

Impact of high nighttime temperature during different growth stages on tuber weight distribution and yield of field-grown potato

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[Introduction]

Anticipated warm nights under global warming will adversely affect potato production. However, scarce studies have documented the impact of high nighttime temperature (HNT) exposed at different development stages on potato growth. Therefore, a field experiment was conducted to assess the effect of HNT during four different growth stages on the tuber weight distribution and yield of field-grown potato.

[Materials and Methods]

The experiment was carried out under a field condition at the experimental farm of Seoul National University in Suwon, South Korea (37.27 °N, 126.99 °E). N-P-K fertilizer of 100-100-120 kg ha⁻¹ was uniformly applied before planting. On March 17, 2017, pre-germinated potato seed pieces of 30–50 g (cv. Superior) with 1–2 cm sprouts were planted in 0.6 m spaced rows with a plant spacing of 0.25 m. Potatoes were grown under five different nighttime temperature regimes: ambient temperature throughout the growing season (T0) and increased nighttime temperature by 3.8 °C during 15–28 (T1), 29–42 (T2), 43–56 (T3), and 57–70 (T4) days after 50% emergence in the temperature controlled poly-houses. Plots were 5.8 m long and 1.8 m wide with three rows of potatoes and were arranged in a randomized complete block design with three replications. To ascertain the shift in tuber yield distribution by HNT, tubers were categorized into five different fresh weight classes (1–40, 40–80, 80–120, 120–160, > 160 g). ANOVA and Duncan multiple range tests were used to assess the impact of the HNT treatments on tuber weight distribution, yield, and related traits.

[Results and Discussions]

Tuber yield was reduced by the HNT, and the reduction was mainly associated with the decrease in total tuber number. The reduced tuber number may have resulted from the increased nighttime respiration. Young plants were more vulnerable to the HNT, and yield loss at T1 was severe (ca. 29.7%) implying that the HNT may have a direct impact on the tuber differentiation process as well as nighttime respiration. The HNT at the early growth (T1 and T2) significantly reduced the yield proportion of large tubers (> 160 g) modifying the tuber weight distribution and thus exacerbating the impact of the HNT. Maturing plants (T4) were not significantly affected by the HNT because most of the yield may have been determined before the HNT treatment. These results suggest that the growth stages, particularly the early tuber growth, should be considered in the adaptation strategies for potato production under the anticipated warming in South Korea.

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