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Characterization of Vegetative Growth of a Supernodulating Soybean Genotype, Sakukei 4

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Abstract: The supernodulating soybean cultivar Sakukei 4 was previously characterized by its superior ability to maintain a high leaf nitrogen (N) content and high photosynthetic rate. Despite these desirable traits, the growth performance of Sakukei 4 was inferior to that of its normally nodulating parental cultivar, Enrei. The physiological basis for the unique growth characteristics of Sakukei 4 remains unclear. The objective of the present study was to characterize in further detail the vegetative growth of Sakukei 4, particularly during the period before pod expansion. In the first experiment, the growth of Sakukei 4 was compared with that of its parental cultivar Enrei under various rates of N fertilizer. The dry weight of tops, roots and nodules of the plants grown at lower rates of N application was greater in Enrei than in Sakukei 4, but it was vice versa at higher rates of N application. The number and weight of nodules were far greater in Sakukei 4 than in Enrei at any rate of N application. These genotypic differences were significant on 39 days after sowing (DAS) and became greater at the flowering stage. In the second experiment, therefore, more detailed growth analysis was made during an earlier growth stage (DAS 31-46). During this period, relative growth rate (RGR), net assimilation rate (NAR) and leaf area ratio (LAR) were lower in Sakukei 4 than in Enrei and the related non-nodulating line En1282, whereas the leaf photosynthetic rate was higher in Sakukei 4 at all leaf positions. The dry-matter partitioning to each plant part excluding nodules was similar in all three genotypes. The rate of leaf expansion in Sakukei 4 during this period was significantly slower than that in the

other genotypes. These results suggest that the inferior growth of Sakukei 4 prior to flowering is probably due to excessive dry-matter partitioning to nodules and depressed capability of leaf expansion and root growth, which might limit dry-matter production of the whole plant during pre-flowering stage.

Keywords: Dry matter partitioning, *Glycine max*, Growth rate, Leaf expansion, Nitrogen fixation, Photosynthesis, Soybean, Supernodulation

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