주제-04

Why pharmaceutical crops? Trends and Future prospects

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[Introduction]

Crops have provided abundant sources of natural products which have been developed as commercial products to be used for human and animal health. Pharmaceutical crops as those cultivated species can be divided into two aspects. One thing is a pharmaceutical crop as genetically modified (GM) or engineered crops to produce vaccines, antibodies, and other therapeutic proteins. The other is a class of pharma crops which is used to designate transgenic plants for the production of pharmaceutical active substances (e.g., antibiotics, diagnostic compounds, antibodies, vaccines, etc.) or industrially-useful biomolecules (e.g., biodegradable plastics, engine oils, food processing enzymes, etc.), rather than for the production of food.

[Methods and Results]

Resveratrol has been clinically shown to possess a large number of human health benefits. As a result, many attempts have been made to engineer resveratrol production in major cereal grains but have been largely unsuccessful. In this study, we report the creation of a transgenic rice plant that accumulates 1.9 μg resveratrol/g in its grain, interestingly, the consumption of the resveratrol-enriched rice (RR) significantly improved the blood lipid profiles and glucose levels in the animal experiments. As a result, our resveratrol-enriched rice could provide anti-metabolic syndrome activity of resveratrol through a synergistic interaction. Genetically engineered resveratrol-enriched rice (RR) reduced the levels of microphthalmia-associated transcription factor (MITF), and downregulated tyrosinase and tyrosinase-related protein (TRP-2) expression, leading to inhibit epidermal melanin production evaluated by western blot analysis. As a result, genetically engineered resveratrol-enriched rice (RR) showed to down-regulate skin melanogenesis. To be developed to increase the bioactivity of RR using calli from plants, RR was adopted for mass production using plant tissue culture technologies. Nanoparticles from Calli of Resveratrol-Enriched Rice showed the anti-melanogenic potentials against UVB-Induced Hyperpigmentation in Guinea Pig Skin. This study suggests that the resveratrol-enriched rice may be a promising candidate in regulating skin pigmentation with UVB exposure. Also, we investigated the efficacy of genetically modified normal edible rice (NR) that produces the anti-aging compound resveratrol (R) as a treatment for skin aging. This resveratrol-enriched rice (RR) overcomes the drawbacks of R and enhances its antiaging potential by controlling the above-mentioned three major pathways of skin aging. RR does not exhibit the toxicity as shown by R alone and promisingly downregulates the pathways underlying UVB-ROS-induced skin aging. These findings advocate the use of RR as a dermaceutical for antiaging purposes.

[Conclusion]

Our study suggests that the resveratrol-enriched rice may be a promising pharmaceutical crop candidate in regulating skin pigmentation, aging, and metabolic diseases. By adding such pharmaceutical crops in our daily food, development of diseases can be delayed or prevented making one‘s life more healthy and long. Therefore, there is a need to develop pharmaceutical crops concentrating on the sustainable production and boosting of target chemical compound (s) from the plants through extensive combined efforts of scientists and researchers belonging to different fields. Future advances on pharmaceuticals crops should be made emphasizing approaches to improve the production and derivitization of therapeutically active molecules and their precursors in a sustainable production system, including the development of high production cultivars and cultivation strategies and processes for the high production of desired compounds.

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