



Saffron Cultivation in Northeast India: Past, Present and Future Prospective- A Review

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Abstract

Saffron is the dried stigmas of *Crocus sativus* L. It is an interesting minor spice which is also known as red gold. It is cultivated only in a few countries around the world. In this review article, the following aspects of saffron have been covered: cultivation, producing states, uses, and scope of extending saffron cultivation in some parts of the north-eastern state. As we all know that saffron is the most expensive spice and India is limited to a few areas in Jammu and Kashmir to date but looking forward to its importance and demand, its cultivation is now being extended toward the north-eastern state.

Introduction

Saffron (*Crocus sativus* L.) is one of the ancient spices known to man and its royal position among all other spices. It is believed that saffron was first introduced to India by ancient Persians (Dalby 2000). A Buddhist legend dates saffron plantations around the 5th century BC (Dalby, 2000). Saffron represents the rich cultural heritage of Kashmir as it is associated with traditional Kashmiri cuisine. It is as precious as gold not only because of its low production and high consumer demand but also because of its wide range of usage in medicinal and religious value. It **revivifies health** and is equally used in **cosmetics** and for medicinal purposes. Saffron is also appreciated for its supplementing coloring properties in foods. Other qualities of spice such as flavor and aroma have been enhanced as in recent era consumer is becoming more and more familiar with the spice and begin to demand a superior quality of saffron. It is an eminent fact that saffron is the only spice able to confer the flavor, color, and aroma in food. Even at 1 ppm concentration, saffron gives distinct yellow tinge color in food. It has 0.5 to 1.0 percent of essential oil. It contains more than 150 volatile and aroma-yielding



compounds mainly terpenes, terpene alcohol, and their esters. Picrocrocin and safranal chemicals are responsible for their bitter taste and iodoform or hay-like fragrance. It assists to improve memory and learning skills and increases blood flow in the retina and choroid (Srivastava, *et al.* 2010). Escribano *et al.* (1996) assured that the extracts of saffron have been found to restrain the cell growth of human tumor cells. It has water-solubility and a high inhibitory growth effect, crocin is the more promising saffron compound to be assayed as a cancer therapeutic agent.

The saffron plant belongs to the Iridaceae family. It is a shorter perennial herb with a globular underground corm and six or more radial, narrow and linear leaves. The pungent smelling bluish-violet flowers are born singly and their strikingly dark red or orange tripartite funnel-shaped stigmas are used as the spice. From September when the day temperature reaches around 25°C and night temperature to around 15°C saffron begins its Commencement stage. Corms begin to sprout with floral and vegetative structures growing in length inside the cataphylls. Each corm produces 1-4 sprouts with some of them producing flowers. During October, sprouts are visible above the ground and the sub-soil stem is short. Very fine roots also start to protrude in the form of the crown from the third basal internodes, possibly reaching a length of 5 cm (Dhar and Mir, 1997; Botella *et al.*,2002).

Uses of Saffron

In ancient India, royal people used saffron to show their monarchs. They used to fascinate with saffron perfume on the royal guests or used as an air freshener, they also used to dye their robes and even used it just as decor. Saffron is also the main part of traditional Indian celebrations like wedding ceremonies where they use it for decoration, as a saffron paste for the bride and guests, and in food and drinks. It is also used in performing some rituals, the Buddhist monks have accepted saffron color as the main part of their livelihood. It is also used in herbal formulations, Ayurvedic medicine, and home remedies. Saffron is used to treat several diseases like a tonic, immunostimulator, anti-poisonous, aphrodisiac, cardiac tonic, livotonic, nervine tonic, carminative, diaphoretic, diuretic, emmenagogue, lactagogue, febrifuge, stimulant, sedative, relaxant, anti-stress and anti-anxiety (Ríos, Recio, *et al.*, 1996), saffron is also used for general debility, alcoholism, inflammation, diabetes, children's disorders of unknown etiology, insect bites and stings, edema, acne, skin diseases, and wounds. It can also brighten up the body. It can also cure asthma, cough, sore throat and cold, enlarged liver, splenic disorders, vomiting and dyspepsia, prolapse of anus, infection of urinary bladder and kidneys, menstrual irregularity, dysmennhorea, impotency. It is also an activator/generator of sperms.



Area and Production

Iran is the world's leading producer of saffron with 430 tons of production in 2019. Whereas, India is the second-largest saffron producer with only 22 tons of production (Shahbandeh, 2020). The major saffron-producing countries are Iran, India, Spain, and Greece, where Iran occupies the maximum area and contributes about 88% of the world's saffron production. In India, Jammu and Kashmir is the only state where saffron is produced. The main merchant to saffron production is **the Pampore region which is** commonly known as the **Saffron bowl**. Taking into consideration that India produces a very limited amount of saffron as compared to its increasing value and demand we have to give more focus on its production or we can say that there is a need to increase production by bringing more area under cultivation and double the average productivity by adopting intensive production system, efficient processing and marketing to make it globally competitive and remunerative to growers. According to Roy and Marar (2020) some efforts to increase its production is already being in full swing viz., the Ministry of Science and Technology, through the Department of Science and Technology (DST), is now looking at extending its cultivation to some states in the Northeast (Sikkim now, and later to Meghalaya and Arunachal Pradesh). Where, the pilot project in Yangyang village of south Sikkim has already initialized its production. There is an enormous similarity of climate and geographical conditions between Kashmir and a few regions of the Northeast. **These types of** initiatives such as the National Saffron Mission and the extension of saffron production to the North-East will undoubtedly help to meet the annual demand of India, also help in reducing imports, and will also diversify agriculture and provide new opportunities to the farmers in the North-East.

Soil and climate

Saffron can be grown best in a warm subtropical climate and can be grown at 2000 meters of mean sea level. An optimum period of 1200 hours of sunlight is desirable. Low temperature together with high relative humidity in the flowering season affects the flowering and spring rain improves the production of new corms. Saffron grows well in acidic to neutral, gravelly, loamy, and sandy soil. It thrives best in **calcareous** (soil that has **calcium carbonate** in abundance), **humus-rich, and well-drained soil with a pH between 6 and 8**. It also requires adequate rainfall that is **1000-1500 mm per annum**. Heavy rains at bloom time or early autumnal frost are not suitable.



Propagation

Saffron is commercially propagated through corms. In India, saffron Corms (seeds) are cultivated during June and July and at some places in August and September. The bulb continues the cycle for 10 to 15 years. Initially, the growth is rather sluggish for the first two years and reaches a peak by the third year and after six-year, the bulb is uprooted for subsequent plating, leaving the ground fallow for nearly 4 to 5 years.

Harvesting and yield

Flowering begins in the second fortnight of October and lasts up to the first week of November. Each flush lasts for 2-6 days. The vegetative phase begins with the appearance of young leaves emerging from the corms in November, immediately after flowering is over. The young sprouts are being transformed into daughter corms start developing due to photosynthesis besides contribution from the mother corm, which becomes wrinkled and leaves space for new corms (Ruceda, 2003). All sprouts produce leaves growing to a height of 40-60 cm till April. Good foliage is the success of future crops as it leads to good corm growth and multiplication. By the first fortnight of April, contractile roots look like a dried-up adjunct and fall off the daughter corms (Oromi, 1992). Leaves also commence changing color. Corms enter a dormant stage from May. Although an important ontogenic process leading to differentiation of floral and vegetative buds takes place (Koul and Farooq, 1984), nothing is observed externally. During this period growers prepare the corms for fresh plantation after digging followed by sorting and cleaning to rejuvenate their saffron crop.

By the end of October, the saffron usually flowers. At this time pickers complete the picking of flowers early in the morning before the sun gets hot or before the flowers wilt on their stem. Later the golden-colored styles from each of the flowers are broken off just below the stigma are dried in the sun. The drying percentage is about 20%. This finest purest and most expensive saffron is known as shahi saffron in trades and lache saffron the inferior grade about 1.5 million flowers on drying gives one kg of this spice. On average, from one hectare about 160 kg of fresh i.e., about 5 kg of dried saffron can be obtained.

Future Propel

Their several factors that affect the productivity of saffron in Kashmir and due to its high demand and low productivity we need to focus on the technological intervention toward the existence and extended



area as well. Firstly, the demarcation of saffron areas and ceiling on sale of land, traditional expansion of the cultivated area to be replaced with intensive production technology is to be done. Government should take incentives to provide infrastructure and input supply with usefulness low volume and high cost with a remunerative price. Motivate rural youth and women for saffron production. Development of scientific production practices and introduction of developmental scheme on mission mode may be useful. As there is a lack of irrigation facilities adoption of rainwater harvesting and moisture conservation practices and development of irrigation schemes and application of drip and irrigation systems is beneficial. Government or cooperative should control quality standard, brand name, international standard grading, processing efficient market, and packaging. Moreover, the isolation and development of high-yielding clones of saffron and large-scale production of quality planting material accompanied by healthy intensive corm production and corm rot management practices may achieve higher production and productivity. In addition to that exploitation of existing clonal variability and introduction of elite material and cytological studies of saffron and development of trisomic line in saffron is helpful. Induction of genetic variability through mutation breeding, somaclonal variation, and polyploidy can be espoused. Development of breeding lines through the production of double haploid which can be used for mapping population for a further breeding program. Development of technologies for in-vitro production of saffron stigma is also possible. Molecular markers can also be used for association mapping of important genetic traits in saffron. Micro-propagation of elite clones is also one of the options for gene transfer techniques. Organic and protected cultivation of saffron is also helpful in the production of superior quality saffron. Development of disease diagnostic and viral indexing of mother clones may be done. Training and exposure of scientific personnel in the latest advancement in the field of saffron improvement and production under human recourse and development is beneficial as well.

Conclusion

As we know saffron production is only limited to Kashmir which is not enough to fulfill the consumer demand and also for export to other countries. Keeping this in view there is a need to extend the production of saffron to another state where the saffron can get the favorable agro-climatic condition to get successful production. Moreover, after reviewing many papers we can suggest that some part of the North East state of India is favorable for growing saffron with the same quality and quantity.



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