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Genetic variation of sensitivity to photoperiod and accumulated temperature in soybean mini core collection lines

Md Rasadul Islam^{1,2)}, Daisuke Fujita³⁾, Shao-Hui Zheng³⁾

¹⁾The United Graduate School of Agricultural Science, Kagoshima University, Kagoshima 890-0065, Japan, ²⁾

Exim Bank Agricultural University, Chapainawabganj 6300, Bangladesh,

³⁾ Faculty of Agriculture, Saga University, Saga 840-8502, Japan

Abstract

The sensitivities to photoperiod and temperature give guidance to choose an adaptable genotype for specific area in soybean production. However, there is insufficient information about the variation of sensitivities to photoperiod and temperature with wide genetic background. We investigated the sensitivities to photoperiod and temperature using 82 soybean mini core collection lines provided by NIAS gene bank of Japan. The seeds were sown on 28 May and 4 August in 2015, 24 May and 5 August in 2016 at field in Saga, Japan (33° 14' 32" N, 130° 17' 28" E) for the early (average photoperiod and temperature: 15.2 h and 25.1 °C) and late (13.6 h and 27.2 °C) sowing respectively. The plants were also grown in the growth chamber under 12 h photoperiod with three temperature regimes (day/night temperature: 25 / 18⁰ C, 28 /22⁰ C and 33/ 28⁰ C). Emergence date, days to first flower were recorded with 10 plants in the field and 2 plants in the growth chamber for each line. The data for daily average temperatures and photoperiodic hours were collected from weather station. The days from emergence to first flower open (DEF) were varied from 23-92 (2015 and 2016) in early sowing whereas 18-68 (2015) and 18-59 (2016) in late sowing. The shortened DEF in late sowing could be caused by both short photoperiod and high temperature in late sowing. However, the accumulated temperatures during emergence to first flower open (ATEF) were less variable in comparison with DEF, suggesting the ATEF is dependent mostly on the photoperiod. The ATEF were found same between early and late sowing in some early flowering lines (e.g. 686.7⁰C and 687.6⁰C in HEUKDAELIPS, 728.8⁰C and 706.3⁰C in WILLIAMS'82) which indicated that these would be insensitive to day length. In the growth chamber experiment, the variation in both DEF and ATEF was a little greater at low temperature (25/18⁰ C) but almost same at middle (28/22⁰ C) and high (33/28⁰ C) temperatures. Since the less differences in ATEF were found between the three temperatures, it is suggested that the temperature plays only a quantitative effect on the flower initiation, and the large ATEF in some lines may indicate the stronger photosensitivity even at 12 h or longer juvenile phase. Some lines with the lowest ATEF regardless of growth conditions, such as FISKEBY V, KE 32 (ATEF: 559.6-666.5, 587.7-709.5) might lack the sensitivities to both photoperiod and temperature. The results suggested that soybean genotypes has wider variation in sensitivity to photoperiod, whereas less variation to temperature.

Keywords: Soybean, Genetic variation, Sensitivity, Photoperiod, Accumulated Temperature.

Corresponding author

Islam Md. Rasadul

The United Graduate School of Agricultural Science, Kagoshima University (Allied: Saga University), 804-0027, International house 528-1, C-204, Honju machi, Honju, Saga City, Saga, Japan

Mobile: +8108058031686

Email: rasadulexim@gmail.com