

Marketing and price forecasting of aggregatum onion in Tamil Nadu, India

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ABSTRACT

Marketing and price forecasting of aggregatum onion were taken up in the Perambalur district of Tamil Nadu with 50 intermediaries of marketing. The study revealed that the marketable surplus was 84.30 per cent of the total small onion production and the rest of the production was retained for seed purpose, home consumption and social obligation. Five types of marketing channels were identified in the study area and price spread was estimated for each of the five marketing channels. Marketing channel I of farmers' market was the efficient marketing channel which was due to better pricing mechanism, lesser price spread due to absence of intermediaries and better regulation despite the operation of traders in this channel. The price forecasting for small onion cultivation was estimated by the ARIMA model. It was found that the difference of order 1 was sufficient to achieve stationarity. The p and q values were identified. According to AIC and SBC values the most suitable model was ARIMA (2,1,2) since it had the lowest AIC and SBC values. The ACF and PACF values of the residual indicated that the aforesaid model was 'good fit'. From the 2,1,2 model the forecasted value was high during the month of September with Rs 3681.11 per quintal and the forecasted January price of Rs 2451.72 per quintal was recorded the lowest forecasted price. Higher price fluctuation, perishability of onion and late payments by commission agents were the marketing constraints expressed by the sample farmers. The lack of storage facility, high handling cost and financial constraints were the most important problems faced by the intermediaries. Higher price fluctuation could be overcome by following DEMIC forecast of TNAU and eliminating price forecast through forward trading.

Keywords: Marketing channel; price spread; marketing efficiency; ARIMA model

INTRODUCTION

In Tamil Nadu major onion growing districts are Perambalur, Dindigul, Trichy, Namakkal and Coimbatore. Perambalur occupies the first position in area under small onion in the state.

The information on the cost and returns in small onion cultivation and constraints in production, processing and marketing of aggregatum onion in Tamil Nadu and especially in Perambalur district is lacking. With the problems of bulkiness and perishability the market for small onion as for most other farm products suffers from several problems. Only an efficient market that helps quick transport, scientific storage and processing can help farmers receive better price. Hence marketing of small onion is an important as is its production to ensure reasonable profits to the

farmers. Though there is no well organized market for onion in Perambalur its impact on value received by farmers for their onion needs a study.

Establishment of cooperative marketing societies in Perambalur has not helped the farmers much because majority of them depended on wholesalers and commission agents for their credit needs and sales were tied to credit even before harvest of the crop. The lack of suitable storage and processing facilities and uncertainty of prices discouraged the farmers from undertaking large scale cultivation of small onion. The present study was aimed at analyzing the marketing problems faced by the farmers and efficiency of the market channels through which onion was marketed with the objectives to work out the marketable surplus, marketing channel, price spread and marketing efficiency to forecast the price of

aggregatum onion production and to identify the constraints in production and marketing and suggest measures for their improvement.

METHODOLOGY

Perambalur district was purposively selected for the present study in the first stage since it occupied the first position in area under aggregatum onion in the state. In the second stage Alathur block was purposively selected for its highest area and production of onion. The list of major small onion growing villages of this block was collected and eight highest onion growing villages namely Alathur, Kolathur, Melamathur, Kannapadi, Therani, Elanthpatti, Naranamangalam and Sirukanpur were selected randomly. From each selected village fifteen small onion growers were selected at random and thus making a total sample size of 120. The intermediaries involved in marketing of onion namely for Vuzhavar Santhai, Varasanthai, retailer, wholesaler and commission agent channels were also selected at the rate of ten for each channel and thus making the total sample size of 50.

Two methods were selected to assess the marketing efficiency in terms of pricing and technical efficiencies by using formulae given by Shepherd (1965) and Acharya and Agarwal (1987).

The average gross margins of all the intermediaries were added to obtain the total marketing margin as well as the breakup of the consumer's rupee.

$$MT = \sum_{i=1}^n \frac{S_i - P_i}{Q_i}$$

where MT= Total marketing margin, S_i = Sale value of a product for i^{th} intermediary, P_i = Purchase value paid by the i^{th} intermediary, Q_i = Quantity of the product handled by the i^{th} intermediary, $i= 1, 2, 3 \dots n$ (number of intermediaries involved)

ARIMA (p,d,q) was developed in the study with 'p' being the number of autoregressive terms, 'd' being the number of differencing the time series and 'q' was the number of moving average terms. The ARIMA model was fitted for aggregatum onion production using the Box-Jenkins methodology of identification of the model with p,d,q values and the selection of best model with minimum AIC (Akaike Information Criterion) and SBC (Schwartz Bayesian Criterion). Estimation of the model was done using

diagnostic checking with mean absolute percentage error (MAPE) criterion and finally forecasting. This was done with the help of SPSS package from the time series data of onion prices from 1995-1996 to 2014-2015. The problems in onion marketing were studied with Garrett's ranking technique

RESULTS and DISCUSSION

Marketable surplus of small onion cultivation

Marketable surplus is defined as the surplus left with the farmer for sale after meeting his own requirement for home consumption, seed purpose and social obligations. It is evident from the Table 1 that on sample farms the marketable surplus was 84.30 per cent of the total small onion production on the sample farms (Singh et al 2011). The rest of the production excluding marketable surplus was highest for seed purpose and social obligation with 11.78 per cent to the total small onion production. Home consumption requirement was 3.92 per cent to the total small onion production in the sample farm.

Table 1. Small onion cultivation and marketable surplus

Parameter	Quantity (kg/farm)	Per cent to total
Production per farm	6324	100.00
Marketable surplus	5331	84.30
Seed purpose and social obligation	745	11.78
Home consumption	248	3.92

Marketing channel

In Perambalur district small onion was marketed through five marketing channels. Hence the price spread of different marketing channels was worked out and the results are presented in Table 2 to 6 (Mehendi Adnan et al 2014). The following five marketing channels were identified in the study area.

Channel I

Producer - Farmers' market - Consumer

Channel II

Producer - Weekly market - Consumer

Channel III

Producer - Village - Merchant - Retailer - Consumer

Channel IV

Producer - Wholesaler - Retailer - Consumer

Channel V

Producer - Commission agent - Wholesaler - Retailer - Consumer

Table 2. Price spread of small onion in marketing channel I

Parameter	Amount (Rs/q)	Percentage
Producer		
Gross price received	1468.45	82.36
Marketing cost	125.00	7.01
Net price received	1343.45	75.34
Farmers' market merchant		
Purchase price	1468.45	82.36
Marketing cost	45.00	2.52
Marketing margin	314.5	17.64
Sale price	1782.95	100
Price paid by consumer	1782.95	100
Price spread	439.50	24.66

Marketing channel I

It can be seen in Table 2 that the farmers had received net price of Rs 1343.45 per quintal which constituted 75.34 per cent to the total consumer price. The marketing cost incurred by producer was Rs 125.00 per quintal which constituted 7.01 per cent to the total consumer price. The marketing cost of farmers' market trader was Rs 45.00 which constituted 2.52 per cent to the total consumer price. His marketing margin was Rs 314.50 which constituted 17.64 cent to the total consumer price. Thus the farmers' share in consumer rupee was 75.34 and price spread was 24.66 per cent.

Marketing channel II

It can be seen in Table 3 that the farmers had received net price of Rs 1299.16 per quintal which constituted 69.22 per cent to the total consumer price. The marketing cost incurred by producer was Rs 114.00 per quintal which constituted 6.07 per cent to the total consumer price. The marketing cost of weekly market merchant was Rs 128.57 which constituted 6.85 per cent to the total consumer price. His marketing margin was Rs 463.50 which constituted 24.70 per cent to the total consumer price. Thus the farmers' share in consumer rupee was 69.22 per cent which was lower than marketing channel I and price spread was 30.78 per cent. Even though the farmers in both the marketing channels received almost similar gross price, due to higher price spread of 30.78 observed in marketing channel II the farmers share was less in marketing channel II.

Marketing channel III

The price spread analysis for marketing channel III (Table 4) shows that the farmers had received net price of Rs 1239.00 per quintal which

constituted 65.17 per cent to the total consumer price. The marketing cost incurred by producer was Rs 108.50 per quintal which constituted 5.70 per cent to the total consumer price.

The marketing cost of village merchant was Rs 119.25 which constituted 6.27 cent to the total consumer price. His marketing margin was Rs 239.25 which constituted 12.59 cent to the total consumer price. The marketing cost of retailer Rs 110.40 which included spoilage loss and transport cost and the marketing margin of retailer was Rs 314.50 per quintal which constituted 16.54 per cent to the total consumer price.

Thus the farmers' share in consumer rupee was 65.17 per cent and price spread was 34.83 per cent. The farmers' share was less in this channel as compared to previous two channels because of the less gross price received (Rs 1347.50/q) and also due to the presence of two intermediaries in this channel namely village merchant and retailer.

Marketing channel IV

The price spread analysis for marketing channel IV (Table 5) show that the farmers had received net price of Rs 1287.75 per quintal which constituted 67.13 per cent to the total consumer price. The marketing cost incurred by producer was Rs 101.50 per quintal which constituted 5.29 per cent to the total consumer price. The marketing cost of wholesaler was Rs 69.09 which constituted 3.60 cent to the total consumer price. His marketing margin was Rs 214.5 which constituted 11.18 per cent to the total consumer price. The marketing cost of retailer which included spoilage loss and transport cost was Rs 102.69. The marketing margin of retailer was Rs 314.50 per quintal

Table 3. Price spread of small onion in marketing channel II

Parameter	Amount (Rs/q)	Percentage
Producer		
Gross price received	1413.16	75.30
Marketing cost	114.00	6.07
Net price received	1299.16	69.22
Weekly market merchant		
Purchase price	1413.16	75.30
Marketing cost	128.57	6.85
Marketing margin	463.50	24.70
Sale price	1876.66	100
Price paid by consumer	1876.66	100
Price spread	577.50	30.78

Table 4. Price spread of small onion in marketing channel III

Parameter	Amount (Rs/q)	Percentage
Producer		
Gross price received	1347.50	70.87
Marketing cost	108.50	5.70
Net price received	1239.00	65.17
Village merchant		
Purchase price	1347.50	70.87
Marketing cost	119.25	6.27
Marketing margin	239.25	12.59
Sale price	1586.75	83.46
Retailer		
Purchase price	1586.75	83.46
Marketing cost	110.40	5.81
Marketing margin	314.50	16.54
Sale price	1901.25	100

Table 5. Price spread of small onion in marketing channel IV

Parameter	Amount (Rs/q)	Percentage
Producer		
Gross price received	1389.25	72.42
Marketing cost	101.5	5.29
Net price received	1287.75	67.13
Wholesaler		
Purchase price	1389.25	72.42
Marketing cost	69.06	3.60
Marketing margin	214.5	11.18
Sale price	1603.75	83.60
Retailer		
Purchase price	1603.75	83.61
Marketing cost	102.69	5.35
Marketing margin	314.5	16.39
Sale price	1918.25	100
Price paid by consumer	1918.25	100
Price spread	630.50	32.87
Price paid by consumer	1901.25	100
Price spread	662.25	34.83

Table 6. Price spread of small onion in marketing channel V

Paramter	Amount (Rs/q)	Percentage
Producer		
Gross price received	1296.51	70.98
Marketing cost	204.50	11.21
Net price received	1092.01	59.79
Commission agent		
Wholesaler		
Purchase price	1296.51	70.98
Marketing cost	69.10	3.78
Marketing margin	225.50	12.35
Sale price	1522.01	83.33
Retailer		
Purchase price	1522.01	83.33
Marketing cost	95.70	5.24
Marketing margin	304.50	16.67
Sale price	1826.51	100
Price paid by consumer	1826.51	100
Price spread	734.50	40.21

which constituted 16.39 per cent to the total consumer price. Thus the farmers' share in consumer rupee was 67.13 per cent and price spread was 32.87 per cent. Even though the farmers in this channel received a similar gross price as compared to marketing channel III they received a higher farmer share due to lesser price spread of 32.87 per cent.

Marketing channel V

The price spread analysis for marketing channel V (Table 6) depicts that the farmers had received net price of Rs 1092.01 per quintal which constituted 59.79 per cent to the total consumer price. The marketing cost incurred by producer was Rs 204.50 per quintal which constituted 11.21 per cent to the total consumer price. The commission charge incurred by the farmer to the commission agent was 5.47 per cent to the consumer price.

The marketing cost of wholesaler was Rs 69.10 which constituted 3.78 cent to the total consumer price. His marketing margin was Rs. 225.50 which constituted 12.35 per cent to the total consumer price. The marketing cost of retailer was Rs 95.70 and the marketing margin of retailer was Rs 304.50 per quintal which constituted 16.67 per cent to the total consumer price. Thus the farmers' share in consumer rupee was 59.79 per cent and price spread was 40.21 per cent. The farmers in this received the lowest farmer share as compared to other previous four channels due to lowest gross price received due to Rs 1296.51/q and the highest price spread of 40.21 per cent.

Thus it can be inferred that the marketing channel I namely farmer-farmers-market-merchant-consumer was the efficient marketing channel as it had highest farmer share of 75.34 per cent and lowest price spread of 24.66 per cent which might be due to better pricing mechanism, lesser price spread and better regulation. This channel was the best channel in spite of the functioning of traders in this channel which has to be eliminated from this channel.

Marketing efficiency

The results of marketing efficiency are presented in Table 7. Both the efficiency measures with values of 3.06 in Shepherd method and 2.58 in Acharya and Agarwal method showed that marketing channel I was the efficient channel. This finding is in tune with the price spread analysis. The order of the efficient marketing channels according to both methods are marketing channel I, marketing channel II, marketing channel IV, marketing channel III and marketing channel V. This ordering is also in tune with price spread analysis.

Table 7. Marketing efficiency of small onion cultivation

Marketing channel	Shepherd method	Acharya and Agarwal method
I	3.06	2.58
II	2.24	2.38
III	1.87	1.96
IV	2.04	2.31
V	1.48	1.99

Price forecasting in small onion cultivation

The month-wise projection of small onion prices were made for the year 2015 by ARIMA model using Box-Jenkins methodology (Kumar et al 2011, Mishra et al 2013).

Model identification and estimation

For forecasting small onion price ARIMA model was estimated only after transforming the variable under forecasting into a stationary series. The stationary series is the one whose values vary over time only around a constant mean and constant variance. In this case difference of order 1 was sufficient to achieve stationarity in mean

The next step was to identify the values of p and q. The ACF and PACF show that the order of p and q at most was 1. Five tentative ARIMA models were encountered and that model was chosen which had minimum Akaike information criterion (AIC) and Schwartz Bayesian criterion (SBC). The models and corresponding AIC and SBC values are presented in Table 8. So the most suitable model was ARIMA(2,1,2) since it had the lowest AIC and SBC values.

Table 8. ARIMA models

P,d,q	AIC	SBC
1,1,0	2914.19	2920.69
1,1,1	2908.22	2917.98
2,1,2	2893.46	2909.72
2,1,0	2912.03	2921.78
2,1,1	2897.28	2910.29

Model verification

The model parameters were estimated using SPSS package. Results of estimation are reported in Table 9. The ACF and PACF of the residual indicated the 'good fit' of the model.

Forecasting with ARIMA model

To judge the forecasting ability of the fitted ARIMA model the important measure of the forecast accuracy was computed. The mean absolute percentage error (MAPE) for small onion price was 18.74. This measure indicated that the forecasting inaccuracy was low. The forecasts for monthly small onion price during 2015 are given in Table 10. The forecasted value was high during the month of September with Rs

Table 9. Estimates of the fitted ARIMA model

Model fit statistics				Box-Ljung Q	
RMSE	MAPE	MAE	MaxAE	Statistics	Sig
462.94	18.78	257.45	2.50	21.32	0.09

RMSE= Root mean square error, MAPE= Mean absolute percentage error, MAE= Mean absolute error, MaxAE= Maximum absolute error

3681.11 per quintal followed by the months of August and October. January followed by February month recorded the lowest forecasted price.

Constraints faced

Marketing constraints faced by sample farmers:

Three major marketing constraints were identified (Barakade 2011, Patilnanagouda and Rajasab 2012) and they were ranked using Garrett's ranking technique and the results are presented in Table 11. The most important constraint identified by the small onion growers was price fluctuation in small onion market (67.65) as the price varied between Rs 700 to 6000 per quintal. The second major constraint ranked by the sample farmers was perishability of onion with a

score of 49.54. The third constraint in onion farms was late payment by commission agents. The results indicated the need for development and promotion of storage facilities which would stabilize the prices. The results also indicated the need for price forecasting of onion and timely information to the farmers and hence a similar exercise was done on price forecasting of small onion price.

Problems faced by intermediaries: The problems faced by the intermediaries were ranked using Garrett's ranking technique and the results are presented in Table 12. The intermediaries expressed that the lack of storage facility was the most important problem (57.23) followed by high handling cost (49.90) and financial constraints (45.30).

Table 10. Forecasted value of small onion price for year 2015

Month	Forecasted value (Rs/q)	LCL	UCL
May	2908.10	2191.96	4115.90
June	2654.51	1267.17	4219.15
July	2627.85	1452.65	4279.10
August	3521.75	1685.05	4328.90
September	3681.11	2102.82	4857.02
October	3367.21	2482.50	4651.15
November	3176.60	2095.01	3682.15
December	2610.59	1536.56	3196.28
January	2451.72	1330.31	3810.05
February	2546.90	1261.20	4141.66
March	2625.01	1240.13	4363.26
April	2689.10	1240.26	4518.46

LCL= Lower confidence level, UCL= Upper confidence level

Table 11. Problems faced in small onion marketing by sample farmers

Problem	Mean score	Rank
Price fluctuation	67.65	I
Perishability of onion	49.54	II
Late payment by commission agents	38.87	III

Table 12. Problems faced by intermediaries

Problem	Score	Rank
Lack of storage facility	57.23	I
High handling cost	49.90	II
Financial constraints	45.30	III

CONCLUSION

The price spread analysis revealed that the farmers' market channel was the best channel in spite of operation of traders in this channel. Hence the agriculture department should take a strict vigil of operation of traders in this channel for more benefits

to the farmers in this region. Higher price fluctuation was the major constraint in the small onion marketing as the small onion price fluctuated between Rs1400 to Rs 5800 per quintal. The price forecast of small onion was regularly communicated by the domestic and export market intelligence cell (DEMIC) of TNAU to the farmers. The study also underlined the establishment of cost efficient scientific storage facilities to stabilize the onion prices and to overcome perishability of onion.

REFERENCES

- Acharya SS and Agarwal NL 1987. Agriculture marketing in India. Oxford and IBH Publishing Co Pvt Ltd, New Delhi, India.
- Barakade AJ 2011. Economics of Rabi onion marketing in Satara district: problems and prospects. *Indian Streams Research Journal* **1(9)**: 1-4.
- Kumar TLM, Surendra HS and Munirajappa R 2011. Holt-winters exponential smoothing and seasonal ARIMA time-series technique for forecasting of onion price in Bangalore market. *Mysore Journal of Agricultural Sciences* **45(3)**: 602-607.
- Mehendi Adnan KM, Rahman MM and Sarker SA 2014. Marketing channels and post-harvest practices of onion: a case of Bogra and Joypurhat district in Bangladesh. *Universal Journal of Agricultural Research* **2(2)**: 61-66.
- Mishra P, Sarkar C, Vishwajith KP, Dhekale BS and Sahu PK 2013. Instability and forecasting using ARIMA model in area, production and productivity of onion in India. *Journal of Crop and Weed* **9(2)**: 96-101.
- Patilnanagouda and Rajasab AH 2012. Constraints experienced by onion growers from Gulbarga district of Karnataka, India. *International Journal of Extension Education* **8(1)**: 48-50.
- Shepherd GS 1965. Marketing farm products: economic analysis. Iowa College Press, Iowa, USA.
- Singh SP, Singh AK and Dwivedi S 2011. Marketable and marketed surpluses of main vegetables crops in eastern Uttar Pradesh. *International Research Journal of Agricultural Economics and Statistics* **2(1)**: 68-70.