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Correlation of Leaf Nitrogen, Chlorophyll and Rubisco Contents with Photosynthesis in a Supernodulating Soybean Genotype Sakukei 4

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Abstract: Soybean requires more nitrogen (N) than gramineous crops because it accumulates a large amount of N in seeds, and its photosynthetic rate per leaf N is low. The supernodulating genotype Sakukei 4 has a superior symbiotic N_2 fixation capability, and thereby is potentially high-yielding. In our previous study, Sakukei 4 was characterized by having a superior ability to maintain high leaf N content and high photosynthetic rate. The objectives of this study were to know photosynthetic characteristics of Sakukei 4 in detail, especially, the responses to CO_2 concentration and light intensity, and to elucidate how the photosynthetic characteristics of Sakukei 4 are associated with the amounts of photosynthesis-related N compounds (chlorophyll and Rubisco). The three genotypes (Sakukei 4 - supernodulating cultivar derived from Enrei, Enrei - normally nodulating cultivar, En1282- non-nodulating line derived from Enrei) were grown at various N levels in this study. The CO_2 exchange rate (CER) in Sakukei 4 was higher than, or equal to that in Enrei at wide ranges of CO_2 concentrations (150-700 mmol mol^{-1}) and light intensities (200-1,500 mmol m^{-2} s^{-1} PPFD). Sakukei 4 had higher leaf N (N_L), chlorophyll (Chl_L) and Rubisco (Rub_L) contents per leaf area, but lower chlorophyll and Rubisco contents per leaf N content (Chl_L/N_L, Rub_L/N_L) than Enrei. The specific leaf weight (SLW) and leaf area trended to be lower in Sakukei 4 than in Enrei. These results indicate that the superior photosynthetic rate in Sakukei 4 is attributed to higher total N, chlorophyll and Rubisco contents per leaf area, but not to high rate of allocation of total N to these N compounds.

Keywords: Chlorophyll, *Glycine max*, Leaf nitrogen, Photosynthesis, Rubisco, Soybean, Supernodulation

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