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TREND ANALYSIS OF AREA, PRODUCTION, PRODUCTIVITY AND SHORT-TERM PRICE VOLATILITY ANALYSIS OF JASMINE IN MADURAI

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ABSTRACT
Jasmine has an important role in floriculture industry, where it plays as an valuable commercial crop with greater demands among people and various industries for its fragrance and religious, traditional value. Among all places Madurai District Jasmine is GI tagged and has prominent place in the hearts of all people in Tamil Nadu. So, it becomes inevitable to study the area, production and productivity trend of jasmine in Madurai using trend analysis. The result showed that the area, production and productivity have shown significant increasing trend over the study period implying the farmers in Madurai are interested and involved in cultivating jasmine for their income and livelihood. And jasmine as highly procured cut flower in the markets it is important to study the price volatility and its persistence. so GARCH (1,1) model is for studying short term price volatility of jasmine in Madurai district which resulted in presence of price shocks and time varying price volatility during the short-term study period. The volatility is moderately persistent in fluctuating the prices of jasmine for a short period and decreases over time.

KEYWORDS: Jasmine, Area, Production, Productivity, Price volatility, GARCH model

INTRODUCTION

Jasmine is one of the commercially valuable flowers acquiring its fragrance due to alkaloids like ‘jasmone’ and ‘terpinol’. Jasmine is a valuable business crop playing its important role in perfume and cosmetic industries. Madurai jasmine holds significant prominence in the state's floriculture industry. Madurai Malli cultivation provides income to many farmers and value actors in Madurai and surrounding areas. Jasmine is climate sensitive crop which needs an appropriate climate for its optimal growth and fragrance quality. So, Jasmine production and cultivation in Madurai have been influenced over the years because of its demand and uniqueness. Madurai Jasmine uniqueness led to greater price fluctuation sin the market. The jasmine price has reached Rs.12000 per kg in January 2026 due to various reasons like less market arrival, relative humidity etc. (New Indian Express, 2026) but a week ago it cost around Rs.2000 per kg. Likewise, the jasmine prices are fluctuating over time which affects farmers, market intermediaries and consumers. So, this study aims to

- To analyze the area, production and productivity trends of jasmine in Madurai district over the time period of 2001-2021
- To examine the short-term price volatility of jasmine in Madurai market

METHODOLOGY:

Data source:

The area, production and productivity data of jasmine in Madurai district is taken from Directorate of horticulture and plantation crop, Chennai (Karuthapandi prakash & Bagavathi Muniyandi, 2014), data.gov.in website and Madurai Horticultural office for the time period 2001-2021 for trend analysis. The daily price data of jasmine in Madurai market is taken from AGMARKNET website from march 2026 to August 2026 (study period – 6 months) for the short-term price dynamics analysis of jasmine.

Methods:

The long term trend in jasmine area, production and Productivity is estimated using both parametric and non-parametric tests, the linear regression is used to measure the average annual change in each variable , the Mann-Kendall , non-parametric test is employed to study the direction of trend and its statistical significance (Mann, 1945).Sen’s method is also used to study the trend magnitude using median slopes between pairs of observation (Sen, 1968).

To examine the long-term changes in jasmine area, production and productivity, trend analysis was carried out. These methods have been widely utilized in agricultural and horticultural studies in India. (Gaurav Sharma, et al., 2022) applied the Mann–Kendall test and Sen's slope estimator to examine long-term trends of horticultural crops in central India.
Pre diagnostics test like Augmented Dickey fuller test for evaluating the null hypothesis of a unit root and ARCH-LM test to check the presence of volatility clustering (Vaishnavi & Santosh, 2026) are employed for the daily price data of jasmine. To measure the volatility in daily price observation of a short-term period, generalized autoregressive conditional heteroscedasticity (GARCH (1,1)) model is used (Ranjith Kumar Paul, et al., 2015)

RESULTS AND DISCUSSION:

Production trend analysis of jasmine in Madurai:

Trend analysis for jasmine area, production and productivity in Madurai was performed from 2001 to 2020 using linear trend analysis, Mann-Kendall test and Sen's slope estimator. The linear trend coefficient quantifies the average annual change, and the Mann–Kendall test determines if the overall trend is statistically significant. Sen's slope is a good estimate of the magnitude of the annual change.

Table 1: Results of trend analysis

Variable	Mean	Minimum	Maximum	Linear slope	Linear p-value	MK Tau	MK p-value
Area	1241.61	589.00	1692.35	51.9344	0.0000	0.9446	0.0000
Production	10791.01	4564.00	17583.52	555.0911	0.0000	0.8391	0.0000
Productivity	8.55	7.52	10.58	0.0979	0.0210	0.4688	0.0057

Table 2: Result of Sen's slope and trend

Variable	Sen's slope	Overall trend
Area	50.4857	significant increasing
Production	611.1419	significant increasing
Productivity	0.0508	significant increasing

The trend analysis for jasmine cultivated area shows a significant increase in jasmine area. The linear trend coefficient is 51.934 ha per year, indicating 51.93 ha of jasmine area is changed annually on average. The Mann-Kendall test value 0.944 with a p-value 0.000 shows that the observed direction of growth is statistically significant, and the Sen's slope is about 50.485 ha per year, overall, the result infers that there is an overall gradual change in the jasmine area of cultivation in Madurai district over the study period.
The jasmine production trend analysis with linear trend coefficient 555.09 tonnes per year shows that the production changed approximately 555,09 tonnes annually on average and the Mann Kendall test result with 0.839 and p-value 0.00 indicates the direction of the long-term trend observed in the result is statistically significant. The Sen's sloe value is 611.1419; the overall result suggests that production of jasmine systematic over the study period rather than fluctuating in each year.
The productivity trend shows a significant increasing trend with linear trend coefficient 0.0979 tonnes per year and the Mann-Kendall test result suggest the direction of trend is statistically significant. Trend analysis results show that there exists a long-term consistent change in productivity over the years.

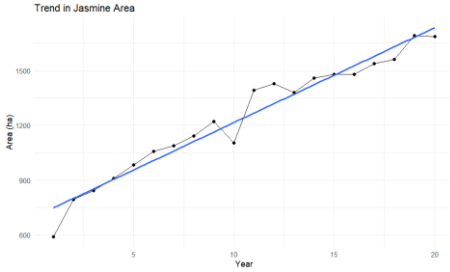

Figure 1: Trend in jasmine area in Madurai (2001-2020)

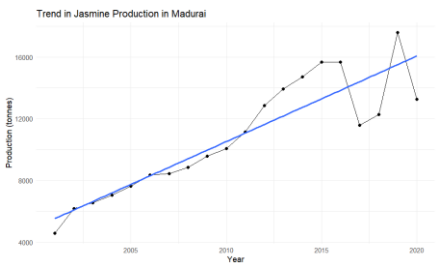

Figure 2: Trend in jasmine production in Madurai (2001-2020)

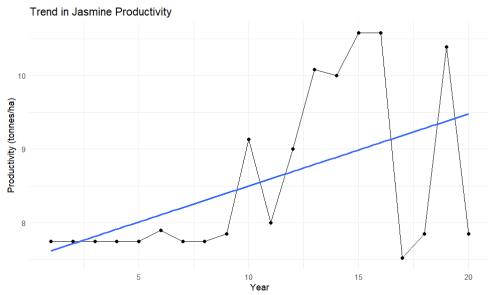

Figure 3: Trend in jasmine productivity in Madurai (2001-2020)

Short term price dynamics:

Daily price observation of jasmine in Madurai market is taken from AGMARKNET website from March 2026 to August 2026 for the price volatility analysis. About 180 daily price observations were taken to employ GARCH (1,1) model. The analysis of data shows that the price range of jasmine ranges between Rs15000 and Rs 65000 around the specified period of time. The mean price is about Rs 31751 and median price about Rs 30000.The standard deviation is Rs.8760.42, which shows there is considerable variation in the prices. The wide range between minimum and maximum prices of jasmine indicates substantial short-term fluctuations in the jasmine market.

Table 3: Descriptive statistics

Statistic	Result
Observations	180
Minimum price	₹15,000
Maximum price	₹65,000
Mean price	₹31,751.53
Median price	₹30,000
Standard deviation	₹8,760.42

Before employing GARCH (1,1) model, it is necessary to check whether the data taken is appropriate or suitable for GARCH model. So, statistical tests like ADF test, ARCH-LM test was used to study the suitability of data taken. Augmented Dickey Fuller test (ADF test) results with -6.8857 statistic value and 0.01 p-value, since the p-value is less than 5 percent significant level, the null hypothesis of unit root is rejected. this means the data is stationery and suitable for subsequent volatility modelling.

The ARCH-LM test result indicates the presence of conditional heteroscedasticity. The test yielded a chi-square statistic of 31.5087 with 12 degrees of freedom and a p-value of 0. 001647.This confirms the presence of time varying conditional volatility in jasmine price and gives a statistical justification for using GARCH model.

The GARCH results indicate that both recent price shocks and previous volatility contributed to current jasmine price volatility.

Table 4: GARCH (1,1) results

Parameter	Estimate
μ	0.636885
ω	164.511680
α_1	0.299692
β_1	0.385076

The arch coefficient (α_1) value is approximately 0.2996, indicating that unexpected movements in jasmine price have some influence on current price volatility. This means sudden change in jasmine price makes the jasmine prices more unstable for the next periods, implying one sudden change in jasmine price can lead to more price fluctuation afterward.

The GARCH coefficient (β_1) is estimated to be 0.385, which is less than 1 indicates the past price volatility create a moderate effect on future on current jasmine price. This means that the strong price volatility effect is moderate carried over to next period and in future it decreases. The volatility persistence in market is stated by the combined persistence coefficient ($\alpha_1 + \beta_1$) which values 0.6848, more than 1 but greater than 0.5 implying if the jasmine price goes up and down, the instability in prices remain in the market for the few periods and gradually becomes stable. The average of estimated price volatility is about 21.56 which shows there exist typical level of uncertainty in jasmine prices. The volatility during the stable period, the minimum volatility ranges about 16.38 showing the prices are less uncertain and the maximum price volatility during most unstable period values about 48.13 for our short-term price data indicating lighter level of price uncertainty. The standard deviation of 5.93 says that the volatility does not remain same level it varied around the average. By using the maximum and minimum volatility value (48.13/16.38), we can infer that the highest volatility is 3 times the lowest volatility. Thes results interpret that the jasmine price uncertainty changed over time. During some periods, prices were relatively stable, while other periods, prices were more unpredictable, meaning the farmers are facing different level of price risk over different periods.

Table 5: Conditional volatility

Measure	Value
Mean conditional volatility	21.56
Minimum conditional volatility	16.38
Maximum conditional volatility	48.13
Standard deviation	5.93

The Ljung box test is used to analyze the volatility pattern; the standard residuals check the price movement patterns and squared standardized residuals checks the volatility patterns. The standardized residuals p-value (0.0964) greater than 0.05 meaning there is no significant pattern remains in the error and the p-value of standardized residuals vis 0.6422 which is greater than 0.05 indicates there is no significant volatility pattern is left unexplained. The result of Ljung box test reveals that the GARCH model performed well, as no significant patterns or volatility were left unexplained in the models.
Price volatility suggests that the expected profits for jasmine farmers are unpredictable. Farmers find it challenging to forecast their revenue and make decisions about production and marketing when prices fluctuate significantly. The degree of price risk over various time periods is shown by the conditional volatility calculated from the GARCH model. While lower volatility indicates comparatively steady market conditions, higher volatility indicates more unpredictability. To determine the primary causes of variations in jasmine price risk, this estimated volatility can be further examined in conjunction with market and climate variables.

CONCLUSION:

The result of trend analysis shows that the area of jasmine cultivation has increased over the study period from 2001-2021 resulting from increased production and productivity but slight fluctuation is also seen during 2019 to 2021 in which the productivity and production is decreasing. This may be due to certain reasons like lockdown or less demand during that period. But as a good commercial crop Jasmine production in Madurai has a considerable increase over the time period. The study revealed that there were variations in the prices of Jasmine in Madurai during the short-term study period. The ARCH-LM test statistic was significant implying that price volatility was time-varying. The GARCH (1,1) model result shows that recent shocks of price and past volatility affect the current volatility. The volatility persistence value is 0.6848, indicating a moderate persistence of volatility in the market. This means that the effect of a price shock lingered for some time, but gradually faded away. The diagnostic tests confirmed that the model could adequately explain the pattern of volatility observed in the jasmine price series. Thus, jasmine farmers were prone to face price risks during the short-term study periods. So, it is better for the farmers to monitor the market current conditions then produce and supply according to the prevailing situation. Floriculture is a vital sub-sector of horticulture, which has a growing domestic and export potential; therefore, the findings of this study are expected to bring valuable insights to help the farmers, policy makers, and government in making better strategic decisions and adoption of new climate resilient technologies

Declaration of Competing interest:

Authors declare no competing interest.

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