

Relationships among pod number and pod number-related traits in determinate soybeans grown at elevated temperatures

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[Introduction]

In soybean, the number of pods, the main yield determinant, is determined by flower number and pod set percentage. High temperature above ambient increases flowering duration, leading to increased the number of flowers. However, high temperature stress during the early reproductive stages of soybean induces pod set failure resulted from abortion and abscission of flowers and young pods. The objective of this study was to identify the relationships among flower number, pod set percentage, and pod number, and to determine the direct contribution of flower number and pod set percentage to pod number under elevated temperature conditions.

[Materials and Methods]

Two Korean soybean cultivars, Sinpaldalkong [maturity group (MG) IV] and Daewonkong (MG VI), were pot-cultured in four sunlit temperature-controlled greenhouses at the Experimental Farm of Seoul National University (37.27°N, 126.99°E). Greenhouses were controlled to the targets of current ambient temperature (AT), AT+1.5°C, AT+3.0°C, and AT+5.0°C throughout the entire growing seasons in 2013, 2014 and 2015. The number of open flowers were recorded everyday during the flowering period and the number of fertile pods were observed at maturity. Correlation and path analysis with pod number and pod number-related traits were conducted using the statistical analysis software SAS version 9.4.

[Results and Discussions]

Air temperature during the flowering period in 2014 was much lower than the other two experimental years, 2013 and 2015. Pod number showed highly significant positive correlations ($r=0.77^{**}$ and 0.98^{**}) with pod set percentage for Sinpaldalkong and Daewonkong cultivars, respectively, in hot summer years, 2013 and 2015; whereas highly significant positive correlations ($r=0.93^{**}$ and 0.91^{**}) with the number of flowers were observed for Sinpaldalkong and Daewonkong cultivars, respectively, in cool summer year, 2014. Regardless of cultivar, pod number variation was more closely associated with pod set percentage rather than with flower number in hot summer years. In cool summer year, however, flower number showed stronger association with the variation in the number of pods rather than with the percentage of pod set. The flower number per pot negatively affected pod set percentage in cool summer year, whereas flower number exerted negligible effects on the pod set percentage in hot summer year. In cool summer year, the number of pods significantly increased with increase in temperature above AT treatment resulted from the increase in the number of flowers. However, pod number decreased with temperature rise above AT+1.5°C in hot summer year because of the decreased pod set ratio.

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