

Exploring the Mechanism of Soybean Oil Deposition and Increasing Soybean Oil Content Through Genetic Engineering

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Project Description

The rising cost of petroleum and vegetable oils has generated high interest in developing soybean with greater oil content. This research addresses that issue.

Specific Objectives

- Objective 1. Testing the ability of GmFUS3 to induce oil biosynthetic genes.
- Objective 2. Increasing soybean oil content by modification of GmFUS3 expression in transgenic soybean.

Procedure for Objective 1

Arabidopsis FUS3 induces oil biosynthetic genes within hours when ectopically expressed in seedlings. To test whether GmFUS3 can induce oil biosynthetic genes rapidly and ectopically, the researchers will transiently express GmFUS3 in soybean protoplasts or introduce a dexamethason inducible GmFUS3 in soybean hairy roots. The response of oil biosynthetic genes will be measured afterwards.

Procedure for Objective 2

Perturbation of FUS3 expression in Arabidopsis seeds indicates that the level and the duration of FUS3 expression significantly affect oil content. Therefore, transgenic soybean will be generated in which the promoter of lectin drives a GmFUS3 transgene. The transgenic seeds are predicted to express GmFUS3 at an elevated level and therefore accumulate a higher percentage of oil.

Impact

This research will provide insights into the molecular mechanisms underlying oil deposition in soybean and lead to improvement of soybean seed oil content through elevation of GmFUS3 expression in transgenic soybean. Because GmFUS3 is likely a developmental factor that coordinates the whole pathway of oil deposition with other processes, we anticipate that improving soybean oil through modification of this single key factor has a high chance of success. If GmFUS3 stimulates soybean oil successfully, we will contact commercial and public breeders to introduce this expression cassette into commercial varieties.