Application of Exponential Smoothing Method on Forecasting The Results of Bandeng Pounds in Cot Muda Itam Village-Keureulak District-Aceh Timur

Penerapan Metode Exponential Smoothing pada Peramalan Hasil Tambak Ikan Bandeng di Desa Cot Muda Itam-Kecamatan Peureulak-Aceh Timur

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ABSTRACT
Pond cultivation until now is counted as a business that can provide extraordinary income. Cot Muda Itam Village is one of the villages in East Aceh Regency that cultivates ponds by producing milkfish. Milkfish yields also vary, sometimes increasing and not infrequently experience a decrease in yields. Therefore, it is necessary to have a study that can predict the production of milkfish in the next harvest. Forecasting is a process of predicting the values of variables based on known values of previously related variables. Based on the results of data processing and data analysis using the linear exponential smoothing method of one brown parameter with $\alpha = 0.2$ and MSE value of 16407.241875 it is obtained that the forecast results in the 11th and 12th months of the harvest decrease, namely 587 kg and 580 kg.

Keywords: Pond, Forecasting, Production, Cot Muda Itam

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PRELIMINARY

Pond cultivation until now is counted as a business that can provide extraordinary income. This evidenced by the production results in newly opened ponds, both at the level of mastery of cultivator technology which is still low to moderate. Pond is one type of habitat that is used as a place for brackish water cultivation located in coastal areas (Muin & Huznul, 2017). Several fishery commodities from ponds are very potential and have prospects to be developed as superior export commodities to provide contribution to improving people’s living standards such as milkfish and tilapia.

According to Maulana (2008), milkfish is one of the fishery commodities commonly consumed by the public. The protein content is quite high, the taste is savory and neutral, the price is relatively affordable, and the texture is not easily destroyed when cooked, making milkfish much in demand. Milkfish has a fairly high protein content, which is about 20 grams (per 100 grams). Therefore, many cultivators and businessmen cultivate milkfish and commercialize it.

East Aceh is one of the districts in Aceh province and has an area of 6,060.60 km², administratively the East Aceh district consists of 24 sub-districts, 59 mukim, and 513 village with a population of 427,032 people (BPS, 2022). The agricultural sector in East Aceh is still a sector that has a major role in the economy of East Aceh. The sector itself consists of 6 sub-sectors, namely food crops, horticulture, plantations, livestock, agriculture, and fisheries.

Cot Muda Itam Village is one of the villages in the East Aceh sub-district with the most people who work as pond farmers and fishermen, which is more than 75%. The location of the village which is on the coast makes many people move in the fishery sector. Milkfish cultivation is one of the pond productions in the village, the community earns income from the cultivation of milkfish ponds, in addition to milkfish, the community also cultivates tilapia and vaname shrimp. The potential for milkfish which is more in demand, less capital and the ease of cultivating milkfish are the reasons for the community to cultivate milkfish more than tilapia and vaname shrimp. The people of Cot Muda Itam Village in cultivating milkfish still use natural ponds, where there is no modern technology that helps in the cultivation period. Milkfish yields also vary in each harvest period, ranging from 350 to 900 kg in harvest. Milkfish production can be caused by several factors such as the size of the pond, the number of seeds, labor, and the distance between the pond and the sea (Wahyuni, et al 2019). The diversity of milkfish production that goes up and down certainly affects the income of farmers (community). Therefore, it is
necessary to have a study that can predict the production of milkfish in the next harvest based on the data from the previous harvest.

According to Sinaga & Irawati (2018) Forecasting is the prediction of the values of a variable based on the known values of the variable. Forecasting comes from the word ramalan, basically forecast is a guess or estimate regarding the occurrence of an event or event in the future. Forecasting is a very important tool in effective and efficient planning (Wardah & Iskandar, 2017). This forecast can be the basis for short, medium and long term planning. The usefulness of forecasting (forecasting) according to Syahputra, et al (2018) includes, among others, accurate forecasting will save company costs, companies/agencies can anticipate future conditions so that the risk of failure can be minimized, and Forecasting can be used for decision making because the results of forecasting contain information that starts at the level of management of the company/agency. In this study, the author uses a linear exponential smoothing method with one brown parameter to predict the milkfish harvest in the next two months.

METHOD

The research is a type of quantitative research where the data used is numerical data (numbers). The data used in this study is secondary data, according to Sugiarto (2017) Secondary data is data or information obtained not directly from the source but from a third party or document. And this data was obtained from one of the milkfish pond farmers in Cot Muda Itam Village, Peureulak, East Aceh from November to August 2021. In this study the authors applied the linear exponential smoothing method with one brown parameter in predicting the production of milkfish harvest. The next two months in Cot Muda Itam Village, Peureulak District, East Aceh.

The formula used in Brown’s implementations is (Purwanti & Purwadi 2019) :

a. Calculating Single Smoothing Value (Single Smoothing)

\[ S_t^\alpha = \alpha X_t + (1 - \alpha)S_{t-1}^\alpha \]  
(1)

Note :

\( S_t^\alpha \) : single exponential value month \( t \)
\( \alpha \) : score \( \alpha \)
\( X_t \) : monthly pond yield \( t \)

b. Calculating Double Smoothing Value (Double Smoothing)

\[ S_t^\alpha = \alpha S_t^\alpha + (1 - \alpha)S_{t-1}^\alpha \]  
(2)
Note:

\( S'_t \): double exponential value month \( t \)

\( \alpha \): score \( \alpha \)

\( S'_t \): single exponential value month \( t \)

c. Determining the smoothing constant

\[
a_t = S'_t + (S'_t - S''_t)
\]

Note:

\( a_t \): value a month \( t \)

\( S'_t \): single exponential value month \( t \)

\( S''_t \): double exponential value month \( t \)

d. Determine The Value Of The Trend Coefficient

\[
b_t = \frac{\alpha}{1 - \alpha} (S'_t - S''_t)
\]

Note:

\( b_t \): value b month \( t \)

\( a_t \): value a month \( t \)

\( S'_t \): single exponential value month \( t \)

\( S''_t \): double exponential value month \( t \)

e. Doing Forecasting

\[
F_{t+m} = a_t + b_t m
\]

Note:

\( F_{t+m} \): forecast value

\( m \): the number of future periods to be forecast

f. Finding Forecast Error Values With MSE

To find the forecast error value using MSE with the following formula:

\[
MSE = \frac{1}{N} \sum_{t=1}^{N} e_t^2
\]

Note:

\( MSE \): MSE value

\( N \): amount of data

\( e \): error value of month \( t \)

where to get the value must first obtain the value by using the equation formula:

\[
e_t = X_t - F_t
\]
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Note:
e : error value of month t
X : lots of data year t
F : forecast value of month t

RESULT AND DISCUSSION

Based on the problem, to increase the yield of good ponds, it is necessary to process data that obtains the value of m for the next period as a comparison to the previous year’s data. In this case, we will analyse the results of the ponds of one of the residents of Cot Muda Itam Village for the 11th month of 2020 to the 8th month of 2021. The data on the results of the pond harvest can be seen in the following table:

Table 1. Pond Harvest Data

| Month   | Yields |
|---------|--------|
| 1st Month | 400 kg |
| 2nd Month | 600 kg |
| 3rd Month | 600 kg |
| 4th Month | 700 kg |
| 5th Month | 550 kg |
| 6th Month | 600 kg |
| 7th Month | 500 kg |
| 8th Month | 800 kg |
| 9th Month | 533 kg |
| 10th Month | 500 kg |

From the data above, for the results of the ponds, it is necessary to analyse the data and predict the results of the ponds for the next 2 months with linear exponential smoothing method with one brown parameter, which can be seen in the following table using $\alpha = 0.1$ to $\alpha = 0.9$.

Table 2. Forecasting pond yield using one parameter linear exponential smoothing method brown with $\alpha = 0.1$

| Month | X_t | S_t' | S_{t+1}' | a_t | b_t | F_{t+1} | e_t | $e_t^2$ |
|-------|-----|------|----------|-----|-----|---------|-----|---------|
| ke1   | 400 | 420  | 402      | 439 | -1.7| 437.3   | 162.7| 26471.29|
| ke2   | 600 | 420  | 402      | 439 | -1.7| 437.3   | 162.7| 26471.29|
| ke3   | 600 | 438  | 405.6    | 471.4| -3.14| 468.26  | 231.74| 53703.43|
| ke4   | 700 | 464.2| 411.46   | 517.94| -5.174| 512,766 | 37,234| 1386,371|
| ke5   | 550 | 472.78| 417.592  | 528.968| -5.4188| 512,766 | 37,234| 1386,371|
| ke6   | 600 | 485,502| 424,383  | 547,621| -6.0119| 523,5492 | 76,4508| 5844,725 |
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\[
\begin{array}{cccccccc}
\text{Month} & X_t & S_t' & S_t'' & a_t & b_t & F_{t+m} & e_t & e_t^2 \\
\text{ke7} & 500 & 486.9518 & 430.63988 & 544.2637 & -5.5312 & 541,6091 & -41,6091 & 1731,317 \\
\text{ke8} & 800 & 518.25662 & 439.401554 & 598.1117 & -7.7855 & 538,7325 & 261,2675 & 68260,69 \\
\text{ke9} & 533 & 519.730958 & 447.434494 & 593.0274 & -7.1296 & 590,3262 & -57,3262 & 3286,291 \\
\text{ke10} & 500 & 517.757862 & 454.466831 & 582.0489 & -6.2291 & 585,8978 & -85,8978 & 7378,428 \\
\end{array}
\]

Note:
\[X_t: \text{lots of Data}\]
\[S_t': \text{equation 1}\]
\[S_t'': \text{equation 2}\]
\[a_t: \text{equation 3}\]
\[b_t: \text{equation 4}\]
\[F_{t+m}: \text{equation 5}\]
\[e_t: \text{equation 7}\]

Then the error value in the brown linear exponential smoothing method with \(a = 0,1\) using MSE (equation 6) is \(21007,81775\).

**Table 3.** Forecasting pond yield using one parameter linear exponential smoothing method brown with \(a = 0,2\)

| Month | \(X_t\) | \(S_t'\) | \(S_t''\) | \(a_t\) | \(b_t\) | \(F_{t+m}\) | \(e_t\) | \(e_t^2\) |
|-------|---------|---------|---------|--------|--------|-------------|--------|--------|
| \(\text{ke1}\) | 400 | 440 | 408 | 473 | -6,2 |
| \(\text{ke2}\) | 600 | 472 | 420,8 | 524,2 | -10,04 | 466,8 | 133,2 | 17742,24 |
| \(\text{ke3}\) | 700 | 517,6 | 440,16 | 596,04 | -15,288 | 514,16 | 185,84 | 34536,51 |
| \(\text{ke4}\) | 550 | 524,08 | 456,944 | 592,216 | -13,227 | 580,752 | -30,752 | 945,6855 |
| \(\text{ke5}\) | 600 | 539,264 | 473,408 | 606,12 | -12,971 | 578,9888 | 21,0112 | 441,4705 |
| \(\text{ke6}\) | 500 | 531,4112 | 485,00864 | 578,8138 | -9,0805 | 593,14888 | -93,14888 | 8676,699 |
| \(\text{ke7}\) | 800 | 585,12896 | 505,032704 | 666,2252 | -15,819 | 569,7332 | 230,2668 | 53022,78 |
| \(\text{ke8}\) | 533 | 574,703168 | 518,966797 | 631,4395 | -10,947 | 650,406 | -117,406 | 13784,16 |
| \(\text{ke9}\) | 500 | 559,762534 | 527,125944 | 593,3991 | -6,3273 | 620,4923 | -120,492 | 14518,39 |

Note:
\[X_t: \text{lots of Data}\]
\[S_t': \text{equation 1}\]
\[S_t'': \text{equation 2}\]
\[a_t: \text{equation 3}\]
\[b_t: \text{equation 4}\]
\[F_{t+m}: \text{equation 5}\]
\[e_t: \text{equation 7}\]
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Than the error value in the brown linear exponential smoothing method with $a = 0.2$ using MSE (equation 6) is $= 16407.241875$.

**Table 4.** Forecasting pond yield using one parameter linear exponential smoothing method brown with $a = 0.3$

| Month | $X_t$ | $S'_t$ | $S''_t$ | $a_t$ | $b_t$ | $F_{t+m}$ | $e_t$ | $e_t^2$ |
|-------|-------|--------|---------|-------|-------|-----------|-------|--------|
| ke1   | 400   | 460    | 418     | 503   | -12.3 |           |       |        |
| ke2   | 600   | 502    | 443.2   | 561.8 | -17.34| 490.7     | 109.3 | 11946.49 |
| ke3   | 700   | 561.4  | 478.66  | 645.14| -24.522| 544.46 | 155.54| 24192.69 |
| ke4   | 550   | 557.98 | 502.456 | 614.504| -16.357| 620.618 | -70.618| 4986,902 |
| ke5   | 600   | 570.586| 522.895 | 619.277| -14.007| 598.1468| 1.8532 | 3.43435 |
| ke6   | 500   | 549.4102| 530.84956| 658.9708 | -5.2682| 605.2967| -105.27 | 11081.71 |
| ke7   | 800   | 624.58714| 558.970834| 691.2034| -19.385| 563.7026| 236.2974 | 55836.44 |
| ke8   | 550   | 597.110998| 570.412883| 624.8091| -7.7094| 607.2186| -138.819 | 19270.59 |
| ke9   | 600   | 624.58714| 558.970834| 691.2034| -19.385| 563.7026| 236.2974 | 55836.44 |
| ke10  | 500   | 597.110998| 570.412883| 624.8091| -7.7094| 607.2186| -138.819 | 19270.59 |

Note: $X_t$: lots of Data
$S'_t$: equation 1
$S''_t$: equation 2
$a_t$: equation 3
$b_t$: equation 4
$F_{t+m}$: equation 5
$e_t$: equation 7

Than the error value in the brown linear exponential smoothing method with $a = 0.3$ using MSE (equation 6) is $= 17628.823294$.

**Table 5.** Forecasting pond yield using one parameter linear exponential smoothing method brown with $a = 0.4$

| Month | $X_t$ | $S'_t$ | $S''_t$ | $a_t$ | $b_t$ | $F_{t+m}$ | $e_t$ | $e_t^2$ |
|-------|-------|--------|---------|-------|-------|-----------|-------|--------|
| ke1   | 400   | 480    | 432     | 529   | -18.8 |           |       |        |
| ke2   | 600   | 528    | 470.4   | 586.6 | -22.64| 510.2     | 89.8  | 8064.04 |
| ke3   | 700   | 596.8  | 520.96  | 673.64| -29.936| 563.96 | 136.04 | 18506.88 |
| ke4   | 550   | 578.08 | 543.808 | 613.352| -13.309| 643.704  | -93.704| 8780.44 |
| ke5   | 600   | 586.848| 561.024 | 613.672| -9.9296| 600.0432| -0.0432| 0.001866 |
| ke6   | 500   | 552.1088| 557.45792| 547.7597| 2.53965| 603.7424| -103.742 | 10762.49 |
| ke7   | 800   | 651.26528| 594.980864| 708.5497| -22.114| 550.2993| 249.7007 | 62350.43 |
| ke8   | 533   | 603.959168| 598.572186| 610.3462| -1.7548| 686.4359| -153.436 | 23542.58 |
| ke9   | 500   | 562.375501| 584.093512| 541.6575| 9.0872| 608.5914| -108.591 | 11792.08 |
| ke10  | 500   | 562.375501| 584.093512| 541.6575| 9.0872| 608.5914| -108.591 | 11792.08 |
Note:

\(X_t\) : lots of Data
\(S_t'\) : equation 1
\(S_t''\) : equation 2
\(a_t\) : equation 3
\(b_t\) : equation 4
\(F_{t+m}\) : equation 5
\(e_t\) : equation 7

Than the error value in the brown linear exponential smoothing method with \(a = 0.4\) using MSE (equation 6) is = 17970.367734.

Table 6. Forecasting pond yield using one parameter linear exponential smoothing method brown with \(a = 0.5\)

| Month | \(X_t\) | \(S_t'\) | \(S_t''\) | \(a_t\) | \(b_t\) | \(F_{t+m}\) | \(e_t\) | \(e_t^2\) |
|-------|--------|---------|----------|--------|--------|-----------|--------|--------|
| ke1   | 400    |         |          |        |        |           |        |        |
| ke2   | 600    | 500     | 450      | 551    | -24.5  |           |        |        |
| ke3   | 600    | 550     | 500      | 601    | -24.5  | 526.5     | 73.5   | 5402.25|
| ke4   | 700    | 625     | 562.5    | 688.5  | -30.75 | 576.5     | 123.5  | 15252.25|
| ke5   | 550    | 587.5   | 575      | 601    | -5.75  | 657.75    | -107.75| 11610.06|
| ke6   | 600    | 593.75  | 584.375  | 604.125| -4.1875| 595.25    | 4.75   | 22.5625 |
| ke7   | 500    | 546.875 | 565.625  | 529.125| 9.875  | 599.9375  | -99.9375| 9987.504|
| ke8   | 800    | 673.4375| 619.53125| 728.3438| -26.453| 539       | 261    | 68121   |
| ke9   | 533    | 603.21875| 611.375  | 596.0625| 4.57813| 701.8906  | -168.891| 28524.04|
| ke10  | 500    | 551.609375| 581.492188| 522.7266| 15.4414| 600.6406  | -100.641| 10128.54|

Note:

\(X_t\) : lots of Data
\(S_t'\) : equation 1
\(S_t''\) : equation 2
\(a_t\) : equation 3
\(b_t\) : equation 4
\(F_{t+m}\) : equation 5
\(e_t\) : equation 7

Than the error value in the brown linear exponential smoothing method with \(a = 0.5\) using MSE (equation 6) is = 18631.025813.
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Table 7. Forecasting pond yield using one parameter linear exponential smoothing method brown with $a = 0.6$

| Month | $X_t$ | $S_t'$ | $S_t''$ | $a_t$ | $b_t$ | $F_{t+m}$ | $e_t$ | $e_t^2$ |
|-------|-------|--------|---------|-------|-------|-----------|-------|--------|
| ke1   | 400   | 520    | 472     | 569   | -28.2 |           |       |        |
| ke2   | 600   | 568    | 529.6   | 607.4 | -22.44| 540.8     | 59.2  | 3504.64|
| ke3   | 700   | 647.2  | 600.16  | 695.24| -27.624| 584.96    | 115.04| 13234.2|
| ke4   | 550   | 588.88 | 593.392| 585.368| 3.3072| 667.616    | -117.616| 13833.52|
| ke5   | 600   | 595.552| 594.688| 597.416| 0.0816| 588.6752  | 11.3248| 128.2511|
| ke6   | 500   | 538.2208| 560.80768| 516.6339| 14.1521| 597.4976  | -97.4976| 9505.782|
| ke7   | 600   | 595.28832| 641.496064| 750.0806| -31.675| 530.786  | 269.214| 72476.15|
| ke8   | 800   | 597.915328| 615.347622| 581.483| 11.0594| 718.4052  | -185.405| 34375.1|
| ke9   | 500   | 539.166131| 569.638728| 509.6935| 18.8836| 592.5424  | -92.5424| 8564.098|

Note:
$X_t$ : lots of Data
$S_t'$ : equation 1
$S_t''$ : equation 2
$a_t$ : equation 3
$b_t$ : equation 4
$F_{t+m}$ : equation 5
$e_t$ : equation 7

Than the error value in the brown linear exponential smoothing method with $a = 0.6$ using MSE (equation 6) is $= 19452.717638$.

Table 8. Forecasting pond yield using one parameter linear exponential smoothing method brown with $a = 0.7$

| Month | $X_t$ | $S_t'$ | $S_t''$ | $a_t$ | $b_t$ | $F_{t+m}$ | $e_t$ | $e_t^2$ |
|-------|-------|--------|---------|-------|-------|-----------|-------|--------|
| ke1   | 400   | 540    | 498     | 583   | -28.7 |           |       |        |
| ke2   | 600   | 582    | 556.8   | 608.2 | -16.94| 554.3     | 45.7  | 2088.49|
| ke3   | 700   | 664.6  | 632.26  | 697.94| -21.938| 591.26    | 108.74| 11824.39|
| ke4   | 550   | 584.38 | 598.744 | 571.016| 10.7548| 676.002   | -126.002| 15876.5|
| ke5   | 600   | 595.314| 596.343 | 595.285| 1.4203| 581.7708  | 18.2292| 332.3037|
| ke6   | 500   | 528.5942| 548.91884| 509.2696| 14.9272| 596.7053  | -96.7053| 9351.915|
| ke7   | 800   | 718.57826| 667.680434| 770.4761| -34.928| 524.1968  | 275.8032| 76067.4|
| ke8   | 533   | 588.673478| 612.375565| 565.9714| 17.2915| 735.5476  | -202.548| 41025.53|
| ke9   | 500   | 526.602043| 552.33441| 501.87| 18.7124| 583.2629  | -83.2629| 6932.703|

Note:
$X_t$ : lots of Data
\[ S_t' : \text{equation 1} \]
\[ S_t'' : \text{equation 2} \]
\[ a_t : \text{equation 3} \]
\[ b_t : \text{equation 4} \]
\[ F_{t+m} : \text{equation 5} \]
\[ e_t : \text{equation 7} \]

Than the error value in the brown linear exponential smoothing method with \(a = 0.7\) using \(\text{MSE (equation 6)}\) is = 20437.40363.

**Table 9.** Forecasting pond yield using one parameter linear exponential smoothing method brown with \(a = 0.8\)

| Month | \(X_t\) | \(S_t'\) | \(S_t''\) | \(a_t\) | \(b_t\) | \(F_{t+m}\) | \(e_t\) | \(e_t^2\) |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| ke1   | 400   |       |       |       |       |       |       |       |
| ke2   | 600   | 560   | 528   | 593   | -24.8 |       |       |       |
| ke3   | 600   | 592   | 579.2 | 605.8 | -9.44 | 568.2 | 31.8  | 1011.24 |
| ke4   | 700   | 678.4 | 658.56| 699.24| -15.072| 596.36| 103.64| 10741.25 |
| ke5   | 550   | 575.68| 592.256| 560.104| 14.06| 684.168| -134.168| 18001.05 |
| ke6   | 600   | 595.136| 594.56| 596.712| 0.3392| 574.1648| 25.8352| 667.4576 |
| ke7   | 500   | 519.0272| 534.13376| 504.9206| 12.8852| 597.0512| -97.0512| 9418.935 |
| ke8   | 800   | 743.80544| 701.871104| 786.7398| -32.747| 517.8059| 282.1941| 79633.52 |
| ke9   | 533   | 575.161088| 600.503091| 550.8191| 12.8852| 571.8927| 25.8352| 667.4576 |
| ke10  | 500   | 515.032218| 532.126392| 498.938| 14.4753| 571.8927| -71.8927| 5168.558 |

Note:
\(X_t\): lots of Data
\(S_t'\): equation 1
\(S_t''\): equation 2
\(a_t\): equation 3
\(b_t\): equation 4
\(F_{t+m}\): equation 5
\(e_t\): equation 7

Than the error value in the brown linear exponential smoothing method with \(a = 0.8\) using \(\text{MSE (equation 6)}\) is = 21684.951325.

**Table 10.** Forecasting pond yield using one parameter linear exponential smoothing method brown with \(a = 0.9\)

| Month | \(X_t\) | \(S_t'\) | \(S_t''\) | \(a_t\) | \(b_t\) | \(F_{t+m}\) | \(e_t\) | \(e_t^2\) |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| ke1   | 400   |       |       |       |       |       |       |       |
| ke2   | 600   | 580   | 562   | 599   | -15.3 |       |       |       |
| ke3   | 600   | 598   | 594.4 | 602.6 | -2.34 | 583.7 | 16.3  | 265.69 |
| ke4   | 700   | 689.8 | 680.26| 700.34| -7.686| 600.26| 99.74 | 9948.068 |
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| Month | $X_t$ | $S_t'$ | $S_t''$ | $a_t$ | $b_t$ | $F_{t+m}$ | $e_t$ | $e_t^2$ |
|-------|-------|--------|---------|-------|-------|-----------|-------|---------|
| ke5   | 550   | 563,98 | 575,608 | 553,352 | 11,3652 | 692,654   | -142,654 | 20350,16 |
| ke6   | 600   | 596,398| 594,319 | 599,477 | -0,9711 | 564,7172  | 35,2828  | 1244,876 |
| ke7   | 500   | 509,6398| 518,10772| 502,1719| 8,5213 | 598,5059 | -98,5059 | 9703,412 |
| ke8   | 800   | 770,96398| 745,678354| 797,2496| -21,837 | 510,693 | 289,307 | 83698,54 |
| ke9   | 533   | 556,796398| 575,684594| 538,9082| 17,8994 | 775,3925 | -242,393 | 58754,14 |
| ke10  | 500   | 505,67964| 512,680135| 499,6791| 7,20045 | 556,8076 | -56,8076 | 3227,101 |

Note :

$X_t$ : lots of Data
$S_t'$ : equation 1
$S_t''$ : equation 2
$a_t$ : equation 3
$b_t$ : equation 4
$F_{t+m}$ : equation 5
$e_t$ : equation 7

Than the error value in the brown linear exponential smoothing method with $a = 0,9$ using MSE (equation 6) is $= 23398,998375$.

Furthermore, the value is compared to determine the value that gives the smallest/minimum MSE value. The comparison of the accuracy of the pond yield forecasting method sees the MSE as follows :

| Table 11. Alpha values with MSE |
|-------------------------------|------------------|
| Alfa                          | MSE              |
| 0,1                           | 21007,81775      |
| 0,2                           | 16407,241875     |
| 0,3                           | 17628,82394      |
| 0,4                           | 17970,367734     |
| 0,5                           | 18631,025813     |
| 0,6                           | 19452,717638     |
| 0,7                           | 20437,403963     |
| 0,8                           | 21684,951325     |
| 0,9                           | 23398,998375     |

After knowing the error contained in the data above, forecasting the results of ponda I carried out. As already described, good forecasting is a method that provides forecasting results that are not much different from what actually happened. In other words, a good forecasting method is a method that produces the smallest possible error value. From the data obtained, it is found that $\alpha = 0,2$ is which gives the smallest error value.
The next stage is the forecasting stage for pond yields obtained with $\alpha = 0.2$ because the error value is the smallest of the overall values of $\alpha$, using equation 5.

1. Forecast for the 11th month with $\alpha = 0.2$, $m=1$

$$F_{t+m}=a_t+b_tm$$

$$F_{10+1}=a_{10}+b_{10}(1)$$

$$F_{11}=593,3991+(-6,3273)1$$

$$F_{11}=587,0718$$

2. Forecast for the 12th month with $\alpha = 0.2$, $m=2$

$$F_{t+m}=a_t+b_tm$$

$$F_{10+2}=a_{10}+b_{10}(2)$$

$$F_{12}=593,3991+(-6,3273)2$$

$$F_{12}=580,7445$$

Table 12. Forecasting pond yield using one parameter linear exponential smoothing method brown with $a = 0.2$

| Month | $X_t$ | $S_t^i$ | $S_t^{i'}$ | $a_t$ | $b_t$ | $F_{t+m}$ | $e_t$ | $e^2_t$ |
|-------|-------|---------|------------|-------|-------|-----------|-------|--------|
| ke1   | 400   | 408     | 473        | -6.2  |       |           |       |         |
| ke2   | 600   | 440     | 524,2      | -10.04| 466.8 | 133.2     | 17742,24 |       |
| ke3   | 600   | 472     | 420.8      | 596.04| 514.16| 185.84    | 34536,51 |       |
| ke4   | 700   | 517.6   | 440.16     | -15.288| 514.16| 185.84   | 34536,51 |       |
| ke5   | 550   | 524.08  | 456.944    | -13.227| 580.752| -30.752  | 945,6855 |       |
| ke6   | 600   | 539.264 | 473.408    | -12.971| 578.9888| 21.0112 | 441,4705 |       |
| ke7   | 500   | 531,4112| 485.00864  | -9.0805| 593,1488| -93,1488 | 8676,699 |       |
| ke8   | 800   | 585,12896| 505.032704| -15.819| 569,7332| 230,2668 | 53022,78 |       |
| ke9   | 533   | 574,703168| 518.966797| -10.947| 650,4068 | -30,752 | 13784,16 |       |
| ke10  | 500   | 559,762534| 527,125944| -6,3273| 620,4923| -12,0492 | 14518,39 |       |

Table 13. Actual data forecasting pond yield

| Month | $X_t$ | $S_t^i$ | $S_t^{i'}$ | $a_t$ | $b_t$ | $F_{t+m}$ |
|-------|-------|---------|------------|-------|-------|-----------|
| ke1   | 400   | 562     | 599        | -15.3 |       |           |
| ke2   | 600   | 598     | 594.4      | 602.6 | -2.34 | 583.7     |
| ke3   | 700   | 689.8   | 680.26     | 700.34| -7.686| 600.26    |
| ke4   | 550   | 563.98  | 575,608    | 553.352| 11.3652| 692,654   |
| ke5   | 600   | 596,398 | 594,319    | 599,477| -0.9711| 564,7172  |
| ke6   | 500   | 509,6398| 518,10772  | 502,1719| 8.52113| 598,5059  |
| ke7   | 800   | 770,96398| 745,678354| 797,2496| -21.857| 510,693   |
| ke8   | 533   | 556,796398| 575,684594| 538,9082| 17.8994| 775,3925  |
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| Month  | $X_t$ | $S'_t$ | $S''_t$ | $a_t$ | $b_t$ | $F_{t+m}$ |
|--------|-------|--------|--------|-------|-------|------------|
| ke10   | 500   | 505,67964 | 512,680135 | 499,6791 | 7,20045 | 556,8076   |
| ke11   |       |         |         |       |       | 587,0718   |
| ke12   |       |         |         |       |       | 580,7445   |

So forecast results for the next 2 month are:

**Table 14.** Forecasting pond yield for the next 2 months

| Month     | Kilogram(kg) |
|-----------|--------------|
| 11th month| 587          |
| 12th month| 580          |

**CONCLUSION**

Based on the results of data processing and data analysis using the linear exponential smoothing method with $\alpha = 0.2$ one brown parameter and an MSE value of 16407,241875, it was obtained that the forecasting results in the 11th and 12th months of harvest decreased, namely, 587 kg and 580 kg. In this case, it is expected that the pond farmers of Cot Muda Itam Village will pay more attention to the factors that are suspected to be the cause of the decline in crop yields in the 11th and 12th months can increase (contrary to the results of forecasting).

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