

International Journal of Statistics and Applied Mathematics

ISSN: 2456-1452

Maths 2023; SP-8(3): 206-209

© 2023 Stats & Maths

<https://www.mathsjournal.com>

Received: 03-02-2023

Accepted: 06-03-2023

Aditya Bhooshan Srivastava

Department of Agricultural Economics, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

KK Singh

Department of Agricultural Economics, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

Supriya

Department of Agricultural Economics, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

Sachin Kumar Verma

Department of Agricultural Economics, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

Harshit Mishra

Department of Agricultural Economics, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

Dr. Riyaz Ahmad

Assistant Professor (Agricultural Economics), Institute of Agricultural Sciences & Technology, SRM University, Hadauri, Tindola, Lucknow-Deva Road, Barabanki, Uttar Pradesh, India

Corresponding Author:**Dr. Riyaz Ahmad**

Assistant Professor (Agricultural Economics), Institute of Agricultural Sciences & Technology, SRM University, Hadauri, Tindola, Lucknow-Deva Road, Barabanki, Uttar Pradesh, India

Production and export dynamics of wheat in India

Aditya Bhooshan Srivastava, KK Singh, Supriya, Sachin Kumar Verma, Harshit Mishra and Dr. Riyaz Ahmad

DOI: <https://doi.org/10.22271/math.2023.v8.i3Sc.1023>

Abstract

Wheat is the primary cereal crop in India and holds an important place in the Indian agricultural system, and is part of Indian households in a significant way. The Northern part of India contributes majorly to wheat production. However, India was one of the top exporters in the world since its export market has historically been a significant economic driver. Data for a period of 2013-2014 to 2022-2023 has been analysed with respect to area, production, productivity, quantity, and value of export of wheat. The Markov chain model and transitional probability matrices was used to report the nature of export for wheat. Results revealed that compound growth rate of area were non-significant whereas compound growth rate (CGR) of productivity, quantity of export and value of export were positively significant at 1% level of probability while, the production was negatively significant at 1% level of probability. The study also revealed that CGR of value of export was 11.61% per annum and quantity of export trend with CGR value 7.10% per annum. The countries like the Bangladesh is one of the major market for wheat which imported 40.63% quantity and it was greater than half of the value of wheat exported from India. Nepal is one of the most stable markets of wheat as reflected by 61.45% probability of retention in terms of quantity export; the Bangladesh remained at top in total value exported as reflected 55.82% retention probability. As per these facts, India has a good and significant potential for increasing production, productivity and export of wheat. Therefore, India must pay more attention for increasing production with superior quality, supported by favourable export promotion policies. Besides, attempts have to be taken to create new market and expand the trade area to other global major existing markets.

Keywords: Compound growth rate, wheat, Markov chain, production, projection, retention

Introduction

Agriculture is the spine of the Indian economy, and now-a-days, it has become input and cost-intensive highly. Wheat is a significant source of carbohydrates (71%). Globally, it is the prominent source of vegetable protein in human food, having a protein content of about 13%, mostly gluten (75-80% of the protein in wheat). When consumed as a whole grain, wheat provides a variety of nutrients and dietary fibre (Islam *et al.*, 2019) [2]. Wheat is vulnerable across the country and has been consumed in various processed forms from pre-historic times. Presently, the Indian population is around 1,392,086,685 which is difficult for planners to feed these ever-increasing human populations. At the same time, they should know how much food and other resources would be in demand. As a result, predicting the production behaviour of major crops is critical for food and nutritional security planners. The planners should have a rough understanding of the major crop's possible development scenarios. Indian people depend on agriculture and the allied sector. India was a net debt in food production and imported wheat for household consumption. India has a surplus of wheat and can sell it on the worldwide market for a profit. Thus, the wheat production is forecast 100 million metric tonnes in the upcoming on forecast higher yield due to favourable weather conditions compared to the previous year. The ICAR also analyzed that wheat production should be increased by 140 million metric tonnes up to 2050. Uttar Pradesh, Punjab, Haryana, Madhya Pradesh together constitutes about 82% of the country's wheat production. (Srivastava, *et al.*, 2022a) [6]. Uttar Pradesh has the largest acreage (32%), with 9.75 million hectares and 28 million tonnes produced (Sendhil *et al.*, 2019) [3].

Today India is exporting a sufficient quantity of all types of wheat. In 2017, world wheat production was 772 million tons, with a prediction of 2019 production at 765 million tons, constituting number two in a sequence after rice. India, on average, imports one million tonnes of wheat and, for various reasons, exports an average of 0.7 million tonnes. Still, under the changed scenario today, forecasting of multiple aspects relating to agriculture is becoming essential for estimation of the future production of the wheat crop in context to the growing population and the need for food to them is an important issue. Wheat is grown in nearly every Indian state. The main wheat-producing states in India are Uttar Pradesh, Punjab, Haryana, and Rajasthan, which account for about 80% of total production. Only 13% of the land is used for wheat production. Gujarat, Maharashtra, Madhya Pradesh, West Bengal, and Karnataka are the key rainfed wheat-growing areas in India. The Central and Peninsular Zones account for 33% of all wheat land in India. Only 33% of the irrigated wheat-growing region obtains the desired irrigation, with the rest receiving only sporadic irrigation. Wheat is India's second most significant food crop, behind rice, accounting for 12% of global wheat production. The majority of Indians eat a high-protein, high-calorie diet. It has traditionally been farmed in India's most fertile and watered northern regions. In India's northern plains, Punjab and Haryana were the leaders in wheat production, but Uttar Pradesh ranks first in total production. T. Aestivum, T. Durum, and T. Dicoccum are the three main wheat species farmed in India (Srivastava *et al.*, 2022b) [5].

India is among the fastest-growing economies in the world. Limited and concentrated resources across the world have made trade an important part of a country's economy. A big influence on the need for importing and exporting goods is the rapid evolution and growth in what people need and desire. On the other hand, trade provides employment and raises standards of living. India's export market had for long been a major contributor to its economy, which made it one of the leading exporters worldwide. Now, as on date, our country is a major supplier of many agricultural products like spices, coffee, tea, rice, oil meals, fresh vegetables & fruits, processed meat, and marine products to the global market (Gopalsamy and Arul kumar, 2020) [1]. Apart from the above products, wheat is also considered as one of the stable food and exporting from India to all over the world. Though India is not among the top ten wheat exporters in the global trade, its rate of growth in exports have surpassed that of other countries, indicating the rapid strides it is taking in reaching new markets worldwide. India's wheat exports are mainly to neighbouring countries i.e. Nepal, Bangladesh, UK, UAE, Malaysia and Sri Lanka. Main factor which is influencing wheat exports from India is unit price of wheat. As it plays an important role in International trade there is an adverse effect on wheat exports from India. So this study made an attempt to study the export performance of wheat from India in order to know the dynamics in direction of India's wheat exports. And it also helps to improve the export performance by formulating suitable policy.

Materials and Methods

Period of study

The time series data is taken from 2013 to 2022 of wheat of eight major importing countries.

Nature and sources of data

The time series data were collected from secondary sources pertaining to the export of Indian wheat to major importing

countries. The data were collected from Ministry of Commerce and Industry.

Analytical Framework

The trade directions of Indian wheat (export) were analyzed using the first-order Markov Chain Analysis. The calculation of the P matrix representing the transitional probability is the core component of Markov Chain Analysis. The matrix P's P_{ij} entries represent the likelihood that exports will eventually shift from country i to country j . The matrix's diagonal elements calculate the likelihood that a country will keep its export market share. In other words, a closer look at the diagonal components of the transitional probability matrix reveals how loyal a country is to its exports. The column elements show the likelihood of trade gains from other competing countries, while the row elements show the likelihood of trade losses due to competing nations.

Markov chain analysis

$$E_{jt} = \sum_{i=1}^r E_{it-1} P_{ij} + e_{jt}$$

Where,

E_{jt} = exports from India during the year t to j th country

E_{it-1} = export to i th country during the year $t-1$

P_{ij} = the probability that exports will shift from i th country to j th country

e_{jt} = the term which is statistically independent of E_{it-1}

r = the number of importing countries and

t = number of years considered for the analysis

The transitional probabilities P_{ij} which can be arranged in a $(c*r)$ matrix have the following properties

$$0 \leq P_{ij} \leq 1$$

$$\sum_{i=1}^n P_{ij} = 1 \text{ for all } i$$

By multiplying the export to these nations in the preceding period ($t-1$) with the transitional probability matrix, the predicted export share of each country during period " t " may then be calculated (Singh *et al.*, 2018) [4]

Results and Discussion

The compound growth rates for area, production, productivity and export of wheat were analysed for a period of ten years (2013-14 to 2022-23) and have been presented in the table 1. The results revealed that compound growth rate in area was positive and non-significant whereas compound growth in productivity quantity and value of export were positive and significant at 1% level of probability while the production was negatively significant at 1%. The compound growth rate regarding quantity and value of export, where the growth of quantity and value of export was increasing at 11.61 percent and 7.10 percent per annum. It implying that greater emphasis has been placed on minimising volatility and optimising processes in wheat area and yield. However, the introduction of new technologies has increased the insecurity of wheat production. It increases the risk of farm production and has an impact on farmer income and the decision to invest in high-paying technology in farming. It also has an impact on price stability and the vulnerability of the low-income household sector.

Table 1: Compound growth rates of area, production, productivity and export of wheat in India (2013-2014 to 2022-2023)

Particulars	CGR (% Per annum)
Area	0.26136 ^{NS}
Production	-6.6539*
Productivity	2.16586*
Quantity of Export	7.10*
Value of Export	11.61*

Note: Figures in parentheses indicate in%.* denotes significant at 1% ($p < 0.01$) level of probability, NS denotes Non Significant, CGR (Compound Growth Rate)

Destination-wise growth rates in the export of fish from India

According to IBEF (2022), table 2 lists the top importers and exporters of Indian wheat as the Nepal, Bangladesh, UK, UAE, Malaysia, Sri Lanka and other countries has been depicted.

Table 2: Destination-wise growth rates in the export of wheat from India (2013-2014 to 2021-2022)

Destination	Growth rate per annum		Share in total quantity export quantity (%)	Share in total value export value (%)
	Quantity	Value		
Nepal	4.19 ^{NS}	0.90 ^{NS}	7.43	6.51
Bangladesh	13.59 ^{NS}	9.15 ^{NS}	40.63	40.48
Hong Kong	-5.19 ^{NS}	-9.84 ^{NS}	0.00	0.00
UK	-42.45*	-48.82*	0.12	0.11
UAE	3.86 ^{NS}	-0.76 ^{NS}	9.87	9.74
Malaysia	1.52*	-2.84 ^{NS}	1.38	1.35
Sri lanka	35.82 ^{NS}	30.98*	3.93	4.22
other	12.89**	7.69**	36.63	37.60
Total	7.10*	11.61*	100.00	100.00

Note: Figures in parentheses indicate exports share in%.* denotes significant at 1% ($P < 0.01$) level of probability, ** denotes significant at 5% ($p < 0.05$) level of probability

The trade direction, prediction of trade and stability of global wheat market has been explored by Markov chain model using both together data of volume and value of export from the current last decade for (2013-14 to 2022-23). The Transitional Probability Matrix presented in table 3 provides a broad indication of changes in the direction of export of wheat from India. The major importing countries in terms of quantity were the Nepal, Bangladesh, the Hong Kong, the UK, UAE, Malaysia, Sri Lanka and all other importing countries were clustered under the category of the other countries. The row elements in the transitional probability matrix provide the information on the extent of loss in trade, because of competing countries. The columns element indicates the probability of gains in volume of trade from other competing countries and the diagonal element indicates probability of retention of the previous year's trade volume by the respective country. It is apparent from table 3 that Nepal was the most stable market among the major importers of

A negative growth rate is recorded in quantity of wheat export to countries like Hong Kong (- 5.19% per annum) and the UK (-42.45% per annum) while, a positive compound growth rate were found in countries like Nepal, Bangladesh, UAE, Malaysia, Sri Lanka and other country but not all are statistically significant. In total value of wheat export revealed that the (40.48%) were alone exported by Bangladesh followed by the other country, UAE, Nepal, Sri lanka, Malaysia, UK and the Hong Kong. The compound growth rate of export for some countries were found positive except to country like UK that was extreme decline in value of export which was (-48.82% per annum) and it is highly statistical significant then followed by Hong kong (-9.84% per annum), Malaysia, UAE. The countries like Sri Lanka (30.98% per annum) were revealed that highly positive and statistically significant ($p < 0.01$).

Indian wheat as reflected by the probability of retention at 61.45% followed by the, UK (49.53%), Bangladesh (48.77%), other country (32.98%), Sri Lanka (28.12%) and the UAE (18.82%). Themost unstable markets among the importing countries were the Hong Kong and Malaysia with the zero% retention.

Malaysia lost to the tune of 88.05 percent from UAE and other country (12.01%) whereas, in the future gained from other country 30.82 percent, Bangladesh (25.45%) and Nepal (20.51%). Hong Kong, lost about 59.79 percent of its previous share to Nepal and about 40.21 percent of its share to the UK, which means in future Nepal can gain its share from UAE and UK.

UAE has a low retention probability of its own share of imports about 0.1882 but is likely to gain from Malaysia (88.05%), Nepal (16.00%), other Country (15.03%) and Bangladesh (09.53%).

Table 3: Transition Probability Matrix for quantity of wheat export from India (2013-2014 to 2022-2023)

Year	Nepal	Bangladesh	Hong Kong	UK	UAE	Malaysia	Sri lanka	other
Nepal	0.6145	0.0596	0.0000	0.0000	0.1600	0.2051	0.0104	0.0000
Bangladesh	0.0000	0.4877	0.0000	0.0000	0.1503	0.2545	0.0159	0.2317
Hong Kong	0.5979	0.0000	0.0000	0.4021	0.0000	0.0000	0.0000	0.0000
UK	0.5018	0.0000	0.2899	0.4953	0.0000	0.0000	0.0000	0.0000
UAE	0.0000	0.0875	0.6973	0.3525	0.1882	0.0000	0.0000	0.0000
Malaysia	0.0000	0.0000	0.0000	0.0000	0.8805	0.0000	0.0000	0.1201
Sri Lanka	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2812	0.7188
other	0.0571	0.2118	0.0000	0.0000	0.0953	0.3082	0.0527	0.3298

Table 4: Transition Probability Matrix for Value of wheat export from India (2013-2014 to 2022-2023)

Year	Nepal	Bangladesh	Hong Kong	UK	UAE	Malaysia	Sri lanka	other
Nepal	0.3069	0.1228	0.0000	0.0000	0.2079	0.1599	0.0917	0.1148
Bangladesh	0.0000	0.5582	0.0000	0.0000	0.0910	0.1372	0.0974	0.1174
Hong Kong	0.0000	0.4036	0.0000	0.6002	0.0000	0.0000	0.0000	0.0000
UK	0.3655	0.0000	0.5737	0.0626	0.0000	0.0000	0.0000	0.0000
UAE	0.0000	0.1430	0.5476	0.1622	0.1447	0.0000	0.0000	0.0000
Malaysia	0.0000	0.0000	0.0000	0.0000	0.8789	0.0000	0.0000	0.1226
Sri Lanka	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2659	0.7341
other	0.0528	0.2058	0.0000	0.0000	0.2042	0.1503	0.0427	0.3469

Transitional Probability Matrix in terms of value export from the table 4 revealed that the Bangladesh was most stable market as reflected by the probability of retention at 55.82% followed by other country (34.69%), Nepal (30.69%), Sri Lanka (26.59%), UAE (14.47%) and UK (06.26%). The most unstable markets among the value of wheat exporting countries were the Hong Kong and Malaysia with the zero% retention. The actual share of Bangladesh had shown a fluctuation. Overall, it had increased from 2.38 to 4.12%. Parallel picture was obtained in prediction of export share too, where the increases was ranging from 2.01% to 3.50%.

Malaysia lost to the tune of 87.89 percent from UAE and other country 12.26 percent whereas, in the future gained from Nepal 15.99 percent, Bangladesh (13.72%) and other country (13.72%). Hong Kong, lost about 60.02 percent of its previous share to UK and about 40.36 percent of its share to the Bangladesh, whereas in future can gain its share from UK and UAE.

UK has a low retention probability of its own share of imports about 6.26 percent but is likely to gain from Hong Kong (60.02%) and UAE (16.22%).

Conclusion

The study highlight the fact that the total area under wheat cultivation of the country has increased with relatively slow and positive significant growth rate for the periods 2013-2014 to 2022-2023. Although India is the second largest producer of wheat in the world is positively significant indicating good potential and more profit for wheat produced. The eight major wheat export destinations (importing countries) were the Bangladesh (40.63%), other (36.63%), the UAE (9.87%), the Nepal (7.43%), Sri Lanka (3.93%), Malaysia (1.38%) U.K. (0.12%) and Hong Kong (0.00%). Nepal is one of the most stable favorite export destination or market since it has retained its original share of 61.45 percent over the period (2013-2014 to 2022-2023). The UK is a second most stable market as it is able to retain their probability of retention at 49.53 percent. The increase in the price of exported wheat is relatively more in the Bangladesh, other country, Nepal, Sri Lanka, UAE and UK while it has not been up to the mark in Hong Kong and Malaysia. The Markov-Chain Analysis for wheat indicates high dependence on a few export markets *viz.*, Hong Kong and Malaysia which would increase the trade risk in the long run. Therefore, India should pay more attention to adoption of favourable export promotion strategies need to evolve to diversify the trade area to other countries and to find new markets besides expanding the existing market in major importing countries.

References

1. Gopalsamy S, Arul Kumar M. Export of Wheat in India- With Reference To Middle East Countries. CLIO an Annual Interdisciplinary Journal of History, ISSN: 509-518; c2020.

- Islam MZ, Hakim MA, Kayum MA, Hossain MM, Alam MA, Kabir MR, *et al.* Performance of eighteen advanced wheat lines grown under irrigated optimum and late sown condition in different region of Bangladesh. Journal of Multidisciplinary Science. 2019;1(1):1-9.
- Sendhil R, Kumar TMK, Singh GP. Wheat production in India: Trends and prospects. In Recent advances in grain crops research (1 ed). London, UK: st Intech Open Limited.; c2019. Retrieved from: <https://www.intechopen.com/chapters/67311>.
- Singh SP, Nandi AK, Adarsha LK. Production, export dynamics and future prospects of fresh mango of India. Journal of Crop and Weed. 2018;14 (2):105-111.
- Srivastava AB, Supriya Kushwaha RR, Yadav S, Verma SK, Mishra P. Source of Growth for wheat in Uttar Pradesh: Decomposition analysis Indian Journal of Economics and Development. 2022b;18(4):976-980.
- Srivastava AB, Supriya Mishra P, Singh KK, Choudhri HPS. Instability and production scenario of Foodgrain production in Uttar Pradesh using ARIMA Model and its role in food security. Indian Journal of Economics and Development. 2022a;18(1):181-188.