
A Glimpse on Indian Honey Exports in Global Market

ABSTRACT

The honey bee is one of humanity's most significant insects. Humans and honey bees are among the few creatures that benefit each other. The global organic honey market had 606.2 million U.S. dollars in 2019, and was forecasted to reach 923.6 million U.S. dollars by 2025. Honey production volume as of 2018 data, China stands tall with 31.4% production followed by Turkey 6.9%, Russia 5%, Iran 5% other countries constitute roughly 41% production combinable. This research paper discusses the work flow involved in the export of Indian honey from peasants to manufacturers, as well as the regulatory requirements for exporting Indian honey to the worldwide market. The growth of the Indian honey industry has been significantly reduced in the last two years because of a wide range of factors. Measures implemented by the national bee board to reinvigorate the industry have been discussed.

Keywords: Honey; Heart disease; Antibacterial; Antiseptic; Crystallisation

Comment [SK1]: Include this factors in conclusion section

INTRODUCTION

Honey has a significant amount of antioxidants and flavonoids, which can help to reduce oxidative stress and inflammation in the body while also protecting against heart disease and cancer

[1]. Aside from that, honey has antibacterial and antiseptic properties that help wound and burn healing by keeping the wound moist and improving the flow of nutrients to the affected area. Because of these causes, the need for honey has increased market appeal for home cures. Honey has become a significant product in today's organic world [2]. Scientific validation of honey's therapeutic use and its increasing value as a premium ingredient in nutritional supplements are also important market drivers in both the national and global markets. When it comes to exporting honey from India to the worldwide market, the only main concerns are antibiotics and adulterants [3].

Indian honey flora and fauna

In terms of flavour, multiflora honey is the most popular honey flavour in India. Export based honey flavours include *Eucalyptus* honey, *Ajwain* honey, mustard honey, lychee honey, sunflower honey, karanj/pongamea honey, multi-flora Himalayan honey, acacia honey, wild flora honey, multi and mono floral honey. Kashmiri honey and *Acacia* honey are the high demand varieties

in export [4-9]. Due to climatic conditions, most export oriented businesses operate in Northern India rather than Southern India. Rajasthan, Punjab, Uttar Pradesh, Himachal Pradesh, Bombay, West Bengal, and Kashmir provide the highest percentage of production to export companies.

Indian honey exports

Beekeepers in India are registered with the national bee board, yet there are still a large number of beekeepers in India who haven't registered. In comparison to the Indian dairy co-operative society, it is an unorganized sector. Hence, traders used to buy honey from scattered farmers and mobilized bee keepers based on cultivation season. Mustard honey relatively contributes higher batches to the global export. Mustard honey is often produced in and around northern hemisphere of India with a high FG ratio, which itself is accountable for honey crystallisation [10]. If the FG ratio is higher, it will crystallize considerably quicker. The storage temperature has a significant impact in honey crystallisation. Honey crystallisation occurs most quickly at 10°C to 15°C (50°F to 59°F). Crystallisation is slowed at temperatures below 10°C (52°F). Low temperatures increase the viscosity of honey, which slows crystal formation and diffusion. Honey resists crystallisation best at temperatures above 25°C (77°F). The crystals disintegrate around 40°C

Comment [SK2]: Write out the full form of the abbreviation wherever needed

(104°F), temperatures above 40°C (104°F) will harm honey's qualities [11].

Farmers used to sell their hand holdings to traders in their region for between 50 and 150 rupees per kilogramme. Rate fluctuates continuously dependent on demand and supply. When we were on a field trip with the national science foundation auditor in the interiors of Uttar Pradesh, the majority of farmers are statistically significant if they receive between 90 and 105 rupees per kilogramme [12]. They are unable to maintain shore properties to execute beekeeping activities in their separate fields if their income falls below 70 rupees. Most farms had 100-200 boxes on average, but no more than that. Some of them had as much as 500 boxes. Because a particular farmer's and beekeeper's production capability is not at its peak, they are unable to approach firms directly for trading another drawback is the distance between the companies and the manufacturer's location. These factors rise to a new type of intermediary in this industry called as a trading agency [13]. Due to commercial considerations, the trading agency used to buy honey from several small merchants using their connections and information, which they solely kept. The export inspection council's executive order for honey includes a quarterly field visit to check the hygiene and quality standards established by them. The risk of price fluctuation and adulterant scope begins here, depending on demand and supply from manufacturers. Manufacturing units only make purchases through agencies based on the annual contracts signed between trade agencies and them for the fiscal year. Little bee impel and sun land trading agency are the most common importers from the United States.

having a single sample part. If the consignment contains 400 buckets, it is divided into eight equal halves. The 8 components would then be effectively mixed together to form a single part [14]. Prior to testing, sampling is critical. If effective sampling is not performed, there is a risk of test findings mismatching, resulting in a defective end product. The sampling is managed by the quality assurance department using a check list provided by the EIA. In house raw honey testing is permitted by the regulatory body norms as well as clients from global markets. Since the majority of countries consider finished product findings from Intertek Germany as a reliable resource and pioneer in this industry. Raw material testing is performed for seven different antibiotic groups, and wet lab testing is performed in accordance with EIA guidelines. Only pass batches progress to the next level, production unit. After testing, all raw honey batches are stored in a cold storage chamber. Temperatures are typically maintained between 16°C and 26°C.

Export price

Colour has a significant impact on honey prices in the export market. When the colour is substantially lower, the price rises as the colour rises, the price falls. A measurement tool is used to determine the colour of the honey. The Gulf countries have a large market for Indian darker and amber colored honey, but juice manufacturers of same region prefer low intensity colour, mostly extra light amber and light amber based contracts are highly manufactured by Indian companies for export (Table 1).

MATERIALS AND METHODS

Sampling of raw honey

As the consignment arrives at the manufacturing unit, sampling is done bucket by bucket using SS rods, with each 50 buckets

Table 1: Colour and description of honey.

Colour	Description
0 mm-8 mm	Water white
9 mm-17 mm	Extra white
18 mm-34 mm	White
35 mm-50 mm	Extra light amber
51 mm-85 mm	Light amber
86 mm-114 mm	Amber
115 mm-200 mm	Dark

Note: Measured in Pfund

Honey processing

The production manager issues batches based on the raw material test results, bearing export agreement elements in account most contracts contain the parameters listed below. Moisture content of 18%, antibacterial and nicotinoids-free honey, quantity and colour requirements. Honey is treated reasonably simple at the manufacturing site, it is fed first into a heating chamber where waxes are removed and passed through a sub-micron filter. The product is then transferred from several heating chambers to a homogenization tank, where it is blended for 5 to 6 hours and held for 3 hours before being filled in food grade drums, each weighing 300 kg. A total export shipment amounts of 18.2 metric to 18.6 metric tons of honey. This sector's HACCP critical control points are moisture content and effective filtration. Drums are labelled with the country of origin, batch number, date of filling, and drum number. These drums are kept in the finished goods section. On a monthly basis, the national bulk handling crop oversees pest management in the plant premises. After each batch processed the plant is washed by hot water. As well as surface swab and hand swab testing is done on regular intervals in order to ensure there are zero microorganism growth and zero contamination

[15]. A member of the national science foundation comes to pursue random sampling with his presence, those samples are scheduled for finished sample testing at Intertek Deutschland. Manufacturers will be waiting for the results if they meet the contract specifications, they will be loaded into containers under the supervision of an NSF inspector. They seal the container to ensure there is no maltreatment during shipping. In the case of the honey industry in Uttar Pradesh, their shipment arrives in Delhi via container Cargo and is then moved to Mumbai via rail, from where it is transported to destination countries via cargo ship.

Table 2: Pareto numeric report production-in-MT.

Year	Production in MT	Cumulative production in MT	Percent	Cumulative percent
2010-2011	25979.21	25979.21	4.4	4.4
2011-2012	26089.03	52068.24	4.42	8.82
2012-2013	25780.7	77848.94	4.37	13.18
2013-2014	28378.4	106227.3	4.81	17.99
2014-2015	29578.56	135805.9	5.01	23
2015-2016	38177.04	173982.9	6.46	29.46
2016-2017	45055.45	219038.4	7.63	37.09
2017-2018	51547.31	270585.7	8.73	45.82
2018-2019	61333.9	331919.6	10.39	56.21
2019-2020	59536.76	391456.4	10.08	66.29
2020-2021	59999.25	451455.6	10.16	76.45

After being shipped from the production site, it may take up to 65 days to arrive in the United States. Several other manufacturing facilities are following the same approach.

Adulteration

Lately, the business suffered a significant setback due to an unanticipated drop in exports compared to the fiscal years 2007-2017. It could be owing to adulterant and surrounding nations of the United States having a self-sufficient stock for immediate deployment due to demand and supply ratio. Several shipments of honey were halted by food safety authorities from the European Union and the United States due to the presence of lead and prohibited animal antibiotics.

Furthermore, they discovered that an even greater amount of honey had been concocted without the assistance of bees, with the majority of them being made from artificial sweeteners and then extensively filtered to remove any proof of contaminants, adulteration, or indications on the same in order to mislead the testing department precisely on the honey's actual origin. China was initially supplying enough quantities of honey to the United States, but regulatory authority examinations and findings revealed that the majority of them were adulterated with corn syrup. Corn syrup behaves like inverted sugars and, once heated, cannot be distinguished from honey because it turns yellow. Honey exports from India increased dramatically after the United States slapped an embargo on China. The Indian export sector performed successfully for several years, most notably from 2007 to 2017. However, the lack of an organised framework and adulterants resulted in a significant setback for the sector (Table 2).

2021-2022	74413.06	525868.7	12.6	89.05
2022-2023*	64682.97	590551.6	10.95	100

Note: Data 2022-2023 resembles April to December.

Testing equipment's

Honey manufacturing sites are equipped with high end equipment's like LCMS/MS (Liquid Chromatography Mass Spectrometer) for antibiotics testing and IRMS (Isotope Ratio

Mass spectrometer) for C4 sugar tests and heavy metals testing specifically for lead by ICPMS inductively coupled plasma mass spectrometry to cross verify the adulteration in raw honey procurement (Table 3).

Table 3: Pareto numeric report value in crores.

Year	Value in crores	Cumulative value in crores	Percent	Cumulative percent
2010-2011	300.87	300.87	3.53	3.53
2011-2012	321.24	622.11	3.76	7.29
2012-2013	356.32	978.43	4.17	11.46
2013-2014	445.01	1423.44	5.21	16.68
2014-2015	535.1	1958.54	6.27	22.95
2015-2016	705.87	2664.41	8.27	31.22
2016-2017	557.79	3222.2	6.54	37.75
2017-2018	653.58	3875.78	7.66	45.41
2018-2019	732.19	4607.97	8.58	53.99
2019-2020	633.79	5241.76	7.43	61.41
2020-2021	716.13	5957.89	8.39	69.81
2021-2022	1221.18	7179.07	14.31	84.11
2022-2023*	1355.96	8535.03	15.89	100

Note: Data 2022-2023 resembles April to December.

RESULTS AND DISCUSSION

Action plans

NBB has 9698 registered bee keepers across India, with a total of 1559771 colonies. Assistance is offered under MIDH, which is conducted by the state departments of horticulture, for the promotion and development of scientific beekeeping in the country. NBB is also one of the MIDH's National Level Agencies (NLAs) (Figure 1). The national bee board is attempting to involve the NDDB, GCMMF, milk federation, and co-operative society in order to structure and lead the sector in a healthy manner. NBB is establishing integrated bee development centres in 16 Indian states (Table 4). The national bee board is also financing the establishment of a sophisticated laboratory for honey testing at the NDDB in Gujarat. Substantially all these are heading to increase the number of skilled and NBB registered bee keepers in the nation. The

national bee board technical committee provided operational guidelines for the October 2019 national bee keeping and honey mission. During the fourth session of the Coronavirus pandemic relief package, finance minister Mrs. Nirmala Sitharaman emphasised the importance of beekeeping and provided a Rs 500/- crore relief packages exclusively for the beekeeping industry (Figure 2). During her address, she also mentioned that the wax used in the domestic market is imported, and that if we boost beekeeping, we would be self-sufficient and will not need to import wax. The funds will be utilised for infrastructure development connected to an integrated beekeeping development centre, collection, marketing, and storage centres, post-harvest, and value addition facilities, which would boost the per person income of 2 lakh beekeepers in India.

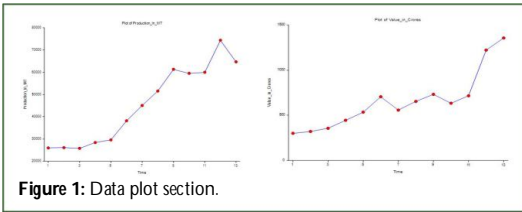


Figure 1: Data plot section.

Table 4: Lag and co-relation value.

Lag	Co-relation value	Lag	Co-relation value
-10	-0.387377	0	0.84135
-9	-0.355993	1	0.532367
-8	-0.343778	2	0.289877
-7	-0.239964	3	0.209939
-6	-0.066294	4	0.083733
-5	0.055785	5	-0.096219
-4	0.253915	6	-0.178866
-3	0.388571	7	-0.261049
-2	0.480117	8	-0.348584
-1	0.719143	9	-0.34028
		10	-0.310319

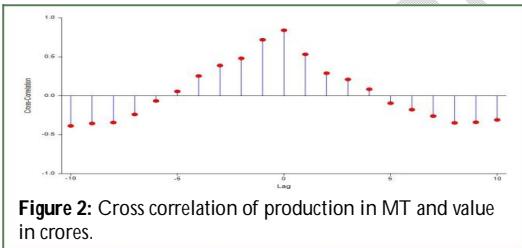


Figure 2: Cross correlation of production in MT and value in crores.

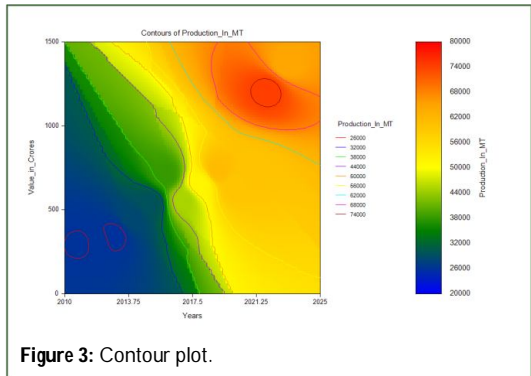


Figure 3: Contour plot.

The above area under the curve was illustrated by the variables as production in metric ton and export values in crores. The maximum export value was ₹1355.96 during the year 2022 to 2023 (Figure 3). The maximum production value was 74413 during the year 2021 to 2022. It is concluded that there is a substantial gap between the Indian honey export value and volume exports compared to other global nations such as New Zealand, Argentina, Germany, Ukraine, Spain, Brazil, and Hungary (Figure 4).

Comment [SK3]: Mention the possible reasons for this gap

Comment [SK4]: Mention the status of export volume during the period to give a clear understanding

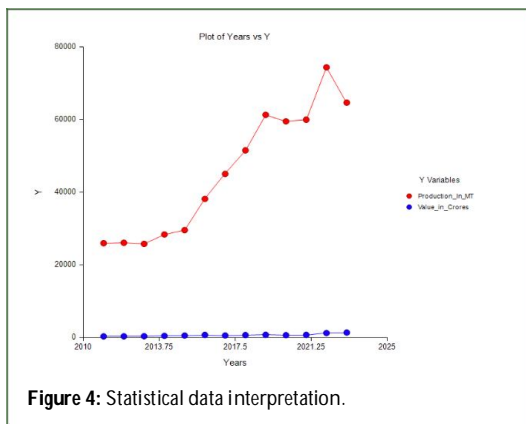


Figure 4: Statistical data interpretation.

CONCLUSION

MPEDA can be used as an exemplary regulatory organisation because it has experienced significant increase in exports year after year. Export inspection officials can conduct surprise audits on manufacturing plants on a regular basis to strictly prohibit adulteration in industrial facilities. NBB can double check and keep an eye out for plant-based vegan products manufactured in China. In addition to routine authenticity testing, natural occurring chemicals such as pinocembrin, apigenin, cardamomin, luteolin, quercetin, chrysin, and tectorigenin abundance in honey can be determined to establish the origin of the country. NBB should meticulously tally export data with bee keeper colonies production data. As a consequence, recent honey exports for the years 2021 to 2023 have exceeded the 1000 crore benchmark in terms of global exports.

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Comment [SK5]: Incorporate some suggestions for the beekeepers in India