**Supplementary Material**

**Supplementary Tables and Figures**

**Supplementary Table 1**

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| **Supplementary Table 1.** Comparison of an exponential equation and linear equation model for key-enzyme activities and photosynthesis rates. Model |
| Key-enzymes |  **Exp. Eq.** | **Linear Eq.** |  **Exp. Eq.** | **Linear Eq.** |
| *AIC* | R2 | *AIC* | R2 |  *AIC* |  R2 |  *AIC* |  R2 |
| ***Triticum aestivum*** | ***Oryza sativa*** |
| NADP-G3PDH | 134.94 | 0.857 | 146.72 | 0.816 |  27.66 | 0.921 | 42.82 | 0.932 |
| PGA Kinase | 30.70 | 0.981 | 49.83 | 0.981 |  20.77 | 0.968 | 51.46 | 0.929 |
| cpFBPase | 39.04 | 0.984 | 80.31 | 0.966 |  23.36 |  0.929 | 41.40 | 0.922 |
|  | ***Zea mays*** |  |  |  |  |  |  |  |
| NADP-ME | 29.05 | 0.828 | 142.67 | 0.24 |  |  |  |  |
| PCK | 42.25 | 0.839 | 144.57 | 0.321 |  |  |  |  |
| Rubisco | 33.83 | 0.851 | 146.31 | 0.346 |  |  |  |  |
|  | ***Sorghum bicolor*** |  |  |  |  |  |  |  |
| Rubisco | 42.63 | 0.87 | 78.97 | 0.597 |  |  |  |  |
| PEPC | 27.84 | 0.953 | 74.02 | 0.79 |  |  |  |  |
| **Note:** Akaike’s information criterion (*AIC*) and best R2 were used. |

**Supplementary Figure 1**

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**Supplementary Figure 1.** Relationships in *Sorghum bicolor* between the photosynthesis rates and leaf N contents (0.05, 0.2, 0.4, or 0.6 g N). Photosynthesis rate increased with increased amount of leaf N content in sorghum, respectively. The error bars indicate the standard errors. Data taken from (Makino and Ueno 2018).

**Supplementary Figure 2**

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**Supplementary Figure 2.** Response of the leaf photosynthesis rates on the intercellular CO2 concentrations (*Ci*), due to the nitrogen deficiencies in the *Sorghum bicolor*. Three types of Hoagland nutrient solution (0, 20, and 100 %) were tested, and after 46 to 50 days measurements were taken of the fully expanded leaves. The nitrogen deficiency in the leaves is seen to cause a decrease in the *Ci*. While, the 0 and 20 % N reduced the leaf photosynthesis rates, they also reduced the intercellular CO2 concentrations, compared with the 100 % N. The error bars indicate the standard errors of three measurements. Data are taken from (Zhao et al, 2005).