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Physiological and Transcriptional Analysis of the Response of Oat (Avena Sativa) Spikelets under Different Temperature Conditions

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[Introduction]
Temperature is one of the major factors affecting oat growth conditions and grain yields during grain filling stage. However, the optimal temperature in oat grain development stage has not revealed yet. To revealed growth effects during grain filling stage, integrated physiological and transcriptional analysis was performed on oat spikelets with five different temperatures.

[Materials and Methods]
Two Korean cultivars, "Joyang" and "Daeyang", were grown under five different degrees (35℃, 32℃, 29℃, 26℃, 23℃) during 33 days after anthesis 15 days. We measured the total chlorophyll contents for indicator of stress response magnitude. Three replicates of oat spikelets were sampling after 14 days and 20 days treatment for measuring malondialdehyde, soluble sugar and reactive oxygen species (ROS) relative enzymes (SOD, POD, APX, CAT) assays and performing qRT-PCR. After the harvest, shoot-dry-weight, hundred-seed-weight and seed numbers per plants were measured. We also observed the phenotypes of oat spikelet shapes. QRT-PCR using spikelet RNA samples was conducted to analysis the expression of genes related on starch synthesis mechanism with specific primers.

[Results and Discussion]
After 33 days of treatment, plants treated under 35℃ degree showed the lowest total chlorophyll contents and highest reduction ratios compare to other treated plants. Malondialdehyde, soluble sugar and ROS enzymes were increased significantly with temperature increased from 23 to 35°C. Increased temperature led to make single kernel spikelet ratios more than large multiflorous spikelets. Shoot-dry-weight was also increased following lower temperature. However, seed numbers per plants, hundred-seed-weight and QRT-PCR results, which were related on grain development and yields, showed that optimal temperature for grain development was 26℃~29℃ during grain filling stage. The results of experiments indicated that relative stress measurement assays were high expression level on more high temperature, while grain developments were depended on other temperature patterns. Analysis of oat seed quality under optimal temperature would be helpful for further studies during grain filling stage. Since high temperature during grain filling period is now considered as a major interference on yield potential, we expect that obtained results allow us to classify optimal temperature for oat grain yields.

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