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Cultivation Practices and Waning Production of Saffron in Jammu & Kashmir

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Abstract

This study aims at studying the cultivating practices, different factors which are responsible for declining the production of Saffron (Crocus sativus) in Jammu & Kashmir. Kashmir is famous for the cultivation of quality Saffron from about 750 A.D and is one of the major Saffron producing areas of the world. Unfortunately, from last couple of decades the production of Saffron in Kashmir has been severely affected and has shown a declining trend. Here, the study is about discussing the problems like non-availability of quality planting material, absence of irrigation facilities, lack of disease control pests, non-availability of suitable markets and reasonable profits to cultivators. Here, it is also been discussed that precipitation in valley has an impact on the productivity and yield of Saffron produce.

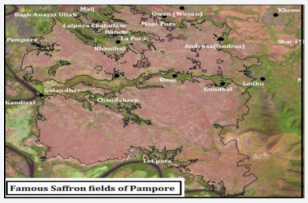
Keywords: Cultivation; Saffron; Irrigation facilities; Glycosylated apocarotenoids

Introduction

Saffron (*Crocus sativus*), originating from the Arabic word 'Zafaran' which comes from the Persian word 'Zarparan' meaning "flowers of golden petals". Its secrets stem from the dried red stigmas which accumulate large amounts of three glycosylated apocarotenoids, namely crocin, picro crocin and safranal, which, among the more than 150 volatile and aroma yielding compounds, contribute to the colour, bitter flavour and aroma so typical of saffron. The spice is used as flavouring and colouring agent in food and is a vital part of the dye, perfumery and flavouring industries. Saffron also has countless biological properties like anticancer, antimutagenic and antioxidant. As a result, saffron fetches the highest price as a spice in the world, depending upon the country of its production. Its production is typically favoured in countries where labour is cheap, such as Iran and Azerbaijan, but is also produced in countries like Greece, Spain, Argentina or the USA and newer areas being brought under its cultivation, viz. China and Japan [1]. Iran, Spain and Kashmir are the major saffron producing regions of the world.

Botanical Classification

Saffron is classified into Domain Eukarya, Kingdom Plantae, Phylum Magnoliophyta (Angiosperm), Class Liliopsida (Monocot), Order Asparagales, Family Iridaceae, Genus Crocus and Species *C. sativus*. Crocus consists of 9 species, *Crocus cartwrightianus* and its derivatives, *C. sativus*, *moabiticus*, *oreocreticus*, *pallasii*, *thomasii*, *badriaticus*, *asumaniae* and *mathewii*. Saffron with sub-hys teranthous behavior is a perennial herbaceous plant attaining a height of 25 to 40cm. Corm, foliar structure and floral organs constitute main parts of saffron plants. Corms consist of nodes and are internally made up of starch-containing parenchyma cells. These corms are 3 to 5cm in diameter and are covered by tunics [2] (Table 1 & Figure 1).



Source: Farooq. M et al., (2016) J & K Envis Newsletter.

Figure 1: Famous saffron fields of Pampore.

Table 1: Botanical Classification.

Domain	Eukarya
Kingdom	Plantae
Phylum	Magnoliophyta (Angiosperm)
Class	Liliopsida (Monocot)
Order	Asparagales
Family	Iridaceae
Genus	Crocus
Species	Sativus

Crown in the Karewas of Kashmir and Bhaderwah (Jammu Division), it is an important cash crop providing employment to about 5 per cent of the total rural workforce in Valley of Kashmir [3]. This "golden" spice is known as 'Kum Kum' and 'Kesar' in Sanskrit, and 'Koung' in Kashmiri language. It is being said that Saffron in Valley originated from the Takshak spring located in Zewan village, almost 11km. away from Srinagar and then from there it had spread to its adjoining areas. Kashmir is the second largest contributor of saffron to the global market [2]. Kashmir's Tehsil of Pampore is the center of saffron cultivation in Valley and is located at 34° 1' N, 74° 56' E, with an average alleviation of 1574mtrs (AMSL). Khunmoh, Zewan, Balhama, Sampora, Ladhoo, Chandhara, Woyan, Khrew, Shar Konibal, Dussu, Namblabal, Kadlabal, Hatiwara, Samboora and Lethpora are prominent saffron villages of Tehsil Pampore where this cultivation is being practiced. Saffron is being grown in the Pampore Karewa of Kashmir from very ancient times.

It is not known when the cultivation of saffron was started in Kashmir, but Saffron is being reported to have been an important ingredient of the prescriptions of Veghbhatta and Sustratta who practiced medicine about 500 B.C. Its cultivation was in vogue Pampore (Padam-pure) even when Kalidas wrote his literary masterpiece Shakuntala and Meghdoot. Kalhan, the well-known historian of Kashmir started in Rajterangani that saffron was under cultivation in Kashmir even before the regime of Lalitadatiya during 725 A.D. Abul Fazal in his Ain-in-Akbari says that the saffron fields in blossom afford a prospect that would enchant those who were most difficult to please. Despite all these stories and beliefs, it is not clear when the saffron cultivation was started in the Valley of Kashmir [3].

Cultivation Practices of Saffron in Jammu & Kashmir

Saffron in the Valley is being cultivated in the Karewas of Pampore and Bhaderwah district of Jammu and Kashmir & the places where we can find the loamy soils which suits the growth of Saffron. Saffron is a perennial crop, lasting for about 10-15 years after sowing [3]. A new cultivator who has a plan to go for Saffron cultivation starts preparing the land one year before the sowing of corms (seeds of saffron). This process needs a lot of labour force and financial support, as the farmer has to prepare his land for good growth of Saffron. Farmers optioned that, before going for Saffron cultivation, the land should be cultivated by oilseeds, in a year before sowing Saffron corms. As it is good for growth of Saffron corms in the succeeding year.

When the spring season (South) in the Valley starts, the concrete preparations for the Saffron cultivation also gets started, by ploughing the land in the starting month of spring season (March or April). Moreover, it also depends upon the weather conditions, if rains or more then the ploughing process is delayed for sometimes as more moisture soils are not good for corms as it can effect the health of corms and the land will not be ploughed efficiently as needed for good cultivation. After ploughing, a good quantity of green manure (farmyard manure) is applied (30-40tonnes per hectare). If the weather conditions are good, that is, field has not plenty of moisture, then the field is ploughed continuously for about 20 days to get the fine tilth (fine soil got from continuous tillage). The farmers are continuously engaged in their fields to get the better results. From the field observations, the farmers believe that at the end of month of June, it is necessary to again plough the land, so that any unwanted plants (weeds) are removed from the fields. Continuously, after 15 to 20 days the field is repeatedly ploughed again upto the time of sowing of corms, i.e., nearly mid of the August, as experienced farmers believe that the good time for sowing of corms is after first week of August upto first week of September (Figure 2).

Figure 2: Sowing of Saffron Corms in Fields of Pampore, Pulwama.

Figure 3: Harvesting/Flower Plucking of Saffron in Pampore, Pulwama.

Late sowing as well as early sowing of seeds is not recommended in the Saffron cultivation. The seeds are generally being sown at the depth of about 8cm to 11cm (4 to 6 inches), however, there is not any strict rule for the planting of seed corms. A distance of about 7cm to 16cm is in between of corms is said to be good for the better yield of crop as when the plant grows it produces a number of baby plants as its outgrowth, so farmer has to left ample space for these outgrowths of the parent plant. The sowing is done by two methods, either by ploughing method or by zoon method. Plough method is practiced by the large number of farmers as it is easy and less expensive method because labour force needed in sowing gets expensive. The corms are sown in rows, and the field is laid out in square beds by providing the drainage channels outside the beds to drain out the excess amount of water after natural showers (rains) or artificial sprinkler or irrigation, so that corms may not get damaged. The bed of Saffron seeds is called as "Poshaware" in Kashmiri. Then after the successful sowing of corms, the field needs time to time water showers, till the time of flowering, as the flowering will do start in the very first year, if properly managed and practiced (Figure 3).

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After the plucking of flowers in very first year of cultivation, the Saffron fields are being left untouched upto the advent of new spring (March/April). The fields are again being prepared for yielding of crop. This time only hoeing is done, i.e., operation of providing aeration to the soil, this is considered very useful for the development of corms. Followed by second hoeing in the mid of August, considered to be very much important for good yield of Saffron. The last hoeing is done in September, about 30 to 35 days before the flowering of crop and the repairing of Saffron beds and drainage channels is also finalized. These operations of hoeings are very much useful for the growth and health of corms and for the good yield of Saffron as it provides the aeration to the soil and corms and through which the delicate stems of flowers emerge on the surface.

It may be noted that the corms may last upto about 7 to 8 years after being sown. However, the lifespan of corms depends mostly upon the type of soil and presence of moisture content in the soil. Adequate moisture content may result in the long lasting of corms, as it has been experienced that the corms may have a lifespan of about 13 to 15 years in certain places. Here, it gives us the intension that for the cultivation of Saffron crop particular soil and favourable moisture content in soil is needed.

The flower picking or harvesting season of Saffron crop is a very short season, as it starts nearly in first week of November upto 20th November. At the time of plucking of flowers an optimum number of labour force is required, farmers also engage their family members in this work and also it needs the skillful labour to pluck the flower from the stem of plant which is done by the fingernails. Farmers also engage their children in this work by providing them knowledge about plucking as they have soft hands. A person who is engaged in the plucking of flowers has to take care of the flowers and move through drainage channels and by stretching their hands and by bending for collecting the flowers so that the blooming flowers do not get blemished. The plucking time starts after the dew drops have disappeared. A good flower collector can collect as much as 3000 flowers a day and these flowers are collected in special kind of baskets made of willow. The plucking is done on alternate days or after every 2 days, depending upon the production and yield.

Production and Distribution of Saffron

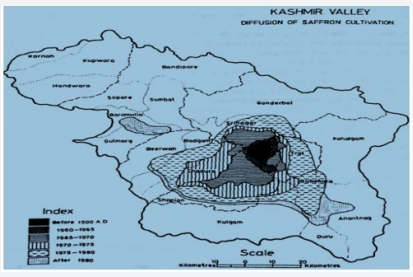

Figure 4: Saffron in Jammu and Kashmir is diffused to some parts of State.

As we know that the Kashmiri Saffron is famous for its quality. The production of Saffron had been witnessed from very ancient times. The cultivation of Saffron is confined to a certain-places in the Valley. Pampore area of Pulwama district is considered as the center for its production, it cultivation is distributed to the adjoining areas of Pampore. Its cultivation was diffused to other areas outside Pampore in 1960's. In 2015, the area under Saffron crop was 3674 hectares and production was 9.6 million tonnes with the yield rate of 2.61kg/ha. (Jammu and Kashmir, Department of Agriculture, 2015) (Table 2 & Figure 4).

Table 2: Yearly Trends of Area, Production and Productivity of Saffron in Jammu and Kashmir.

Year	Area (Ha.)	Production (MTs)	Yield Rate (KG/ha.)
1997	5707	15.85	2.8
1998	4161	12.88	3.13
2000	2880	7.65	2.27
2001	2742	3.59	1.88
2002	3075	0.3	1.57
2003	2989	6.5	2.96
2004	2928	5.15	1.66
2005	2436	6.86	3.75
2006	3110	7.04	1.63
2007	3130	6.5	2.25
2008	3010	8.2	2.15
2008	3000	7.7	2.5
2009	3280	9.46	2.34
2010	3785	9.55	2.5
2011	3790	8.85	3.52
2012	3674	10	2.72
2013	3674	11.5	3.13
2014	3674	15	4.08
2015	3674	9.6	2.61

Source: Jammu and Kashmir Agriculture Department.

The above map shows that the Saffron in Jammu and Kashmir is diffused to some parts of State and when it had been started cultivating in these areas. Pampore area of District Pulwama has highest area under saffron and was the center of Saffron cultivation before 1500 A.D, followed by the areas of adjoining to Pampore after 1960's and at present it is being cultivated mainly in districts of Srinagar, Shopian, Anantnag and Budgam.

Waning of Saffron Production in Jammu and Kashmir

The area under Saffron crop in 1997 was 5707 hectares, production was 15.85 million tonnes and yield per hectare was about 2.8 kilograms and in 2015 the area under thus crop is just 3674 hectares, production has gone down to just 9.6 million tonnes and yield per hectare is as low as 2.61 kilograms, according to the data

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sources of Department of Agriculture, state of Jammu and Kashmir (Table 2). From the last couple of decades, we have witnessed a declining trend of Saffron production in the valley of Jammu and Kashmir as the data also reveals. The land under this famous cash crop of state has also shown a waning trend from the past years and the farmers are also now moving out of this cultivation. There are a number of reasons due to which production has shown a waning trend and the people who were engaged in the cultivation of this 'Golden Spice' are now not showing much of the interest in it. Some of the reasons behind this waning trend of Saffron in State of Jammu and Kashmir are given under:

Non-availability of good quality corms

The Saffron plant being triploid, fails to set seeds, and thus is propagated vegetatively through corms. Good quality and disease-free corms result in the good production of crop. A flowering corm contains 10-12 buds and each sprouting bud produces a cormel. Pandy et. al. [4] found larger corms produced more flowers and leaves. In Kashmir the corm seeds which are sown mostly in the fields are of about 2cm in diameter and 10g in weight. Here the farmers have non-availability of sound quality corms that is why they go for the low standard corms. Due to which the yield from these corms is low. It is also seen that if the good quality corms are available then they have high rates which a small farmer is not able to buy them. Government also provided the facilities to farmers to buy the corms at subsided rates, but the majority was much away from getting these benefits. Small corms do not have the potential to produce flowers in the first year [5], while as corms larger than 2.5cm in diameter only flower in the very first year [6]. Therefore, quality of the corms matters a lot in the production of Saffron crop. These corms have very high rates and government should try to make available good quality corms for these farmers at reasonable rates.

Lack of adequate irrigation facilities

From the very beginning, the Saffron fields were completely dependent on the rain and if there were no rain there was no production, that rains have direct relationship with the production of Saffron. Saffron crop needs the time to time showers and mostly the crop has need of water during its initial stages. Srivastava [7] reported that areas receiving 100-150cm of well distributed rainfall with snow in the winters are best suited for Saffron cultivation, and rains in September are essential for meeting the water requirements of corms for good flower yields. The State of Jammu and Kashmir faced an acute drought in 1999-2003 [8], and during this period productivity was reduced from 3.12kg/ha to 1.57kg/ha. However, in 2004-05, favourable rainfall improved the productivity also to 2.96 kg/ha.

So, for getting better productivity there is a need of providing artificial irrigation to the fields but, at ground levels it also seems that there is no facility to the farmer to provide their fields an adequate irrigation. Government under the National Saffron Mission, set up in 2010, to rejuvenate Saffron cultivation in Jammu and Kashmir, assured the farmers to provide the irrigation facility at their fields but a little of their intension was seen. Therefore, cultivators were left with no choice to switch to high-density crops such as apple, walnut and garlic, etc. While most farmers complained of inaction, some were reportedly obstructive in the laying of pipelines, fearing land damage. Tired of waiting for the sprinklers to become functional, a handful of enterprising individuals even set up their own irrigation facilities.

Lack of technology

The world is fastly going industrialized and use of technology is seen in every sector. Here the Saffron is being grown by indigenous technique. To improve the yield and productivity this sector also need the latest technology for improvement. We can see the countries were Saffron is being cultivated do use of technological tools in sowing, harvesting and in post harvesting process. Here, the farmers are lacking the new technologies and machinery to get benefitted from them. The outdated technology is also considered as the cause of fertility loss of soil and in decrease in production. There is also the need of educating and awaring the farmers about the post harvesting methods and use of techniques for storing of the crop. There is a high percentage of Crocin (14-17%) in the fresh stigmas of Kashmiri Saffron [9]. The Crocin content present in stigmas of Kashmiri Saffron is found to be decreased (9-11.5%) after harvesting and storing process because of unawareness about the postharvest handling, right time and right stage of separating the stigma from style, popularizing the use of solar dryers, branding, etc. Kashmir is lacking in terms of production, with an average yield of 2.23kg/ha as compared to 8.24kg/ha in Spain and 10. 0kg/ha in Italy [10]. So, it is obvious to add it here that with the help of modern techno tools the production can be increased, and the farmer will get benefit from it and will make cultivation economically viable and ecologically sustainable.

Absence of good fertilizers and disease control pests

The intensive cultivation and monoculture of Saffron in saffron-growing areas of Kashmir valley, together with the continual use of diseased material has resulted in the frequent occurrence of corm rot diseases caused by pathogens such as, *Fusarium moniliforme* var. intermedium, a non-sporulating basidiomycetous fungus [11], *Macrophominia phaseolina* [12], *Fusarium oxysporum*, *F. solani*, *Fusarium moniliforme* [13]. Out of these diseases, corm rot of Saffron caused by *F. oxysporum* and *F. solani* is considered to be most destructive in Kashmir [13]. These diseases directly effect the corms of saffron. If the corm seeds are injured there are maximum, chances of that the corms will get damaged. With the result the farmer has to go for new seed corms or has to use the particular and good quality fertilizers and pesticides for controlling these diseases. In Kashmir it is seen that almost every year these diseases effect the cultivation and ample proportion of produce gets reduced. Dhar [11] observed that although none of the Saffron-growing areas of Kashmir valley were free from disease (almost 100% disease incidence). Nehvi [14], however, reported the

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incidence of corm rot as 46% in traditional saffron-growing areas of Pampore. These studies reveal that there is a need of providing the quality fertilizers and pesticides for the control of these diseases. The application of different doses of Carbendazim against corm rot of Saffron can result in better flowering yields [10]. Under the Saffron Mission 2010, Government provided the facility centers at many places in the saffron growing areas, but from the empirical observation, it revealed that at ground level it was seen as a failed mission or benefitted at a negligible rate.

Lack of optimum profit for cultivators

As discussed above, the farmer suffers from these problems yet he continues with the cultivation of Saffron, but he does not earn optimum profit to enjoy the good life. After a conversation with the cultivator, namely Farooq Ahmad Wani [3], Saffron Cultivator, 1:00pm Pampore, District Pulwama, Jammu and Kashmir, India, told that, "at certain times we don't get a suitable rates for our products as we are lacking the facility of an authorized market where we can sell our products an get the optimum profits even sometimes we have to sell our final good quality products on very low rates because of the Dalals (middlemen), as they have to earn their own share or commission from our product". As the marketing of Saffron is mainly in the hands of these Dalas and marketing firms. The price of the Saffron in State is generally determined by these firms and Dalas. Due to this reason they are moving towards a period where they have to stop cultivating this golden spice and switch to any other farming or any other work. Government has also not taken any concrete steps towards providing some incentives or creating any market where they can sell their product on suitable rates. Under Saffron Mission 2010, the government of state started a programme but was not strictly implemented, and only those persons got benefitted who had any connections to the higher authorities or who had any links with the marketing firms in state or outside state which take their product to the national and international markets. The small farmers just sell their production to these big firms and middlemen to clear their debts, and under these conditions farmer sell their produce at very cheap rates and gets negligible profit. There are very few farmers who sell their produce directly to the dealers in national markets, like Delhi, Mumbai, Kolkata, Amritsar, etc.

Apart from the above problems, there is major reason of climate change in the Valley which has affected its production and yield. The livelihood of the society can be badly affected directly or indirectly due to the climatic changes. Climate change has emerged as an important issue ever to confront mankind. The prolonged dry spell in the months in which Saffron has a need of showers left the farmers worried. In Kashmir, the Saffron crop is mainly dependent on rains and if rains are received at the sprouting and pre-flowering stages, flowering is optimum and saffron yield is good. Due to insufficient rainfall, the state has seen the lowest productivity in the past 2 to 3 decades. It was seen in the State of Jammu and Kashmir which faced an acute drought in 1999-2003 [8], and during this period productivity was reduced from 3.12kg/ha to 1.57kg/ha. However, in 2004-05, favourable rainfall improved the productivity also to 2.96 kg/ha. It means that without rainfall the productivity of Saffron experiences a severe downfall. The variations in the time of precipitations in valley has been connected with waning trend of Saffron as experienced by the farmers that if there is less snowfall in the winter season it effects directly the productivity and yield in the succeeding year. As in winter season snow covers the saffron fields and provides moisture to the corms continuously upto the next spring season and corms do not get effected and remain healthy. It is necessary that corms have optimum moisture level during the winter (dormant) season otherwise corms get infected and don't produce the outgrowth. In the spring season when first hoeing is done the soil gets aerated and after the first hoeing the fields need time to time rain showers upto the time of flowering. For precipitation, mountainous parts of valley have shown a drastic decrease in precipitation (10.3mm/year) while as flood plains have shown relatively less rate of decrease of 3.6mm/year and with foothills and Karewa's having moderate rate of decrease 6.3 and 5.8mm/year, respectively [15].

Conclusion

In Kashmir, the cultivation of saffron has been started from the very ancient times nearly from about 750 A.D. The study revealed that Kashmiri Saffron had lost its quality and had shown a waning trend in the productivity and yield from last 20 to 25 years. Saffron is being cultivated mainly in the Karewas of Pampore and its adjoining areas. Soil in the Karewas has also lost some of its fertility due to the old techniques used by farmers in their fields. Other factors responsible for decline in production are non-availability of some basic facilities to farmers. Variation in precipitation level has also added a fuel in the waning trend of Saffron produce. Finally, we can say that by providing the basic facilities to the cultivators which have been discussed here can result in the increase of production of the crop.

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