | 0.201 | 0.002 | 0.001 | |
| N level (N) | 0.324 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | |
| Year (Y) | 0.299 | 0.001 | 0.001 | 0.020 | 0.070 | 0.001 | 0.358 | |
| I × N | 0.051 | 0.988 | 0.078 | 0.007 | 0.011 | 0.054 | 0.001 | |
| I × Y | 0.009 | 0.071 | 0.374 | 0.410 | 0.115 | 0.386 | 0.054 | |
| N × Y | 0.126 | 0.001 | 0.002 | 0.297 | 0.008 | 0.001 | 0.257 | |
| I × N × Y | 0.520 | 0.492 | 0.327 | 0.067 | 0.106 | 0.055 | 0.083 | |

**Sup Table 4.** Factor loadings of a principal component analysis for wheat crop; bold loadings > 0.3.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Without *A. brasilense* inoculation | | | |
| Parameters | PC1 | PC2 | PC3 | PC4 |
| Shoot dry mass | **0.37** | 0.14 | -0.01 | -0.06 |
| Root dry mass | **0.32** | -0.06 | -0.02 | **-0.57** |
| Grain yield | 0.10 | -0.21 | **0.53** | 0.06 |
| Leaf N concentration | **0.36** | -0.18 | -0.08 | 0.07 |
| Leaf NH4+ concentration | **0.37** | -0.05 | -0.01 | 0.05 |
| Leaf NO3- concentration | 0.19 | **-0.33** | -0.28 | **0.38** |
| Shoot N accumulation | **0.32** | **0.31** | 0.09 | 0.29 |
| Shoot NH4+ accumulation | **0.33** | **0.31** | 0.09 | 0.19 |
| Shoot NO3- accumulation | 0.10 | **0.53** | 0.10 | 0.26 |
| Root N accumulation | -0.11 | **0.48** | 0.04 | -0.26 |
| Root NH4+ accumulation | 0.28 | -0.13 | **-0.34** | 0.13 |
| Root NO3- accumulation | **0.33** | 0.01 | 0.03 | **-0.47** |
| Grain N accumulation | 0.18 | -0.23 | **0.45** | -0.01 |
| Agronomic efficiency | -0.04 | -0.13 | **0.53** | 0.13 |
| Apparent N-fertilizer recovery | **0.32** | **0.32** | 0.07 | 0.18 |
| Variance (%) | 41.8 | 19.6 | 17.4 | 8.1 |
| Cumulative variance (%) | 41.8 | 61.4 | 78.9 | 87.0 |
| Eigenvalues | 5.9 | 2.75 | 2.44 | 1.14 |
|  | With *A. brasilense* inoculation | | | |
| Parameters | PC1 | PC2 | PC3 | PC4 |
| Shoot dry mass | **0.33** | -0.17 | -0.10 | **-0.35** |
| Root dry mass | **0.31** | **-0.33** | -0.28 | **0.30** |
| Grain yield | 0.23 | 0.04 | **0.48** | -0.14 |
| Leaf N concentration | 0.23 | **0.39** | -0.28 | 0.05 |
| Leaf NH4+ concentration | 0.15 | **0.42** | **-0.34** | 0.24 |
| Leaf NO3- concentration | 0.18 | **0.44** | -0.06 | 0.04 |
| Shoot N accumulation | **0.37** | -0.21 | -0.09 | -0.19 |
| Shoot NH4+ accumulation | **0.37** | -0.08 | -0.11 | -0.16 |
| Shoot NO3- accumulation | **0.37** | -0.10 | 0.01 | -0.20 |
| Root N accumulation | 0.22 | **0.30** | **0.31** | 0.26 |
| Root NH4+ accumulation | 0.17 | -0.19 | 0.16 | **0.65** |
| Root NO3- accumulation | 0.28 | -0.20 | -0.27 | 0.24 |
| Grain N accumulation | **0.30** | 0.28 | 0.27 | -0.12 |
| Agronomic efficiency | 0.18 | -0.17 | **0.44** | 0.21 |
| Apparent N-fertilizer recovery | **0.36** | -0.09 | -0.12 | -0.20 |
| Variance (%) | 39.3 | 18.6 | 15.6 | 8.5 |
| Cumulative variance (%) | 39.3 | 57.9 | 73.5 | 82.0 |
| Eigenvalues | 5.5 | 2.61 | 2.18 | 1.18 |

**Sup. Table 5.** Total operating expenses (TOE) structure model for wheat crop in the control treatment (0 kg N ha-1 in side-dressing) without inoculation with *A. brasilense* (per ha).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Description | Specification1 | Times | Coefficient | Unitary Value (US$) | Total Value (US$) |
| A. OPERATIONS |  |  |  |  |  |
| Liming (applied in the predecessor crop) | HM | 1.00 | 0.30 | 15.95 | 4.78 |
| Weed control | HM | 1.00 | 0.50 | 15.95 | 7.97 |
| Hoeing (triton) | HM | 1.00 | 0.50 | 15.95 | 7.97 |
| Sowing | HM | 1.00 | 0.60 | 28.14 | 16.89 |
| Pulverization | HM | 1.00 | 0.60 | 15.95 | 9.57 |
| Side-dressing | HM | 1.00 | 0.40 | 28.14 | 11.26 |
| Harvest | HM | 1.00 | 1.00 | 22.14 | 22.14 |
| Irrigation (pivot) | mm | 1.00 | 150 | 0.47 | 70.36 |
| Subtotal A |  |  |  |  | 150.94 |
| B. AGRICULTURAL INPUTS |  |  |  |  |  |
| Dolomitic limestone | Mg | 1.00 | 0.49 | 22.51 | 10.92 |
| Fertilizer 08-28-16 | Mg | 1.00 | 0.28 | 487.43 | 134.04 |
| Urea | Mg | 1.00 | 0.00 | 381.94 | 0.00 |
| Inoculant (*A. brasilense*) | L | 1.00 | 0.00 | 1.88 | 0.00 |
| Wheat seed CD 1104 | 50-kg sc | 1.00 | 2.90 | 15.01 | 43.53 |
| Glyphosate | L | 1.00 | 4.00 | 2.72 | 10.89 |
| 2,4-D | L | 1.00 | 1.00 | 2.48 | 2.48 |
| Metsulfuron methyl | g ha-1 | 1.00 | 3.00 | 0.19 | 0.57 |
| Seed treatment pyraclostrobin + thiophanate-methyl + fipronil | L | 1.00 | 0.04 | 65.67 | 2.63 |
| Subtotal B |  |  |  |  | 205.06 |
| Effective operating expenses (EOE) |  |  |  |  | 356 |
| Other expenses |  |  |  | 17.8 | |
| Interest cost |  |  |  | 11.57 | |
| Total operating expenses (TOE) |  |  |  | 385.37 | |

HM = hour machine, sc = sack. Dolar average exchange rate: R$5.33 = US$1.00.

# Supplementary Figures

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| **A.** |
| **B.** |

**Sup. Fig 1.** Daily rainfall (bar) and temperature (lines) in 2016 (A) and 2017 (B) during wheat cropping season.

Av. T., Max. T. and Min. T. refers to average, maximum and minimum temperatures, respectively.