Table-3: Physicochemical Properties of Chemically Superior Samples of *Balanites aegyptiaca* (Hingota)

S. No.	Population	% Oil Yield (Mean ± S.E.)	Acid Value	Saponification Value	Ester Value	Free Fatty Acid Value	Peroxide Value	Iodine Value	Refractive Index
1	Alwar	53.33 ± 3.04	4.60	211.11	206.51	2.31	2.20	102.41	1.46
2	Pali	55.12 ± 4.24	2.18	197.52	200.87	1.87	2.87	98.43	1.45
3	Tonk	50.62 ± 0.79	2.25	193.28	204.89	0.89	3.01	98.72	1.47
4	Jodhpur	46.15 ± 0.58	2.32	195.75	200.62	1.25	2.88	97.65	1.46

Note: Oil Yield = Percentage of oil extracted from seeds; Acid Value = Indicator of the acidity of the oil; Saponification Value = Indicates the molecular weight of fatty acids; Ester Value = Represents the amount of ester compounds present in the oil; Free Fatty Acid Value = Indicates the extent of hydrolysis in the Oil; Peroxide Value = Measure of the oxidative stability of the oil; Iodine Value= indicator of the degree of unsaturation; Refractive Index = Indicator of the purity of the oil.

Value-Added Product: Soap Production and Analysis from *Balanites aegyptiaca* Oil

The fatty oil extracted from the seeds of *Balanites aegyptiaca* has been successfully used in the production of herbal soap. The details are as follows:

Materials:

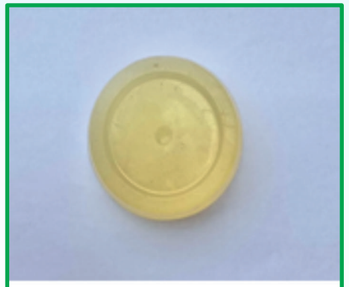
Balanites aegyptiaca oil, Sodium Hydroxide (NaOH), Distilled Water, Thermometer (for temperature measurement), Beaker, Flask, Measuring Cylinder, Mixing Stirrer (manual or electric), Soap Molds, pH Meter, etc.

Method:

For 100 ml of *Balanites aegyptiaca* oil, a solution was prepared using 14 grams of NaOH and 38 ml of distilled water. This ratio was based on the saponification value of the oil to ensure no excess alkalinity remained.

The oil and the alkali solution were heated separately to a temperature of 40–45°C, which is considered ideal for the reaction. Thereafter, both were gradually mixed and continuously stirred to facilitate the reaction between the fatty acids and alkali resulted in soap formation. During this process, thickening and a change in colour of the mixture were observed indicating a successful reaction.

The prepared mixture was then poured into moulds and left to set for 24–48 hours. After setting, the soap was removed from the moulds and kept in a shaded, well-ventilated area for 3–4 weeks. During this period, pH tests were conducted at various stages and the soap's pH was found between 7 to 9 which is considered suitable and mild for the skin.



Soap Made from Hingota Oil (A)

Soap Made from Hingota Oil and Extract of Dried Palash Flowers (1:1) (B)

The quality of the herbal soap made from *Balanites aegyptiaca* oil was evaluated through various tests. Two types of soaps — Soap-A and Soap-B — were analyzed during the testing. The first parameter assessed was the **Total Fatty Matter (TFM)** was recorded as **61.32%** in Soap-A and **62.58%** in Soap-B. This indicates a high fat content in both soaps making them gentle and beneficial for the skin.

The **Total Alkali Matter** was recorded **0.15%** in Soap-A and **0.20%** in Soap-B confirming that the soaps do not have a harsh effect on the skin. Similarly, **Free Caustic Alkali** content was **0.05%** and **0.06%,** respectively, making the soaps safe for daily use.

The **Moisture Content** was **13.11%** in Soap-A and **15.68%** in Soap-B. A higher moisture content makes the soap softer and more soluble, while lower moisture ensures longer usability. Finally, the **pH level** was measured as **8.89** for Soap-A and **8.75** for Soap-B. These pH values fall within the skin-friendly range and indicate that the soaps are within a safe level of alkalinity.

This herbal soap made from *Balanites aegyptiaca* is free from synthetic chemicals, fragrances or preservatives. Its production highlights the plant's potential as a valuable resource for rural entrepreneurship and natural product development for cottage industries. There is a strong need for further research to explore the commercial production potential of this plant-based product.

Published by

Director

ICFRE-Arid Forest Research Institute

Post – Krishi Mandi, New Pali Road, Jodhpur

Web: http://afri.icfre.org email: dir_afri@icfre.org

Phone +91-0291-2722549

Funded by :

National Authority CAMPA-2025,

MOEF&CC, Government of India

Research, Testing & Article by:

Sangeeta Tripathi, CTO

Silviculture & Forest Management Division

Designed by : Kusum Parihar, ACTO, Ext. Div.

Balanites aegyptiaca (Desert Date): Seed Oil as Potential Raw Material in Soap Making

ICFRE-ARID FOREST RESEARCH INSTITUTE

JODHPUR

INDIAN COUNCIL OF FORESTRY

RESEARCH & EDUCATION, DEHRADUN

(AN AUTONOMOUS BODY OF MOEF&CC, GOVT. OF INDIA)

Balanites aegyptiaca (Desert Date/Hingota)

Balanites aegyptiaca is a thorny shrub or tree commonly found in arid regions and is known by various names such as Hingot, Hingol, Hingan, Desert Date and Soapberry. It is believed to have originated in Africa and the Middle Eastern countries. The species is also found in various Asian countries including Burma (Myanmar), India, Pakistan, Iran, Jordan, Oman, Palestine, Saudi Arabia, Syria and Yemen etc.

In India, it naturally occurs in Rajasthan, Gujarat, Madhya Pradesh, Andhra Pradesh, Karnataka, Tamil Nadu, Maharashtra etc. In Rajasthan, it is naturally disbributed in Jodhpur, Pali, Alwar, Nagaur, Bundi, Sirohi, Tonk, Sawai Madhopur, Ajmer, Bikaner and Churu districts.

Botanical Description:

It is a multi-branched, thorny shrub or tree that grows up to about 10 meters in height. The trunk is short and the yellow-green thorny branches emerge near the base. The bark is dark brown or brown in colour. The flowers are small, bisexual, fragrant, yellowish-green and bloom in clusters. Flowering and fruiting begin in the age of 5 to 7 years, with peak seed production occurring between 15 to 25 years of age. The fruits are green when immature and turn yellow and smooth upon ripening. The pulp is bitter but edible. The seeds are light brown, fibrous, and extremely hard.

Major Uses and Medicinal Properties:

Balanites aegyptiaca has traditionally been used to treat various ailments such as jaundice, intestinal worm infections, wounds, malaria, syphilis, epilepsy, dysentery, constipation, diarrhea, hemorrhoids, abdominal pain, asthma and fever.

The seeds are used as antipyretic, expectorant, antibacterial and antifungal agents. The fruits are used to treat whooping cough, leucoderma and other skin disorders. The bark is used in the treatment of abdominal disorders. The oil is applied for relief from headaches. The seeds contain about 49% edible oil and further research is in process on exploring its potential for biodiesel production. The wood yields high-quality charcoal used as fuel.

Oil extracted from the seeds is also used in the production of soap and shampoo. The leaves are used for treating sleeping sickness and diabetes. A decoction made by boiling the roots is used to treat inflammation and abdominal pain. The leaves and fruits are also used as animal fodder.

Balanites aegyptiaca: Research Conducted by ICFRE – Arid Forest Research Institute (AFRI), Jodhpur

Considering the diverse uses of *Balanites aegyptiaca* (Hingota) in daily life, a study was conducted by the Indian Council of Forestry Research and Education – Arid Forest Research Institute (ICFRE-AFRI), Jodhpur. In this study, samples from 14 geographically isolated populations covering 57 accessions of *Balanites aegyptiaca* were collected from various districts of Rajasthan and Gujarat for oil yield analysis.The results are as follows:

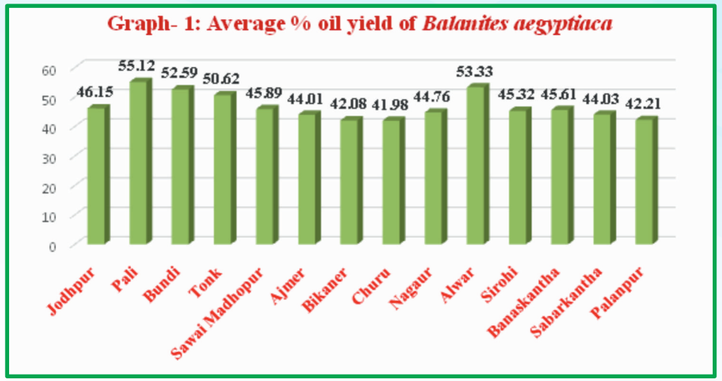
Significant variation in oil content was observed among the different populations of *Balanites aegyptiaca*, ranging from 41.98% to 55.12%. The highest oil content was recorded in samples collected from Pali (55.12%), followed by Alwar (53.33%) and Bundi (52.59%). The lowest oil content was observed in Churu (41.98%) and low oil percentages also recorded in samples from Bikaner (42.08%) and Palanpur (42.21%). Detailed results are provided in Table-1.

Table-1: Oil Content in Geographically Isolated Populations of Hingota (*Balanites aegyptiaca*) in Rajasthan and Gujarat

S. No.	Population (Location)	Yield Range (%)	Average Oil Yield (%)
1	Nagaur	35.92 – 53.6	44.76
2	Jodhpur	40.36 – 55.18	46.15
3	Churu	41.98	41.98
4	Pali	52.71 – 55.31	55.12
5	Tonk	51.12 – 53.34	50.62
6	Bundi	43.24 – 56.42	52.59
7	Sawai Madhopur	45.89	45.89
8	Alwar	48.56 – 61.1	53.33
9	Bikaner	47.00	42.08
10	Ajmer	43.50 – 44.52	44.01
11	Sirohi	44.52 – 45.88	45.32
12	Banaskantha	46.22 – 47.00	45.61
13	Sabarkantha	43.84 – 44.23	44.03
14	Palanpur	45.23 – 46.89	42.21

Balanites aegyptiaca : Geographical Coordinates of Samples Collected from Rajasthan and Gujarat

The presence of high-quality and high-oil-yielding accessions in the arid regions of Rajasthan, especially in the districts of Pali and Alwar makes the species highly significant from both medicinal and commercial perspectives. In view of this, chemically superior accessions were identified and their physicochemical properties were studied. The results of this analysis are as follows:



Chemically Superior Genotypes:

To identify chemically superior samples, statistical analysis was carried out using Tukey's Honest Significant Difference (HSD) method. The samples collected from the following locations were found to be chemically superior (Table-2). The results of the physicochemical analysis of these samples are presented in Table-3.

Table-2: Chemically Superior Samples (Chemically Superior Genotypes)

S. No.	Population	Location (Coordinates)	Oil Yield % (Mean ± Standard Error)
1	Alwar	N=27.22008, E=76.28491	53.33 ± 3.04
2	Pali	N=25.19022, E=73.10575	55.12 ± 4.24
3	Tonk	N=25.45332, E=75.60008	50.62 ± 0.79
4	Jodhpur	N=26.32278, E=72.79841	46.15 ± 0.58

In the physicochemical analysis of *Balanites aegyptiaca* (Hingota) oil obtained from chemically superior populations of Rajasthan, variations were observed in oil yield and key chemical properties. The highest oil yield was recorded in the Pali population (55.12±4.24%) while the lowest was found in Jodhpur (46.15±0.58%).

The **acid value** ranged from 2.18 to 4.60, indicating differences in oil quality and stability. The **saponification value** ranged between 193.28 and 211.11 reflecting variation in the molecular weight of fatty acids. The **ester value** was highest in Alwar (206.51) and lowest in Tonk (204.89). The **free fatty acid (FFA)** content was lowest in Tonk (0.89) and highest in Alwar (2.31), indicating varying levels of hydrolysis.

The **peroxide value** ranged from 2.20 to 3.01, indicating the oxidative stability of the oil. The **iodine value** varied between 97.65 and 102.41suggesting differences in the level of unsaturation. The **refractive index** remained nearly uniform in all populations (1.45–1.47), confirming consistency in oil purity.

These variations indicate that geographical factors influence the chemical composition and quality of *Balanites aegyptiaca* oil (Table-3).