Production of Crocus sativus L (Saffron) in water scarcity area Supa Village, Ahmednagar of Maharashtra providing alternative crop production options for local farmers

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Abstract: **The development of Corcus sativus L (Saffron) for commercial production was done using aeroponic system implemented at Ahmednagar District of Maharashtra. The system was designed for achieving maximum flowering. A combination of factors including Light, Nutrients, and Growth Regulators were applied in 3 different batches of Saffron corms. Some corms were found to show poor flowering may be due to small size of bulbs. This system can be applied for commercial production and yield of saffron for increasing the resource of important pharmacological compounds found in saffron. Saffron can be grown efficiently using artificial and controlled environmental conditions but the conditions needs more improvement to achieve a sustainable growth. Implementing such system for production of Saffron can be a good option for the local farmers who are hit by water scarcity and environmental factors including uneven distribution of rainfall.**

Keywords: Saffron , Safranal , Kashmir , India , Farmer , Temperature , Iran.

Introduction: Saffron is the spice derived from the flower of Corcus sativus; commonly known as "Saffron Corcus".It probably descends from the eastern medditerian autumn flowering corcus cartwrightianus which is also known as " wild saffron" and originated in crete or central asia (Rubio and Moraga et al 2009). Saffron is cultivated mostly in Iran which accounts for nearly 90% of total world production (Bedani and Fallahi ,2015).It is a sterile triploid form , which means that three homologous sets of chromosomes make up each specimen's genetic complement.C.sativus bears eight chromosome bodies per set , making for 24 in total (Kafi et al , 2006 p23). Being sterile the purple flowers of C.sativus fail to produce viable seeds reproduction hinges on human assistance. Cluster of corms, underground bulb like starch – storing organs , must be dug up , divided and replanted.

History of Saffron Cultivation : Saffron has been grown extensively in the near east and the Mediterranean Basin since the late Bronze Era (Zohary and Hoaf 1994).Although there are some discrepancies on the origin of this plant, some evidences indicate that the saffron was discovered for the first time on the slope of Zagros Mountains of Iran in the median era (559-609 BC) and the world's first saffron fields were established in the same era by the indigenous inhabitants (Kafi et al 2006).The word "Saffron" seems to originate from the old name Karkum in the ancient Persian Achaemenian (Abrishami 2004). Saffron was introduced to Andalus (Spain) by Muslims and thereafter to Sagaliyah (Sicily) in the period of expansions of Islam. In another reference it is stated that groups of Parthians (Zoroastrians) migrated to India (500-600 AD) introduced saffron to Kashmir in Indian sub continent. There are different theories about origin of saffron. Some research documents have proved that Iran is the native land for saffron which originally grew wild at the foot of Zagros Mountains and surrounding areas of Alvand.

Saffron Properties: There are various chemical components present in the stigma of Saffron plant including Carbohydrates , Minerals , Mucilage , Vitamins such as riboflavin, and thiamin , colour pigments such as crocin, anthocyanin , carotene , lycopene , zeaxanthin and aromatic terpenic essence called "Safranal" and flavoring substance called picrocrocin.Saffron carbohydrates are mostly from reductive sugars which consist of about 20% of saffron dry weight. Among these carbohydrates the presence of glucose, fructose, gentibose and small quantity of xylose and ramnose were fixed.The major pigment a water soluble carotenoid giving saffron its value as a dye is Crocin a yellow red pigment found at the levels of upto 2%. Picrocrocin is a bitter tasting principle that gydrolyses to glucose and safranal on drying (Mohammadi 1997).Crocin (C44 H 64 024) is the most influential chemical in the coloring of the saffron. The oil soluble color pigments include lycopene , alpha carotene , beta carotene and zeaxanthin.

Supa Village : Supa is the village in Parner Taluka in Ahmednagar district of state of Maharashtra. Located Latitude: 18.93585 and Longitude: 74.53655. Historically speaking this village of Ahmednagar is one of the water scarce zone receiving on average an annual rainfall of 450 mm in 20-30 rainy days of monsoon season.Beacuse of this the rain dependent agriculture in this area suffers greatly. Hence farmers are in great need of alternative sources of income and technologies which can help them gain more income with limited environmental dependency.

Materials and Methods: Plant material for Corcus sativus L (saffron) was purchased from Pampor area of Jammu and Kashmir India. All the plants were grown in controlled grow room developed at Supa (temperature maintained at 15°c +/- 2°), light period of 12 hours light / 12 hours dark was established in culture room to mimic the natural light conditions in Kashmir where the saffron is commercially produced. Lighting was done as maximum 1000 Lux. From white LED strips mounted on walls of the grow room. Corms were not sterile hence a treatment was ethanol wash was given to minimize the initial bacterial load. The

corms were than transferred to Plastic Trays containing inert material. The aeroponic system was designed with the commercial humidifier with nutrient solution contained in its chamber and was auto set to the humidity level of 75-80%. Corms were harvested 90 days after beginning of this experiment. Flowers were picked after 4-5 days of appearance. Blooming date was noted on all the plant growth trays.

Results and Discussion:

Flowering was observed in most all the planted trays. However the flowering percentage was found less. Flowers were harvested and the stigmas of the flower were dried and stored for further studies and research. A relative increase in the air temperature during flowering emergence stages will postpone the blooming and will reduce the percentage of the flowering corms (Askari – Khorasgani and Pessarakli 2019 ; Rezvani Moghaddam 2020). In the present study the air temperature showed variation and was not optimal for some days, which can also be a reason for lower flowering in both the systems. Another reason for lower flowering can be the lower weights of the corms which were used in the present study (Monila et al 2010) stated that it is possible to gain 600-700 kg / hectare spice during 8-9 harvests from Sep – May under green house conditions , when all flowering stages pass under optimally controlled environment. A new batch with more efficient and optimal conditions needs to be tested for further optimizations of the conditions for proceeding for commercial production.

Figure 01 : Saffron (Crocus sativus L)

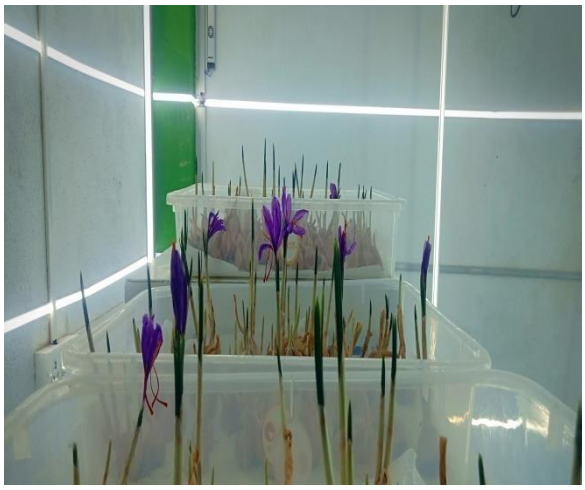

Figure 02: Flowering of Saffron in controlled environmental conditions

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