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Trends and Price Behaviour Analysis of Onion in India

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ABSTRACT

The study is undertaken to analyse the price behaviour and growth trend in the area, production and productivity of onion in Lasalgaon market in Maharashtra and Bangalore market in Karnataka. For the study of growth trend in area, production and productivity, regions of Karnataka, Maharashtra and the whole country was selected. The time-series analysis is used to study the price behaviour and the compound growth rate is used to study the area, production and productivity of the onion. The analysis indicated that seasonality factor influenced the price behaviour of onions but was not the sole factor. Seasonality has some influence on the price of the onion.

Keywords: Trend analysis, Price, Onion, Productivity, Growth, Seasonality.

JEL.: Q11, Q12, Q18

I

INTRODUCTION

Onion is the most important vegetable and commercial crop. Onion is consumed around the year by people of all varieties in the world. It is valued for its distinct pungent flavour and is an essential ingredient in the cuisine of many regions (Seth *et al*., 2018). Onion is used either in raw form or dehydrated form to add flavour and taste to Indian cuisines.

Onion has medicinal value it is used in some pharmaceutical preparation. The pungency in onion is due to a volatile oil known as allyl-propyl disulphide. It rejuvenates the body, removes toxins, revitalises the bloodstream and stimulates blood circulation in the body (Tripathi and Lawande, 2006). Freshly extracted juice has antiseptic and moderate anti-bactericidal properties due to the presence of several sulphur compounds and is used as an inhaler in faintness caused by hysterical fits and used to provide relief from sore throat too. Recent reports have suggested that onions play some part in preventing heart diseases and other ailments (Corzo-Martínez *et al*., 2007).

The composition of onion varies according to variety, agronomic and environmental conditions of growth. It is a rich source of amino acids, anthocyanin's, flavones and phenolics (Pérez-Gregorio *et al*., 2014). The onion bulb is rich in minerals like phosphorous, calcium and carbohydrate (Bhattacharjee *et al*., 2013). Common onion ranks medium in the supply of proteins, caloric value and vitamin B and C. Also,

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onions are a common source of folic acid. However small onions were more nutritive than big onions. The nutritional composition of onion is given below in Table 1.

TABLE 1. NUTRITIONAL VALUE OF ONION (VALUES ARE IN PER 100 G EDIBLE PORTION)

(1)	(2)
Energy	301 kJ (72 kcal)
Carbohydrates	16.8 g
Sugars	7.87 g
Dietary fibre	3.2 g
Fat	0.1 g
Protein	2.5 g
Vitamin B1 (Thiamine)	0.06 mg (5 per cent)
Vitamin B2 (Riboflavin)	0.02 mg (2 per cent)
Vitamin B3 (Niacin)	0.2 mg (1 per cent)
Vitamin B9 (folic acid)	34 mg (9 per cent)
Vitamin C	8 mg (10 per cent)
Calcium	37 mg (4 per cent)
Iron	1.2 mg (9 per cent)
Manganese	0.292 mg (14 per cent)
Phosphorus	60 mg (9 per cent)
Potassium	334 mg (7 per cent)

Source: National Horticulture Board.

Onion cultivation is widely practised across the globe with an estimated area of 5.4 million hectares and 104.5 million tonnes of production (FAO, 2020). India, China, USA, Egypt and Turkey are the top five onion producing countries in the world. According to FAO data (2020), India ranks first in area (1.4 million hectares) followed by China (1.08 million hectares). In production, India contributes 26.7 MT of world onion production followed by China at 23.7 MT (Table 2). Even though the largest onion producer, India significantly lags behind in productivity. The Republic of Korea with the highest onion productivity of 79.61 tonnes/ha in the world followed, by Australia (54.66 tonnes/ha), Spain (52.10 tonnes/ha) and Japan (49.31 tonnes/ha).

TABLE 2. TOP 10 ONION PRODUCING COUNTRIES IN THE WORLD

Sl. No.	Country	Area (hectares)	Production (tonnes)	Yield (kg/hectare)
(1)	(2)	(3)	(4)	(5)
1.	India	14,34,000	2,67,38,000	18,645
2.	China	10,85,340	2,37,23,552	21,858
3.	USA	53,742	38,21,044	71,099
4.	Egypt	89,018	31,55,649	35,449
5.	Turkey	70,275	22,80,000	32,444
6.	Iran	52,762	20,64,317	39,125
7.	Pakistan	1,48,200	21,22,000	14,318
8.	Bangladesh	1,85,273	19,53,800	10,545
9.	Russian Federation	59,908	17,38,165	29,013
10.	Brazil	47,487	14,95,618	31,495

Source: FAOSTAT Database (2020).

In India, the total area under onion cultivation constitutes about 15 per cent of the total area under vegetables (DAC&FW, 2020). In India, onion is produced mainly in

the states of Maharashtra, Madhya Pradesh, Karnataka, Rajasthan, Gujarat, Bihar, Andhra Pradesh, Haryana, Uttar Pradesh, Tamil Nadu and Telangana which together constitute around 91.14 per cent (DAC&FW, 2020) of the total country production. In the country, onion is cultivated mainly in three different seasons, viz., *Kharif* (21 per cent), late *Kharif* (9 per cent) and *rabi* (69 per cent) (DAC&FW, 2020). Sowing of rainy *Kharif* takes place during February-April in Southern India while in Maharashtra and other parts takes place during May-June. And so, late *Kharif* is in August-September and *rabi* is in October-November. Most of the farmers cultivate onion crops in *rabi* season (69 per cent), then late *Kharif* (9 per cent) and least in *Kharif* season (21 per cent).

TABLE 1.3 PRODUCTION AND MARKETING CYCLE OF ONION

Season	Transplantation	Harvesting
(1)	(2)	(3)
Kharif	July – August	October- December
Late *Kharif*	October -November	January- March
Rabi	December -January	End of March-May

The price of onion generally remains in a limited band in the retail market from January to June. Onion price starts to increase around September and October. The low supply creates volatility leading to market distress causing a steep rise in the price of onion that eventually affects the end consumers. In 2015-16 budget, the Government operationalised a Price Stabilisation Fund for purchasing an agriculture commodity at market prices and releasing the agricultural commodities in a market in case of price rise. However, due to lack of infrastructure and efficient supply chain along with fiscal constraints, it was not possible for the government to build a massive stock of perishable commodities. Organisations like NAFED, the apex body of agri-marketing co-operatives and the Small Farmers Agribusiness Consortium (SFAC) play an active role in the storage of onions. In the year 2019, NAFED purchased about 56,000 tonnes of *rabi* onion for selling in big cities to manage the onion prices better. However, it is not easy to store perishable produce like onion for longer period. An adequate scientific storage facility is required to check the supply volatility and steep rise in onion prices. An analysis of price and market arrivals over time is important for understanding the price fluctuation of onion in market. Fluctuations in market arrivals largely contribute to the price instability of the produce. Market arrivals of onion depend upon area under cultivation, production, productivity and exports. In order to devise appropriate ways and means for reducing price fluctuations of agricultural commodities, there is a need to have a thorough understanding of price behaviour over time and space.

In the above context the study aims to understand: (1) Price behaviour of onion in the selected market and (2To study the trend in the area under cultivation, production and productivity of onion in the selected region.

II

METHODOLOGY

For the present study, a two-stage purposive sampling was adopted. In the first stage two largest onion producing regions were selected. Then in the second stage, the largest market for onions based on the arrivals was selected. Based on the above criteria the states of Maharashtra and Karnataka was selected for the study of the area, production and productivity of onion cultivation. The Lasalgaon and Bangalore markets were selected for the study of onion price analysis.

Time-series data on monthly prices of onions required for the study were collected from a secondary source, i.e., from NHRDF (National Horticulture Research and Development Foundation) website. The data on prices used for the study refers to the modal prices in a month. Modal price is considered to be superior to the monthly average price as it is closer to the actual price of the commodity market during the month in a particular market. The data relating to monthly modal prices (Rs./qtl) were collected for the period from 1996 to 2019 for the Lasalgaon market, and from 2004 to 2019 for the Bangalore market. Analytical tool like time series analysis was employed to study of price behaviour and compound growth rate for the study of growth in the area, production and productivity of onion.

All the calculations and analysis required for the study was done using statistical software such as Microsoft excel and SPSS.

2.1 *Time Series Analysis*

A time series is a complex mixture of four components namely, Trend (Tt), Seasonal (St), Cyclical (Ct) and Irregular (It). These four types of movements are frequently found either separately or in combination in a time series. The relationship among these components is assumed to be additive or multiplicative, but the multiplicative model is the most commonly used, which can be represented as:

Monthly data: $Yt = T \times C \times S \times I$
Yearly data: $Yt = T \times C \times I$

where,
Yt : Original observation at time period ‘t’
Tt : Secular trend at time period ‘t’
St : Seasonal variations at time period ‘t’
Ct : Cyclical movements at time period ‘t’
It : Irregular fluctuations at time period ‘t’

2.2 *Compound Growth Rate*

The growth rates for the area, production, productivity for studying the performance of crop in India and export of onion (in terms of both quantity and value) has been estimated using the exponential function or quadratic function as follows:

$$Y = a\, b^{t}\, e_i \qquad \ldots (1)$$

where,
Y= Dependent variable for which growth rate is to be estimated,
a and b are parameters of exponential regression,
a = Intercept
b = Regression coefficient
i = Time variable
e = Random Error
Compound growth rate will be computed using the relationship
Compound growth rate = CGR = (b -1) x 100

III

RESULTS AND DISCUSSION

To analyse the nature of intertemporal behaviour in prices, time-series data on prices are necessary. A weekly or monthly observation of price has four components, trend (T), cyclical (C), seasonal (S) and irregular (I).

3.1 *Price Analysis of Onion in Selected Markets*

Analysis of the trend component in monthly series of prices involves ascertaining the general direction of the movement of prices over a period of several years. The trends in price are the changes over years and are associated with changes in the technology of production, input supply, infrastructure etc. The study of price trends enables us to indicate the general direction of prices in different markets. In order to ascertain, the long-run movements of onion prices in the selected markets, the model price of the Lasalgaon and Bangalore plotted against time and trend line was plotted and regression was used for ascertaining the growth rate significance and trend analysis had shown that there was an increasing trend in both Lasalgaon and Bangalore markets. The price was indicating an increasing trend clearly with a very high significance level. CAGR is calculated from January 1996 to November 2019 for the Lasalgaon market and is found to be 1 per cent with very high significance. Similarly, CAGR is calculated from January 2004 to January 2020 for the Bangalore market is found to be 1 per cent with a very high significance.

TABLE 4. TRENDS IN THE PRICES OF ONION IN THE SELECTED MARKETS

Market	CAGR	Significance
(1)	(2)	(3)
Lasalgaon	1.00 per cent	0.00 per cent
Bangalore	1.00 per cent	0.00 per cent

*Significance level of 99 per cent.

3.1.1 *Seasonality in Prices of Onion in Selected Markets*

Seasonal fluctuations are the changes that occur regularly every year during the same period. Seasonal price variations resemble a cycle covering a period of 12 months or less. The general pattern of general variation in prices i.e., lower prices during the post-harvesting months and higher prices during the pre-harvest or off-season months is a normal feature for many agricultural commodities and it is repeated year after year. Some of the factors that affect the extent of seasonality in prices include the extent of seasonal concentration in production, degree of the perishability of the commodity, the cost of storage (including direct cost, losses in storage, and the risk involved), degree of seasonality in consumption, facility of storage available to farmers or public agencies, restriction imposed on traders in terms of stock limits (Chengappa *et al*., 2012).

In order to check for seasonality, the model price from each market was subjected to regression analysis with seasons as one of the input variables. The forecast of the regression model has been plotted along with the actual model price from each market. From the study of the chart, it was found that seasons have some influence on the price of the onion in both the Lasalgaon and Bangalore markets. Also, from Table 5, with the R square value too low and a high significance of approximately zero we can conclude that seasonality is one of the factors in the price variation of onion at both Bangalore and Lasalgaon markets.

TABLE 5. SEASONALITY IN THE PRICE OF ONION IN THE SELECTED MARKET

Market	R square	Significance
(1)	(2)	(3)
Lasalgaon	0.3709	1.09E-21*
Bangalore	0.3180	2.33E-10*

*Significance level of 99 per cent.

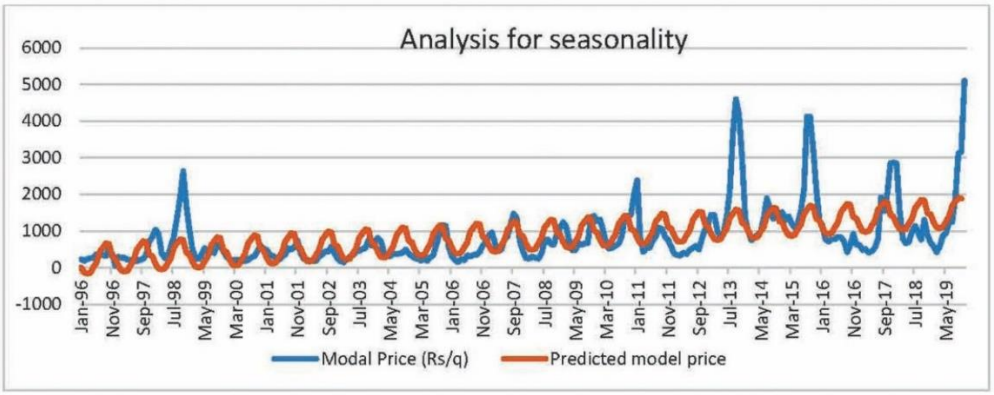

Chart 3.3. Seasonality of Lasalgaon Market.

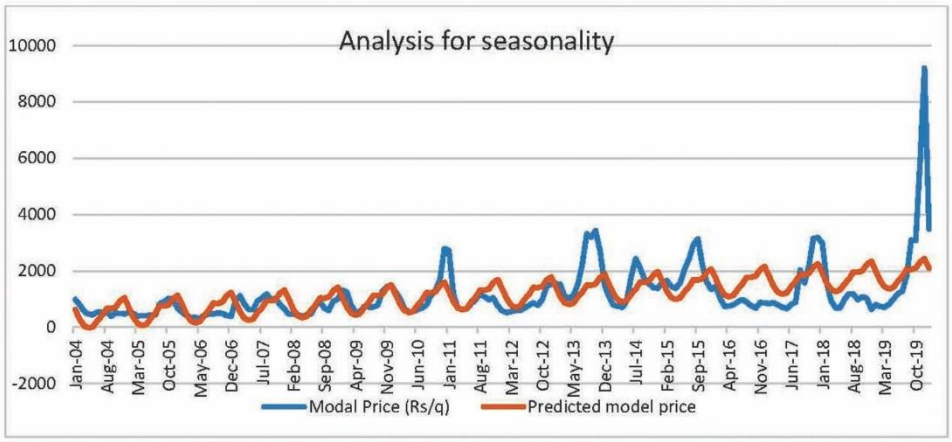

Chart 3.4. Seasonality of Bangalore Market.

3.1.2 *Cyclical Variations in Prices of Onion in Selected Markets*

The term 'cycle' refers to the recurrent variations in time series that usually last longer than a year and are regular neither in amplitude nor in length. Amongst all the methods of arriving at estimates of the cyclic movements of time series, the residual method is most commonly used (Naidu, 2013). Here, an attempt has been made to examine the cyclical behaviour of onion prices in the major markets (Lasalgaon, Bangalore and Kurnool) of India.

From the study for the plot of model price in both the market, it is found that there is no cyclical variation of prices in onion in both Bangalore and Lasalgaon markets.

3.1.3 *Irregular Price Fluctuations of Onion in Selected Markets*

Irregular price movements represent that part of the behaviour of prices, which is not systematic. A particular price movement may not recur in the future. No generalisation can be made about such price fluctuations because of the irregularity in their occurrence. The important factor responsible for such price movement is drought, floods, strikes, elections, early and late arrival of the monsoon and various government policies directly or indirectly affecting the production and consumption of onion.

There was no periodicity in the occurrence of irregular price fluctuation of onion in the selected market. In Charts 1 and 2 we observe irregular price fluctuation during September 2013 because of excess export of onions. Around, 40 per cent onions of in total production were exported during 2012-13. Again, this problem came up during the October and December months of the year 2019. This was due to the flood situation in onion growing states of India. To handle price fluctuation later government imposed a minimum export price.

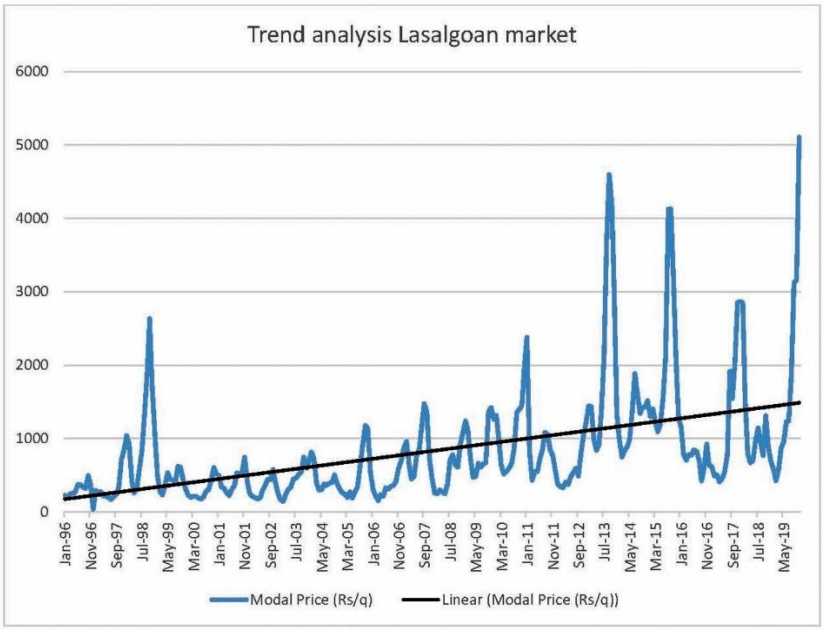

Chart 3.1. Trend Analysis of Lasalgaon Market.

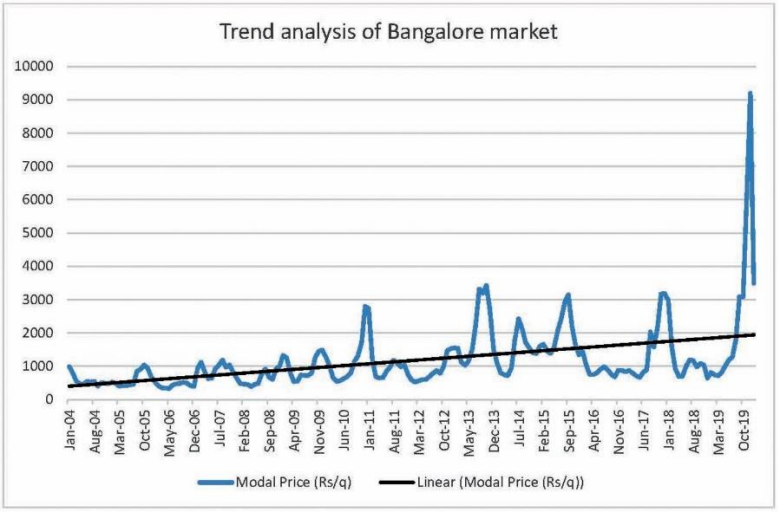

Chart 3.2. Trend Analysis of Bangalore Market.

3.2 *Area, Production and Productivity Analysis of Selected Region*

To study the area, production and productivity of onion in Karnataka, Maharashtra and India, data is collected from the national horticulture research and development board for the period 1981 to 2018. To study the area under cultivation of onion, the production of onion and productivity of onion cultivation in the selected region mean is calculated. To calculate the compound growth rate in the area, production and productivity of onion in the selected region the data is subjected to regression analysis.

During the year 2018 in India, the area under cultivation of onion was 1284990 hectares, the production of onion was 23262300 metric tonnes and productivity was at 18.10 metric tonnes per hectare. The mean area under cultivation is 593800 hectares, the mean production of onion is 8306300 metric tonnes and mean productivity is 12.6 metric tonnes per hectare. The area under onion cultivation in India grew at a CAGR of 5.1 with a very high level of significance. The production of onion in India grew at CAGR 6.8 with a very high level of significance. The productivity of onion cultivation in India grew at a CAGR of 1.5 per cent with a very high level of significance.

During the year 2018 in Karnataka, the area under cultivation of onion was 1952800 hectares, the production of onion was 2986600 metric tonnes and productivity was at 15.29 metric tonnes per hectare. The mean area under cultivation is 104900 hectares, the mean production of onion is 1139800 metric tonnes and mean productivity is 9.3 metric tonnes per hectare. The area under onion cultivation in Karnataka grew at a CAGR of 5.1 with a very high level of significance. The production of onion in Karnataka grew at CAGR 8.1 with a very high level of significance. The productivity of onion cultivation in Karnataka grew at a CAGR of 2.9 per cent with a very high level of significance. The area under cultivation of onion

in Karnataka grew at the same rate as the national growth rate of area under cultivation of onion. Production and productivity of onion grew at a higher rate in Karnataka when compared national growth rate during the period of study.

During the year 2018 in Maharashtra, the area under cultivation of onion was 1284990 hectares, the production of onion was 8854100 metric tonnes and productivity was at 17.43 metric tonnes per hectare. The mean area under cultivation is 175000 hectares, the mean production of onion is 2443400 metric tonnes and the mean productivity is 13.7 metric tonnes per hectare. The area under onion cultivation in Maharashtra grew at a CAGR of 7.0 with a very high level of significance. The production of onion in Maharashtra grew at a CAGR 7.0 with a very high level of significance. The productivity of onion cultivation in Maharashtra grew at a CAGR of 0.3 per cent with a very high level of significance. The area under cultivation of onion and production of onion grew at a higher rate than the national growth rate for the area under cultivation and production of onion. But the growth rate of productivity for onion cultivation in Maharashtra was lower than the national growth rate for productivity for onion. The details of the growth rate and mean of the area, production and productivity are indicated in Table 6.

TABLE 6. GROWTH IN AREA, PRODUCTION AND PRODUCTIVITY OF ONION IN SELECTED REGIONS

		Mean	CAGR (per cent)	R-square	Significance
(1)	(2)	(3)	(4)	(5)	(6)
Karnataka	Area (in '000 ha)	104.9	5.1	0.83	0.00*
	Production (in '000 mt)	1139.8	8.1	0.78	0.00*
	Productivity (in mt/ha)	9.3	2.9	0.38	0.00*
Maharashtra	Area (in '000 ha)	175.0	7.0	0.87	0.00*
	Production (in '000 mt)	2443.4	7.3	0.84	0.00*
	Productivity (in mt/ha)	13.7	0.3	0.03	0.00*
India	Area (in '000 ha)	593.8	5.1	0.93	0.00*
	Production (in '000 mt)	8306.3	6.8	0.89	0.00*
	Productivity (in mt/ha)	12.6	1.5	0.58	0.00*

*Significance level of 99 per cent.

IV

CONCLUSION

The study found that in the long run, in both the markets viz., Lasalgoan and Bangalore prices showed an increasing trend. The compound growth rate was 1 per cent in both the markets indicating a very high significance level of 1 per cent. There was seasonality in the price behaviour. From the regression analysis with got R^2 values of 0.37 and 0.31 for Lasalgoan and Bangalore markets respectively with a very high significance level of 1 per cent. From this, we can conclude that seasonality is a factor in the price behaviour of onions but not the sole factor. Seasonality has some influence on the price of the onion. Through the study plot of the model price, the study did not find any kind of cyclic variation in the price of onions in the selected market. There

was an irregular movement of onion price in the selected market, but the study didn't find any periodicity in the irregular spike of onion price in the selected market. As part of market reforms, minimum support prices for onions and the implementation of market intelligence systems can help in discovering the right prices for producers as well as consumers.

The results of the study also indicated significant growth in area, production and productivity of onion in Maharashtra, Karnataka and India. The growth in the area was 5.1 per cent for Karnataka and India, and 7.0 per cent for Maharashtra. The growth in production for Karnataka, Maharashtra and India was 8.1 per cent, 7.3 per cent and 6.8 per cent respectively. The growth in productivity for Karnataka, Maharashtra and India was 2.9 per cent, 0.3 per cent and 1.5 per cent respectively. The study also found that the growth rate of the area in the selected regions was equal to or higher than the national growth rate. The growth rate of production was also higher than the national growth rate in the selected region. But the growth rate in productivity was significantly low when compared to the growth rate of area and production. The productivity growth rate of Maharashtra was just 0.3 per cent also lower than the national average.

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