ABSTRACT

Unique proteases secreted by pathogenic organisms have been identified to play important roles in these organisms’ pathogenesis. These proteases allow pathogenic microorganisms, re-appropriate host nutrients, and evade host immune systems. Among these peptidases, cysteine proteases have been identified as the most important players in the parasitic infection of plants. Cysteine protease inhibitors have been shown to be the most effective compounds produced by plants to help them prevent infection by pathogenic microorganisms (Wasilewski et al. 1996). Overexpression of soybean cysteine protease inhibitor 1 (GmCPI1) in Arabidopsis significantly enhances its resistance to pest infection (Luo et al. 2014). In this project, we are attempting to develop novel soybean cultivars that overexpress GmCPI1 by using the Agrobacterium-mediated plant transformation method. Such cultivars will potentially show increased resistance to pest infections and adapt favorably to other unfavorable conditions. This research may provide a promising strategy to enhance the pest resistance of other economically important plants and food crops, as well as to improve their performance under adverse conditions, resulting in increased crop yields.

BACKGROUND

Soy is currently recognized as one of the most important crops globally in terms of both economic value and nutrient content. Soybean crops have been shown to be more profitable than most other food crops, including corn. Furthermore, soybean has been identified to be an ideal source of protein, carbohydrates, oils, fibers, vitamins, and minerals, and is being used to address issues of malnutrition in many developing countries. However, soy is very susceptible to nematode infections and other adverse conditions such as drought and high salinity. Nematode infections, especially those of the soybean cyst nematode, have had a disastrous effect on soybean production in the U.S (Paul, 2006). Various studies have shown that high stress and long periods of drought significantly reduce yield of soybean crops (Lenssen, 2012 & Lindsey & Thomison, 2013). Here, we are developing a new soybean cultivar that has the ability to resist nematode infections and to thrive under unfavorable conditions through overexpression of the CPI1 gene.

RESEARCH METHOD

Agrobacterium-mediated plant transformation method was employed in this research project. Soybean William B2 cultivar was transformed with pHLe61 gene construct in Agrobacterium strain EHA105. The construct pHLe61 was engineered to contain the CPI1 gene under control of the 35S promoter, allowing for constitutive expression of CPI1 in transgenic plants. As shown in the map below, the hptII gene was also incorporated into the construct, permitting the straightforward selection of transformed plant cells with hygromycin B. The pHLe61 construct contains a kanamycin-resistance gene for Agrobacterium selection.

DISCUSSION

This project is still in progress. We have not yet regenerated a whole transgenic soybean plant exhibiting CPI1 overexpression. To date, we have transformed William B2 soybean explants. We are currently preparing to accelerate the transformation procedure, and have subcultured resulting explants to the point of shoot elongation medium. The results are very promising because all of our regenerated shoots are growing well in the selective media, tentatively signifying successful transformation and regeneration of transgenic plants.

REFERENCES


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