THE INFLUENCE OF DARK CHILLING ON THE ENDOGENOUS RHYTHMS OF PHOTOSYNTHESIS AND SUCROSE SYNTHESIS IN *Glycine max* [L.] MERRILL

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PROJECT 2:

THE INFLUENCE OF DARK CHILLING ON THE ENDOGENOUS RHYTHMS OF PHOTOSYNTHESIS AND SUCROSE SYNTHESIS IN SOYBEAN

In the case of soybean [*Glycine max* (L.) Merrill], the underlying cause of the severe inhibition of photosynthesis by dark chilling is largely unknown. The main objectives of this investigation were to improve the understanding of the physiological and biochemical basis of chilling tolerance. 'Maple Arrow' (chilling tolerant genotype) and 'Java 29' (chilling sensitive genotype) were used throughout the study. These genotypes were subjected to three consecutive nights of chilling. A number of key parameters of photosynthesis were determined using a portable photosynthesis system. In addition the activity of sucrose-phosphate-synthase (SPS) and sucrose synthase (SuSy) was determined in the leaves of these genotypes

It was determined that dark chilling resulted in a very similar inhibition of CO_2 assimilation rate and stomatal conductance in the two genotypes, but that the underlying cause of the inhibition was very different. In 'Java 29', the chilling sensitive genotype, gas exchange analysis revealed that mesophyll limitation was a major factor contributing towards the inhibition of photosynthesis, while in 'Maple Arrow', the chilling tolerant genotype, only minor mesophyll limitation occurred.

Dark chilling caused a disruption in the regulation of SPS that prevented the normal diurnal increase in SPS activity during the light period following dark chilling. Inhibition of SPS activity was identified as a distinguishing characteristic between the two genotypes and could have been a major factor contributing towards the observed mesophyll limitation of photosynthesis in 'Java 29'.

It is concluded that disruption of the internal time-keeping mechanism of SPS, which co-ordinates its activity with diurnal changes in the rate of photosynthesis may be one of the main reasons for the difference in chilling tolerance between soybean genotypes of the early

and late maturity groups.