Researchers find sucrose breakdown is key to melon seed germination in cold conditions

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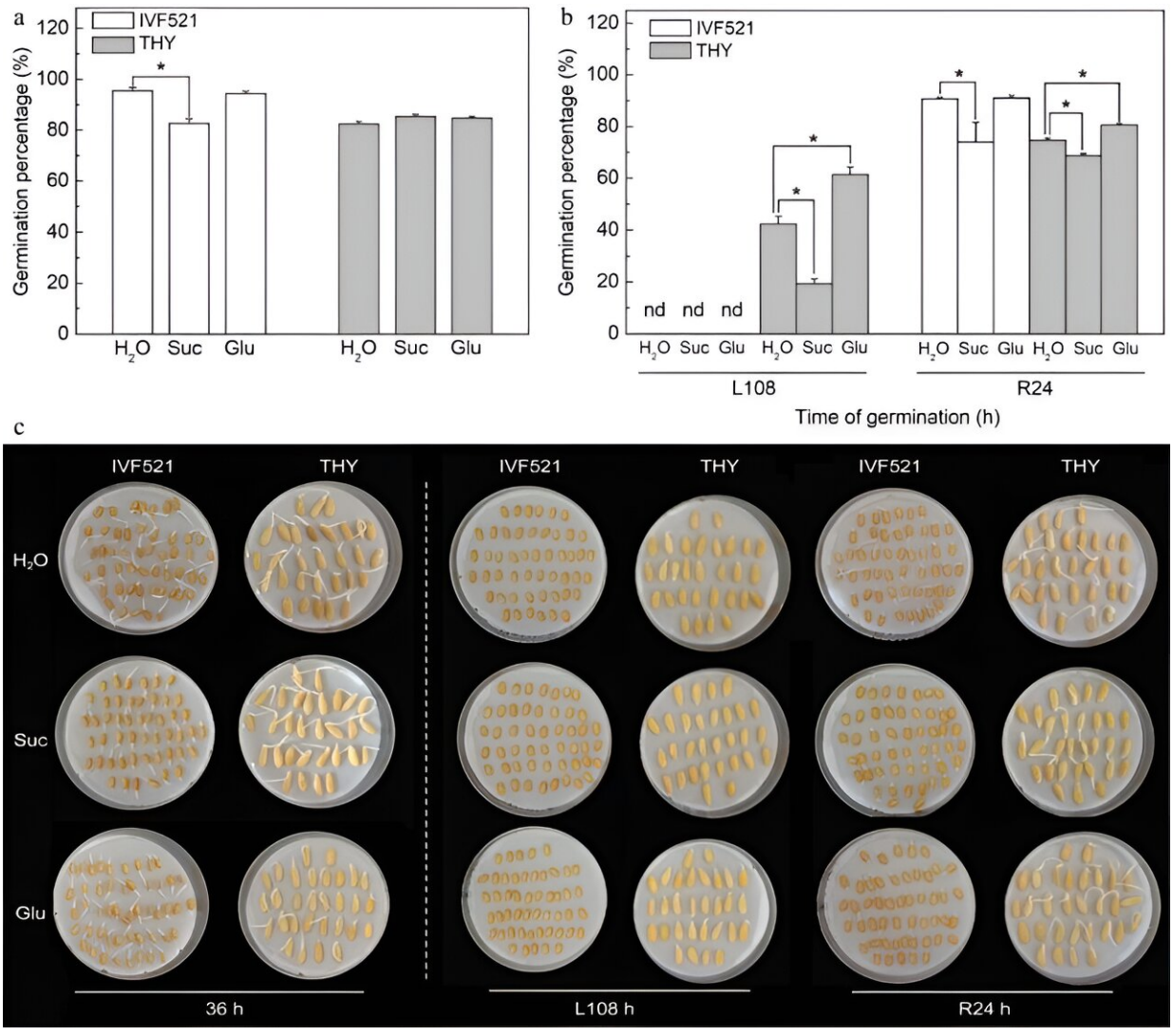

Effects of Suc and Glu on germination percentage of different varieties of melon seeds under normal or low temperature. Credit: *Vegetable Research* (2024). DOI: 10.48130/vegres-0024-0020

A research team has found that cold-tolerant melon seeds (THY) maintained higher neutral invertase activity at low temperatures, enabling sustained sucrose decomposition into glucose, which supports seed germination. This contrasts with cold-sensitive IVF521 seeds, which had higher nutrient content but were more inhibited by low temperatures.

These findings highlight the physiological mechanisms behind melon seed germination at low temperatures, suggesting that soaking seeds with glucose can improve germination rates, potentially enhancing melon production in colder climates.

Seed germination is a crucial phase in the morphogenesis of spermatophyte and an essential trait in crop production. The primary nutrients, including sugars, fats, and proteins, are vital energy sources for germination.

Current research highlights the significant role of sugars, especially glucose, in providing energy during germination. During the germination stage, sucrose is degraded into glucose by acidic and neutral convertases, providing energy for seed germination. Melons are widely cultivated vegetable crops in winter, spring, and autumn. However, low temperatures inhibit melon seed germination, affecting crop yields.

The new study, published in *Vegetable Research* on 2 July 2024, explores sugar metabolism during melon seed germination at low temperatures and assesses the impact of exogenous sucrose and glucose on improving germination rates.

In the study, the germination rates of two melon varieties, IVF521 (cold sensitive) and THY (cold tolerant), were analyzed under normal and low-

temperature conditions. Under normal conditions, IVF521 seeds showed a significantly higher germination rate at 24 hours compared to THY seeds, but no difference at 36 hours. At low temperatures, THY seeds began germinating at 84 hours, reaching 52% by 108 hours, while IVF521 seeds did not germinate.

Sugar metabolism studies revealed that IVF521 seeds had higher starch and soluble sugar contents than THY seeds. Starch content decreased in both varieties during germination, but under low temperatures, THY seeds maintained higher soluble sugar levels. Neutral invertase (NI) activity was higher in THY seeds early in germination under both conditions, while acid invertase (AI) activity showed no significant difference.

Gene expression analysis indicated higher CmNIs gene expression in THY seeds under normal and low temperatures. Soaking seeds in exogenous glucose improved germination rates in THY seeds under low temperatures, while sucrose soaking inhibited it. Additionally, ABA levels were higher and GA levels lower in IVF521 seeds under low temperatures, and ABA/GAs are significantly higher than THY.

According to the study's lead researcher, Hongyan Qi, "Overall, sucrose catabolism may play key roles in melon seed germination under low temperature."

The research found that THY melon seeds exhibit higher cold tolerance than IVF521 seeds, with better sucrose to glucose conversion under low temperatures due to sustained neutral invertase activity. This conversion supports seed germination, and soaking seeds in exogenous glucose improves germination rates in cold conditions.

Future research should explore the molecular mechanisms regulating sucrose metabolism and the role of glucose in seed germination, aiding

melon production in cooler climates.

More information: Tao Liu et al, Sucrose catabolism play vital roles in seed germination of melon at low temperature, *Vegetable Research* (2024). DOI: 10.48130/vegres-0024-0020

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