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PRODUCTION, PROCESSING AND MARKETING OF RAPESEED IN INDIA

S. Nayi Mit*, Chirag Bharodia, Nariya Jensi, Datta Amitkumar and Radhika J. Bani

PG Institute of ABM, Junagadh Agricultural University, Junagadh, Gujarat, India.
*Corresponding author E-mail : mitnayi991@gmail.com

ABSTRACT

Rapeseed (*Brassica napus*) is a vital oilseed crop globally and plays a significant role in India's agricultural economy. This study presents an overview of the production, processing, and marketing channels of rapeseed in India. The study highlights India as one of the major producers, contributing to 8.54% of global rapeseed production, predominantly from states like Rajasthan. The processing of rapeseed into oil and meal for animal feed is crucial, while marketing analysis reveals various channels with efficiency affected by factors such as price spreads and government policies. Rapeseed's economic significance extends beyond production, generating employment for farmers, processors, and traders, contributing to GDP and agricultural growth and earning foreign exchange through exports. Despite the crop's economic value, challenges like high input costs, fluctuating market prices and infrastructural gaps persist. Research focuses on developing high-yielding, disease-resistant varieties, integrated pest management strategies, precision agriculture techniques, and biofortification. Government initiatives and research projects are focused on increasing yield and market support for rapeseed farmers. The findings emphasize the need for sustainable practices and enhanced support mechanisms to optimize the rapeseed value chain.

Key words : Rapeseed, Oilseed, Production, Processing, Marketing.

Introduction

Rapeseed of commercial significance is primarily cultivated in cooler regions of the world, including North America, northern Europe, Canada, China and India. It comes from species within the *Brassica* genus, part of the *Cruciferae* family, which includes around 160 species, mostly annual and biennial herbs. The oil-producing varieties are mainly derived from two species: *Brassica napus* L. and *Brassica campestris* L. (syn. *Brassica rapa* L.). *Brassica rapa* is commonly known as turnip rape, while *Brassica napus* is referred to as Swede rape, with winter types present in both. *Brassica campestris* also goes by names such as toria, sarson, summer turnip rape, and Polish rape, while *Brassica napus* is sometimes called Argentine rape, Swede rape, or colza, as a outlined by Gupta and Pratap (2007).

According to the AGMARKNET (2004), Rapeseed (*Brassica napus*), a bright yellow-flowering plant from the *brassicaceae* family, is extensively cultivated for its oil-rich seeds, making it a vital crop in agriculture, especially in temperate regions. While its origins date back to ancient times, it gained major commercial importance in the 20th century. Beyond its agricultural value, rapeseed is crucial in industrial applications, particularly in biofuel production, where its oil is used to produce biodiesel. Additionally, its biomass is utilized to create biodegradable materials, supporting environmentally sustainable products and contributing to renewable energy solutions. Rapeseed-mustard crops in India comprise traditionally grown indigenous species, namely toria [*Brassica campestris* syn. *B. rapa* L. var. toria, 2n (AA) = 20], brown sarson [*B. campestris* syn. *Brassica rapa* L. var. brown sarson, 2n (AA) = 20], yellow sarson [*B. campestris* syn. *Brassica rapa* L. as a highlighted by Chauhan *et al.* (2011). In India, traditional rapeseed-mustard seed oil accumulates high amounts of erucic acid comprising 40-57% of total fatty acids and 80-160 µmole glucosinolate/g of oil-free seed meal. In

1996-97, a 'National Network project for Improvement of Oilseed Brassica quality' was established by ICAR to transfer improved quality traits from exotic germplasm into agronomically suitable cultivars of B. juncea as outlined by Priyamedha *et al.* (2016).

The name "rape" comes from the latin word *rapum*, meaning "turnip," while its close relative, mustard, traces its origins to the latin *mustum* (meaning "grape juice") and *ardens* (meaning "burning" or "hot"). Rapeseed is valued not only for its oil, widely used in cooking and industrial applications, but also for its protein-rich meal, which serves as animal feed. Historically, rapeseed has been a versatile crop, used as a lubricant for ancient machinery and now as a biofuel source. Its adaptability and economic importance make it a key crop in agricultural systems worldwide, as noted by Goyal *et al*. (2021). The presence of a high quantity of erucic acid in natural rapeseed oil makes it toxic for consuming and the edible rapeseed oil is prepared from plant's hybrid (contained little or no eurcic acid) which used as cooking oil, as a noted by Saeidnia and Gohari (2012). Rapeseed oil (known as canola oil in the USA, Canada and some other countries) is a potential substitute for olive oil since it has a similar MUFA content to that of olive oil and its overall fatty acid (FA) profile is favourable due to a low content of SFA and a high content of PUFA, including α-linolenic acid (ALA), as noted by Hoffman and Gerber (2014).

Production of rapeseed

According to the ICAR–DRMR, (2021), the global rapeseed market is projected to grow by 5.00% from 2021 to 2028, driven by increased production and sales of farm equipment, which will boost cultivation efficiency. In the 2023-24 season, rapeseed and mustard were cultivated on 42.58 million hectares worldwide, yielding 88.34 million tons with an average yield of 2.07 metric tons per hectare. The European Union holds the largest share in global cultivation, accounting for 30.87%, followed by Canada with 26.36% and China with 20.41%. India contributes 8.54%, while "Others" represent 8.89%, and Australia holds the smallest share at 4.93%. In terms of area, another ICAR–DRMR dataset highlights that Canada occupies the largest share with 24.27%, followed by China (21.23%) and the European Union (19.09%), with India contributing 17.19%, and Australia accounting for 7.47%.

According to the APEDA, (2023), the European Union led global rapeseed production in 2023, producing 20.5 million metric tons. Canada ranked second with 18.8 million metric tons, followed by China with 15.4 million metric tons. India ranked fourth, producing 12.02 million metric tons. Japan's production was significantly lower at 4 million metric tons. "Other countries" collectively produced 21.16 million metric tons, indicating that while a few countries dominate, numerous others contribute notably to global rapeseed production.

In India, rapeseed- mustard is widely grown in diverse agro-climatic environments from North-East, North-West, Central to Southern states under different conditions such as sole crop/mixed crop, early/timely/late, rainfed/irrigated and saline or alkaline soils. Based on average of 2014-2015 to 2018-2019 area and production data, major rapeseed-mustard growing states are Rajasthan (producing 44.9% of total rape- seed-mustard from 40.7% area), Madhya Pradesh (producing 11.3% from 11.9% area) and Uttar Pradesh (producing 10.6% from 11.2% area). Rapeseed-mustard crops in India comprise eight spemes *viz.*, Indian mustard, toria, black mustard, yellow sarson, brown sarson, gobni sarson, karan rai and taramira, as a outlined by Chand *et al.* (2021), Oganja *et al.* (2024a). Under the name of rapeseed-mustard, seven important annual oilseeds belonging to the Brassicaceae (Cruciferae) are grown in India. They are Indian mustard or raya [*Brassica juncea* (L.) Czern. & Coss.]; the three ecotypes of *B. campestris* L. *viz.*, toria, brown sarson and yellow sarson; gobhi sarson (B. napus L.), Ethiopian mustard (*B. carinata* Braun.) and taramira (*Eruca sativa* Mill.), as a noted by Rai *et al.* (2016). According to Directorate of Rapeseed-Mustard Research. Bharatpur, Rajasthan (ICAR–DRMR, 2021), During the 2018-19 crop season, Indian rapeseed accounted for approximately 75-80% of the total 6.23 million hectares dedicated to these crops in the country.

According to the ICAR–DRMR (2021), Rajasthan leads the country, occupying 41% of the total rapeseed cultivation area, making it the largest contributor to rapeseed farming in India. Other states follow with smaller but notable shares. States such as Assam, Bihar, Chhattisgarh, Gujarat, Jammu & Kashmir and Jharkhand contribute around 4-5% each to the total rapeseed cultivation area. According to the ICAR–DRMR (2021), Rajasthan stands out as the largest producer, accounting for 45% of the country's total rapeseed output, highlighting its dominance in the sector. Following Rajasthan, Madhya Pradesh and Haryana are also significant contributors to rapeseed production. Additionally, states like Punjab, Jharkhand, Gujarat, Bihar and Assam produce rapeseed, though their contributions range from 1-5%.

According to the APEDA, (2023), Rajasthan consistently leads India in both rapeseed cultivation area and total production, followed by Uttar Pradesh, Haryana,

and Madhya Pradesh, which also contribute significantly. Gujarat, however, excels in yield, achieving 1932 kg per hectare in 2019-20. Bihar ranks as the lowest producer. These differences reflect regional variations in farming practices, climate, and soil conditions. While rapeseed is cultivated in 13 states, Rajasthan, Uttar Pradesh, Haryana, and West Bengal account for 77% of the total production, with shares of 45%, 13%, 11%, and 8%, respectively, as a noted by Singh and Bansal (2020).

According to the PIB, (2023), The Minimum Support Price (MSP) of rapeseed in India over the years from 2018-19 to 2023-24. Starting at ` 4,200 per quintal in 2018-19, the MSP has seen consistent increments, reaching ` 4,425 in 2019-20, ` 4,650 in 2020-21 and ` 5,050 in 2021-22. The upward trend continued with the price rising to ` 5,450 in 2022-23 and finally reaching ¹ 5,650 per quintal in 2023-24. This gradual increase reflects the government's effort to provide better financial support to farmers, addressing inflationary pressures and rising costs of production inputs, while ensuring the profitability and sustainability of rapeseed.

Brassica (rapeseed-mustard) is India's second most important edible oilseed crop after groundnut, with Rajasthan leading production at 46% as a reported by Bansal and Kukkar (2020). In Gujarat, rapeseed was cultivated on 3.40 lakh hectares, yielding 6.78 lakh metric tons at a productivity rate of 1995 kg/ha. Banaskantha emerged as the top contributor, accounting for 44.97% of Gujarat's rapeseed production, followed by Patan and Mehsana. Gujarat is a major player in India's oilseed production, with five oilseed crops covering more than 95% of the area. Rapeseed-mustard production has shown irregular growth with medium instability from period I to III, as a noted by Ramoliya *et al.* (2022).

According to the STATISTA, (2024), The Country Wise Export of Rapeseed in thousand metric tons across five countries. The United States leads significantly, exporting 5.19 thousand metric tons, making it the largest exporter among the countries shown. The UAE follows with 2.52 thousand metric tons, closely trailed by Canada at 2.29 and Australia at 2.11 thousand metric tons. Bhutan, on the other hand, exports the least amount, with just 0.693 thousand metric tons. This comparison emphasizes the dominance of the United States in rapeseed exports relative to the other nations listed.

According to the STATISTA, (2024), The trends in rapeseed imports over five years, from 2019-20 to 2023-24. In 2019-20, rapeseed imports were at their peak, reaching 70 thousand metric tonnes. However, imports sharply declined to 25 thousand metric tonnes in 2020-21, signaling a significant reduction. The following year, 2021-22, saw a slight rebound with imports rising to 34 thousand metric tonnes. Despite this temporary recovery, imports dramatically fell again to just 6 thousand metric tonnes in 2022-23 and further decreased to 5 thousand metric tonnes in 2023-24. This decline suggests a shift in rapeseed trade dynamics, possibly due to increased domestic production, reduced demand, or policy changes affecting imports.

Cost of cultivation of rapeseed

Cost of cultivating rapeseed (mustard) in the Fatehpur district of Uttar Pradesh revealing significant insights into its economic viability. They found that the average per capita cost of cultivation amounted to ` 30,448, encompassing all expenses related to production. Interestingly, the study indicated that marginal farms, which are typically smaller, achieved the highest gross income, recorded at ` 44,173.71. This finding suggests that even smaller farming operations can generate substantial returns from mustard cultivation. Overall, the research concluded that mustard farming is indeed profitable, with evidence showing a further increase in profit per unit of time and area as cultivation continues. This indicates not only the economic benefits of mustard as a crop but also it's potential for sustainable agricultural practices in the region. The cost of production per quintal on a C3 basis averages ` 2302, showing marginal differences across farmer groups. Family labour income and family investment income are higher for marginal farmers, indicating better returns for smaller farms despite their lower total production. By providing insights into costs and income, the study serves as a valuable resource for farmers, agricultural planners, and policymakers aiming to enhance agricultural productivity and farmer welfare. As a highlighted by Sahu *et al.* (2018).

Processing of rapeseed

Rapeseed oil is usually expelled from the seed at high temperatures. Refining removes most of the nontriacylglycerol components, including many sinapic acid derivatives typical for rapeseed. The effect of these phenolic constituents on the oxidative stability of the oil was studied using rapeseed and turnip rapeseed oil samples resulting from different expelling conditions and refinement steps. Rapeseed oil is usually expelled from the seed at high temperatures. Refining removes most of the nontriacylglycerol components, including many sinapic acid derivatives typical for rapeseed. The effect of these phenolic constituents on the oxidative stability of the oil was studied using rapeseed and turnip rapeseed oil samples resulting from different expelling conditions and

refinement steps as a noted by Koski *et al.* (2003).

Rapeseed is mainly known as a source of edible and industrial oil, as well as protein. Multiple extraction methods have been tested, and their variation affects oil and protein yield and quality, notably the usage of solvents, temperature, pressure, and the time of processing. However, some of these methods have not been tested at an industrial level. One of the most common oil extraction methods is with a solvent (mostly hexane). In brief, seeds are heated for softening, flaked to burst cell walls and cooked to promote cell disruption, before compression to release the oil, leaving the rest of the seeds to form a protein cake. Residual oil is then extracted using the solvent, which filters the cake and removes the oil. The solvent is removed from the cake and the oil, which undergo refining and processing stages before their release in the market. As highlighted by Raboanatahiry *et al*. (2021).

There are different stage are involve in the processing such as a Seed cleaning, Husking, Drying, cooking, Flaking, Pressing and Refining. At the end of the process we get primarily rapeseed oil and rapeseed cake. Oil which can use in mostly cooking and rapeseed cake are use in fertilizer or animal feed as well.

Marketing channels for rapeseed

Marketing encompasses distribution channels that involve individuals, organizations and processes necessary to move goods from their production origin to their final consumption destination Katariya *et al.* (2016), Sulthana *et al*. (2019), Vasoya *et al*. (2024). The study in Fatehabad district, Haryana, analyzed mustard marketing efficiency across four channels. With a sample of 35 respondents (including farmers, wholesalers, and retailers), it found that Channel-I (direct producer-to-consumer) was the most efficient with a 2.76% marketing efficiency, due to no intermediaries and low costs. Channel-II followed with 2.62% efficiency. The most commonly used channel, "Producer → Wholesaler → Retailer → Consumer," handled the most mustard trade but was the least efficient due to higher costs and margins from multiple intermediaries as a outlined by Verma and Rathore (2018).

Channel I: Producer — Consumer

Channel II: Producer — wholesaler—Retailer—Consumer

Channel III: Producer – wholesaler—Miller—Retailer— Consumer

Channel IV: Producer—Miller—Retailer—Consumer

The study was conducted in Sardhana and Sharurpur Khurd blocks in Meerut district of Uttar Pradesh State, India. Hundred farmers were selected randomly from ten villages from these blocks to collect the required information on the cost of cultivation, marketing and other aspects for the present study. The three types of marketing channel identified in the study area were Channel-I: Producer – Consumer, Channel-II: Producer – Retailer – consumer and Channel-III: Producer – Wholesaler - Retailer – Consumer. Price spread of mustard cultivation in channel-I net price received by the producer in consumer's rupee 95.82 per cent was found and total marketing cost is 4.18 per cent. Chanel-II net price received by the producer in consumer rupee's 90.59 per cent and total marketing cost was found is 9.41 per cent. Channel-III net price received by the producer in consumer rupee's 83.53 per cent and total marketing cost is 16.47 per cent. More than 81.00 per cent rapeseed-mustard producers perceived that transportation of small quantity of produce was not an economical option if they sold their small produce in the market, As a outlined by Kumar *et al*. (2017).

Channel-I: Producer-Consumer

Channel-II: Producer-Retailer-Consumer

Channel III: Producer-Wholesaler- Retailer-Consumer

Constraints

Key challenges to agricultural productivity in India include the limited availability of improved or hybrid seeds, insufficient seed multiplication capacity and the low profitability and efficiency associated with the adoption and use of insecticides, bio-pesticides, organic fertilizers, fertilizers, bio-fertilizers and plant growth regulators. These challenges are further compounded by the lack of complementary improved agricultural practices Ghangale *et al.* (2018), Sathish *et al.* (2019), Sathish *et al.* (2022), Kumar *et al.* (2024a), Kumar *et al.* (2024b), Pithiya *et al.* (2024), Oganja *et al.* (2024b). A constraints analysis on rapeseed and mustard cultivation in the Begusarai district of Bihar. Primary data was gathered from 120 farmers using the SRSWOR technique, focusing on key challenges faced by rapeseed-mustard growers in the area. The study identified the "Lack of improved varieties of seed" as the most significant constraint, with a Garrett score of 89.3. This was followed by "High transportation cost due to small quantities," which ranked second with a score of 76.58. Other notable issues included agro-ecological constraints, market price fluctuations, and lack of subsidies on inputs. Farmers also reported challenges like insufficient market information, labor availability, long

distances to regulated markets, and difficulties in weed and pest management. Overall, the study highlighted critical areas that need attention to improve rapeseed-mustard cultivation in the district. As a reported by Rathour *et al.* (2021).

Conclusion

Rapeseed is one of the most significant oilseed crops in India, ranking among the top seven edible oilseeds cultivated in the country. India holds a prominent global position, ranking 4th in both area and production, with 11.9 million metric tons produced from 9.3 million hectares. Rajasthan leads the nation in rapeseed production. Beyond its contribution to domestic oil production, the rapeseed industry supports biofuel generation, animal feed, and provides employment opportunities. However, the sector faces challenges such as high input costs, volatile market prices, and gaps in infrastructure for processing and marketing. Despite these hurdles, the rapeseed market is projected to grow at a rate of 5.00% from 2021 to 2028. To optimize this sector, government interventions, including farmer support and the promotion of sustainable practices are essential. Enhancing marketing efficiencies and reducing price disparities will further ensure the profitability and sustainability of the rapeseed industry, driving growth and resilience in the coming years. Sustainable agricultural practices, better infrastructure and enhanced market access will be key to optimizing the rapeseed value chain and ensuring long-term growth and profitability for farmers, processors and traders.

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