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Comprehensive evaluation of fuel properties and complex regulation of intracellular transporters for high oil production in developing seeds of *Prunus sibirica* for woody biodiesel

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Abstract

Background: Based on our previous studies of 17 *Prunus sibirica* germplasms, one plus tree with high quality and quantity of seed oils has emerged as novel potential source of biodiesel. To better develop *P. sibirica* seed oils as woody biodiesel, a concurrent exploration of oil content, FA composition, biodiesel yield and fuel properties as well as prediction model construction for fuel properties was conducted on developing seeds to determine the optimal seed harvest time for producing high-quality biodiesel. Oil synthesis required supply of carbon source, energy and FA, but their transport mechanisms still remains enigmatic. Our recent 454 sequencing of *P. sibirica* could provide long-read sequences to identify membrane transporters for a better understanding of regulatory mechanism for high oil production in developing seeds.

Results: To better develop the seed oils of *P. sibirica* as woody biodiesel, we firstly focused on a temporal and comparative evaluation of growth tendency, oil content, FA composition, biodiesel yield and fuel properties as well as model construction for biodiesel property prediction in different developing seeds from *P. sibirica* plus tree (accession AS-80), revealing that the oils from developing seeds harvested after 60 days after flowering (DAF) could be as novel potential feedstock for producing biodiesel with ideal fuel property. To gain new insight into membrane transport mechanism for high oil yield in developing seeds of *P. sibirica*, we presented a global analysis of transporter based on our recent 454 sequencing data of *P. sibirica*. We annotated a total of 116 genes for membrane-localized transporters at different organelles (plastid, endoplasmatic reticulum, tonoplast, mitochondria and peroxisome), of which some specific transporters were identified to be involved in carbon allocation, metabolite transport and energy supply for oil synthesis by both RT-PCR and qRT-PCR. Importantly, the transporter-mediated model was well established for high oil synthesis in developing *P. sibirica* seeds. Our findings could help to reveal molecular mechanism of increased oil production and may also present strategies for engineering oil accumulation in oilseed plants.

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