ANALYSIS OF TREND AND SEASONALITY IN PRICES AND ARRIVALS OF SELECTED AGRICULTURAL COMMODITIES IN INDIA

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Abstract: To find out the fluctuation in the prices and arrivals of the selected agricultural commodities. The study was conducted for the period of 2004-2020 by collecting secondary data from CMIE database. The major agricultural commodities are selected purposively on the basis of high prices and arrivals in the market. The selection of the agricultural commodities for the present study includes Castor seeds, Coriander, Soybean, Jeera and Turmeric. For Castor seeds (Deesa), for Coriander (Kota), for Soybean (Akola), for Jeera (Unjha) and for Turmeric (Nizamabad) market were selected. The selection of the markets was proposed according to the volume of trade. To examine the growth of prices and arrivals of selected agricultural commodities over the years, Compound Growth rate (CGR) was employed. The seasonality in prices and arrivals of selected agricultural commodities over the year is calculated by using moving average method. The results of the study showed that there is a positive and significant growth rate has been observed in the prices of selected commodities with Jeera showing the highest growth rate of (9.87%) in arrivals followed by Turmeric (9.05%) and the lowest in Coriander (5.06%) as against the prices where it showed all together a different scenario with highest in case of Coriander (7.55%) followed by Soybean (7.24%) and lowest in Jeera with (5.69%) respectively. The results of the findings revealed that in all the commodities high seasonal indices are observed from March to June indicating high post-harvest arrivals during these months. In case of Soybean and Turmeric, the seasonal index for prices is high in the months from April to September, which reveals that there is lack of storage facilities and the production during these months is very low. This study suggested for improvement in the infrastructure, storage and post-harvest techniques, so that the arrivals of these commodities get increased and availability should be throughout the year so that the prices get minimized.

Keywords: Seasonal indices, Commodities, Growth rate, Arrivals, CMIE database

INTRODUCTION

There is a very high level of price fluctuation of agricultural commodities because of both biotic and stress (abiotic) factors which effect the yield of the crop. Another factor contributing to production is the area under the particular crop. There is an absence of effective price support mechanism by the government intervention which makes the farmers reluctant in growing these crops. Efficient marketing of agricultural commodities has become an important aspect for the overall development of agriculture in particular and various sectors of rural economy in general. Pricing signals guide and regulate production, consumption and marketing decisions over time, form and place (Kohl and Uhl, 1980). Therefore, we estimate growth trend in prices and arrivals of the selected agricultural commodities. Seasonal price variations resemble a cycle covered in the period of 12 month. The general pattern of seasonal variations in prices i.e., lower prices during the post-harvest months and higher prices during the pre-harvest or off-season months is generally reported year after year. Therefore, it is necessary to study the fluctuations in the monthly average prices and arrivals of market, which help farmers to plan their sale in the period which will give them a better price for their produce. In (Asmatoddin, 2009) estimated the fluctuations in market arrivals and prices of important crops and identified the peak and slack periods of arrivals.

MATERIALS AND METHODS

The study was conducted for the period of 2004 to 2020 by collecting purely secondary data from the CMIE database provided by Securities and Exchange Board of India. The selection of the agricultural commodities for the present study includes Castor seeds, Coriander, Soybean, Jeera and Turmeric. For Castor seeds (Deesa), for Coriander (Kota), for Soybean (Akola), for Jeera (Unjha) and for Turmeric (Nizamabad) market was selected. The selection of the markets was proposed according to the volume of trade.

Examination of Growth Rate
To examine the growth of prices and arrivals of selected agricultural commodities over the years, Compound Growth rate (CGR) was employed.
$Y = ab^t$

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Where Y the variable for which growth rate is calculated i.e., prices, arrivals

t = time variable taking 1, 2, 3……., n.

a = intercept

b = regression co-efficient of "Y" on t.

Exponential equation can be expressed in log form

$LogY = Loga + tLogb$

Or

$Ln\ Y = \alpha + \beta T$

Where,

Y=time series data of price and arrival

T= trend term

α= constant coefficient

β= slope coefficient measure relative change in Y for a given absolute change in explanatory variable T. If we multiply the relative change in Y by 100, we will get percentage change or growth rate in Y for absolute change in variable T, Compound Growth Rate (CGR) was calculated by following formula CGR%= (Antilog β- 1) × 100. CGR was estimated by applying Ordinary Least Square (OLS) method. The t-test was performed to test the significance of 'β".

Seasonality Analysis

The seasonality in prices and arrivals of selected agricultural commodities over the year was calculated by using moving average method. To study the seasonal indices simple moving average method developed (Acharya et al. 1995). was employed and calculated through following steps;

1. Express price of each month as percentage of average price for the concerned year.

2. Work out the average (over years) of percentage for each month computed in (1)

3. Calculate the sum of 12-month averages(s) worked out in (b) and multiply the average of each month by the correction factors (k=1200/s) to make total 1200 or average 100.Seasonal indices of price and arrival of selected agricultural commodities can be worked out separately with ratio to moving average method as suggested (Godara et al. 2006, Tierney et al. 1999).

Seasonal Index (prices) = Actual average prices for the month / Moving average price for the month × 100

Seasonal Index (arrivals) = Actual average arrivals for the month / Moving average arrivals for the month × 100.

Literature Review

Godwin and Okafor (2012) the objectives of this paper was (i) to study the trends in the production and productivity of a soft drink bottling company, and (ii) Analyze the demand of the firm with a view to identifying trend that exists in the company using time series analysis. A software program was developed based on applicable methodology to facilitate accurate and faster analysis of data. Characterization of demand data using decomposition was done, which reveal the nature of seasonality, cyclical activity, trend and

noise. On the whole, the results of the decomposition analysis clearly show that there is a remarkable linear trend in demand pattern. The study of seasonality shows that the highest peak in demand of the product occurred at 12th, 24th, 36th, 48th 60th, 72nd, 84th and 96th months which turn out to coincide with yuletide. The study further indicated a positively increasing trend in the demand rate of company's product.

Singh and Singh (2015) investigated the Chana futures market for efficiency and seasonality. The study was conducted for the time-frame of ten years from 2005 to 2014. Data on spot and futures prices was analyzed for efficiency using Johansen cointegration approach and seasonality effect using dummy variable in regression model. Analysis of the available data suggested that Chana futures market is efficient although it is affected by the seasonality pattern of the crop.

Arismendi et al (2016) analyzed the importance of seasonal behavior in the volatility for the pricing of commodity options. They proposed a seasonally varying long-run mean variance process that is capable of capturing empirically observed patterns. Semi-closed-form option valuation formulas were derived.

Gilbert et al (2017) systematically measures seasonal price gaps at 193 markets for 13 food commodities in seven African countries. It shows that the commonly used dummy variable or moving average deviation methods to estimate the seasonal gap can yield substantial upward bias. This can be partially circumvented using trigonometric and saw-tooth models, which are more parsimonious. Among staple crops, seasonality is highest for maize (33 percent on average) and lowest for rice (16½ percent). This is two and a half to three times larger than in the international reference markets. It was revealed that seasonality varies substantially across market places but maize is the only crop in which there are important systematic country effects. It was also observed that in Malawi, where maize is the main staple, emerges as exhibiting the most acute seasonal differences. It was suggested that for reaching the Sustainable Development Goal of Zero Hunger renewed policy attention to seasonality in food prices and consumption is required.

RESULTS AND DISCUSSION

Examination of Growth in the Prices and Arrivals of Selected Commodities

The behaviour of prices in response to arrivals of various commodities has remained an area of interest to study with the researchers over a period of time, especially with those agricultural commodities which have a lot of export potential. This uncertainty in the prices of agricultural commodities are influenced by number of factors such as annual variation in production, low price elasticity of demand and effect

of the seasonal variation on agricultural production (Khalon and Tyagi, 1989). To study this behaviour Compound growth rate (CGR) was computed for the selected/ identified agricultural commodities for both prices and arrivals. The results presented in (Table 1) reveal positive and significant growth rate in prices of agricultural commodities with Jeera showing the highest growth rate of (9.87%) in arrivals followed by Turmeric (9.05%) and the lowest in Coriander (5.06%) as against the prices where it showed all together a different scenario with highest in case of Coriander (7.55%) followed by Soybean (7.24%) and lowest in Jeera with (5.69%) respectively. Sahoo and Singh (2017) observed similar results for Bengal gram which they opined is either due to unavailability or lack of storage facilities and suggested that improvement in the storage facilities through remodelling of warehouse structure, storage chambers is need of the hour to improve the retention capacity of the farmers.

Table 1. Growth rate of prices and arrivals of selected agricultural commodities

Item	Particular	Study Period (Jan 2004-July 2020)				
Prices		**Castor seed**	**Coriander**	**Soybean**	**Jeera**	**Turmeric**
	F value	51.45*	27.72*	58.31*	51.40*	10.84*
	R^2	0.77	0.64	0.80	0.77	0.42
	Growth rate	7.15	7.55	7.24	5.69	6.59
Arrivals	**Study Period (Jan 2004-July 2020)**					
	F value	3.76	6.95*	4.38*	16.30*	8.62*
	R^2	0.20	0.31	0.23	0.52	0.36
	Growth rate	5.57	5.06	6.44	9.87	9.05

Significant at 5% level of confidence

Seasonality Analysis of Selected Commodities
The seasonality in prices and arrivals is a cause of availability of produce and its demand in various seasons. Therefore, if the market arrivals are more prices are less and vice versa. Thus, it is an inverse relationship between the demand A linear equation and moving averages to examine the trend as well as seasonal variation of arrivals and price was adopted (Singh et al. 2000). The findings revealed that in all the selected commodities high seasonal indices of arrivals are observed from March to June indicating high post-harvest arrivals during these months. During the peak harvest season, there were high arrivals so prices were low, but in off seasons the prices were high due to shortage of supply and lack of storage facilities. In the months from July to September, the seasonal indices of prices for castor seed as shown in Table 2 is as high as 104.01, while as in case of arrivals, the seasonal index is as high as 207.13 in the month of April. The highest seasonality index in case arrivals was observed in the months of March and April in case of Coriander (245.43 and 208.98), Jeera (239.08 and 178.48) and Turmeric (226.03 and 218.02). The oscillatory movements affecting the prices are regular in period and amplitude. The long-term price behaviour is approximately linear and the cyclical trend is less pronounced (Mehta, 2000).
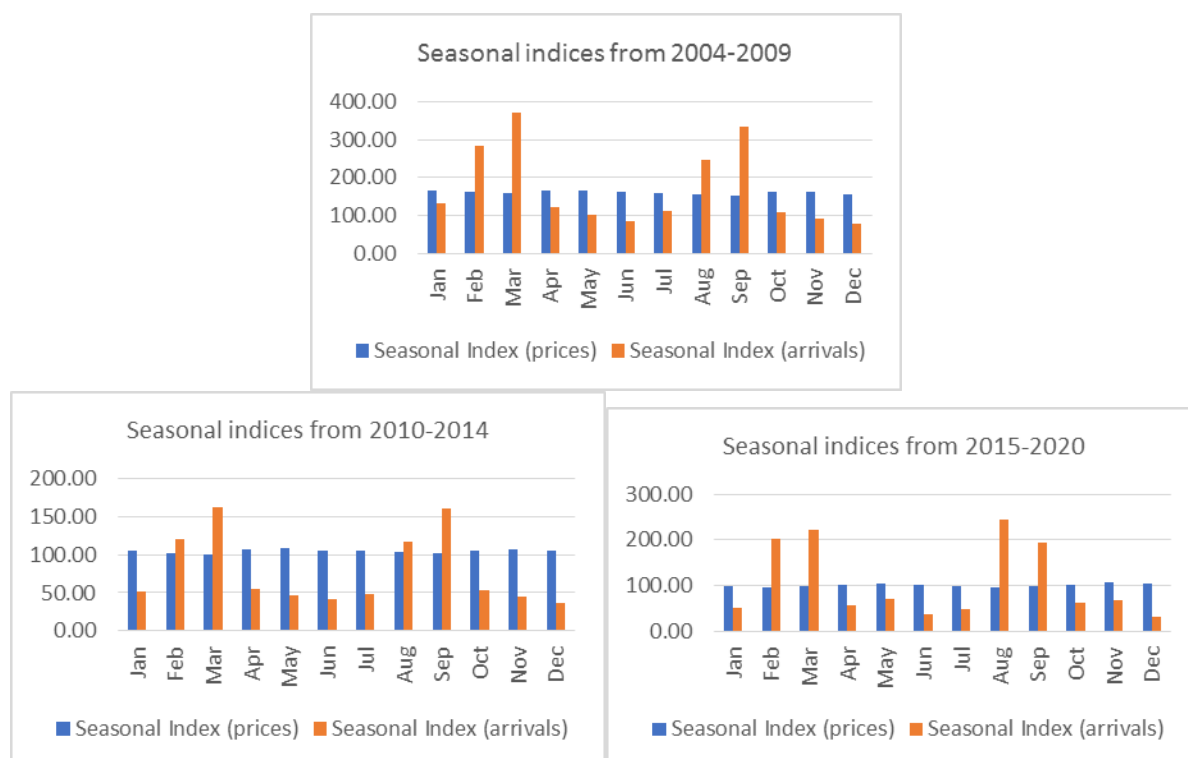
Table 2. Seasonality indices of prices and arrivals of selected commodities from Jan 2004 to July 2020 (%)

Months	Castor	Coriander	Soybean	Jeera	Turmeric
January					
Prices	98.53	98.42	97.80	101.54	93.52
Arrivals	67.89	50.22	103.81	53.96	50.40
February					
Prices	98.90	89.66	99.06	97.26	95.57
Arrivals	96.37	107.07	68.05	107.35	140.86
March					
Prices	97.66	96.43	99.77	94.07	98.94
Arrivals	149.94	245.43	44.07	239.08	226.03
April					
Prices	98.16	101.42	105.50	94.72	102.22
Arrivals	207.13	208.98	39.66	178.48	218.02
May					
Prices	96.56	97.97	106.97	95.98	104.45
Arrivals	204.00	150.88	39.17	134.79	159.27

June					
Prices	97.35	98.67	104.47	96.87	104.42
Arrivals	103.97	92.33	48.93	101.10	97.71
July					
Prices	102.42	102.40	105.04	102.70	106.19
Arrivals	68.86	55.93	53.56	77.55	66.44
August					
Prices	104.01	103.74	102.08	104.43	106.76
Arrivals	51.27	41.17	36.36	54.20	51.69
September					
Prices	103.47	101.64	97.16	101.60	102.84
Arrivals	60.73	63.05	46.20	62.33	45.98
October					
Prices	99.64	102.98	90.50	102.48	95.44
Arrivals	66.43	56.73	278.83	53.75	36.28
November					
Prices	101.51	104.67	93.88	105.45	95.30
Arrivals	52.85	59.22	284.78	70.53	38.41
December					
Prices	102.45	102.94	96.59	103.95	94.02
Arrivals	58.18	55.82	175.52	54.85	52.75

The seasonal indices were breakdown into three periods i.e., from 2004-2009, 2010-2014 and 2015-2020. This was done to check the effect of seasonality over the time intervals. For castor seeds, as it is both kharif and rabi crop, there were mixed results, the prices were high and arrivals were low in Kharif season and in Rabi season it was vice-versa.
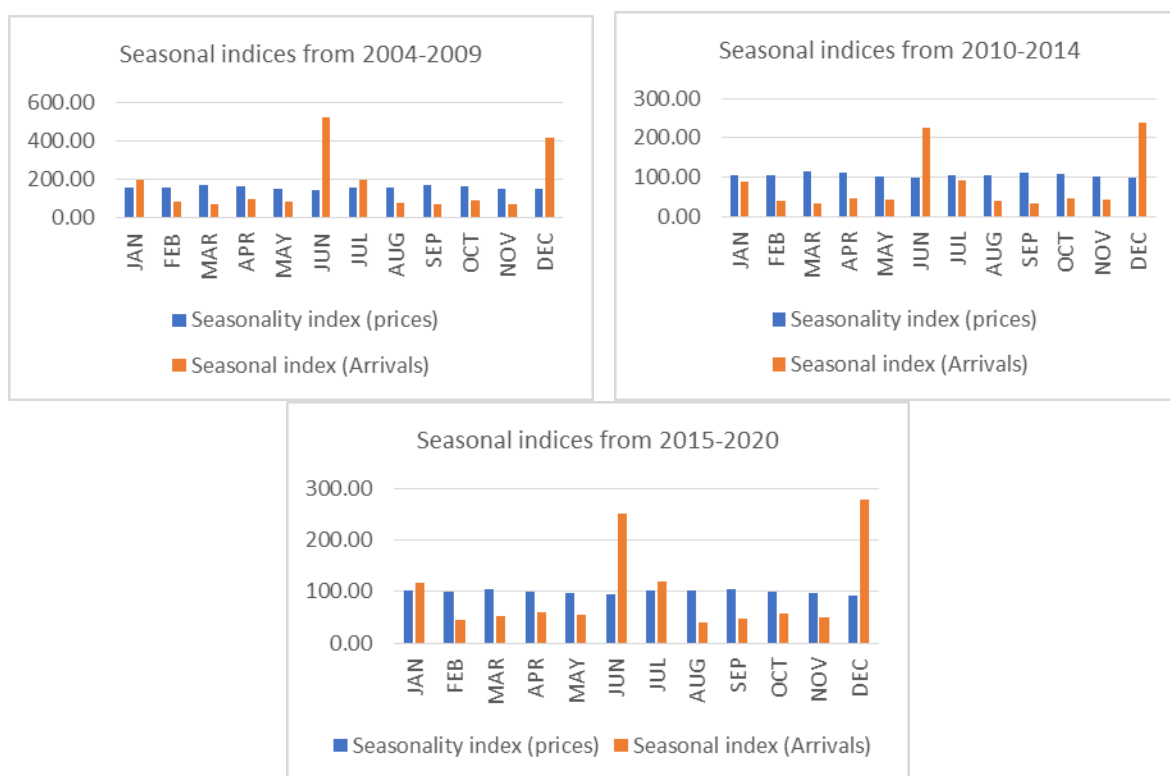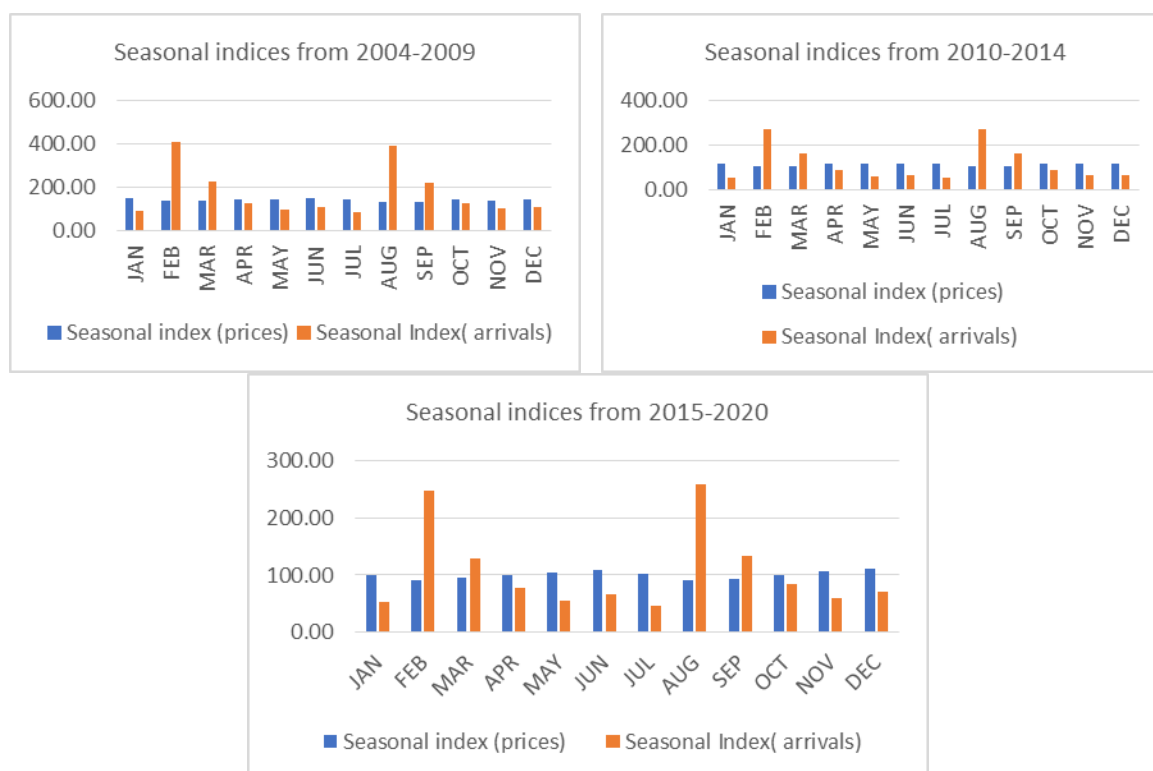

Figure 1: Seasonal indices for Castor seeds

Figure 2: Seasonal Indices for Coriander

For coriander, the arrivals were found more in the months of Feb-March and August-September because these months are the peak season for the procurement of coriander in India. The highest arrivals were found from the period 2004-2009 in the months of Feb-March because of the bulk production during that period. Over the years, the production of coriander has shown an declining trend because of lack of storage and infrastructure facilities which is an area of concern which needs to be redressed by the government and the Farmer producer organizations.
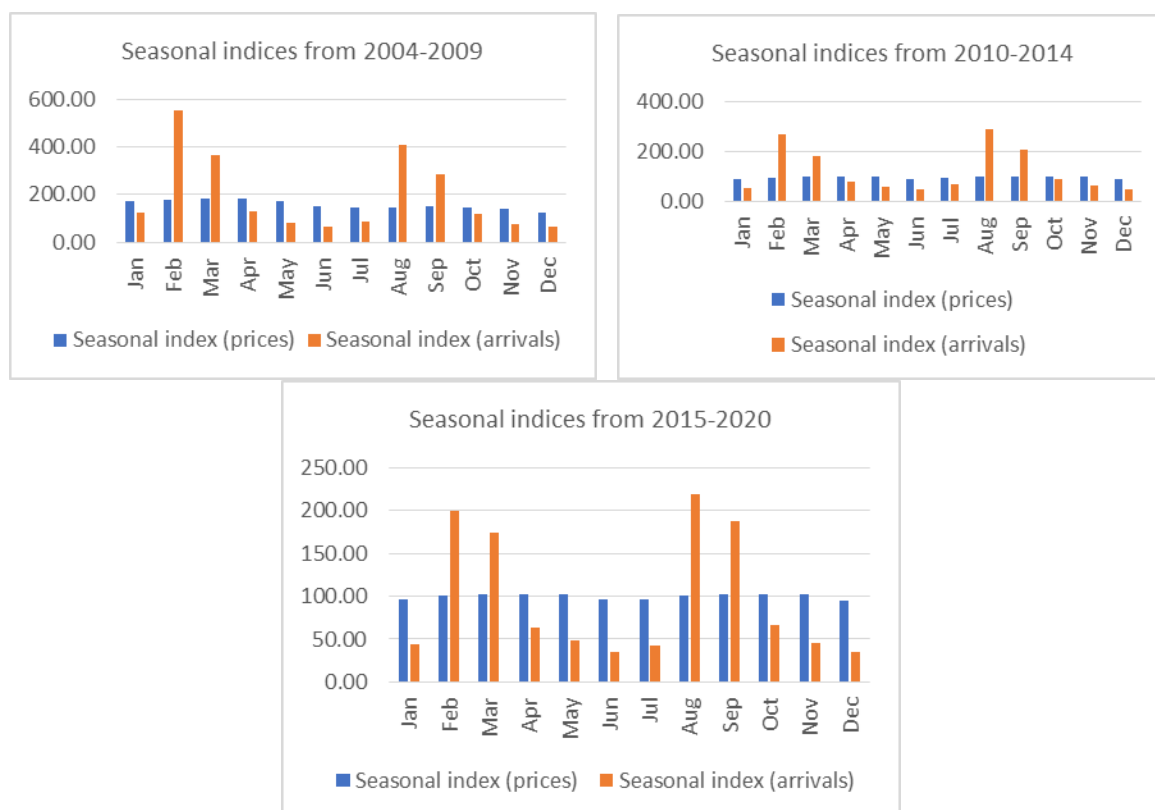

Figure 3: Seasonal indices for Soybean

Figure 4: Seasonal Indices for Jeera

In case of Soybean and Turmeric, the seasonal index for prices is high in the months from April to September, which reveals that there is lack of storage facilities and the production during these months is very low which needs to be redressed by improving the post-harvest techniques, so that the arrivals of these commodities get increased and availability should be throughout the year so that the prices are kept under check.

Figure 5: Seasonal Indices for Turmeric

Overall, it was found that the period from 2004-2009 has shown an increase in the arrivals of all the selected agricultural commodities. Keeping this scenario in view, the government and non-government organizations needs to gear up so that the production of these commodities made available in bulk, so that the farmers and consumers of these commodities may avail benefit at remunerative prices, also the availability of these commodities made available throughout the year with proper infrastructure and storage facilities which may help to reduce the post-harvest losses.

CONCLUSION AND RECOMMENDATIONS

- The behaviour of prices in response to arrivals for selected commodities was computed by using Compound growth rate, where it showed a positive and a significant growth rate for both prices and arrivals.
- The effect of seasonality on the prices was observed during the peak season because of the high post-harvest arrivals. A reverse relationship between prices and arrivals of all the selected agricultural commodities was observed. It was suggested that improvisation in the storage and infrastructure facilities needs to be done, so that the disposal of the commodities gets available throughout the year.
- There must be improvement in the storage facilities through improvement in warehouse structure, storage chambers in order to improve the retention capacity of the farmers. It will also help to reduce the post-harvest losses.
- Government should ensure that there must be availability of reliable and consistent data about prices and arrivals on daily basis in different markets.
- The overall yield of the commodities needs to be increased with proper institutional support so that the supply of these commodities can be made available throughout the year to have desired impact on the prices of the agricultural commodities.

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