

Series - 100
Date and Time - April 03, 2025 (3:30 PM IST / 12:00 IST)
Venue - Zoom
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Extending Saffron Cultivation: Challenges and Prospects

In India commercial cultivation of saffron (*Crocus sativus* L.) is traditionally limited to specific niches in Kashmir area of Jammu & Kashmir state. The issue of concern is that the demand of saffron is increasing but its production is decreasing day by day. Expanding saffron cultivation beyond traditional areas offers a promising prospect but it has inherent challenges including the requirement for specific agroclimatic conditions, limited availability of healthy corms for large-scale plantations, lack of region-specific agronomic practices, and susceptibility to diseases, pests, and rodent infestations. However, technological interventions can play a crucial role in addressing these limitations. The development of cost-effective tissue culture protocols for large-scale production of healthy and robust micro-corms, alongside optimized agro-technologies and integrated pest and disease management strategies, can enhance productivity. Furthermore, advancements in indoor cultivation systems and tailored post-harvest technologies can improve yield quality and economic returns. An interdisciplinary approach incorporating niche modeling, omics-based insights, artificial intelligence (AI)-driven predictive tools, and eco-friendly bioinsecticides can provide innovative solutions for sustainable saffron cultivation. By leveraging these advancements, it is possible to revitalize saffron production and expand its cultivation into non-traditional regions, ensuring long-term sustainability and profitability.



AIST-INDIA DAILAB CAFE - Series 100

SAFFRON

April 3, 2025 (Thursday)
(12:00 - 13:40 h IST; 15:30 - 17:10 h JST)



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Date and Time - April 03, 2025 (3:30 PM IST / 12:00 IST)
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Understanding the biology of Saffron to strategize its production in a changing environment

The dried stigmas of *Crocus sativus* constitute the Saffron of commerce. Saffron is considered to be the most expensive spice in the world. It has been used from ancient times as a spice in food, as a dye, in perfumes and cosmetics preparation and for medicinal purposes. It is mainly cultivated in Iran, India, Greece and Spain; Iran being the largest producer. In India, Saffron is predominantly cultivated in Kashmir and Kishtwar regions of Union Territory of Jammu and Kashmir. *C. sativus* is a triploid, sterile geophyte and is propagated vegetatively by means of corms. The autopolyploid nature of this plant renders chances of crop improvement through conventional means, very difficult. Saffron is a rich source of apocarotenoids which have immense therapeutic value. Our studies during the last decade have not only helped in unraveling the mechanism of synthesis of apocarotenoids but are also proving useful in devising strategies for their enhanced production. In Kashmir valley, consistent decline in saffron production has been observed over the years. The reduction has been ascribed to changing environmental conditions. There are several studies wherein effect of various abiotic and biotic stresses on saffron production has been evaluated. However, to sustain the production of saffron particularly in a changing climate, understanding the biology of saffron production is imperative. The present paper shall give an overview of the various developments in Saffron biology and suggest possible strategies for improving the quality and production of this high value crop.

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Date and Time - April 03, 2025 (3:30 PM IST / 12:00 IST)
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Saffron, a Golden herb with multiple health benefits: Insight into its potential therapeutic benefits in neurological ailments

Regardless of the nationality or age, there is a global surge in patients suffering from neuropsychiatric and neurodegenerative disorder like Alzheimer's, and major depressive disorder (MDD) or depression for various reasons. The increased risk of chronic neurological disease has substantial healthcare and financial burden. MDD is the third highest cause of disability in the world and is projected to be placed as the leading cause of disability by 2030 by WHO. There is an unmet need to find out alternate natural sources that can improve the quality of life of depressed patients. From last several years, Saffron has been positively studied for its role as neuro-protective and antidepressant properties in laboratory as well as in clinical trials. However, many of these studies have been conducted on saffron without any chemical characterization or chemical composition based on the individual markers. So, the saffron used in these studies may vary in the chemical composition and this may affect the outcome of the treatment. Our lab and colleagues have recently shown strong neuro-protective effect of Saffron and its potential therapeutic use in Alzheimer's and in the treatment of MDD by using chemically standardized botanical formulations and associated potent compounds using in vitro mice experiments models. Our studies established proof of concept of the neuro-protective effects of saffron by proving insight into its molecular mechanism associated with its possible therapeutic benefit for neurological ailments.

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Generation of genome edited "SMART SAFFRON" with enhanced quality and stress tolerance

Crocus sativus is an economically and pharmaceutically important crop. The dried stigmas of *Crocus* flowers constitute saffron, the only commercial source of apocarotenoids like crocin, picrocrocin, and safranal. These compounds are responsible for the organoleptic properties of saffron and have been used in the treatment of diseases like cancers, depression, Alzheimer's, etc. Genetic improvement of saffron through breeding is not possible because of its sterile nature. Metabolic engineering provides an alternative approach for enhancing apocarotenoid content. The *Crocus* apocarotenoids are formed by cleavage of β -branch carotenoids. Cyclization of lycopene is the key branch point in the carotenoid/apocarotenoid pathway. While lycopene β -cyclase converts lycopene into β -carotene, the combined action of β and ϵ -cyclases forms α -carotene. Thus regulating lycopene cyclizations can adjust the flow of substrates between the two branches and help in modulating apocarotenoid biosynthesis. Two approaches can be used for enhancing β -branch carotenoids and apocarotenoids. One of the approaches involves reducing expression of lycopene ϵ -cyclase, which would lead to conversion of more lycopene into β -carotene which can be cleaved further into different apocarotenoids. Another approach is altering structure of lycopene β -cyclase in such a way that it sterically hinders its binding of β -carotene but does not affect lycopene binding thereby diverting metabolic flux towards β -carotene formation. Both the approaches reduce α -branch flux and enhance β -branch carotenoids. The β -branch carotenoids in turn act as substrates for the formation of various apocarotenoids. This branch also leads to abietic acid formation which is involved in stress signalling and leads to stress tolerance. These approaches can thus lead to better quality and stress tolerant SMART SAFFRON.

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Date and Time - April 03, 2025 (3:30 PM IST / 12:00 IST)
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Saffron cultivation in Northeast India - A new frontier

Saffron (*Crocus sativus* L.) is one of the world's most expensive and sought-after spices, known for its distinct aroma, color, and medicinal properties. It is widely used in culinary, pharmaceutical, and cosmetic industries. Loaded with powerful medicinal benefits, including anti-inflammatory, antioxidant, and antidepressant properties, making it valuable in modern pharmaceuticals. It is a high-value crop with immense global demand. India's primary saffron production has traditionally been centered in Kashmir region only, but challenges such as climate change, declining yields, and increasing dependency on imports have necessitated the search for alternative cultivation sites to meet the ever-increasing demand. To address this, NECTAR has been spearheading efforts to introduce saffron cultivation to the hills of Northeast India, which has conducive climate similar to Kashmir. Initially launched as a pilot project, the initiative taken in collaboration with State & Central establishments, NGOs & farmers has already yielded significant results across Sikkim, Arunachal Pradesh, and Meghalaya. Building on this success, NECTAR plans to expand its efforts to other hilly regions, in the States of Nagaland and Manipur, bringing more land under cultivation and increasing farmer participation. With a vision to establish the Northeast as India's next "Saffron Hub" after Pamposh in Jammu & Kashmir, NECTAR is aiming to unlock new opportunities for farmers, enhancing the region's agricultural potential, and position saffron cultivation as a thriving industry in Northeast India.



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