

Forecasting Vegetable Crop Production in Jambi Province Using Linear Trend Analysis

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ABSTRACT

This research aims to analyze the development trends and forecast the production of 10 main vegetable commodities in Jambi Province over a period of 10 years (2015–2024). This analysis is crucial given the strategic role of the horticulture sector in providing nutritious food and its potential contribution to the Free Nutritious Food Program (MBG). The approach used is descriptive quantitative with a linear trend analysis method. Secondary data on annual vegetable production were obtained from the Central Bureau of Statistics (BPS) of Jambi Province. The linear trend equation $Y_t = aX_t + b$ was calculated using the least squares method to measure the average annual change in production (a) and the model's coefficient of determination (R^2). The analysis results show that all 10 commodities recorded a positive average annual increase trend. Large Chili had the highest growth rate, averaging 15,098 tons per year. The model showed a strong fit for commodities such as Chinese Cabbage/Mustard Greens ($R^2=0.8225$) and Spring Onions ($R^2=0.8237$). However, significant fluctuations were identified in Cabbage ($R^2=0.4983$) and Bird's Eye Chili ($R^2=0.4799$), indicating a high influence of non-linear factors. A very sharp surge in production occurred in the last two years (2023–2024), especially for Bird's Eye Chili and Eggplant, which recorded the highest production. Based on the strong linear trend projections, vegetable production in Jambi Province is predicted to continue increasing and stabilize at a high level, with Large Chili projected to reach 213,294 tons by 2027. The implications of this research are the need for risk mitigation of volatility (especially for Cabbage and Bird's Eye Chili) and an increase in post-harvest and distribution infrastructure capacity to accommodate larger production volumes in the future.

Keywords: *forecasting, trend linear, vegetable production, Jambi province, volatile*

INTRODUCTION

The agricultural sector, particularly the horticulture sub-sector, plays a highly strategic role in the framework of national food security and macroeconomic stability in Indonesia (Arianti, Hidayati dan Elza, 2025). Amidst the dynamic global challenges such as extreme climate change and rapid population growth, the demand for nutritious food commodities, including vegetables, continues to show an increasing trend. Adequate availability of vegetables is not only crucial for meeting community nutritional needs but also significantly contributes to regional inflation control, considering that volatile food groups like chili and onion often become major contributors to inflation (Bank Indonesia, 2024). Therefore, ensuring supply stability through increased domestic production is a priority agenda for national agricultural development to reduce import dependency and maintain price stability at the consumer level.

In a regional context, Jambi Province possesses potential land and agro-climatic resources that support the development of various types of vegetable commodities, both from lowlands and highlands. The agricultural sector in this region not only functions as a local food provider but also supports the rural economy. However, a frequently observed phenomenon in the field is the uncertainty of production volume over time. The realization of vegetable crop production in Jambi Province often experiences significant fluctuations from year to year, influenced by unpredictable weather factors, pest and disease attacks, and poorly planned planting patterns by farmers. These uncontrolled supply fluctuations often lead to price surges during scarcity or price drops during harvest season, ultimately harming farmers as producers and the community as consumers (Adiyoga, 2020).

The uncertainty in production volume creates significant challenges for local governments and relevant stakeholders in formulating effective food planning policies. The absence of accurate information regarding future supply projections complicates strategic decision-making related to distribution, stock management, and market intervention. To address this issue of uncertainty, a scientific approach is required that can provide an estimated outlook of future conditions based on existing historical data. This is where the role of quantitative forecasting methods becomes crucial as a decision support system for mapping the development trajectory of agricultural commodity production.

Various previous studies have extensively applied forecasting methods in agricultural economics. These studies utilize diverse approaches, ranging from complex econometric models to simpler time series analysis methods. For example, a study conducted by Sari, Iskandar and Putra, (2022) demonstrated that using historical production data analyzed with statistical methods can provide short-term projections that help mitigate the risk of food shortages. Another study by Pratama and Hidayat (2023) affirmed that understanding past data patterns whether they contain trend, seasonal, or cyclical elements is key to selecting the appropriate forecasting method to achieve reliable accuracy in agribusiness planning.

Despite numerous studies on agricultural production forecasting, there remains a research gap that needs to be addressed. Most existing studies tend to focus on national strategic food commodities such as rice and corn, or are concentrated in major production areas on Java Island. There are still few quantitative studies that specifically examine trends and forecast production for vegetable crop groups in the local context of Jambi Province. Furthermore, some previous research often utilizes highly complex mathematical models, which, although accurate, are frequently difficult to replicate or intuitively understand for practitioners and policymakers at the regional level who require a more practical yet robust analytical tool for observing long-term trends.

This research aims to address these shortcomings by focusing on the application of Linear Trend Analysis to forecast the production of main vegetable crops in Jambi Province. The selection of the Linear Trend Analysis method is based on its ability to clearly capture the direction of long-term data movement (secular trend) and its relatively easy interpretation, making it accessible to various stakeholders. The novelty of this research lies in providing specific empirical evidence regarding the historical growth patterns and future projections of vegetable commodities in Jambi, for which data has thus far been minimal. This information is expected to serve as a quantitative foundation, which has not been adequately available, for regional agricultural development planning.

Based on the problem description above, the primary objective of this research is to analyze historical data patterns and forecast the production of vegetable crops in Jambi Province for several upcoming periods using the Linear Trend Analysis method. Theoretically, this research is expected to enrich the literature on the application of applied statistical methods in regional agricultural economics. Practically, the results of this forecast are anticipated to provide significant benefits for the Jambi Provincial Agricultural Office and related agencies in formulating annual production targets, planning intensification programs, and developing strategies for stabilizing the supply and prices of vegetables in the region.

RESEARCH METHODOLOGY

This research employs a quantitative descriptive approach focusing on linear trend analysis to forecast vegetable crop production in Jambi Province. The data used in this study are secondary annual vegetable production data obtained from the Central Bureau of Statistics (BPS) and the Jambi Provincial Central Bureau of Statistics over the last 10 years (2015-2024). The main dependent variable (Y) in this study is vegetable crop production (tons), while the independent variable is time (X) represented by the year of observation. Linear trend analysis is performed using the least squares method to determine the trend line equation that best fits the production data. The linear trend equation used is as follows.

$$Y_t = aX_t + b$$

Where Y_t represents production in year, X_t denotes time (year), a is the slope coefficient indicating the average annual change in production, and b is the constant (intercept). Data analysis in this study was conducted using Microsoft Excel tools with the aim of identifying the production trends of vegetable crops in Jambi Province and estimating their projected output for the next three years through trend graph visualization. The trend graphs are employed to facilitate interpretation of the results and to provide visual information regarding the development tendencies of each vegetable commodity. By using Excel tools, the coefficient of determination (R^2) can also be obtained, which indicates the degree of fit between the trend model and the actual data. The closer the R^2 value is to 1, the better the trend line represents the actual data pattern. Therefore, the findings of this study are expected to serve as a reference for planning and decision-making in the agricultural sector by farmers, government agencies, relevant institutions, and agribusiness stakeholders.

RESULTS AND DISCUSSION

The vegetable commodities discussed in this study are shallots, scallions, potatoes, cabbage, Chinese cabbage/mustard greens, carrots, large chili peppers, bird's eye chili peppers, tomatoes, and eggplants. This selection is based on the fact that these ten commodities contributed the largest share of production in 2024. After conducting the analysis, the results of the linear trend analysis indicate changes in vegetable production in Jambi Province during the period 2015–2024, with varying patterns across commodities. This study also includes projection figures for the next three years.

1. Shallots



Figure 1. Shallot Production Trend Chart

Source: Processed data 2025

The shallot production graph presents data from approximately 2015 to 2024, which overall demonstrates a strong and consistent upward trend despite annual fluctuations. Production began at its lowest level of around 4,000 tons at the start of the period and gradually increased, reaching a significant peak of about 18,500 tons in 2023. The depicted linear trend, expressed by the equation $Y = 1314.3X - 3E+06$ with a coefficient of determination (R^2) of 0.7853, confirms that the average annual growth in production is approximately 1,314.3 tons. This relatively high R^2 value indicates that the long-term trend model is sufficiently relevant to represent most of the data movements. However, in 2024 the actual production experienced a sharp decline from its peak, falling back to around 12,000 tons. This sudden drop disrupted the stable growth pattern and highlights the presence of significant external factors that strongly influenced short-term harvest outcomes.

Based on the linear regression equation reflecting the long-term growth trend, shallot production forecasting for the next three years was conducted by projecting an average annual increase of 1,314.3 tons from the estimated trend line in 2024 (around 17,000 tons). Using this method, the forecast results suggest that shallot production will continue to rise if historical trends are maintained. Production is projected to reach approximately 18,314 tons in 2025, increase to about 19,628 tons in 2026, and surpass the 20,000-ton threshold, reaching around 20,942 tons in 2027. This projection provides an optimistic outlook on the long-term potential of the shallot sector, indicating the capacity and tendency for production to continue increasing over time. When comparing the growth rates of harvested area and productivity in relation to production growth, it appears that the increase in shallot production is more influenced by the expansion of harvested area rather than productivity, as the average growth rate of harvested area is slightly higher than that of productivity (Sofyan dan Sitorus, 2025).

Nevertheless, the causes of the production decline in 2024 must be further analyzed to promptly identify and mitigate the factors responsible, ensuring that shallot production can return to its positive growth trajectory. Previous production trends also reveal a tendency toward increasing instability in yield per unit area. This underscores the need to identify the causes of yield instability in several vegetable commodities from the perspectives of research, extension services, and policy (Adiyoga, 2020).

Domestic shallot production over the past three decades has shown positive growth, accompanied by considerable increases in exports as well as significant growth in imports. According to FAO (Food and Agriculture Organization) data from 2018–2022, Indonesia ranked fourth among ASEAN countries in shallot exports, with an

average export value of USD 6.72 million, while simultaneously ranking second in imports, with an average import value of USD 52.65 million (Sofyan dan Sitorus, 2025)

2. Onion



Figure 2. Trend Graph of Onion Production

Source: Processed data 2025

The scallion production graph from 2015 to 2024 shows a very strong and accelerating upward trend throughout the period. In the early years (around 2015–2017), production remained relatively stable below 2,000 tons, even experiencing a slight decline. However, since 2018, production began to increase consistently and demonstrated significant acceleration, particularly during 2022 to 2024. Scallion production reached its peak at the highest level of approximately 11,000 tons in the final year (2024). The linear trend line, represented by the equation $Y = 944.28X - 2E+06$, confirms an average growth tendency of 944.28 tons per year. With a very high coefficient of determination (R^2) of 0.8237 (82.37%), the model is considered highly effective in explaining most of the data variation, indicating that the observed growth is strongly tied to time and trend factors.

Although the linear trend model indicates strong average growth, the significant surge in production during 2023 and 2024 reveals that the actual growth rate in recent years has exceeded the historical average trend. This surge was likely driven by high market demand, successful expansion of cultivated land, or the adoption of more effective agricultural technologies. Using the linear trend equation, the projected average growth of scallion production is 944.28 tons per year from the trend point in the last year (around 10,000 tons in 2024 on the dotted line). Based on this projection, scallion production is expected to continue increasing, reaching approximately 10,944 tons in 2025, rising to 11,888 tons in 2026, and approaching 12,832 tons in 2027.

The high R^2 value confirms that this growth trend is a stable characteristic of scallion production, making it a promising prospect. Scallions (*Allium fistulosum L.*) are one of the vegetable commodities with strong potential for intensive and commercial agribusiness development (Susmawati, 2017). The surge in actual data above the trend line in recent years suggests that production potential may even exceed the predictions of a simple linear model. For stakeholders, it is crucial to understand the specific driving factors behind the surge in 2023–2024. Farmer characteristics, such as farming experience, can significantly influence scallion production (Sattwika dan Fauziyah, 2021). In addition, the use of inputs such as urea fertilizer, NPK fertilizer, and appropriate pesticides can also enhance scallion production (Dianoor, Irawan dan Yunus, 2022)

3. Potatoes

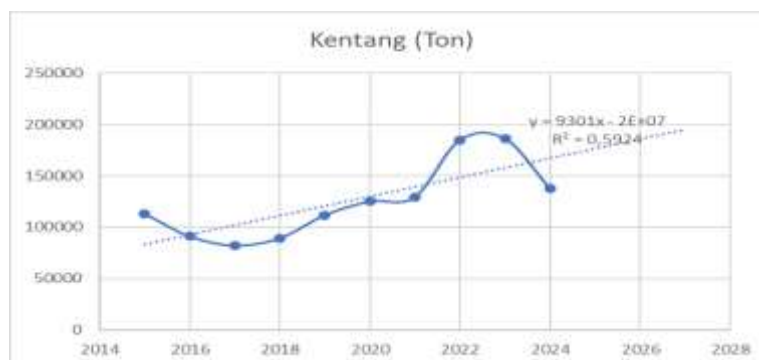


Figure 3. Potato Production Trend Chart

Source: Processed data 2025

The potato production graph from 2015 to 2024 illustrates a long-term upward trend accompanied by highly extreme short-term fluctuations. In the early period (2015–2017), production tended to decline, reaching its lowest point at around 80,000 tons. Production then began to recover and showed an increase up to 2021. The peak of this period occurred in 2022 and 2023, when production surged dramatically, reaching historic highs of approximately 185,000 to 190,000 tons. However, this surge was followed by a sharp and significant decline in 2024, when production fell back to around 140,000 tons. These extreme fluctuations, particularly the peaks and drops in 2022–2024, indicate strong influences from non-structural factors such as extreme weather, pest/disease outbreaks, or highly volatile market dynamics.

The linear trend line shows an average growth tendency of 9,301 tons per year ($Y=9301X-2E+07$), which represents a substantial annual increase. However, it is important to note that the coefficient of determination (R^2) is relatively moderate at 0.5924 (59.24%). This indicates that only about 59% of the variation in potato production can be explained by time-trend factors, while nearly 41% of production fluctuations are driven by other factors (such as climate, seed quality, policies, or other variables) not captured by the linear model. The lower R^2 value compared to shallots and scallions statistically confirms that potato production data are far more unstable and difficult to predict solely based on time trends.

Although historically the potato sector shows potential for growth (a positive trend of 9,301 tons/year), the unstable data pattern—particularly the sharp decline in 2024—makes short-term forecasting highly risky. If relying only on the linear trend, potato production is projected to gradually rise again, but such predictions would carry a large margin of error given the model’s inability to account for the sharp surge and decline in 2024. For decision-makers, the most critical task is to identify and address the causes of the major decline in 2024, as well as to understand the factors that drove the production surge in 2022 and 2023.

Potatoes are one of the vegetable commodities rich in carbohydrate content, making them a potential staple in food diversification by substituting for wheat, maize, or rice (Muhibuddin, 2016). The main potato production centers in Indonesia with the highest output are West Java, North Sumatra, and Central Java (Rahmah dan Wulandari, 2020).

Stability in the potato sector requires policies capable of mitigating the risks of extreme fluctuations (such as pest/disease control, irrigation management, availability of superior seeds, and other measures). Research by Widia et al. (2021) found that declining potato production was largely due to farmers using Granola varieties of the third (G3) and fourth (G4) generations, whereas before the Covid-19 pandemic, farmers used Granola varieties of the second (G2) and first (G1) generations. According to Mulyono *et al.*, (2017), the earlier the seed generation, the better the seed quality, resulting in higher yields. Amarullah et al. (2019) noted that most farmers resorted to later-generation seeds due to the high cost of quality seed potatoes, which led to lower productivity. Furthermore, Kusuma, Edison and Ernawati (2015) emphasized that differences in production levels are influenced by variations in the quality of agricultural inputs, land ownership size, and farm management practices such as crop maintenance.

4. Kubis

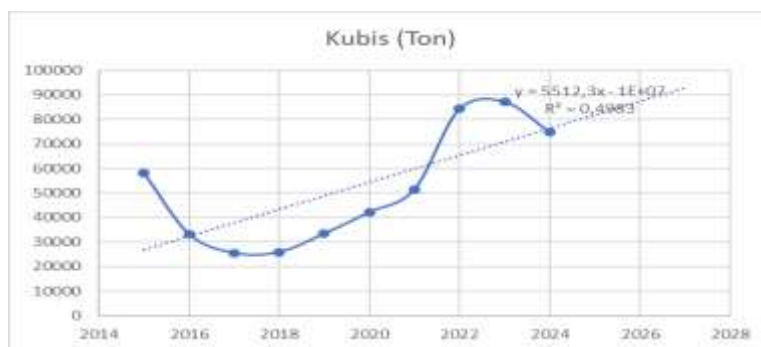


Figure 4. Cabbage Production Trend Chart

Source: Processed data 2025

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Cabbage production data from 2015 to 2024 shows significant fluctuations. In early 2015, production was relatively high, approaching 60,000 tons, but then experienced a sharp decline, reaching its lowest point of around 25,000 tons in 2017 and 2018. Afterward, production began to show a stable upward trend from 2018 to 2023, peaking at approximately 87,000 tons in 2023. However, in 2024, production declined again to around 75,000 tons. These fluctuations indicate the influence of non-linear factors such as weather conditions, market prices, or agricultural policies that strongly affect annual production outcomes.

Despite annual fluctuations, the linear trend line indicates a positive long-term growth tendency in cabbage production. The trend line equation is $Y=5512.3X-1E+07$, with an R^2 value of 0.4983. An R^2 value close to 0.5 suggests that this linear model explains only about 49.83% of the variability in the data, meaning the model is not fully accurate for projections due to high volatility. Nevertheless, the positive slope coefficient (5512.3X) confirms an average annual production growth of 5,512.3 tons.

Using the available linear trend model, cabbage production projections for the next three years (2025, 2026, and 2027) are expected to continue increasing in line with the long-term trend, reaching 80,512 tons, 86,025 tons, and 91,537 tons, respectively. However, since the model is only moderately reliable with a relatively low R^2 , these projections should be interpreted with caution. Even so, policymakers and stakeholders may anticipate that average production will continue to grow, offering opportunities for increased processing and distribution capacity, while also preparing for high annual production volatility.

Cabbage (*Brassica oleracea L.*) is one of the important horticultural commodities in Indonesian agriculture. It is widely consumed either fresh or processed due to its mild sweetness. The average cabbage consumption in Indonesia in 2022 was approximately 0.0264 kg per capita per week, equivalent to 1,378 kg per capita per year (Ardiansyah *et al.*, 2024).

High production levels may be partly attributed to planting seasons, which do not significantly affect horticultural crops such as cabbage, since the crop can grow well in both rainy and dry seasons. Cabbage can be cultivated year-round, particularly in regions with stable climates. In addition, the use of standardized quality seeds also influences production, as farmers increasingly adopt globally certified seeds considered to have superior quality (Baharsyah, Prasetyo dan Ekowati, 2025).

5. Petsai / Sawi

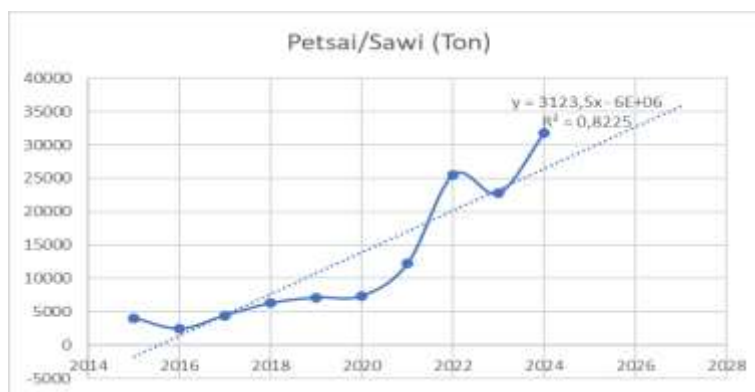


Figure 5. Petsai/Mustard Production Trend Chart
Source: Processed data 2025

The production data of Chinese cabbage/mustard greens (petsai) from 2015 to 2024 reveals two main phases. The first phase, spanning 2015 to 2020, was characterized by relatively stable and low production levels, ranging between 2,500 and 7,500 tons, with a decline below 5,000 tons in 2016. The second phase, beginning around 2021, shows a drastic increase in production, rising sharply from 7,500 tons to more than 30,000 tons in 2024. A temporary peak was reached in 2022 at approximately 25,000 tons, followed by a slight decline in 2023, and then a new record of about 32,000 tons in 2024.

The graph presents a linear trend line with the equation $Y=3123.5X-6E+06$ and an R^2 value of 0.8225. This relatively high R^2 indicates that the linear trend model explains the variability of the data well, suggesting that the upward production trend is a strong and consistent pattern over the period. The positive slope coefficient (3123.5X) confirms an average annual production growth of approximately 3,123.5 tons. This strong

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upward trend is likely driven by factors such as increased market demand, expansion of cultivated land, adoption of more effective agricultural technologies, or other influences.

Based on the strength of the model ($R^2=0.8225$), projections for the next three years (2025–2027) are expected to continue the significant upward trend, with estimated production of 35,124 tons, 38,247 tons, and 41,371 tons, respectively. This indicates substantial opportunities for supply chain development and investment in infrastructure to accommodate the increasing harvests of mustard greens in the future.

The rising production of mustard greens is expected to help meet market demand in the coming years. Therefore, strategies must be designed to prevent declines in productivity. According to Sutarto, Koesriharti and Aini (2016), mustard greens are among the most popular vegetables in Indonesian society. With demand growing in line with population increases, efforts to expand and improve mustard green cultivation are necessary to ensure sustainable growth. Hermansyah, Patiung dan Wisnujati (2021) highlight several strategies to support production growth, including improving productivity, expanding cultivated land, and strengthening farmers' economic conditions. Furthermore, Isyanto *et al.*, (2020) emphasize that one of the efforts to increase food production is the utilization of marginal lands, as national food production has long relied heavily on paddy fields, particularly in Java.

6. Carrot

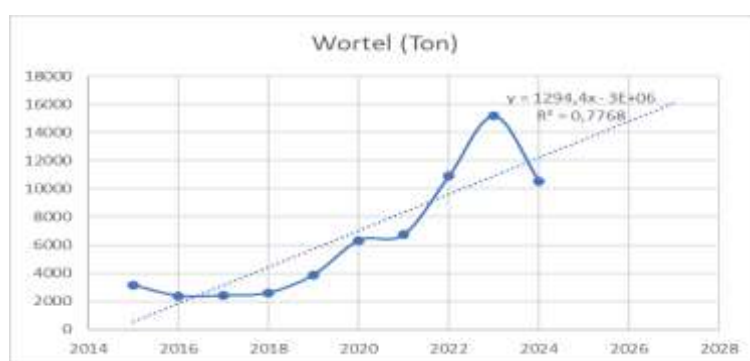


Figure 6. Chart of Carrot Production Trends

Source: Processed data 2025

Carrot production data from 2015 to 2024 demonstrates highly significant growth. Production began at a relatively low level (around 3,000 tons in 2015) and remained stagnant or slightly declined between 2016 and 2018, ranging from 2,000 to 3,000 tons. However, starting in 2019, production entered a sharp acceleration phase. The increase continued until it reached its peak in 2023 at approximately 15,300 tons. Although production declined in 2024 to around 10,500 tons, this figure was still far above the average production of the early period, indicating that carrot production has undergone large-scale growth over the past decade.

The linear trend line in the graph is represented by the equation $Y=1294.4X-3E+06$ (where $3E+06$ equals 3,000,000), with an R^2 value of 0.7768. This high R^2 indicates that the linear model is highly relevant and fairly accurate in predicting the upward trend of carrot production. The positive slope coefficient (1294.4X) confirms an average annual production growth of 1,294.4 tons. The strong model fit provides a solid basis that, despite annual fluctuations (such as the decline in 2024), the long-term direction of carrot production remains upward.

Based on this robust trend model, production projections for 2025 to 2027 are estimated at 11,794 tons, 13,089 tons, and 14,383 tons, respectively. The projection analysis suggests that the growth trend will continue, offering positive signals for decision-makers to sustain and enhance investment in the carrot production sector.

Carrots are one of the horticultural crops that have shown annual increases, partly because they have become a health trend in society, associated with eye health, blood sugar regulation, and even beauty care. Based on these trends, carrot production has increased not only as a local supply but also as an export commodity to other regions and abroad (Hafni *et al.*, 2023). Carrots are also relatively easier to cultivate compared to other crops, requiring less time to reach harvest.

Carrots are among the most widely cultivated vegetable commodities by farmers, as markets for selling carrots are relatively accessible. They contribute significantly to vegetable consumption both locally and internationally. Supporting factors for carrot cultivation include strategic locations with suitable temperatures and

soil conditions, which enable carrots to grow well with superior quality. This makes farmers more inclined to cultivate carrots, as the crop is already widely recognized for its excellence and quality (Hafni *et al.*, 2023).

7. Big Chili

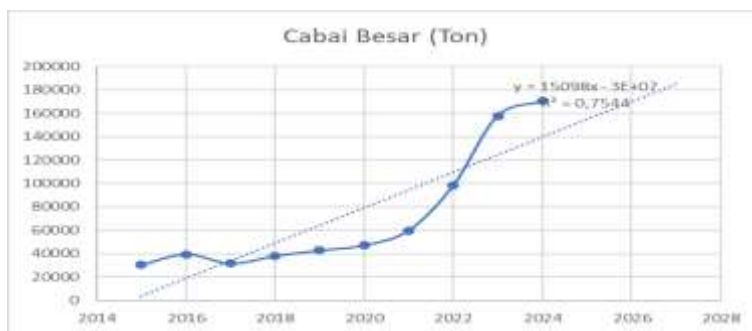


Figure 7. Big Chili Production Trend Chart
Source: Processed data 2025

Large chili production data indicates a rapid acceleration in growth over the past decade. From 2015 to 2020, production remained relatively stable and low, ranging between 30,000 and 45,000 tons with minor fluctuations. However, a turning point occurred after 2020, when production began to rise sharply. Output nearly doubled from around 60,000 tons in 2021 to nearly 100,000 tons in 2022, and reached its highest peak of approximately 168,000 tons in 2023. Although the 2024 data does not specify a point on the Y-axis, the overall upward trend remains dominant.

The graph is complemented by a linear trend line with the equation $Y = 15098X - 3E+07$ and an R^2 value of 0.7544. This relatively high R^2 demonstrates that the linear trend model fits well and effectively captures the long-term growth in large chili production. The positive slope coefficient confirms an average annual production growth of 15,098 tons. The high R^2 value suggests that the increase in production is not merely a temporary fluctuation but rather a strong structural trend, likely driven by rising market demand or agricultural intensification. Based on this model, production projections are estimated at 183,098 tons in 2025, 198,196 tons in 2026, and 213,294 tons in 2027.

Red chili is a horticultural crop widely cultivated commercially by farmers. In recent years, it has become a leading commodity among 18 types of commercial vegetables cultivated in Indonesia. Despite sharp price fluctuations, farmers’ interest in cultivating red chili remains high (Asir *et al.*, 2023). In 2022, the highest production of large chili occurred in December, reaching 138.54 thousand tons with a harvested area of 32.08 thousand hectares. The provinces with the largest production of large chili are West Java, North Sumatra, and Central Java. West Java contributed 24.24% to national production, with output reaching 357.7 thousand tons and a harvested area of 25.4 thousand hectares. The significant contribution of West Java to national chili production has a tangible impact on the stability of national chili availability (Fazrulliansyah, Andrie dan Nurahman, 2025).

8. Cayenne Pepper

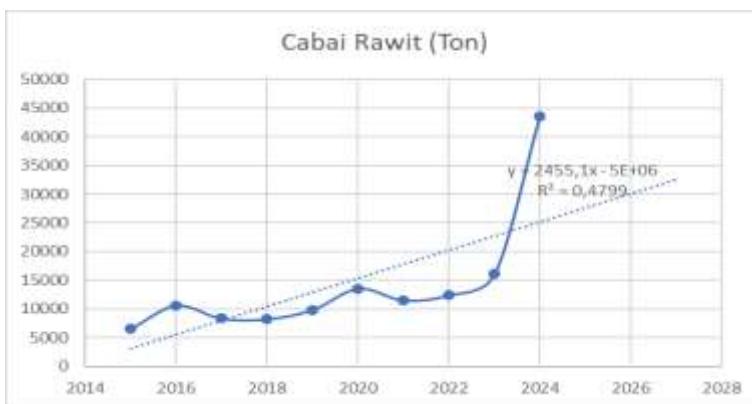


Figure 8. Graph of Cayenne Pepper Production Trends
Source: Processed data 2025

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Bird's eye chili production data from 2015 to 2024 reveals an extremely volatile pattern. From 2015 to 2022, production remained relatively low and stable, ranging between 7,000 and 14,000 tons. During this period, production peaked at around 11,000 tons in 2016 and 14,000 tons in 2020. However, an extraordinary surge occurred in the last two years. In 2023, production rose sharply to approximately 16,000 tons, and then skyrocketed to an unprecedented record of about 44,000 tons in 2024. This surge suggests the presence of very strong and sudden driving factors, such as highly favorable weather conditions or agricultural intensification policies.

The linear trend line in the graph is represented by the equation $Y=2455.1X-5E+06$ $Y = 2455.1X - 5E+06$, with an R^2 value of 0.4799. The relatively low R^2 (less than 0.50) indicates that the linear model is not well-suited to explain the overall data pattern, especially due to the sharp spike in 2024. The model accounts for less than 48% of the variability in production. Nevertheless, the positive slope coefficient (2455.1X) confirms an average long-term growth of approximately 2,455.1 tons per year. This average increase provides a basis for projections, though the high annual volatility—particularly in 2023 and 2024—must be carefully considered.

Although the historical linear trend model is relatively weak, the sharp increase in 2024 provides a more relevant baseline for short-term projections. Using realistic projections based on the latest data (44,000 tons in 2024) plus the average annual increase, bird's eye chili production is expected to continue rising from this elevated baseline. Production is projected to reach approximately 46,455 tons in 2025, increase to about 48,910 tons in 2026, and surpass 51,365 tons in 2027. These projections suggest that production will stabilize at levels far higher than the historical average before 2023. However, the historical volatility of this commodity requires close monitoring of weather and market factors.

Bird's eye chili can be considered a strategic farming commodity due to its many advantages, including high economic value, multiple uses in daily life, strong market potential, and versatility in product forms such as fresh chili, frozen chili, and various processed chili products (Hoar dan Fallo, 2017). Beyond weather and market influences, other factors such as capital, land area, labor, farming experience, farmer education, and the use of organic fertilizers collectively have a significant impact on bird's eye chili production (Bete dan Taena, 2018).

9. Tomatoes

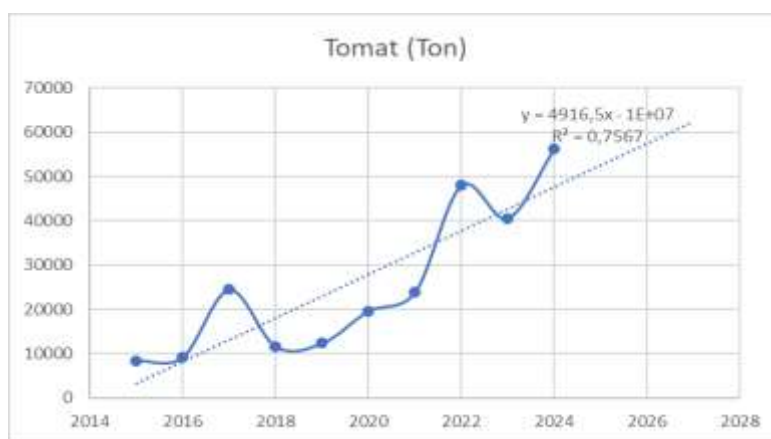


Figure 9. Tomato Production Trend Chart

Source: Processed data 2025

Tomato production shows extreme fluctuations in the early period but a clear upward trend toward the end. From 2015 to 2019, production was highly unstable, starting at around 8,000 tons (2015), then sharply rising to a peak of about 25,000 tons (2017), before dropping back to around 11,000 tons (2018). However, after 2019, production entered a strong growth phase, rising from about 12,000 tons (2019) to a new peak of approximately 56,000 tons in 2024. Although there was a significant decline in 2023 (around 40,000 tons) from the 2022 peak (about 48,000 tons), the overall trend indicates substantial growth in production scale.

The graph presents a linear trend line with the equation $Y=4916.5X-1E+07$ $Y = 4916.5X - 1E+07$ and an R^2 value of 0.7567. This relatively high R^2 (around 0.76) suggests that the linear model is fairly effective in explaining the average increase in tomato production, despite considerable annual volatility. The positive slope coefficient (4916.5X) confirms an average long-term production growth of 4,916.5 tons per year. The strong model fit indicates that, although prices may fluctuate, structural efforts to increase production have been relatively successful during this period.

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Realistic projections based on the latest high data point (56,000 tons in 2024) and the average annual growth trend suggest continued increases. Production is projected to reach approximately 60,917 tons in 2025, rise to about 65,833 tons in 2026, and surpass 70,750 tons in 2027. These projections indicate that tomato production will reach historic highs, though stakeholders must remain cautious of price volatility and weather conditions, as evidenced by sharp declines in 2018 and 2023.

Indonesia ranks 30th globally as a tomato supplier (Fajri *et al.*, 2022). Tomatoes have very high potential for cultivation in Indonesia (Siregar, Najib dan Suparno, 2019). Depending on the variety, tomatoes can be grown flexibly from lowland to highland areas. Tomatoes are one of the most important horticultural commodities due to their high nutritional value, affordability, and health benefits (Chitra Anggriani Salingkat, A. Noviyanty, & Syamsiar, 2020).

Tomatoes are also considered a multifunctional commodity, not only consumed as fruit and vegetables but also used in beauty products and medicinal mixtures (S. A. Assagaf, 2020). Their distinctive taste makes them popular across all social groups, explaining their frequent use in cooking. Farmers in Indonesia cultivate tomatoes extensively due to strong demand both domestically and internationally. Higher productivity and favorable market prices further increase profitability. High production potential is influenced by multiple factors, including land area dan seed quality, fertilizer inputs such as urea (Onibala dan Sondakh, 2017), and labor availability for tomato cultivation (Majid, Noor dan Kurnia, 2022).

10. Eggplant



Figure 10. Eggplant Production Trend Chart

Source: Processed data 2025

Eggplant production shows significant growth with two main phases. The first phase (2015–2020) was characterized by relatively stable and low production, ranging between 9,000 and 11,000 tons. Fluctuations during this period were minor, reflecting limited production stability. However, starting in 2021, production entered a rapid growth phase. Output increased from around 15,000 tons (2021) to approximately 22,000 tons (2023), followed by a sharp surge to a record high of about 36,000 tons in 2024. This drastic increase in 2023–2024 indicates rising market demand or intensification of cultivation practices.

The graph presents a linear trend line with the equation $Y = 2166.6X - 4E+06$ and an R^2 value of 0.626. This moderate R^2 (around 0.63) suggests that the linear model is fairly relevant in explaining the average growth trend of eggplant production. Although the model is not as strong as those with higher R^2 values, the positive slope coefficient (2166.6X) confirms an average annual production growth of approximately 2,166.6 tons in the long term. This growth rate provides a solid basis for projections, even though the extreme surge in 2024 suggests that actual growth may be steeper than captured by the simple linear model.

Using realistic projections based on the latest high data point (36,000 tons in 2024) and the average annual increase ($a = 2,166.6$ tons), eggplant production is expected to continue rising. Production is projected to reach about 38,167 tons in 2025, increase to around 40,334 tons in 2026, and surpass 42,500 tons in 2027. These projections indicate that eggplant production will stabilize at a high level. Stakeholders should plan for increased handling and distribution capacity to accommodate this growth, while also analyzing the factors behind the 2024 surge to ensure sustainable production.

CONCLUSION

The research conducted leads to the following conclusions:

1. The ten vegetable commodities in Jambi Province show a positive average annual growth trend (positive slope coefficient a) during the period 2015–2024, confirming that the vegetable production sector in this region is in a phase of structural expansion. The commodities with the highest average growth rates are large chili at 15,098 tons/year, followed by potatoes at 9,301 tons/year. Most linear trend models demonstrate good levels of fit, particularly mustard greens (*petsai/sawi*) with an R^2 of 0.8225 and scallions with an R^2 of 0.8237, underscoring the consistency of long-term upward patterns.
2. Despite the positive long-term trend, commodities such as cabbage ($R^2=0.4983$, $R^2 = 0.4983$) and bird's eye chili ($R^2=0.4799$, $R^2 = 0.4799$) exhibit high annual volatility, indicating that nearly 50% of production fluctuations are influenced by non-linear factors (climate, pests, market dynamics, etc.). Moreover, sharp production surges occurred in the last two to three years (2022–2024), where actual outputs—particularly bird's eye chili at 44,000 tons in 2024 and eggplant at 36,000 tons in 2024—far exceeded historical averages, setting record highs that suggest the presence of new large-scale driving forces.
3. Based on the strong positive growth trend, vegetable production in Jambi Province is projected to continue increasing until 2027, stabilizing at levels far higher than the historical averages prior to 2023. Large chili production is projected to reach 213,294 tons by 2027. The implication is that local government and agribusiness stakeholders need to focus policies on strengthening post-harvest infrastructure, supply chains, and logistics to accommodate the projected higher production volumes. In addition, further studies using non-linear forecasting models are strongly recommended for volatile commodities to mitigate risks.

REFERENCES

- Adiyoga, W. (2020) "Persepsi Petani Sayuran terhadap Risiko Ketidakpastian Cuaca dan Hama Penyakit di Indonesia," *Jurnal Hortikultura*, 30(1).
- Ardiansyah, M. et al. (2024) "Tren Spektral Kubis (*Brassica oleracea* L.) pada Beberapa Tingkat Pemupukan yang Berbeda," *Jurnal Ilmu Tanah dan Lingkungan*, 26(2), pp. 77–84. Available at: <https://doi.org/10.29244/jitl.26.2.77-84>.
- Arianti, D., Hidayati, R. and Elza, N.I. (2025) "Perilaku Petani Hortikultura dalam Adopsi Kompos Sampah Kota Di Kecamatan Kotabumi Kabupaten Lampung Utara Horticultural Farmers ' Behavior in Adopting Municipal Waste Compost in," *Plantiba*, 2(2), pp. 51–64.
- Asir, M. et al. (2023) "Strategi peningkatan penjualan produk pertanian cabai di Kabupaten Sinjai," *JPPI (Jurnal Penelitian Pendidikan Indonesia)*, 9(2), p. 725. Available at: <https://doi.org/10.29210/020231803>.
- Baharsyah, R., Prasetyo, E. and Ekowati, T. (2025) "Analisis Trend dan Faktor-faktor yang Memengaruhi Volume Penjualan Produk Benih Kubis Green Nova di PT. Tani Murni Indonesia," *Mimbar Agribisnis : Jurnal Pemikiran Masyarakat Ilmiah Berwawasan Agribisnis*, 11(2), p. 3026. Available at: <https://doi.org/10.25157/ma.v11i2.18683>.
- Bete, K. and Taena, W. (2018) "Faktor-Faktor yang Mempengaruhi Produksi Usahatani Cabe Rawit Merah di Desa Tapenpah Kecamatan Insana Kabupaten Timor Tengah Utara," *Agrimor*, 3(1), pp. 7–9. Available at: <https://doi.org/10.32938/ag.v3i1.240>.
- Dianoor, A.A., Irawan, A. and Yunus, R. (2022) "Pengaruh Pemberian Pupuk Npk Terhadap Perubahan Intensitas Warna Relatif Air Yang Dilewatkan Pada Tanah Gambut Secara in Vitro," *Jurnal Natural Scientiae*, 2(1), pp. 41–50. Available at: <https://doi.org/10.20527/jns.v2i1.5020>.
- Fajri, S. et al. (2022) "Prediksi Hasil Produksi Tanaman Tomat di Indonesia Menurut Provinsi Menggunakan Algoritma Fletcher-Reeves," *Building of Informatics, Technology and Science (BITS)*, 4(3). Available at: <https://doi.org/10.47065/bits.v4i3.2704>.
- Fazrulliansyah, F.-, Andrie, B.M. and Nurahman, I.S. (2025) "Strategi Pemasaran Cabai Merah Besar Di Desa

- Hidayati, et al. **Forecasting Vegetable Crop Production in Jambi Province Using Linear Trend Analysis** Cibereum Kecamatan Sukamantri Kabupaten Ciamis,” *Jurnal Ilmiah Mahasiswa AGROINFO GALUH*, 12(1), p. 580. Available at: <https://doi.org/10.25157/jimag.v12i1.17415>.
- Hafni, R. et al. (2023) “Analisis Produksi Petani Wortel di Kecamatan Simpang Empat Kabupaten Karo Sumatera Utara,” *Ekonomikawan: Jurnal Ilmu Ekonomi dan Studi Pembangunan*, 23(2), pp. 385–396. Available at: <https://doi.org/10.30596/ekonomikawan.v23i2.16983>.
- Hermansyah, D., Patiung, M. and Wisnujati, N.S. (2021) “Analisis trend dan prediksi produksi dan konsumsi komoditas sayuran sawi (*Brassica Juncea*) di Indonesia Tahun 2020 - 2029,” *Jurnal Ilmiah Sosio Agribis*, 21(2), pp. 34–46.
- Hoar, E. and Fallo, Y.M. (2017) “Pengaruh Faktor Sosial Ekonomi Petani terhadap Produksi Usahatani Jagung di Desa Badarai Kecamatan Wewiku Kabupaten Malaka,” *Agrimor*, 2(03), pp. 36–38. Available at: <https://doi.org/10.32938/ag.v2i03.307>.
- Indonesia, B. (2024) *Laporan Nusantara: Asesmen Ekonomi Regional - Februari 2024*. Jakarta, Departemen Ekonomi dan Keuangan Regional Bank Indonesia <https://www.bi.go.id/id/publikasi/laporan/litsus/Pages/Laporan-Nusantara-Februari-2024.aspx>.
- Isyanto, A.Y. et al. (2020) “Faktor-Faktor yang Berpengaruh terhadap Efisiensi Usahatani Padi Lahan Rawa di Kabupaten Ciamis,” *Mimbar Agribisnis : Jurnal Pemikiran Masyarakat Ilmiah Berwawasan Agribisnis*, 6(2), pp. 784–793.
- Kusuma, N.P., Edison and Ernawati (2015) “Analisis Pedapatan Petani Kentang Di Kecamatan Jangkat Kabupaten Merangin,” *Sosio Ekonomika Bisnis*, 18(1), pp. 93–99.
- Majid, N.K., Noor, T.I. and Kurnia, R. (2022) “Faktor Faktor Yang Mempengaruhi Produksi Usahatani Tomat,” *Jurnal Ilmiah Mahasiswa Agroinfo Galuh*, 9(3), p. 1357. Available at: <https://doi.org/10.25157/jimag.v9i3.8442>.
- Mulyono, D. et al. (2017) “Kelas Benih Kentang (*Solanum tuberosum* L.) Berdasarkan Pertumbuhan, Produksi, dan Mutu Produk [Seed Class Potatoes Based on Growth, Production, and Quality Products (*Solanum tuberosum* L.)],” *J. Hort*, 27(2), pp. 209–216.
- Onibala, A.G. and Sondakh, M.L. (2017) “Analisis Faktor-Faktor yang Mempengaruhi Produksi Padi Sawah,” *Agri-Sosio Ekonomi Unsrat*, 13(2), pp. 237–242.
- Pratama, R.Y. and Hidayat, S.I. (2023) “Komparasi Metode Peramalan Double Exponential Smoothing dan Trend Projection pada Produksi Kedelai Nasional,” *Jurnal Ekonomi Pertanian dan Agribisnis (JEPA)*, 7(3).
- Rahmah, S.A. and Wulandari, E. (2020) “KERAGAAN PRODUKSI DAN HARGA KENTANG DI KECAMATAN PANGALENGAN, KABUPATEN BANDUNG,” *Mimbar Agribisnis : Jurnal Pemikiran Masyarakat Ilmiah Berwawasan Agribisnis*, 6(1), pp. 265–274.
- Sari, D.N., Iskandar, D. and Putra, A. (2022) “Penerapan Metode Forecasting untuk Perencanaan Produksi Cabai Merah Menggunakan Data Runtun Waktu di Tingkat Kabupaten,” *Jurnal Ilmiah Mahasiswa Pertanian*, 7(2).
- Sattwika, D.S.A. and Fauziyah, E. (2021) “Efisiensi Teknis Usahatani Bawang Daun (*Allium fistulosum* L) di Kecamatan Pacet Kabupaten Mojokerto,” *Agriscience*, 2(2), pp. 397–407. Available at: <https://doi.org/10.21107/agriscience.v2i2.11731>.
- Siregar, I.C., Najib, M. and Suparno, O. (2019) “Strategi Pengembangan Usaha Tani Tomat Dalam Upaya Menembus Singapura (Studi Kasus Mitra Tani Parahyangan),” *Jurnal Aplikasi Bisnis dan Manajemen*, 5(1), p. 24. Available at: <https://doi.org/10.17358/jabm.5.1.24>.
- Sofyan, S.N. and Sitorus, Z. (2025) “Implementasi Data Mining untuk Clustering Lowongan Pekerjaan Menggunakan Metode Algoritma K-Means,” *Jurnal JTik (Jurnal Teknologi Informasi dan Komunikasi)*, 9(2), pp. 703–712. Available at: <https://doi.org/10.35870/jtik.v9i2.3438>.
- Sutarto, ulfa A., Koesriharti and Aini, N. (2016) “RESPON TIGA JENIS SAWI (*Brassica* sp.) TERHADAP APLIKASI MACAM MULSA RESPONSES OF THREE TYPES MUSTARD (*Brassica* sp.) ON APPLICATIONS TYPE OF MULCH,” *Jurnal Produksi Tanaman*, 4(6), pp. 447–453.