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Extracting Castor oil and Castor Seed Production in Iran Arid Zone

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Abstract

The area under castor oil cultivation in Iran has varied over the years. In 2019, the area under castor oil cultivation in Iran was about 11.02 thousand hectares, according to the FAO report (FAO, 2021). This is while in 1996, the area under castor oil cultivation was higher and then decreased. Castor oil can be extracted using a variety of methods, including cold pressing, solvent extraction, and screw pressing. These methods utilize different tools and techniques to separate the oil from the castor seeds. Deserts are often associated with areas of high atmospheric pressure, particularly subtropical high-pressure zones. This high pressure is due to sinking air, which warms and dries, leading to low rainfall and desert conditions. Conversely, low-pressure systems typically bring cloudy, rainy weather, not desert conditions. Chromosomes are string-like structures that store genetic information and are located in the cell nucleus. These structures are made up of DNA and protein and pass genetic information to new cells during cell division. The number of chromosomes in a castor bean seed is 20 (2n=20). This number means that each castor bean cell has 20 chromosomes, which are located in pairs (10 pairs) in the cell nucleus. Castor (Ricinus communis) is important in Iran as a valuable plant, both medicinally and industrially. Castor oil is traditionally used in traditional medicine for various treatments and is also known as an important source for oil production in industry. In this research we concluded that castor bean plants can be cultivated in desert environments, particularly in arid and semi-arid regions, due to their drought tolerance and adaptability to various soil types. While they prefer well-drained, fertile soil and a specific temperature range, castor beans can thrive with minimal rainfall and even tolerate slight soil acidity. Their deep-rooted nature allows them to draw moisture from deeper soil layers, making them suitable for water-scarce regions. In this research we concluded that the toxicity of raw castor beans depends on the percentage and size of the ricin toxin. Although the lethal dose for adults has been identified as about 4 to 8 seeds, reports of human poisoning from these seeds are very rare. In addition we concluded that Castor beans contain a highly toxic protein called ricin. During the oil extraction process, high heat inactivates and destroys this protein. After processing and purifying castor ricin, the final product is completely purified and becomes usable. Castor oil is one of the oldest medicinal plants in the world. Determining the genetic diversity of plants, including castor oil, plays an important role in identifying superior genotypes for use in plant breeding programs. For this purpose, the genetic diversity and relationship of castor oil ecotypes, resistance to salinity, and response to organic and mineral fertilizers were investigated in this study.

Keywords: Iran desert, climatology, castor oil.

INTRODUCTION

Semnan province is home to numerous plant species and is one of the richest sources of castor oil crop species in the country due to its climatic conditions, topography and soil. Unfortunately, our knowledge about the wild relatives of crop species is very limited, while genetic erosion has increased alarmingly in some regions of the world and Iran, especially Semnan province. Given the genetic diversity of crop species and the severe and increasing erosion, these species are at risk of extinction. Therefore, there are several reasons for collecting and reviving crop plants, including identification, revitalization of botanical classification, and study of genetic diversity and their protection. Castor oil grows in most regions of the country, and the most important of these regions are Semnan, West and East Azerbaijan, Khuzestan, Kerman, Fars, Lorestan, Zanjan, Kurdistan, Hamadan and Isfahan provinces. Castor oil is one of the important industrial and medicinal plants that has been cultivated in Iran since about 5000 BC.

The compounds in castor oil give it anti-inflammatory and antibacterial properties, and therefore

it is suitable for reducing inflammation and treating respiratory diseases and skin conditions (fig 1, 3). Regular consumption of castor oil can be effective in reducing anxiety, tension, and stress. Castor oil contains antioxidant compounds, and its consumption is useful in preventing damage to skin cells and improving and repairing skin wrinkles. Consuming this plant can be effective in controlling blood sugar levels. (Of course, you should consult a doctor before consuming it.)

The antioxidant and anti-inflammatory compounds in castor oil are effective in improving cardiovascular function and reducing the risk of heart disease. The compounds in castor oil are very suitable and useful for promoting hair growth and maintaining skin freshness. Castor oil extract is available in liquid or dry form, in the form of drops and ampoules. This extract is used to treat colds, lung infections, and asthma. Castor oil can also be obtained in the form of tablets and capsules. Taking castor oil pills strengthens the immune system, improves body function, and regenerates tissues. Castor oil capsules can also be used as a dietary supplement to maintain body health.

The most important aspect of castor oil, derived from the castor seed, is its versatility. It's used in medicine, skincare, agriculture, and industry due to its unique chemical composition and properties. While known for its laxative effects and skincare benefits, it also has industrial applications like lubricants and biodegradable plastics.

Figure 1: Castor oil tools extraction

Material and methods for castor oil production

Availability of materials, appropriateness, economic feasibility, and serviceability were among the factors considered when selecting the machine-building components. The frame, discharge chute, motor gear, shaft, nuts, and bolts are the components, with mild steel making up the majority of the materials employed. It was fixed to the machine frame and linked to the apparatus by the shaft, which revolves within the extraction chamber. Bolts and nuts are fasteners that are utilized to securely bind the machine's components to the frame. Figures 3 and 4 show simplified and exploded views of the developed extractor. The hopper allows the shell that is fastened to the chassis to be delivered into the extraction chamber. The built metallic stainless steel has a trapezoid design 270 mm in length, 220 mm in width, and 180 mm in height with a capacity of 10.69 kg. The equipment is secured to the structure by bolts and nuts, and it conceals the rotating shaft. Power transmission from the motor to the machine is accomplished by the motor gear. Collections of 17.8 kg castor seeds were prepared and introduced through the hopper into the device at varying masses for ten times ranging 0.78 – 2.58 kg. The fat is extracted by squeezing and compressing the seeds to extract the oil where the shaft spins ahead. After turning on, the machine was left to operate for eight minutes until the castor was crushed. For a repeat, the machine was preheated for fifteen minutes before breaking to allow it to finish dehydrating the cake and producing clean castor oil.

The following step-by-step procedures were taken for effective performance and evaluation of the developed machine.

The required power for shelling a castor seed is calculated by equations 1 and 2.

$$P = M_t X \omega \quad (1)$$

$$P = \frac{2\pi N M_t}{60} \quad (2)$$

The utilized torque in de-hulling a castor seed is found by equation 3.

$$M_t = Fr \quad (3)$$

The angular speed and extraction shaft diameter for rotating the shaft per minute of operation are contained in equations 4 and 5.

$$\omega = \frac{2\pi N}{60} \quad (4)$$

$$d^3 = \frac{16}{\pi \tau_a}\sqrt{(K_b M_b)^2 + (K_t M_t)^2} \quad (5)$$

The shaft operation is evaluated by twisting moment and torsional equation 6.

$$\frac{T}{J} = \frac{\tau}{r} \quad (6)$$

The polar moment of inertia of the shaft about the axis of rotation is found by equation 7.

$$I = \frac{\pi}{32} d^4 \quad (7)$$

The volume of castor seeds put into the hopper is calculated by equation 8.

$$V = \frac{1}{2}\pi(R^2 H - r^2 h) \quad (8)$$

Where, K_b is combined shock and fatigue factor applied to bending moment, K_t is combined shock factor applied to torsional moment, M_b is maximum bending moment, M_t is maximum torsional moment, d is diameter of the shaft, P

Typically, one major town has dominated each basin, and there were complex economic relationships between the town and the hundreds of villages that surrounded it. In the higher elevations of the mountains rimming the basins, tribally organized groups practiced transhumance, moving with their herds of sheep and goats between traditionally established summer and winter pastures. There are no major river systems in the country, and historically transportation was by means of caravans that followed routes traversing gaps and passes in the mountains. The mountains also impeded easy access to the Persian Gulf and the Caspian Sea.

Figure 2: Different City in Iran Desert

The Iranian Plateau is a plateau with an area of 3,700,000 square kilometers located in Iran, Afghanistan, and Pakistan, but also includes other countries such as Armenia, Azerbaijan, Turkmenistan, Tajikistan, Turkey, Iraq, and parts of the South Caucasus and Georgia. The country of Iran, with an area of 1,648,195 square kilometers, is approximately half the size of the Iranian Plateau(fig 2).

The Iranian Plateau is of great importance due to its strategic geographical location, rich history, and cultural and civilizational influences. As a bridge between East and West Asia, the plateau has played a key role in human migrations and cultural exchanges. Also, the presence of the Zagros and Alborz mountain ranges makes this region a naturally defended area, doubling its geopolitical importance.

Figure 3: NAMSKARA Organic Castor Oil

In the present study, seeds were grown in the research greenhouse of Semnan University and at the three-leaf stage, organic and mineral fertilizer were added to the experimental treatments (fig 5, 6).

RESULT

If castor oil is processed properly and systematically, the toxic compounds in it will be eliminated and this valuable plant can be used with peace of mind. To buy various medicinal plants, buy herbal medicines online, buy herbal teas, buy original organic herbal oils online, you can visit pharmacies.

Castor leaves have numerous medicinal and therapeutic properties, including anti-inflammatory, antimicrobial, and laxative properties. Also, these leaves are used in traditional medicine to treat some diseases such as skin infections, arthritis, and constipation.

To obtain castor oil, the outer shell of these seeds is separated and their kernels are pressed under sufficient hydraulic pressure in the cold. The resulting oil is refined by steaming, filtering, and bleaching. This oil is a transparent, almost colorless or slightly yellow, viscous liquid, with a very slight odor and a mild taste that gradually becomes slightly pungent. This oil is non-drying and only turns sour when exposed to high temperatures. Castor oil is a native product of the tropical regions of North Africa and is cultivated in areas with warm climates. The general distribution of this species includes: Europe, Anatolia, Afghanistan, India, parts of Asia, Africa, and Central and South America. In Iran, it is also widely cultivated in the western and southern regions. "

Grow Lush, Long Eyelashes:

Used by famous TV stars, this 100% pure, USDA Organic Castor Oil is the secret to voluminous, thick eyelashes and naturally beautiful eyebrows. Includes 2 applicator brushes for simple application to lashes, browlines and detailed areas

Boosts Hair Growth:

Extracted from raw castor seeds with the highest quality standards, this cold pressed castor oil for hair is a natural hair regrowth tonic that provides vitamins and nutrition for strong, long and thick hair. This premium hair growth treatment also helps regrow hair and prevent hair loss.

Promotes Gorgeous, Glowing Skin:

Achieve supple, smooth skin with this unrefined castor oil treatment - rich in all-natural vitamins and fatty acids, it can be used as a castor oil moisturizer to hydrate skin and deliver anti-aging benefits instantly!

All-Natural Beauty Solution:

This organic extra-virgin castor oil is a real beauty remedy! It works as a natural eyelash growth serum (eyelash growth enhancer), conditioner, hot oil treatment, moisturizer, and mask to boost beautiful hair, eyelashes, brows and skin naturally - without the harsh chemicals!

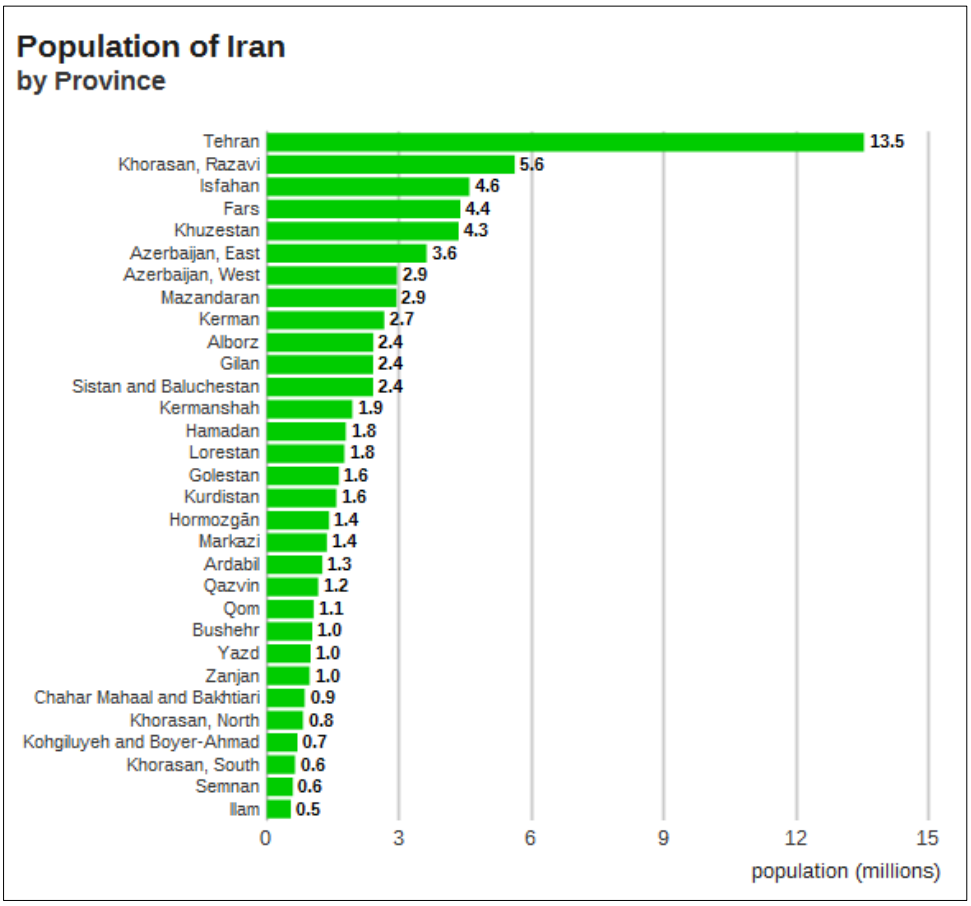

Figure 4: Population of Iran by province

Figure 5: Castor Production in Iran at Semnan University- arid zone

Figure 6: Production castor in green house in Iran arid zone at Semnan university

DISCUSSION

Chemical composition of castor oil present in fig below:

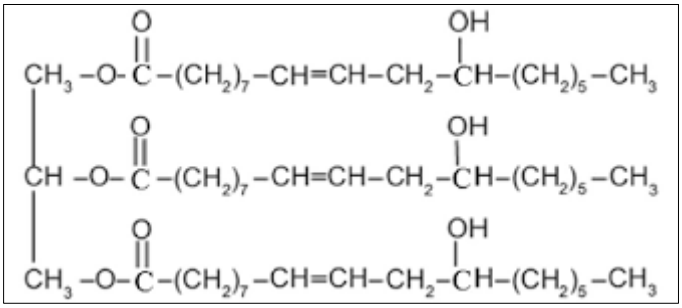

Figure 7: Castor Oil Chemical formula

Castor oil can be grown in desert areas. Castor oil is a drought and salt tolerant plant that grows in a variety of soils, except for heavy, poorly drained clay soils. It is particularly popular in areas that are unsuitable for other crops.

Castor (Ricinus communis) is important in Iran as a valuable plant, both medicinally and industrially. Castor oil is traditionally used in traditional medicine for various treatments and is also known as an important source for oil production in industry.

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