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PRICE FORECASTING FOR TUR IN LATUR DISTRICT OF MAHARASHTRA, INDIA

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Abstract

As a major Kharif crop, it is predominantly cultivated during the rainy season, contributing significantly to the country's agricultural output during this period. India holds a prominent global position in the cultivation of Pigeonpea. productivity of tur in Maharashtra is more than three times the productivity of tur in Karnataka. Maharashtra is the top producer of turin India, with an area of 1274.02 thousand hectares, production of 1327.53 thousand tonnes,and a productivity of 1042 kg/ha. the area under tur cultivation with a compound annual growth rate (CAGR) of 0.96 % with the production of tur at 1.09% but the significant growth percentage yield of the tur crop was not shown which is 0.092%. Many factors canaffect the productivity of tur, including soil quality, rainfall, and temperature. The use of improved varieties of tur and better farming practices can also help to increase productivity.A study was conducted in Maharashtra's Latur district to analyze the wholesale price of turusing data from January 2010 to December 2022 from the Latur market Latur. The forecasting values by using the expansional smoothing model for the next six months of January 2023 to July 2023 by using the MINITAB software. By using the expansional smoothing model there is Double exponential model is suitable for forecasting the values of Tur prices.

Keyword: *Price Forecasting, Tur, Area, Production, Yield Exponential Smoothing*

INTRODUCTION

The pigeon pea, known by various names such as Red gram, Arhar, or Tur, is a significant pulse crop in India, primarily grown during the kharif season. The Significance in Pulse Crops the Pigeonpea ranks as the second most important pulse crop in India, following gram (chickpea), emphasizing its agricultural significance in the country. As a major Kharif crop, it is predominantly cultivated during the rainy season, contributing significantly to the country's agricultural output during this period. India holds a prominent global position in the cultivation of pigeonpea. It stands as the world's top producer, accounting for a substantial share of global land and production. Area-wise, India covers approximately 80% of the globalacreage dedicated to pigeonpea cultivation. Likewise, around 67% of the world's pigeonpea production is contributed by India. The significant dominance of India in both acreage and production underlines its pivotal role in the global pigeonpea market. This reflects the country'sextensive cultivation and substantial output in meeting domestic demand and contributing to international markets. Pigeonpea holds economic importance for farmers and plays a vital rolein providing nutrition to the population due to its high protein content and versatility in culinaryuse.

1.1 Area, Production, and Productivity of Tur in India:

Pulses, in general, are nutritionally enriched as they have high protein content, relative to staple cereals. In addition to their nutritional content, there are several reasons that stronglymost of the legumes are also good sources of carbohydrates (30-60%; USDA 2013). (Gowda, Chaturvedi and Gaur). Pigeonpea is an important grain legume mostly cultivatedin Africa, Asia, and the Americas. The global chickpea area, production and yield (in 2013) were 6.22 MHA, 4.74 MT, and 762.4 kg respectively (FAOSTAT 2015). During 2013, 83.09% of global pigeonpea production and ~85.50% of area was in Asia, 14.34% and 12.19% in Africa, 2.57% and 2.31% in the Americas (FAOSTAT 2015). The major pigeon pea-producing countries include India (63.74% of global production), Myanmar (18.98%),Malawi (6.07%), Tanzania (4.42%) and Uganda 1.98%). In India, pigeonpea was cultivatedon 4.65 mha with a total production of 3.02 MT and a yield of 650.0 kg in 2013. (Gowda, Chaturvedi and Gaur). India is prominent for its diverse range of pulses that are producedand exported worldwide. The states that contribute the most to pulse production in India are Madhya Pradesh, Rajasthan, Gujarat, Andhra Pradesh, Uttar Pradesh, Telangana, Karnataka, Maharashtra, and Jharkhand. The area, production, and productivity of Tur in India are presented in Figures 1, 2, and 3.

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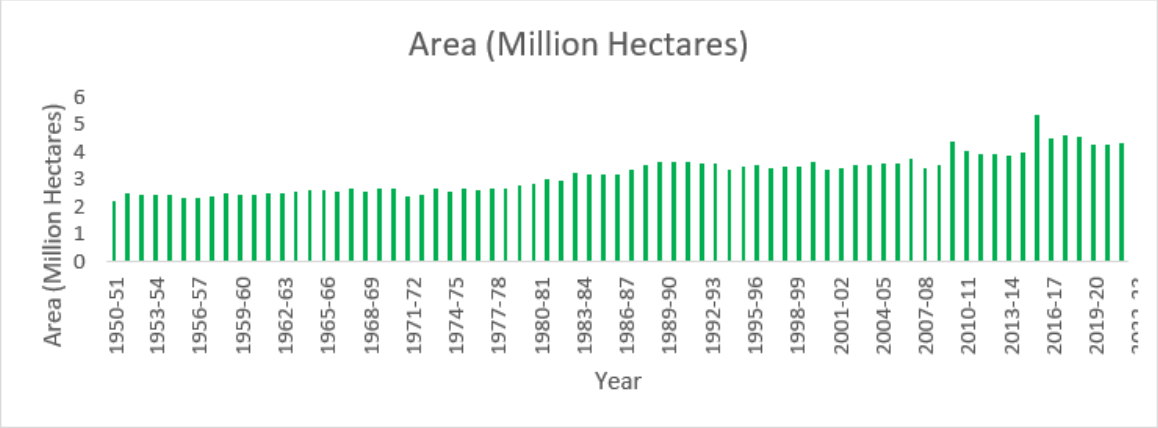
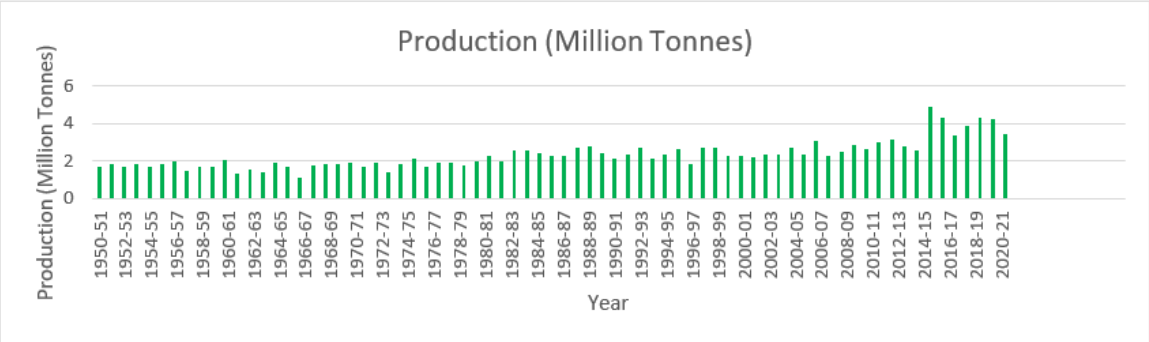
Figure 1. Area of Tur in India (Million Hectares)



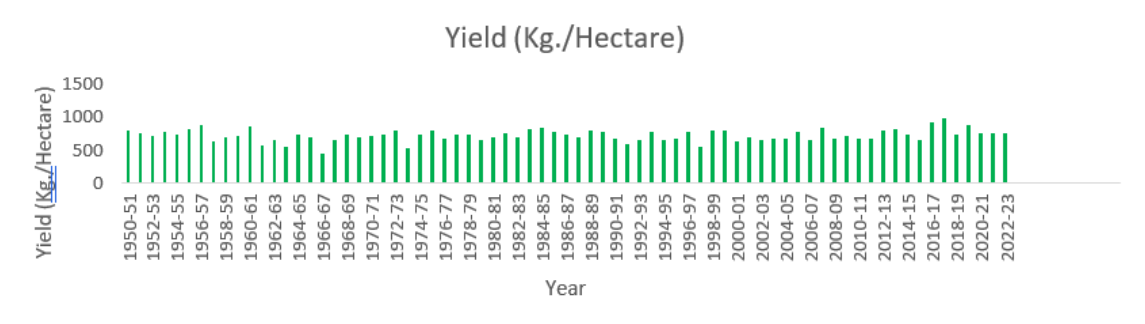
Source: EPW Database

Figure2. Production of Tur in India (Million Tonnes)



Source: EPW Database

Figure 3. Yield of Tur in India (Kg./Hectare)



Source: EPW Database

Table 1. State-wise area, production, and productivity of Tur in India (2020-2021).

States	Area (ThousandHectares)	Production (Thousand Tonnes)	Yield (Kg./Hectare)
Andhra Pradesh	231	83.85	363
Assam	6.04	5.17	856
Bihar	14.6	23.45	1606
Chhattisgarh	45.36	27.17	599
Gujarat	241.02	285.85	1186

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Haryana	0.82	1.02	1250
Himachal Pradesh	0.01	0.01	875
Jharkhand	235.39	259.87	1104
Karnataka	1631	1237.93	759
Kerala	0.2	0.33	1647
Madhya Pradesh	219	285.8	1305
Maharashtra	1274.02	1327.53	1042
Manipur	0.56	0.57	1018
Meghalaya	1.19	1.55	1302
Mizoram	0.4	0.42	1030
Nagaland	3.21	2.95	919
Odisha	129.69	151.22	1166
Punjab	1.8	2.09	1163
Rajasthan	7.77	6.83	879
Tamil Nadu	47.33	49.63	1048.58
Telangana	325.7	252.42	775
Tripura	4.84	3.78	780
Uttar Pradesh	296	297.48	1005
Uttarakhand	3	3.56	1185
West Bengal	4.49	5.43	1210

Source: EPW Database

Table 1 shows that the productivity of tur varies widely from state to state. For example, the productivity of tur in Maharashtra is more than three times the productivity of tur in Karnataka.Maharashtra is the top producer of tur in India, with an area of 1274.02 thousand hectares, production of 1327.53 thousand tonnes, and a productivity of 1042 kg/ha. Madhya Pradesh is the second largest producer of tur, with an area of 219 thousand hectares, a production of 285.8thousand tonnes, and a productivity of 1305 kg/ha. Karnataka is the third largest producer of tur, with an area of 1631 thousand hectares, a production of 1237.93 thousand tonnes, and a productivity of 759 kg/ha. Andhra Pradesh is the fourth largest producer of tur, with an area of231 thousand hectares, a production of 83.85 thousand tonnes, and a productivity of 363 kg/ha.Gujarat is the fifth largest producer of tur, with an area of 241.02 thousand hectares, a production of 285.85 thousand tonnes, and a productivity of 1186 kg/ha. Overall, the table shows that tur is an important crop in India and that there is significant potential to increase production by improving productivity.

Table 2. Area, production, and productivity of Tur in Maharashtra (2000-2001 to 2020-2021)

Year	Area (Thousand Hectares)	Production (Thousand Tonnes)	Yield (Kg./Hectare)
2000-01	1096.1	660.3	602.41
2001-02	1023	773	755.62
2002-03	1060	777	733.02
2003-04	1056	695	658.14
2004-05	1074	658	612.66
2005-06	1100	792	720
2006-07	1123	815	725.73
2007-08	1175	1083	921.7
2008-09	1009	605	599.6
2009-10	1093	919	840.81
2010-11	1302	976	749.62
2011-12	1233	871	706.41
2012-13	1180	966	818.64
2013-14	1141	1034	906.22
2014-15	1210	726	600
2015-16	1237	556.65	450
2016-17	1435.6	1495.75	1041.9
2017-18	1240.7	1127.8	909
2018-19	1261.3	834.48	661.6
2019-20	1195.5	1084.32	907
2020-21	1274.02	1327.53	1042

Source: EPW Database

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The table suggests that tur is an important crop in Maharashtra and that its production is increasing. This is likely due to a combination of factors, including government support, improved varieties, and better farming practices. The area under tur cultivation in Maharashtrahas increased from 1096.1 thousand hectares in 2000-01 to 1274.02 thousand hectares in 2020-

21. The production of tur in Maharashtra has also increased from 660.3 thousand tonnes in 2000-01 to 1327.53 thousand tonnes in 2020-21. The productivity of tur in Maharashtra has fluctuated over the years but has generally increased from 602.41 kg/ha in 2000-01 to 1042 kg/ha in 2020-21. possible reasons for the increase in area, production, and productivity of turin Maharashtra included Increased government support for tur cultivation, such as through the provision of subsidies and improved access to credit. The adoption of improved varieties of turthat are more resistant to pests and diseases and have higher yields. Improved farmingpractices, such as the use of drip irrigation and precision agriculture techniques.

1.2 Trend Analysis of Tur Productivity, Production, and Area in India.

During the period of (1950-51 to 2020-2021), the area under tur cultivation with acompound annual growth rate (CAGR) of 0.96 % with the production of tur at 1.09% butthe significant growth percentage yield of the tur crop was not shown which is 0.092%. Many factors can affect the productivity of tur, including soil quality, rainfall, and temperature. The use of improved varieties of tur and better farming practices can also helpto increase productivity.

Table 3 shows highly significant observed relationships between tur area, production, andyield. The P-value shows there is significant growth in the area and the production but on

the other hand, there is no significant growth in yield. The high R-squared values indicate a strong correlation between the Area and production variables, but there is no correlationbetween the year and yield of the crop but the factor studied significantly impacts the area,production and yield.

Table 3. CAGR of area, production, and yield of Tur in India.

Variables	CAGR (%)	P -Value	Regression Statistics (R Square)
Area (Million Hectares)	0.96	< 0.0005	0.90
Production (Million Tonnes)	1.09	< 0.0005	0.70
Yield (Kg./Hectare)	0.092	> 0.185	0.024

MATERIALS AND METHOD

The study achieved its objective by utilizing secondary data. Monthly tur prices from January 2010 to December 2022 were collected from the agricultural marketing information network (AGMARKNET) website, a reliable secondary source. Various sources including books, magazines, journals, reports, and institutional websites were referred to identify the factors influencing Tur prices. To analyse the data, use statistical techniques like exponential smoothing for price forecasting. The processing of data MINITAB Software

2.1 Study area

India's Maharashtra state contains the district of Latur. With the district headquarters situated there, it is the sixteenth-largest city in Maharashtra. The district is located in Maharashtra's Marathwada area. The Latur district in Maharashtra is ahead in the production of the pulses. Latur district is the largest producer of tur in the country.

Price Forecasting: - (a)Exponential smoothening model:

For smoothing the common techniques discussed by Gardned (1985) i.e. Single exponentialsmoothing (SES) and double exponential smoothing (DES) are used.

(i) Single Exponential Smoothing(SES):

For the time series $Y_1, Y_2, \ldots, Y_t$ forecast for the next value, say Y_{t+1}, F_{t+1}, is based on the weights α and (1-α) to the most recent observation Y_1 and recent forecast F_1 respectively, where is a smoothing constant, the form of the model is,

$$F_{t+1} = F_1 + (Y_1 - F_1)$$

The choice of has a considerable impact on the forecast. The optimum value of thecorresponding to Minimum Mean Square Error (MSE) is then identified.

(ii) Double Exponential Smoothing (DES):The form of the model is

$$L_t = \alpha Y_t + (1-\alpha)(L_{t-1} + b_{t-1})$$

$$b_t = \beta(L_t - L_{t-1}) + (1-\beta)b_{t-1}$$

$$F_{t+m} = L_t + b_t m$$

Where,

L_t is level of series at time t.

b_t is slope of the series at time t.

α and β (= 0.1,0.2,……0.9) are the smoothing and trend parameters.

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The pair of values of parameters, α and β, which gives minimum MSE are taken. Selection of weights (W1,W2, W3) Value of all three smoothing constant or weights areobtained by trial and error method. The time series are analyzed by giving different weights
and the best exponential model in each case is selected, based on minimum MAPE and
MSD values under different weights.

Criteria Measurement for Forecast Error:

To measure the forecast error or accuracy of the forecast, following measures have beenused.

(i) Mean Square Error (MSE):- This is similar to simple variance.

$t=1$

Where,

MSE = $\sum$

$|At - F t| 2 / T$

A t = Actual value at time t.F t = Forecast value at time.

(ii) Mean Absolute deviation (MAD) :- This is the average of absolute deviation or absoluteforecast error.

MAD = $\sum^{T}$ $|forecast$ error $| / T$ $t=1$

$= \sum^{T}$ $|At- Ft| /T$

$t=1$

(iii) Mean Absolute Percent Error (MAPE):- This is average value of percent absoluteerror. (KUMBHAR, GAIDOLE and SHARMA)

MAPE = $100\sum^{T}$ $[|A t - F t| / A t] / T$

RESULTS AND DISCUSSION

$t=1$

Table 3: Different exponential smoothing criterion for Tur forecast model

Model	MAPE	MAD	MSD
SES	6.45	195.8	95589.68
DES	6.17	165.9	75049.17
Winters Model	12	289	143148

Author Calculated

Price Forecasting of Tur

The table 3 observed that the Double exponential smoothing technique was most appropriate for the price forecast because in DES model the values of MAPE, MAD, and MSD were lowest. Table 4 shows the truthfulness of different forecasting prices, which were compared with the actual price in the market. The actual price data of tur from the period January 2023 to June 2023 are used for the validation of the forecastedprice and actual price. As a result, here the correctness percentage varies from 76.63 to
1.00 percent based on the double exponential model. The prevailing price as comparedto other predicted model prices varied from 69.67 to 96.26 percent in case of the singleexponential smoothing (SES), while the actual percentage for winter's model varies from 71.49 to 96.67 percent. From the observation, the analysis, and conclusion the Double exponential model was the suitable model for the Tur price forecast in APMC of Latur for the selected period and as per the same model examined by (Meera and Hemant).

Table 4: Truthfulness of forecast price of Tur

Month and Year	Actual Wholesale Price	SES(Forecasted)	DES (Forecasted)	Winter model (Forecasted)
Jan-23	7297.5	7024.99 (96.26)	7346.69 (1.00)	7055.11(96.67)
Feb-23	7702.5	7024.99 (91.20)	7510.22 (97.50)	7085.7 (91.99)
Mar-23	8203.929	7024.99 (85.62)	7533.93(91.83)	7116.28 (86.74)
Apr-23	8414.706	7024.99 (83.48)	7641.28 (90.80)	7146.86 (84.93)
May-23	9042	7024.99 (77.69)	7670 (84.82)	7177.45 (79.37)
Jun-23	10082.5	7024.99 (69.67)	7706.71(76.63)	7208.03 (71.49)

Figure in parentheses are the percentages of respective actual prices

CONCLUSION

The study of price variation of Tur crop over time is important for formulating a resonance agricultural policy.

that tur is an important crop in Maharashtra and that its production is increasing. Maharashtra is the top producer of tur in India, with an area of 1274.02 thousand hectares, production of 1327.53 thousand tonnes, and a productivity of 1042 kg/ha. Tur crop shows there is no correlation between the year and yield of the crop but the factor studied significantly impacts the area, production and yield. The assessmentof all three forecasting models was carried out in the procedure based on the Double Exponential model with MAD (165.9) and MAPE (6.17) values, which were considered to
be the least. The accurate value among the predicted price and prevailing price of tur werefound in between 76.1 to 1.00 percent. Tur crop is more volatile So, DES the most appropriate model was observed for tur price forecasting. This study can be used for further research in the field of market intelligence and production forecasting to achieve better prices.

POLICY IMPLICATION

Given the price fluctuations influenced by seasonal factors, especially for tur, farmers should adjusttheir sowing schedules to capitalize on higher prices in line with demand and supply trends throughout the season. Additionally, selling produce immediately after harvest can ensure farmersfetch favorable prices. Efforts to disseminate market intelligence and price forecasts should be continuous to benefit stakeholders. Establishing processing units for value addition to selected commodities is crucial. This initiative aims to improve farmer incomes and stabilize prices by reducing fluctuation.

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