DOI: 10.15740/HAS/AU/11.1/70-74
Agriculture Update
Volume **11** | Issue 1 | February, 2016 | 70-74
Visit us : *www.researchjournal.co.in*
e ISSN-0976-6847

RESEARCH ARTICLE :

Production and export performance of Indian onion- Markov chain analysis

D.K. KUSUMA AND SHREESHAIL RUDRAPUR

ARTICLE CHRONICLE :
Received :
17.11.2014;
Revised :
11.01.2016;
Accepted :
23.01.2016

SUMMARY : South Asia is native to onion (*Allium cepa*) and India is the second largest producer of onion after China. In the present study Markov chain analysis was attempted through linear programming method to assess the transition probabilities for the major onion markets. It was estimated that during 2010-11 the major onion export destinations were Bangladesh (36.55 %), Malaysia (21.03 %) and others contributing about 16.47 per cent. The increasing share of other countries clearly showed the need to explore and exploit the market potential of other countries. Efforts are also needed to improve the efficiency of production and quality in order to stabilize the markets.

How to cite this article : Kusuma, D.K. and Rudrapur, Shreeshail (2016). Production and export performance of Indian onion- Markov chain analysis. *Agric. Update*, **11**(1): 70-74.

KEY WORDS :
Compound growth rate, Instability index, Structural change, Direction of trade and markov chain

Author for correspondence :
SHREESHAIL RUDRAPUR
Department of Agricultural Economics, College of Agriculture, University of Agricultural Sciences, DHARWAD (KARNATAKA) INDIA
Email: shree4476@gmail.com
See end of the article for authors' affiliations

BACKGROUND AND OBJECTIVES

Onion (*Allium cepa*) is indigenous to South Asia. Onions are cultivated and used around the world. As a foodstuff they are usually served cooked, as a vegetable or part of a prepared savoury dish, but can also be eaten raw or used to make pickles or chutneys. They are pungent when chopped and contain certain chemical substances which irritate the eyes. Onions contain phenolics and flavonoids that have potential anti-inflammatory, anti-cholesterol, anticancer and antioxidant properties. About 170 countries cultivate onions for domestic use and about eight per cent of the global production is traded internationally. Top ten producers of onion in the world include China, India, US, Egypt, Iran, Turkey, Pakistan, Brazil, Russia and Republic of Korea. India is the second largest producer of onion after China with 15118000 million tones of production. Major onion producing states are Maharashtra, Bihar, Karnataka, Gujarat, Andhra Pradesh, Uttar Pradesh, Orissa and Madhya Pradesh.The major importing countries of Indian onion are Malaysia, Bangladesh, Sri lanka, UK, UAE and others. This is made possible both due to increased export and due to diversification in countries of exports. However, no attempt has been made to understand the dynamics of these changes. The paper attempts to quantify the production and share of export, changing structure of onion exports so as to understand and the dynamics of the changes.

RESOURCES AND METHODS

The secondary data based on area, production, productivity and exports of onion were obtained from Indian Horticulture database (2011) and various published issues of APEDA.

Growth rate analysis:

For evaluating the trend in area, production and productivity under onion in India, compound growth rates were computed using the following form of the relationship.

$$Yt = ab^t u_t$$

where

Yt = area, yield or production of crops in year t

t = year which takes values 1, 2 …….n

Ut = disturbance term

'a' and 'b' are parameters to be estimated. Logarithmic transformation of provided the estimating equation

$$\text{Log } Yt = \log a + t \log b + \log Ut$$

was estimated by ordinary least square technique (OLS). Compound growth rate (g) was then estimated by the identity given in equation

g = (b-1) 100 where,

g = estimated compound growth rate in percent per year and

b = anti log of b

The standard error of the growth rate was estimated and tested for its significance with't' statistic

Tabular analysis:

This technique was adopted to determine the extent and share of quantity exported to know export potentiality. The data were summarized with the aid of statistical tools like averages, percentages etc. to obtain the meaningful results.

Markov chain analysis:

Annual export data for period 2001-02 to 2010-11 were used to analyze the direction of trade and changing pattern of Indian onion export. The major Indian onion importing countries considered were Malaysia, Sri lanka, U.A.E, Bangladesh and Singapore. Estimation of the exports was done for the study period using Markov chain analysis.

Markov chain analysis was employed to analyze the structural change in any system whose progress through time can be measured in terms of single outcome variable (Dent, 1967). In the present study, the dynamic nature of trade patterns that is the gains and losses in export of Indian onion in major importing countries was examined using the Markov chain model. Markov chain analysis involves developing a transitional probability matrix 'P', whose elements, P_{ij} indicate the probability of exports switching from country 'i' to country 'j' over time. The diagonal element P_{ij} where I=j, measures the probability of a country retaining its market share or in other words, the loyalty of an importing country to a particular country's exports.

In the context of current application, structural change was treated as a random process with seven importing countries for onion the assumption was that the average export of onion from India amongst importing countries in any period depends only on the export in the previous period and this dependence was same among all the periods. This was algebraically expressed as

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

where,

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

E_{it-1} = exports of 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 error term which is statistically independent of E_{it-1}

n = the number of importing countries

The transitional probabilities P_{ij}, which can be arranged in a (c x n) matrix, have the following properties.

$$\sum_{i=1}^{n} P_{ij} = 1 \text{ and } 0 \leq P_{ij} \leq 1$$

Thus, the expected export share of each country during period't' is obtained by multiplying the exports to these countries in the previous period (t-1) with the transitional probability matrix. The probability matrix was estimated for the period 2000-01 to 2010-11.

Thus transitional probability matrix (T) was estimated using linear programming (LP) framework by a method referred to as minimization of mean absolute deviation (MAD).

Min, OP* + I e

Subject to

X P* + V = Y

$GP^* = 1$

$P^* \geq 0$

where,

P^* is a vector of the probabilities P_{Ij}

O is the vector of zeros

I is an appropriately dimensional vectors of areas

e is the vector of absolute errors

Y is the proportion of exports to each country.

X is a block diagonal matrix of lagged values of Y

V is the vector of errors

G is a grouping matrix to add the row elements of P arranged in P* to unity.

Prediction of quantity of fresh onion export ware made by using the transitional probability matrix.

$B_t = B_0 * T$

$B_{t+i} = B_{t+i-1} * T$

where,

B_0 = Quantity exported in base years

B_t = Quantity exported in next year (prediction)

T = Transitional probability matrix

OBSERVATIONS AND ANALYSIS

Onion is being cultivated in almost all the states of India. State wise area, production and productivity of onion during 2010-11 are presented in Table 1. It is being cultivated in an area of about 10.63 lakh hectares with a production of about 151 lakh tones in India. The national average productivity was 14.2 MT per ha. Among states Gujarat, Haryana, Bihar, M.P., A.P. and U.P. had above national average productivity and rest of the states had below national average productivity. From the table, it was observed that even though Maharashtra was leading in both area and production it was having very low productivity. But Gujarat with 62000 ha area and 15 lakh tonnes production it stood first in productivity.

The compound growth rate of area, production and productivity of onion is presented in Table 2. It could be observed that a highly positive and significant growth was in area, production and productivity. Area under onion is growing at a rate of 8.80 per cent per annum, production is growing at a rate of 14.74 per cent per annum but productivity of onion is growing at a rate of 5.48 per cent per annum. Table 2 also depicts the growth in quantity exported and value gained out of onion export. The data taken for the study was from2001 to 2010. The results revealed that there was a positive and significant growth in export of onion. Quantity of onion exported was growing at 16 per cent per annum where as value gained by onion export was growing at 30 per cent per annum. The study indicated that both production and export bring better returns for the producers.

Table 3 depicts the quantity of onion exported out of production. Production has increased from 5252.10 thousand MT to 15118.00 thousand MT and export has increased from 343.25 thousand MT to 1163.42 thousand MT share of onion exported is in increasing trend. Export share was about 6.54 per cent in 2001 where as increased up to 13.69 per cent in 2009. But in the last year *i.e.* 2010 export of onion has decreased from 13.69 per cent to 7.70 per cent.

The transitional probability matrix presented in Table 4 provides a broad indication of changes in the direction of export of fresh onion from India for the study period (2001-02 to 2010-11). The major Indian fresh onion importing countries were Bangladesh, Malaysia, UK, UAE, Sri Lanka, Singapore and all other importing countries were grouped under the category of the other countries. The transitional probability matrix was obtained for the study period by using the actual proportion of exports to different importing countries. This matrix explained the changing direction of Indian fresh onion trade among importing countries which was necessary for taking the proper decision in view of their expected changes (Kumar *et al.*, 2007).

The row elements in the transitional probability matrix provide the information on the extent of loss in trade, on account 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 evident from Table 4, that Bangladesh was one of the most stable markets among the major importers of Indian onion as reflected by the probability of retention at 1.00 *i.e.*, the probability that Bangladesh retains its export share over the study period was 100 per cent. Thus, Bangladesh was the most reliable and loyal market for Indian onion. United Arab Emirates and Sri Lanka had zero probability retention. Malaysia retained 71 per cent, Singapore retained 51 per cent and other countries retained 9 per cent of the export. These results are in line with findings of Mokashi (2012). This implied that Bangladesh was the most stable market; Malaysia and Singapore were the moderately stable markets, where as Sri Lanka and UAE were the most instable markets.

Table 1 : State-wise area, production and productivity of onions in India (2010-11)

Sr. No.	State	Area	Production	Yield
		000' ha	000'mt	(ha/mt)
1.	Maharashtra	415.0	4905.0	11.8
2.	Karnataka	190.5	2592.2	13.6
3.	Gujrat	62.0	1514.1	24.4
4.	Bihar	53.3	1082.0	20.3
5.	Madhya Pradesh	58.3	1021.5	17.5
6.	Andhra Pradesh	47.8	812.6	17.0
7.	Rajasthan	49.0	494.2	10.1
8.	Haryana	22.2	453.9	20.5
9.	Orissa	34.8	385.9	11.1
10.	Uttar Pradesh	23.2	368.6	15.9
11.	Others	107.8	1487.7	13.8
	Total	1063.8	15117.7	14.2

Table 2 : Compound growth rates for production and export of onions in India (2001-2010)

Sr. No	Particulars	Compound growth rate
1.	**Production**	
	Area	8.80
	Production	14.74
	Productivity	5.48
2.	**Export**	
	Quantity	15.93
	Value	24.97

Table 3 : Share of onion export in total production of onion (2001-2010) (Qty: 000'mt)

Year	Production (Qty)	Export(Qty)	Per cent share
2001	5252.10	343.25	6.54
2002	4209.50	441.84	10.50
2003	6267.60	859.93	13.72
2004	7760.60	870.21	11.21
2005	9432.50	960.50	10.18
2006	10847.00	1378.37	12.71
2007	13900.00	1008.60	7.26
2008	13565.00	1670.18	12.31
2009	12158.80	1664.92	13.69
2010	15118.00	1163.47	7.70

Table 4 : Transitional probability matrix of Indian onion exports (2001-2010)

	Malaysia	Sri Lanka	U.A.E	Bangladesh	Singapore	Others
Malaysia	0.7152	0.0237	0.0766	0.0203	0.0285	0.1358
Sri Lanka	0.0000	0.0000	0.0000	0.0408	0.0000	0.9592
U.A.E	0.4544	0.5456	0.0000	0.0000	0.0000	0.0000
Bangladesh	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000
Singapore	0.0000	0.0000	0.0000	0.0000	0.5162	0.4838
Others	0.5316	0.1689	0.2034	0.0000	0.0018	0.0943

Authors' affiliations :

D.K. KUSUMA, Department of Agricultural Economics, College of Agriculture, University of Agricultural Sciences, DHARWAD (KARNATAKA) INDIA

REFERENCES

Dent,W.T. (1967). Application of Markov analysis to International Wool Flows. *Rev. Econ. & Statistics*, **49** (2) : 613-616.

Mokashi, P. (2012). An economic analysis of export potential of grapes from Northern Karnataka. M.Sc. (Ag.) Thesis, University of Agricultural Sciences, Dharwad, KARNATAKA (INDIA).

Kumar, Pramod, Badal, P.S. and Achoth, Lalith (2012). Changing direction of Indian mango exports. *Indian J. Agril. Mktg.,* **21**(1) : 2007

Ramachandra, V.A. (2006). Production and marketing of Sapota in Northern Karnataka - An economic analysis. M.Sc. (Ag.) Thesis, University of Agricultural Sciences, Dharwad, KARNATAKA (INDIA).

Indian Horticulture database 2011

WEBLIOGRAPHY

www.apeda.com