

Chapter 3- Onion Price and Arrival Statistical Behavior- Explanatory Analysis

3.1. PRICE INTEGRATION

METHODOLOGY: Lasalgaon, Pimpalgaon and Nasik monthly price data from these three markets, from January 1997 to April 2010 (available continuous data for all the three markets) is examined for price integration of markets and the pattern of price differences. The price difference within these three markets is found out. The average of the price differences for all the years quantifies the price spread between markets (between Lasalgaon-Pimpalgaon, Lasalgaon-Nasik, and Pimpalgaon-Nasik).

RESULT AND DISCUSSION: The price difference within Lasalgaon, Pimpalgaon and Nasik moves around the average of -0.02. Prices in these markets move together without large differences. Table 3.1 presents the price correlation matrix.

Table 3.1 Onion Price Correlation Matrix			
	<i>Lasalgaon</i>	<i>Pimpalgaon</i>	<i>Nasik</i>
<i>Lasalgaon</i>	1		
<i>Pimpalgaon</i>	1.00	1	
<i>Nasik</i>	0.96	0.96	1

Source: Author's estimates based on NHRDF online data, 2010.

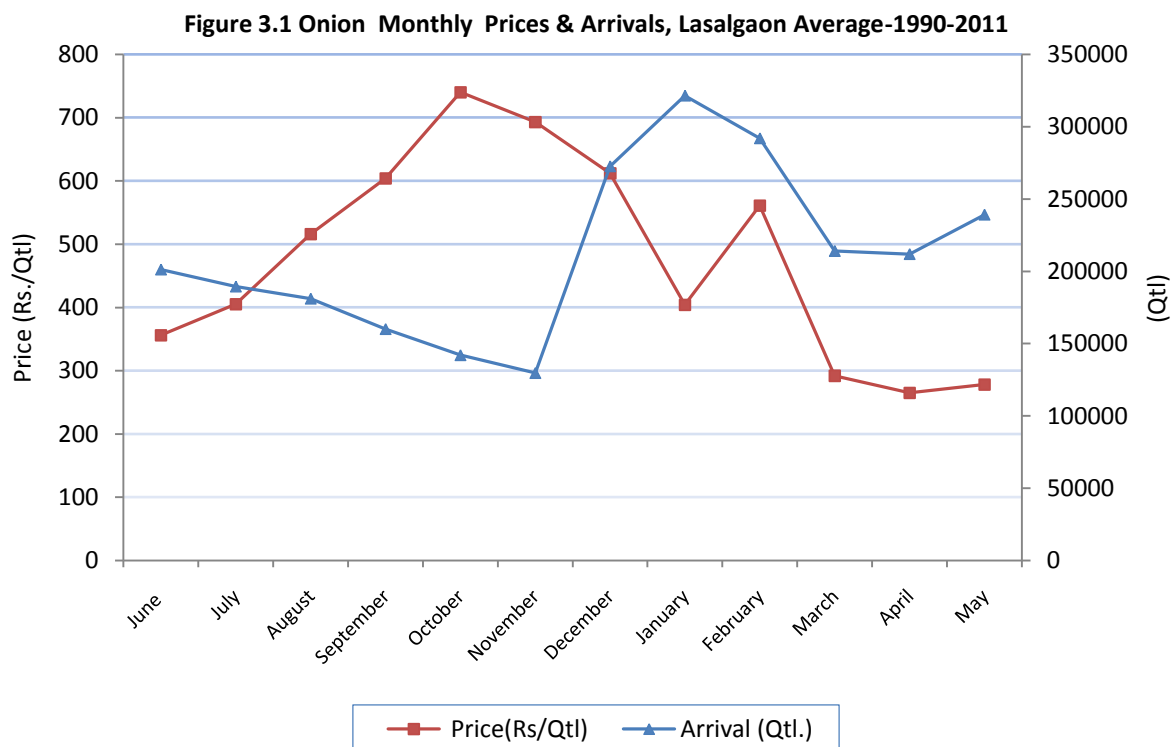
The correlation matrix between the wholesale prices of onion clearly point out the integration of prices. The positive correlation indicates that prices in markets are governed not only by the market arrivals in the given market but also prices and other factors (like quality and quantity of the produce) prevailing in other markets. The market price integration also highlight the reduction in influence of any local or market factors (local factors like single market preference, market distance from the village, availability of transportation for a particular market etc).

The analysis of price integration among markets helps in judging the extent of efficiency of marketing system as well as it also point towards the similarity of arrivals and price trends between the selected markets. Price integration highlights the similar pattern of movement of market prices. It is clear, that market prices along with market factors are determined by national level factors. With the price integration of different markets, only Lasalgaon market price behavior is presented in the study as other markets follow the same price pattern.

3.2 MONTH WISE ARRIVAL AND PRICE BEHAVIOR

METHODOLOGY: The onion market is traditionally characterized by high level of supply and price volatility. Years of high onion prices are often followed by years of low onion prices that do not allow onion growers to recover their production costs. The severity of onion price volatility can be judged from the fluctuations of average prices within the months of a harvesting year and within the seasons. The month wise and season wise average prices focus on the range of price fluctuations as well as the season wise returns for the produce. Month wise average prices are calculated by the simple average of month wise data of 1990-2010 and for season wise average prices, months as per the seasons are clustered together to get seasonal average of prices for period 1990-2010.

RESULTS: Month wise oscillation of the average prices of Lasalgaon market from 1990 to 2011 (figure 3.2) indicate the price fluctuation range, from Rs 265 per quintal to Rs 693 per quintal.



Month wise average prices for all the years indicate the month wise movements of prices. Prices start picking up from Sept onwards i.e. when fresh arrivals are low and much

of stocks of previous summer crop are utilized, they reach their maximum in November, when the main Kharif enters the markets, continue with the same or slightly lower levels in December and January- the period of late Kharif season but start falling from February onwards. The prices reach their lowest levels in April and May during the period of Rabbi or the summer season.

DISCUSSION -MONTHLY ONION ARRIVAL PATTERN AND THE PRICE RESPONSE ANALYSIS, LASALGAON

A detailed analysis of monthly price response to monthly arrivals, reveal the different factors and considerations prevailing in the market, which are responsible for peculiar movement of prices. These factors become the basic inputs for the formulation of any production planning or storage policy. The pattern of arrivals in the markets is not evenly spread throughout the months. There is either a problem of plenty or problem of scarcity. The main Kharif season of onion starts from the second week of November. Kharif crop starts arriving at the APMC market in small quantities during the second fortnight of November. The prices in November reach their pinnacle of all the months. It is mainly for the reasons that the stocks made from the earlier Rabbi season are dwindling and there are still two weeks for main Kharif to enter the markets. The limited arrivals fetch a good price and normally the prices during this month are rewarding.

During December and January, the market is flooded with onions as the average arrivals during these two months, amount to nearly 40 to 42 percent of the annual supplies. Active demand from foreign countries and modest reduction in inflow in some markets impart additional strength to prices during the two months and farmers normally get the highest price during this period of the year.

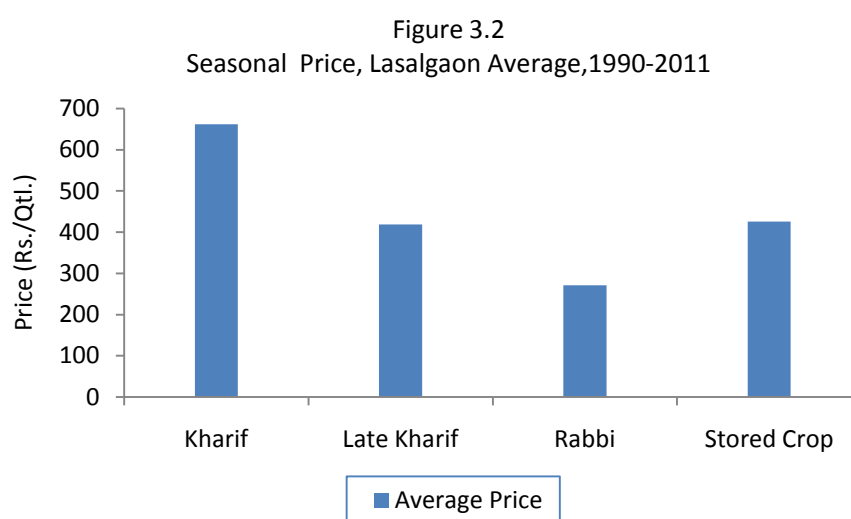
In the month of February, although the arrivals decline by half as compared to those of the previous months, it being the end of the Kharif season, the prices reflect a distinct easiness on account of subdued demand and slightly inferior quality of onion. However, in recent years, a trend of quality onions being harvested in these months and increase in exports is seen. In March, the prices go down further even in the face of poor arrivals as the merchants prefer to postpone the purchases to next month when the Rabbi crop enters in market in full swing.

Out of the total annual supply, 60 percent of the supply is in the summer i.e. in the months of April and May. It's a good quality, high yield storable produce. The abundant quantity therefore acts as a price reducing factor. The prices in these months are the lowest of all other months.

Thus, the price response to the changes in arrivals in each month is different. Prices respond not only to arrivals but also to host of other factors such as the expectations of production levels, the yield levels and the variety of each month.

3.2.1 SEASON WISE PRODUCER'S RETURNS AND INCOME INSTABILITY.

RESULTS: In an onion harvesting year, the price levels are different for each of the three seasons. The first harvesting main Kharif crop fetches highest prices of the year, Rs 650 to Rs 1000 per quintal, the late Kharif season crop receives lower prices than the Kharif season, at Rs 400 to Rs. 600 per quintal and the third Rabbi season or the summer season produce, fetches the lowest levels of prices, Rs 250 to Rs 400 per quintal. Figure 3.2 represents the season wise average prices of the Lasalgaon market during 1990-91 to 2009-10. The average prices of non harvesting season of onion from June till to November represent prices fetched for the stored onion of Rabbi season. The season records price range in between Rs. 425-600/ qtl which is higher than the Rabbi and Late Kharif season prices



DISCUSSION: Comparison of seasonal prices with the cost of production of each season, present the unprofitable and unremunerative levels of producer's income.

Table 3.2 : Onion Cost of Production

		Rs per quintal
Season	Variety	Cost/Qtl.
Kharif	Common	354 to 954
Kharif	Bulbet	622
Rabbi	Red	330 to 721

Source: NHRDF Annual Report 2011-12

In addition to cost of production, farmer's 'Patti' (bill) is deducted for the commission of commission agent (6 to 10%), market fees (1%), village commission agent (1.5%), grading, weighing (1.5%), and transportation (25%). Comparison of season wise returns and cost of production (in brackets), highlight the low earnings of the producers'.

- Kharif- Rs.1000/qt. (1000/qt)
- Rabbi-Rs. 400/qt. (721/qt)

According to the farmers of Pimpalgaon, the onion produced from August onwards would reach a break even if it is sold at following rates and the farmers could earn a margin if it is sold at the rates shown in parenthesis.¹

- Common onion Rs. 15 (Rs. 20/Kg. or Rs. 1500 to Rs.2000/qt)
- Red Rs. 11 (Rs 15/Kg. or Rs. 1100 to Rs. 15/qt)

As can be observed the current onion prices do not cover the cost of production. In addition to the cost of production, other costs and charges are also increasing. For instance due to rise in oil prices, transport cost has become a major part of total costs. Farmers are unable to recover transport costs and other market charges through the sale of their produce, thus turning the already low revenue, into losses.

3.3 ONION PRICE INSTABILITY DERIVED FROM PRODUCTION INSTABILITY

Methodology: Coefficient of variation of prices of crops like potato, garlic, paddy, wheat and onion is estimated with the help of standard procedure of standard deviation/ mean of prices, expressed as percentages for the period of 1999-2011 (total 13 years). The monthly price data of potato and garlic is for Pune market, onion monthly data for Lasalgaon market, data for paddy and wheat prices is for the state. Onion price and arrival coefficient of variation is estimated year wise as well as for the three harvesting seasons and for the period June to November, which is named as storage season. Season wise monthly

data of each year is separated out as Kharif, late Kharif, Rabbi and storage season. Coefficient of variation of prices and arrivals is then calculated season wise, across the years. The data period is 1990 to 2011 with total 256 numbers of observations.

RESULTS: The coefficient of variation of prices of different crops likes potato, garlic, paddy, wheat and onion, in table 3.3 show that among other crops, onion prices have remained most volatile during the last 13 years.

(in percent)	
Crops	Coefficient of Variation
Potato	41.51
Garlic	66.74
Paddy	33.93
Wheat	23.64
Onion	67.72

Note: Bold figure indicate highest price variation
Source: Author's estimates based on NHRDF online data (2011).

DISCUSSION: An examination of factors contributing to the volatility of onion prices, reveal that production uncertainty and price seasonality are the two main sources of price instability. Presumably, the delisting of onion crop from the 'Necessary Items List' in year 2004 may be an important factor contributing for high percentage of onion price variance. Prior to 2004, government had control on onion prices. But after the delisting of onions from 'Necessary Item List', prices have moved up and down more frequently affecting the producer's income to a great extent.

The CCI Report (2012) has commented on onion price variability, that the wholesale prices of onion are more volatile than the retail prices in all major markets. The wholesale price coefficient of variation for period 2008-2011 for Delhi it is 57.02, Mumbai it is 58.51 and for Lasalgaon 56.83 and the retail price coefficient of variation is 46.98, 48.69, and 47.15 respectively. It is stated in the Report, that wholesale and retail prices are increasingly becoming volatile since 2009 onwards. Volatility is more common during the months of September to January. This period happens to be the main Kharif and late Kharif period with maximum production uncertainty.

3.3.1 ONION PRICE VARIATION COMPARED WITH PRODUCTION INSTABILITY

Year wise price and production coefficient of variation, presented in table 3.4 indicate that in each year the price instability has remained higher than production instability.

(in percent)		
Year	Arrival	Price
2000	38.02	48.29
2001	20.04	35.30
2002	36.67	40.41
2003	36.29	45.73
2004	29.86	36.90
2005	44.08	71.30
2006	32.07	46.36
2007	44.81	40.27
2008	33.79	54.32
2009	32.50	40.43
2010	33.84	46.21
2011	29.17	62.39

Source: Author's estimates based on online data, NHRDF, 2011.

Note: Figures in bold indicate years of high instability and corresponding rate of price and arrival instability.

In the 12 years, production instability was the highest in 2004-05 and so the price instability. Onion production instability is attributed to fluctuations in yield levels. The yield level of onion is unstable mainly because dependency of the production on rains. Unseasonal, incessant rains or droughts have caused crop losses in many years like during Rabbi 1997, Kharif 1998, Kharif 2005, Kharif 2007, Kharif 2009, and Kharif 2010. Out of the three harvesting seasons, main Kharif is more susceptible to the whims of nature, resulting in heavy crop losses, which is indicated by the highest arrival instability at 56 percent in table 3.5.

Seasons	(In percent)	
	Price Instability	Arrival Instability
Main Kharif	71.14	55.55
Late Kharif	94.33	44.15
Rabbi	51.25	29.84
Storage Season	57.63	36.13

Source: Author's estimates based on NHRDF online data.

As can be observed from the table 3.5, out of the four seasons the Kharif and late Kharif season record the highest price instability and main Kharif records the highest arrival instability. As has been mentioned above, main Kharif crop losses are higher than any other season. The traders take undue advantage of this production instability by manipulating prices and speculative practices. Traders and commission agents exploit the situation of production uncertainty for their benefit.

3.4 ONION PRICE- ARRIVAL SEASONALITY AND FARMER'S INCOME INSTABILITY.

METHODOLOGY: The price and arrival seasonal indices are calculated by the normal procedure of calculating the ratios of actual prices with their corresponding (13 month) moving averages and averaging these ratios for each month. The Lasalgaon market monthly price and arrival data from 1990 (January) to 2011 (September), total 22 years with 261 number of monthly observations are examined for seasonality.

RESULT: Apart from production instability, second factor creating onion price instability, is high price seasonality. The monthly price seasonality starts increasing above average from July onwards and remains high till January; however seasonality in prices is the lowest in April and May at 56% and 57% respectively (table 3.6). The arrival seasonality, on the other hand starts increasing above average from November onwards, remains high till April. June to October is the non harvesting period and hence market relies more on stored crop of March, April and May. The seasonality analysis clearly indicates scope for adoption of on farm storage policy, mainly by the farmers (instead of by only a handful of traders). The summer season crop is marked for its lowest price seasonality. Farmers incur losses in this season as the prices reach their lowest levels of the year. Hence storage policy is suggested for this season as the produce is storable and the price seasonality of non

harvesting months from June till to November is higher than April and May which may assure good returns for storage of onions.

Table 3.6: Onion Seasonality Index of Arrivals and Prices, Lasalgaon (1990-2011)

	Seasonal Index	
	Arrivals	Prices
Jan.	127.5	101.3
Feb.	109.5	78.3
March	104.3	65.6
April	115.1	56.1
May	89.1	57.3
June	88.1	81.3
July	81.3	92.6
Aug.	72.5	113.1
Sept.	73.3	135.2
Oct.	57.6	158.0
Nov.	132.8	133.6
Dec.	148.6	127.8

Note: Above average arrival seasonality in bold corresponds with low price seasonality (gray cells), gray colored low arrival seasonality corresponds with above average price seasonality (in bold).

Source: Author's estimates based on NHRDF online data, 2011.

Price and arrival seasonality (table 3.6) examination bring out the scope for an on farm storage policy. Instead of undertaking distress sales of summer season crop, farmers should develop holding (storage) capacity to take advantage of the high price seasonality of the coming non harvesting months (July to November).

DISCUSSION: FACTORS RESPONSIBLE FOR ONION PRICE SEASONALITY

The onion varieties of Kharif, late Kharif and Rabbi Season are different. Storage life and the yield levels get determined as per the variety, which creates seasonality.

- Storage Life and Demand Conditions: The Kharif and late Kharif produce does not have any storage life. It lasts for maximum 10 to 15 days. Further, the crop is in heavy demand from all other states as this season marks the start of arrivals of the new harvest after the long six months of non harvesting season. Therefore demand from exports as well as from other states is heavy.

Further this period also marks the increase in demand of onions (due to end of Chatur-mass –four months of no onion and garlic consumption due to religious ritual, start of the wedding season with large public meals, major festivals like Diwali, Eid etc.). Therefore in these seasons the prices generally rule at higher end.

- The summer crop (with a storage life of at least 6 months) is mainly demanded by the traders and exporters. Traders store the crop in huge quantity. These stocks are utilized in monsoon period. The abundance of crop and lack of 'on farm storage' structures (Kanda Chawl) with the farmers, reduces prices at the time of harvest. Hence low price seasonality is observed in summer season.
- Yield levels of each season: For the Kharif season the yield level is low, at 100 to 150 quintals per acre, whereas for the summer season, it is double at 200 quintals per acre. Since the yield levels of summer season are more certain and abundant, the prices take a dip right from the end of late Kharif produce in March. But for Kharif season with uncertainty of the yield levels (due to dependency on rains), price seasonality remains high.
- Supply and weather conditions in other states: Along with Maharashtra, Gujarat and Karnataka are also significant contributors to all India onion supply. The supply and weather conditions and the expected yield levels in these states are also significant determinants of monthly prices.

These factors give peculiar movement to onion prices in each month, generating price seasonality. In addition to mentioned factors, expectations of the commission agents and traders about the success or failure of the main Kharif production depending on the weather and supply conditions of other onion producing states also has an important bearing on onion price seasonality especially for prices of non harvesting season (from June to November).

- Traders Expectations of future season: From June to November i.e. for six months fresh onion is not harvested and dependency on the stored onion goes up. In this rainy season the best dry quality stored onion commands high price. If rains are heavy and if the moisture content of the air is high

then the possibility of stored produce loss is heavy (up to 50 to 60 percent of the total stored produce). Therefore the best dry quality and crop stored in good conditions fetches good price. This has been experienced in Nov. 2006. Due to heavy rains the stored crop damage was high up to 50 percent of the total stored onions. So in November prices soared up to Rs. 850/qtl, nearly Rs. 350 more than the usual market price. The crop that was stored in good conditions fetched high price.

- If the monsoon is heavy and has affected the Kharif crop which comes in December then the presumption of low level of December arrival builds pressure on prices from the month of October itself and prices remain high in November and reach sky high in December. In the year 2009, prices picked up right from October itself owing to the concerns of an expected decline in the production and delayed arrivals. The price rise was sharper in the last week of September following heavy rains in the producing centers of Maharashtra and floods in the South². Stocks that were damaged by the rains could not fetch more than Rs 400/qtl. Alternatively, if the monsoon is favorable assuring abundant crop in December then the expectations of heavy arrivals make prices fall in October and November for the stored crop.

3.5 LASALGAON MARKET PRICE TIME TREND

The price time trend or price growth rate suggest the growth rate to be applied to the price stabilization measures like price stabilization fund. The simple linear regression of log of monthly prices on time i.e. months explain price variance with r-square at 0.43. The regression equation (period 1990 January to 2011 September-Lasalgaon, total 249 numbers of observations, without the year of 1998 as a year of exceptionally high prices) is shown in the following table 3.7. Month 1 is January 1990 and month no. 249 is Sept. 2011.

Model 1; $\log P_t = a + bt$, where: $\log P_t$ is the log of monthly onion prices, t is the time i.e. months, a and b are coefficients.

Table 3.7 : Regression Results of Price Time Trend, Lasalgaon- 1990-2011

Dependent variable	Constant term (a)	Independent variable (b)	Overall Significance of model	R ²
Log price	2.204 (76.17)	0.00278(time) (13.86)	0.00	0.43

Figures in parentheses are the values of the 't' statistic.

P-value significant at 0.01 levels

Number of observations are 249.

The time trend of prices, the 'b' coefficient is small at 0.002 for a month, i.e. 2.4% per annum, whereas for potato, annual price growth rate is at 3.6% and garlic price growth rate is 3.02% per annum. The CAGR of production and area of onion (for period 1974-75 to 2011-12) has been 4.94, 5.33 respectively³. Low price growth rate, coupled with high price instability are sufficient enough to destroy any single price stabilization measure. Thus it is clear that even though the onion production has increased by multiple times but the returns to the farmers are not rewarding and stable. Hence immediate need for implementation of price stabilization instruments is seen.

3.6 ONION NATIONAL PRICE INDEX (ONPI) TIME TREND

The onion national price index with base 2004-05 time trend is established with simple linear regression. The data period is from April 1994 to April 2011, total 205 observations. Model No. 2: $ONPI_t = a + bt$, where: $ONPI_t$ is monthly onion national price index, t is the time i.e. months, a and b are regression coefficients.

Table 3.8 Regression Results of Onion National Price Index Time Trend, 1994-2011

Dependent Variable	Constant term (a)	Independent variable (b)	Overall significance of model	R ²
Onion National Price Index	53.76 (5.99)	0.70(time) (9.30)	0.00	0.29

Figures in parentheses are the values of the 't' statistic.

P-value significant at 0.01 levels

Number of observations are 205.

ONPI time trend prediction Equation no. 1: $ONPI = 53.76 + 0.70 * \text{time}$.

3.7 CHAPTER CONCLUSIONS:

High onion price instability is observed with low growth rate of prices. Price instability is caused by production instability and price seasonality. Production instability of main Kharif crop is due to the irregularity of rains. Rabbi crop supply instability, on the other hand, is due to lack of large scale on farm storage of onions. Irregular supply of stored crop for non harvest or for rainy season leads to price fluctuations. Price seasonality is the result of difference in quality (variety) and quantity (yield) of the produce within three main seasons. Along with production instability and price seasonality, market imperfections (defective auction practices, traders hold on prices, speculative activities etc. discussed in chapter 5) also play a major role in creating onion price crisis.

To control the production instability and to create regular supply throughout all the months of the Kharif season, planning in production in terms of production of required consumption quantity is the requisite. Efforts to control the production losses will help in reducing production irregularity.

To gain benefits from price seasonality, regularizing production supply through storage policy can be adopted. Seasonality analysis shows the scope for on farm storages by the farmers. Storage may prove beneficial to farmers as high arrival seasonality of Rabbi crop corresponds with low price seasonality and low arrival seasonality of storage season corresponds with high price seasonality. But the storage is mainly undertaken by the traders (nearly 80% of the total produce) and some handful of big farmers (20% of the total produce). Therefore the gains of high price seasonality from July onwards are swallowed by the traders.

Since input costs, market charges, transport costs have increased; it is becoming difficult for the farmers to break even. Onion is mostly grown by small farmers (who own 2 to 4 acres of land), who are not able to earn sustainable income from onion cultivation. There is an immediate need to reduce the impacts of price fluctuations from incomes, through price stabilization measures. When producers don't receive sustainable income, they have to borrow for even small amounts to fulfill their basic needs. As per the NCAER report (2012), onion farmers take a loan of approximately Rs 1 lakh from the commission agents to meet their financial needs. Farmers generally take a loan in the month of June

and have to repay by March, the next year. The rate of interest is 6 percent per annum but if the loan is not repaid in March then rate of interest goes up to 12 percent. This suggests that farmers are susceptible to exploitation even for small amounts. The need for sustainable income can be fulfilled through the establishment of price stabilization fund.

NOTES

1. See NCAER Onion Report, 2012
2. See Business Standard, October 7, 2009: 'Onion Prices on Fire', www.businessstandard.com
3. See NCAER Onion Report, 2012.