



Golnaz Toranjani Moneghi

PORTFOLIO 2024

AEROPONIC SAFFRON CULTIVATION



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**INTRO**

Greetings!

I Am **Golnaz Toranjani Moneghi**, An Agriculturalist With A Bachelor's Degree. I Had The Pleasure Of Conducting An Experiment On Saffron Cultivation Utilizing Greenhouse (Aeroponic) Techniques Back In 2017. Through This Innovative Approach, I Was Able To Yield An Impressive 5 To 7 Kilograms Of Dried Saffron Per Ton Of Corms. In The Forthcoming Paragraphs, I Will Delve Into The Inspiration Behind My Project And Elucidate Why I Opted For This Specific Methodology.





BRIEF STORY

In the bustling halls of Roudehen University, nestled amidst rolling hills and fertile fields, I began my journey as an agricultural specialist named Golnaz Toranjani Moneghi. From the moment I set foot on campus, I knew that I had found my true calling.

I enrolled in the prestigious Agricultural Sciences program, where I thrived under the guidance of esteemed professors who shared my passion for the earth and its bounties. I immersed myself in my studies, absorbing every lesson with fervor and determination.

I learned about the intricacies of plant biology and the complexities of soil chemistry, soaking up knowledge like a sponge and eager to unlock the secrets of sustainable agriculture. However, it was in the university's experimental farms where I gained valuable experience and practical skills.

Together with my fellow students, armed with shovels and notebooks, we ventured into the fields, eager to till the soil and sow the seeds of change. We conducted experiments, tested new techniques and technologies to improve crop yields and conserve natural resources.

As time passed, my reputation as a dedicated student and promising young agronomist grew. I spent countless hours in the university's research labs, analyzing data and brainstorming innovative solutions to the challenges facing modern agriculture.

But it wasn't just the academic pursuits that fueled my passion. It was the sense of camaraderie and shared purpose that permeated the campus—a collective belief in the power of agriculture to nourish both body and soul.

Upon graduation, I emerged from Roudehen University not only as a graduate but also as a visionary, ready to make a tangible difference in the world of farming. Armed with knowledge, experience, and an unyielding passion, I set out to sow the seeds of change wherever I went, leaving an indelible mark on the agricultural landscape for generations to come.

And as a testament to my unwavering determination, I embarked on a groundbreaking venture: growing aeroponic saffron. With grit in my heart and saffron in the skies, I continued to push the boundaries of what was possible in the world of farming. I forged a path toward a brighter, more sustainable future and paved the way for agricultural innovation. Stay tuned for the rest of my story, as I continue to share my journey of aeroponic saffron cultivation.



FUNDAMENTALS

The origin of the word "aeroponic" can be traced back to its Greek roots "aer," meaning air, and "ponos," meaning work.

Mr. Zhao Ji, a Chinese farmer and entrepreneur, has made significant contributions to the saffron cultivation industry in China.

He is widely acknowledged as the pioneer who successfully cultivated saffron aeroponically, utilizing an innovative technique that revolutionized the traditional saffron cultivation practices in the region.

By relinquishing conventional irrigation and cultivation methods, Mr. Zhao was able to increase the production of saffron, which opened up new opportunities for farmers and entrepreneurs in the saffron industry.

This pioneering method has facilitated the improvement of the quality and yield of saffron while reducing the environmental impact of conventional cultivation practices.

As a result of Mr. Zhao's pioneering work, China has emerged as a leading player in the global saffron industry and is exporting high-quality saffron to markets worldwide.

What is Aeroponic?

The origin of the word "aeroponic" can be traced back to its Greek roots "aer," meaning air, and "ponos," meaning work.



KEY DIFFERENTIATIONS * WHY AEROPONIC!?

Water Efficiency

Aeroponic saffron cultivation uses less water since it delivers water directly to the corms without any squandering.

Saving Space

Aeroponic systems are predominantly vertical and limited spaces, allowing for cultivation in compact areas.

Increasing Yield

Controlled environmental conditions and optimum nutrient supply in aeroponic systems facilitate the cultivation process and ultimately lead to higher quality crop harvesting compared to traditional methods.

Reducing pollution and diseases

By eliminating soil and using sterile nutrient solutions, the risk of plant diseases and contamination is minimized.

Better Environmental Control

Precise control over factors such as temperature, light, and nutrient solution contributing improves saffron growth and performance.



KEY DIFFERENTIATIONS * WHY AEROPONIC!?

Increasing Quality

Controlled environments and the direct supply of nutrients to the plant, causes higher quality product compared to traditional method.

Growth Rate Acceleration

Plants in aeroponic systems have easy access to nutrients, leading to faster growth.

Preservation of Plant Diversity

Aeroponics can be easily transformed, allowing for the cultivation of different plant species. Spinach, Microgreens, Ganoderma mushrooms, etc, can be grown in saffron pallets using aeroponic method after harvesting.

Suitability for Any Location

Due to its soil-less nature, it can be implemented in areas with poor soil, humid climates, desert regions, and even indoor environments.

Creation of Employment Opportunities

The expansion of aeroponic farming creates job opportunities in production, sales, and related technologies.

**KEY DIFFERENTIATIONS**

Title	Traditional	Aeroponic
Cultivation Method	In the traditional method, saffron corms are planted in soil	In the aeroponic method, saffron corms are planted in wooden pallets using nutrient-rich solution from fogger nozzle without using soil.
Water Usage	Traditional cultivation consumes more water because the soil requires frequent irrigation.	Aeroponic cultivation tends to use less water since it delivers water directly to the corms, thereby minimizing water loss.
Environmental Management	Traditional cultivation require larger space and more precise soil management.	Aeroponic cultivation allows for precise environmental control and requires less space. Additionally, aeroponic growing environments can be easily transported and installed in various locations.
Productivity and Quality	Quality is much lower In traditional cultivation, because food is divided between the roots, the corms, and the final product.	In aeroponic cultivation, corms do not take root, so the food is given to the flower instead of being used for root growth, which makes the quality of the crop more than traditional cultivation where the food is divided between the root and the flower.
Costs and Investment	Traditional cultivation may require higher initial investment and have lower profitability.	Setting up and maintaining an aeroponic system typically requires lower initial investment compared to traditional methods, but it more profitable in the long run.



Why Saffron!?

Saffron, which is derived from the flower of *Crocus sativus*, is a highly valuable spice that belongs to the family of Iridaceae. It's rare and expensive to harvest and process, which makes it one of the most expensive spices globally. The primary saffron-producing countries are Iran, Spain, India, and Greece. However, the United States also cultivates high-quality saffron through aeroponic companies.

Saffron is known for its use in cooking as a coloring and flavoring agent, but it also offers various health and medicinal benefits. The antioxidant properties of saffron are recognized as a preventive medicine against cancer and an anti-aging agent at the cellular level.

Iran is a significant contributor to global saffron production, accounting for around 178 tons of the 200 tons produced worldwide. Increased exports would mean more significant economic benefits to the country. Therefore, there is a need to enhance saffron production and exports to achieve greater economic benefits. Iran is responsible for nearly 95% of the world's saffron production. However, most Iranian farmers still rely on traditional and soil cultivation methods, with only a small amount of saffron produced in greenhouse sites using hydroponics and aeroponics methods. This is due to a lack of support and the large capital required to start an aeroponic site. Currently, major Spanish companies monopolize the large-scale cultivation of saffron in greenhouses in Iran.

All parts of saffron have multiple applications. For instance, saffron flowers can be used in hair dye production, a method employed by companies such as L'Oréal. Additionally, the husk of saffron corms can be converted into highly nutritious fertilizer for various purposes.



Problem

These are the most challenging parts of a traditional Saffron cultivation

Land Scale

The traditional method of cultivating Saffron requires a large amount of land and capital, making it necessary to be a landowner as there are no leasing options available.

Product quality

The demand for higher quality Saffron in the international market requires advanced technology for production.

Production and market monopoly

In Iran, there are certain cities where Saffron can be cultivated. However, for the traditional method of Saffron cultivation, one needs to be included in the local clans or parties. It is worth noting that natives usually do not allow strangers to participate in their Saffron business.



Solution

"I decided to utilize the Aeroponic technique for cultivating Saffron in order to overcome obstacles on my path to becoming a successful player in this market. In the upcoming sections of my portfolio, I will share the entire story of my journey."

Land Scale

I rent a small greenhouse at Tehran Greenhouse Center in Varamin, which I can grow the business by adding more space when needed.

Product quality

I invested in cutting-edge technology for my greenhouse and purchased high-quality Saffron corms.

Production and market monopoly

I successfully produced Saffron using the highest quality corms bought from the native traditional farmers in Torbat-e-Heydariyeh, while avoiding participation in the monopolized production chain there.



Market Insights

The global saffron market size is estimated to reach US\$ 337.9 million in 2024 and US\$ 687.8 million by 2034. Over the forecast period, global saffron demand is anticipated to rise at a healthy CAGR of 7.4%.

End-users mostly prefer saffron threads because of their advantages over other forms, such as powdered saffron and liquid saffron. The target segment is anticipated to account for a revenue share of 78.7% in 2024.

Derived from the flower *crocus sativus* (or saffron crocus), saffron is known for its vibrant red-orange color. It is often used to add flavor and color to various dishes.

Saffron is a key ingredient in many traditional dishes, especially in cuisines such as Indian, Persian, and Spanish. Besides its culinary uses, saffron is used for various purposes, including traditional medicine, perfumes, and dyes.

The demand for saffron is growing as it is known for its unique flavor and aroma, which adds a distinct taste to various dishes. As consumers are becoming more adventurous with their culinary preferences, the demand for high-quality and exotic ingredients like saffron is rising rapidly.

**MARKET**

Saffron Market Overview

Top manufacturers are expanding their product lines to include a wider range of saffron products. They also focus on establishing a strong online presence through websites and social media platforms that allow them to reach a broader audience.

E-commerce platforms provide a convenient way for consumers to purchase saffron, and manufacturers often use online channels to share information about their products. Many companies are introducing new products to meet growing end-user demand for high-quality saffron products. For instance,

- In 2023, Tata Consumer Products expanded its product portfolio by introducing Grade 1 Kashmiri saffron under the Himalayan brand. The new saffron products are directly imported from Kashmir and wrapped with an AI-enabled QR code that can be used to verify their authenticity.

Attributes	Key Insights
Estimated Global Saffron Market Value (2024E)	US\$ 337.9 million
Projected Saffron Market Revenue (2034F)	US\$ 687.8 million
Value-based CAGR (2024 to 2034)	7.4%



MARKET

Category-wise Insights

The table below provides in-depth insights into leading segments in the saffron market. This information can help companies invest in popular forms and frame their strategies accordingly.

- Based on form, the threads segment is estimated to account for a revenue share of 78.7% in 2024.
- By functionality, the food/feed/pharma grade segment will likely account for a value share of 69.5% in 2024.
- Based on end-use applications, the food & beverages processing industry is set to hold a market share of 56.9% in 2024.
- The conventional saffron category is expected to have a market share of 58.7% in 2024.
- By saffron compound, the crocin segment is anticipated to account for 42.8% of the market share in 2024.

Segment	Estimated Market Share (2024)
Threads (Form)	78.7%
Food & Beverages Processing Industry (End-use Application)	56.9%
Food/Feed/Pharma Grade (Functionality)	69.5%
Conventional (Product Claim)	58.7%
Crocin (Saffron Compound)	42.8%



Detailed Journey

Aeroponic Saffron Project

Step 1 – Decision making

I decided to start the project that took a total of two and a half months. It started on August 1st, with one month for preparation and approximately one month for saffron corms to become dormant and then emerge from dormancy.

Step 2 – Finding quality Saffron corms

We traveled to Torbat-e Heydariyeh in Khorasan Razavi province, Iran to obtain bigger and more nutritious saffron corms with higher nutritional value. Torbat-e Heydariyeh is one of the best locations for the growth and production of saffron in Iran. Our journey began with enthusiasm and we drove for 10 hours to reach our destination.



Detailed Journey

Aeroponic Saffron Project



Travel to Torbat-e-Heydariyeh started



Just arrived to Torbat-e-Heydariyeh



Central trading center of Saffron mother corms in Iran



Detailed Journey

Aeroponic Saffron Project

Step 3 – Saffron corms handpicking & acquisition

We visited three main locations and searched through 20,000 corms, carefully selecting larger corms (Saffron corms: 6–8 years old) with the help of some villagers. We spent two days meticulously searching for high-quality saffron corms suitable for Aeroponic cultivation.

The individuals were taken aback when they saw a girl from Tehran who seemed to have no prior experience in farming, enthusiastically and precisely testing a new approach to cultivate better-quality saffron. They were so intrigued that they requested me to teach them this method after conducting the test.

Prior to implementing this method, only a handful of individuals had tested it out. Meanwhile, the residents of Torbat-e-Heydarieh were unfamiliar with it, as they were primarily engaged in traditional saffron cultivation. After the completion of our project, I made a commitment to conduct a workshop for them. The workshop's objective would be to share the expertise we had gained throughout our project.



Detailed Journey

Aeroponic Saffron Project



Handpicking the Saffron mother corm



Handpicking the Saffron mother corm



Natives helping to handpick the best Saffron corms



Detailed Journey

Aeroponic Saffron Project



Handpicking the Saffron mother corm



Children there know how to handpick



Finally we acquired the desired Saffron corms for the project



Detailed Journey

Aeroponic Saffron Project

Step 4 – Heading back to Tehran

During our return trip to Tehran, we faced several risky situations due to the unfavorable weather conditions. Our vehicle was carrying more than a ton of saffron corm cargo, and the strong winds were constantly buffeting it. As a result, we had to continue the journey without making any stops. Any pause could have exposed the corms to serious risks, which could have caused them to become compacted in the sacks and susceptible to mold. This stressful trip lasted for nearly 10 hours, but we eventually arrived safely in Tehran with all the cargo intact.

After we arrived in Tehran, we had to conduct a thorough recheck on the Saffron corms to ensure that they were still healthy and in good condition. We carefully opened all the sacks and spread them out on the clean and dry ground, making sure to handle them with utmost care. We then proceeded to inspect each corm individually, examining them for any potential signs of illness. We checked for discoloration, softness, and any other abnormalities that could be indicative of damage or disease. This process was time-consuming, but we wanted to be sure that we were delivering only the highest quality corms to our aeroponic cultivation process.



Detailed Journey

Aeroponic Saffron Project



Returning to Tehran



Rechecking the Saffron corms



Getting ready for the peeling process



Detailed Journey

Aeroponic Saffron Project

Step 5 – Preparing the greenhouse

After conducting a thorough exploration of the greenhouses located in Pakdasht Varamin, which is deemed as the epicenter of Tehran's floral and botanical industry, we promptly identified a suitable location. Subsequently, we proceeded to prepare and equip the greenhouse, with the aim of ensuring that it was ready for the cultivation process. Our focus was on ensuring that the greenhouse was optimally equipped and maintained to promote the growth and development of the intended crops.

In order to prepare the greenhouse for the installation of racks and equipment, it's essential that we perform a complete cleaning and sterilizing process. This includes removing any debris or lingering plant matter from the space, scrubbing the floors and walls, and disinfecting all surfaces to prevent the growth of harmful bacteria or pests. By taking these steps, we can ensure a safe and healthy environment for our plants to grow and thrive.



Detailed Journey

Aeroponic Saffron Project



Cleaning and sanitizing the greenhouse



Sterilizing the greenhouse



Insulation the greenhouse



Detailed Journey

Aeroponic Saffron Project



Insulation process



Preparing racks, shelves and pallets



Preparing racks, shelves and pallets



Detailed Journey

Aeroponic Saffron Project

Step 6 – Separating, sorting corms and peeling carefully

Before placing the Saffron corms onto pallets, it is crucial to undertake a series of steps to ensure that each mother corm is healthy and in good condition. These steps include separating the corms, sorting them, and peeling them a second time. The separation process involves carefully separating each corm from the others to ensure that they are not damaged or bruised. The sorting process is necessary to eliminate any corms that are not of the required quality or size, as well as to group the corms according to their size. Finally, the corms are peeled a second time to ensure that they are free from any disease or defects that may have been missed during the first peeling process. By completing these steps, and meeting our acceptance criteria, we can guarantee that the Saffron corms are of the highest quality and ready to be placed onto pallets for cultivation.

We hired approximately ten workers for this process, ranging in age.



Detailed Journey

Aeroponic Saffron Project



Spreading Saffron corms



Spreading Saffron corms



Finding unhealthy Saffron corms



Detailed Journey

Aeroponic Saffron Project



Sorting Saffron corms



Sorting Saffron corms



Sorting Saffron corms



Detailed Journey

Aeroponic Saffron Project

Step 7 – Fungicide treatment for corms

While sanitizing the environment, we also submerged the corms in an antifungal solution. It was an operation that was both highly stressful and crucial. It was important to remove the corms from the fungicide and disinfectant bath within the specified time to prevent them from becoming more susceptible to fungal infection.



Cleaning bathtubs for the antifungal solution



Detailed Journey

Aeroponic Saffron Project



Making the antifungal solution



Submerging corms into the solution



Submerging corms into the solution



Detailed Journey

Aeroponic Saffron Project

Step 8 – Placing corms in pallets

Now, in the controlled environment, the corms are ready to be placed in pallets. The pallets have been thoroughly sanitized.



Placing corms in pallets



Detailed Journey

Aeroponic Saffron Project



Placing pallets on the racks



Placing pallets on the racks



Placing pallets on the racks



Detailed Journey

Aeroponic Saffron Project

Step 9– Monitoring the environment

We meticulously provided all necessary environmental conditions to create an optimal environment for plant growth, including:

- Using zeolite
- Air circulation facilitated by fans
- Variations in light intensity
- Temperature fluctuations day and night
- Implementation of a misting system

To induce artificial dormancy, we completely cut off the light and adjusted the temperature to 17 to 25 degrees Celsius while maintaining humidity in the range of 70 to 100 percent and We used zeolite to keep the environmental moisture.



Monitoring system



Detailed Journey

Aeroponic Saffron Project



Mist sprayer



Pump setting



Zeolite clinoptilolite



Detailed Journey

Aeroponic Saffron Project

Step 10 – Drip irrigation system

In aeroponic saffron cultivation, a drip irrigation system is used to provide the necessary moisture for plant growth. This irrigation system is typically placed above the growing medium and moistens the roots of the plants with a spray of water or an irrigation system. The drip irrigation system used in aeroponics must be adjustable to precisely control moisture levels. Additionally, it should be capable of creating uniform spray or distributing water in a drip irrigation system evenly onto the plant roots to prevent issues such as dryness or excessive moisture in the growing environment. We used an irrigation system to keep the environment moist and deliver the desired moisture to the saffron corms.



Spray irrigation



Detailed Journey

Aeroponic Saffron Project

Step 11 – Greenhouse space isolation

During the dormancy period of the plant, we took necessary precautions to restrict access to the plant area. Only experts and workers who wore specialized attire were allowed entry within specific hours. Our area was designed to accommodate 2 tons of saffron corms, but we used only one ton of corms in a 20x20 space. This ensured that the plants had sufficient room to grow and flourish. By implementing such measures, we were able to create an optimal environment for the saffron corms to thrive and produce high-quality saffron.



Isolated Saffron corms were completely healthy



Detailed Journey

Aeroponic Saffron Project

Step 12 – Increasing light intensity

After a period of dormancy, during which the plant remained underground, we aimed to initiate the next stage of growth by simulating the end of the underground process. The objective was to create an environment that would prompt the plant to emerge from the soil. To achieve this, we increased the intensity of light, providing the plant with the necessary energy to start the process of photosynthesis and the production of chlorophyll. With the right amount of light, the plant's stems began to grow and push through the corm, eventually emerging from the corm. This stage is crucial for the plant's development, as it marks the beginning of its transition from a state of dormancy to active growth and development.



Increasing light intensity



Detailed Journey

Aeroponic Saffron Project

Step 13 – Full spectrum lighting

After the stems reached a height of 5 to 7 centimeters, we increased the light intensity to 100 percent during the day. Additionally, to provide a full spectrum of light, we installed full spectrum) lights in the space. We meticulously regulated the day and night temperatures accordingly. The use of full spectrum lighting played a fundamental role in our project, significantly enhancing the growth process and nearly doubling or tripling it. By strategically using this light at different time intervals, we induced artificial environmental stress on the plants. All environmental changes were controlled by a remote control monitoring system, allowing us to adjust the environment and make desired stress as needed.



Increasing intensity to 100 percent full spectrum light



Detailed Journey

Aeroponic Saffron Project

Step 14 – Blossoming

Once the corms had matured, we took a series of steps to induce flowering. We began by increasing the intensity of the light that the corms received. This was done gradually, to avoid any unwanted shock to the plants. We monitored the moisture levels carefully at the same time, ensuring that they remained between 60 and 80 percent. This range was chosen as it is optimal for the growth and development of the corms. By maintaining these conditions, we were able to successfully induce flowering in the corms.

Finally, the Saffron flower blossoms started to show up.



Saffron blossoms starting to show up



Detailed Journey

Aeroponic Saffron Project



Healthy Saffron flower



Healthy Saffron flowers together



Healthy Saffron flowers together



Detailed Journey

Aeroponic Saffron Project

Step 15 – Harvesting

This was my first attempt at saffron cultivation using the aeroponic method. Success during this challenging process with minimal errors is considered a triumph for me. This process required extensive efforts and meticulous attention to detail at every stage. Fortunately, any challenges that arose were quickly resolved through proper management. At the end of this project, I realized that it is possible for everyone to cultivate greenhouse saffron using the aeroponic method in their personal space. By utilizing this method, we not only assist individuals in generating income but also contribute to the increase in the production of high-quality saffron.



Harvested Saffron flowers



Detailed Journey

Aeroponic Saffron Project



Saffron threads



Saffron flowers and Threads



Saffron flowers and Threads



Conclusion

Completing the saffron aeroponic cultivation process marks a significant milestone in my journey within agriculture. Through meticulous attention to detail and relentless dedication, I have honed my skills and deepened my understanding of this intricate cultivation method. This hands-on experience has not only expanded my knowledge but has also instilled in me a profound appreciation for the complexities of agricultural production. Armed with this expertise, I am now poised to embark on the next chapter of my educational journey.

With a fervent desire to further my understanding of agriculture, I am committed to pursuing advanced studies abroad. By immersing myself in a diverse academic environment, I seek to engage with leading experts, explore innovative techniques, and gain invaluable insights into global agricultural practices. This pursuit of higher education represents not only a personal ambition but also a steadfast commitment to contributing meaningfully to the agricultural industry.

As I set my sights on international education, I am fueled by a relentless determination to excel and make a tangible impact in the field of agriculture. With a solid foundation in saffron cultivation and a voracious appetite for learning, I am ready to embrace the challenges and opportunities that lie ahead. By harnessing the knowledge and skills acquired through my journey thus far, I am confident that I will emerge as a catalyst for positive change in the agricultural landscape, both locally and globally.

Thank you!

Golnaz Toranjani Moneghi

**PORTFOLIO-2024
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