

PA-119

## Effects of Low Temperature on Leaf Senescence and Seed Growth during Late Reproductive Stage (R5–R6) in Soybean (*Glycine max* (L.) Merrill)

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### [Introduction]

Soybean is a representative summer crop in Korea, but the possibility of exposure to low temperatures during the seed growth period is increasing due to the frequent occurrences of abnormal climatic events in recent. This study was conducted to find out the influences of the low temperature during the seed growth period in the Korean soybean cultivar.

### [Materials and Methods]

Soybean (cv. Sunpoong) plants were grown in pots (15cm D and 13 H) containing mixed soil (silty loam soil: commercial horticultural nursery soil = 1:1). The growth temperature for vegetative growth in the greenhouse was 25 to 30°C (day) and 20°C (night) with 13 h day length. The average night temperature was controlled to 20°C (control), 10°C, and 7°C after R5 or R6 stage. Physiological characteristics were measured on SPAD, chlorophyll fluorescence, and NDVI with portable devices and net photosynthetic rate (Pn) with a handheld device (CID-340, Bio-Science, USA), and hyperspectral properties with a snap-shot type camera (Specim IQ, Specim Ltd, Finland) at intervals of 5 days from day 0 of temperature treatments.

### [Results and Discussion]

Among the physiological characteristics, NDVI and SPAD were different between temperatures from the 15th day of treatment, showing higher values in the order of control, 10°C-R6, 10°C-R5, 7°C-R6, and 7°C-R5. Chlorophyll fluorescence (Fv/Fm) was similar to the results of SPAD and NDVI on day 20. Pn showed a higher value in low-temperature treatment than in the control, especially, the treatment of 7°C-R5 showed higher photosynthesis by 96% as compared to the control on the 10th day. The hyperspectral reflectance of the pods was similar on the 15th day, but the hyperspectral reflectance increased only in the control on the 20th day. The hyperspectral reflectance of the uppermost (youngest) leaf was more affected by temperature than the growth stage, and the occurrence of increases in hyperspectral reflectance occurred early in the order of control, 10°C-R6, 10°C-R5, 7°C-R6, and 7°C-R5. The vegetation indices that showed significant differences from the beginning of hyperspectral analysis were GCI, PSSRb, and PSSRc. The shoot dry weight was the lowest in control and higher at 7°C treatment. The fresh weight of pods was 64% higher at 10°C and 83% at 7°C compared to the control, but 7°C-R5 was about 20% lower in dry weight. The other treatments, however, showed similar weight. The seed number and seed weight showed lower values as the treated temperature was lower and the treatment time was faster. Therefore, low temperatures delay leaf senescence and leaf falling, making harvesting difficult and interfering with the translocation of photosynthates, affecting the seed yield, and this damage becomes more severe when the seed is less filled.

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