

# ANALYSIS OF FARMERS' INCOME AFFECTED ATTACKS OF PLANT DISTURB ORGANISMS IN SUSOH DISTRICT SOUTHWEST ACEH DISTRICT

Sufriadi<sup>1</sup>, Yossi Mardhiah<sup>2</sup>, Aswin Nasution<sup>3</sup>, Hasan Husein<sup>4</sup>

<sup>1,3,4</sup>Lecturer in Department of Agribusiness, Faculty of Agriculture, Universitas Teuku Umar

<sup>2</sup>Student in Department of Agribusiness, Faculty of Agriculture, Universitas Teuku Umar

Corresponding email: [sufriadi@utu.ac.id](mailto:sufriadi@utu.ac.id)

## Abstract

Paddy field in Susoh District, Southwest Aceh Regency are very vulnerable to the impacts of climate change such as drought and floods which have caused the intensity of attacks by Paddy field Pest Organisms (OPT) decreased as it had in the previous growing season. Some farmers make mitigation efforts by spraying pesticides according to the recommendations of the local Plant Pest Organism Observer (POPT), but some other farmers do not carry out mitigation due to considerations of production costs that are quite large and ultimately affect the total revenue and income of farmers. This study aims to look at the differences in total production and average income between farmers who mitigate and farmers who do not mitigate pest attacks. The sample was divided into two categories, each category was taken by 28 farmer respondents randomly. The results of the independent test sample t-test on production obtained t-count (4.056) greater than t-table ( ) while for income obtained t-count (4.056) greater than t-table (2.46) indicating there is a difference in production and average income between mitigating and non-mitigating farmers. Total GKP production obtained by mitigating farmers was an average of 2.608 tons and farmers who did not mitigate an average of 2.011 tons. The average income of farmers who mitigate pest attacks is IDR 4,821,834.79 per 0.4 hectare or IDR 12,054,600 per hectare, while farmers who do not mitigate pest attacks are IDR 2,888,103.86 per 0.4 hectare or IDR 7,220,260 per hectare per planting season.

Keywords: *Income, Farming Business, Mitigation, Not Mitigation, OPT*

## 1.INTRODUCTION

Global climate change is a natural phenomenon that continues to threaten the world's population today. Experts from academia continue to study the causes and impacts of climate change on humans, plants, livestock and the environment on planet earth today. The extreme climate anomaly in the last few decades has caused changes in natural resource and environmental management policies. The research results reveal that world temperatures have increased over the past few decades and are expected to continue to increase with indications of rising sea levels until 2100. This condition causes low-lying areas along the coast to have a higher risk of experiencing flood disasters (Peace, 2007). Climate anomalies also hit the Southwest Aceh District. High rainfall caused lowland rice plants to be flooded in several sub-districts in Aceh Barat Daya district, followed by a cycle of relatively high (extreme) dry season which triggered populations and attacks by Plant Destructive Organisms (OPT) on lowland rice plants. One area that was quite affected by the attack of Plant Pest Organisms (OPT) was Susoh District. Of the total area of OPT attacks throughout the Aceh Barat Daya District area of 1,052 hectares in the Aceh Barat Daya District, 185 hectares or 12.32% of them were in Susoh District with the number of affected farmers and cultivators of 94 households (POPT, District Southwest Aceh, 2021).

Some farmers are trying to mitigate this OPT attack so that it does not have a broad impact on the production and revenue of their farming, but some other farmers respond to OPT attacks in a conventional way without using pesticides. On the other hand, efforts to mitigate pest attacks cause

*ANALYSIS OF FARMERS' INCOME AFFECTED ATTACKS OF PLANT DISTURB ORGANISMS IN SUSOH DISTRICT SOUTHWEST ACEH DISTRICT*

*Sufriadi, Yossi Mardhiah, Aswin Nasution, Hasan Husein*

production costs incurred by farmers to purchase pesticides and labor costs to be quite high. The increase in production costs is expected to affect the total revenue and income of farmers and have implications for decreasing the welfare of farmers in meeting their daily needs and the continuity of their farming business in the following planting season. Departing from the impact of farmers' decisions in responding (mitigating or not mitigating) OPT attacks on income from their lowland rice farming, the research problem is formulated as follows: (1) Is there a difference in average income between farmers who mitigate and farmers who do not mitigate pest attacks, (2) What is the average income between farmers who do mitigation and farmers who do not mitigate OPT attacks in Susoh District, Aceh Barat Daya District. The aims of this study were to (1) analyze the difference in average income between farmers who mitigated and those who did not mitigate pest attacks and (2) find out the amount of income between farmers who mitigated and farmers who did not mitigate pest attacks due to the impact climate change (anomaly) in Susoh District, Southwest Aceh District.

## 2. METHODOLOGY

### 2.1. Location and Time of Research

This research was conducted in Susoh District, Aceh Barat Daya District, Aceh Province in November 2022. The location for the research was determined purposively (purposively) with the consideration that the intensity of attacks by Plant Pest Organisms (OPT) in Susoh District was relatively high (12.32%) compared to other districts.

### 2.2. Data Types and Sources

Types and sources of research data consist of (1) Primary data obtained from respondents through interviews (interviews) using a structured questionnaire, including data on the characteristics of farmers, farming, costs, production, income and income of paddy rice business, (2) Secondary data, data obtained from a second party, i.e. data published by other institutions consisting of the Regional Library, the Central Bureau of Statistics (BPS), the Agriculture and Livestock Service Office of Southwest Aceh District, the Observer for Plant Pest Organisms (POPT) of Southwest Aceh District and the Regional Disaster Mitigation Agency (BPBD) Southwest Aceh District.

### 2.3. Population and Sample

The population in this study were lowland rice farmers who were attacked by OPT in Susoh District, totaling 94 people. The sample used the Category Random Sampling method by grouping farmers into 2 (two) categories or characteristics, namely farmers who did mitigation and farmers who did not mitigate OPT attacks which were taken randomly (Random) with a total sample of 28 respondents each.

### 2.4. Data Analysis Models

Cost and Revenue Analysis. Soekartawi (2006) states that cost is the acquisition price sacrificed in order to earn income and will be used as a repetition of income. Production costs are calculated by adding up the total fixed production costs and variable production costs according to the following formula:

$$TC = TFC + TVC \quad (\text{Source: Soekartawi, 2006})$$

Description:

tc = Total Cost (Rp/year)

TFC = Total Fixed Costs (Rp/year)

TVC = Total Variable Cost (Rp/year)

In connection with the analysis of farming revenue put forward by Surtiyah (2015) that revenue is the total income received by farmers in the form of money obtained from the sale of crops for one production, according to the calculation of the following formula:

$$TR = P \times Q \quad (\text{Source: Surtiyah, 2006})$$

Information

TR (Total Revenue) = Total Revenue Lowland Rice Farming (Rp)

P (Price) = Selling Price GKG (Rp/ Per Kg)

Q (Quantity) = Total Production of GKP (Kg)

Furthermore, Soekartawi (2006) states that income is the gross receipt (gross) received by farmers, resulting from the sale of crops, calculated by deducting revenue from the total cost for one production, according to the following formula:

$$\Pi = TR - TC \quad (\text{Source: Soekartawi, 2006})$$

Information :

$\Pi$  = Revenue/Profit (Rp)

TR = Total Revenue (Rp)

tc = Total Cost (Rp)

Analysisji Independent Sample t-Test using the program SPSS for Windows v-20. According to Arikunto (2016) that the independent sample t-test is part of the parametric inferential statistical test used to determine whether there is an average difference between two groups originating from different subjects.

The t test formula mathematically is as follows:

$$t = \frac{R1 - R2}{\sqrt{\frac{SS1 + SS2}{(n1 - 1)(n2 - 1)} \left( \frac{1}{n1} + \frac{1}{n2} \right)}}$$

Information:

R1 = The average income of farmers who do Mitigation of OPT attacks

R2 = The average income of farmers who do not Mitigation of OPT attacks

SS1 = Sum of squares income of farmers who mitigate pest attacks

SS2 = Sum of squares income of farmers who do not mitigate pest attacks

N1 = The number of farmers' income data that do Mitigation of OPT attacks

n2 = There are many data on farmers' income that are not Mitigation of OPT attacks

The hypothesis to be tested is formulated as follows:

Ho : R1 = R2 : No There is a difference average income between farmers who mitigate against the average income of farmers who do not mitigate pest attacks.

Hi: R1  $\neq$  R2 : There is a difference average income between farmers who mitigate against the average income of farmers who do not mitigate pest attacks.

Test criteria:

If  $t_{\text{arithmetic}} > t_{\text{table}}$  or  $\text{sig } \alpha \text{ 2-tailed} < 0.05$  then Hi is accepted Ho is rejected. This means that there is a difference average income between farmers who mitigate against the average income of farmers who do not mitigate pest attacks.

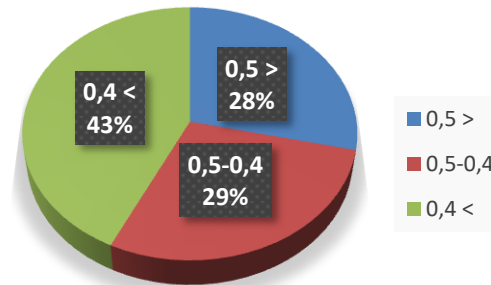
If  $t_{\text{count}} < t_{\text{table}}$  or  $\text{sig } \alpha \text{ 2-tailed} > 0.05$  then H0 is accepted H1 is rejected meaning No There is a difference average income between farmers who mitigate against the average income of farmers who do not mitigate pest attacks.

## 1. Characteristics of Respondent Farmers

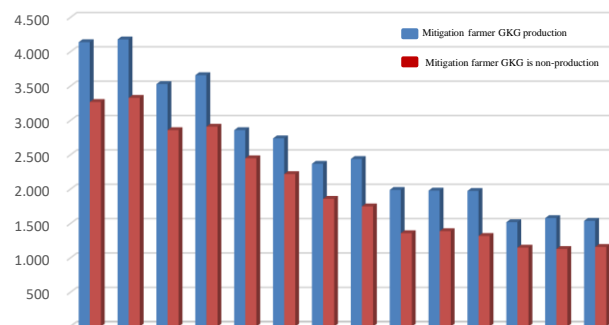
*ANALYSIS OF FARMERS' INCOME AFFECTED ATTACKS OF PLANT DISTURB ORGANISMS IN SUSOH DISTRICT SOUTHWEST ACEH DISTRICT*

*Sufriadi, Yossi Mardhiah, Aswin Nasution, Hasan Husein*

Distribution of Mitigation and Non Mitigation of Farmers' Planting Against OPT Attacks



## 2. Farmer Grain Production



## 3. Plant Pest Organisms (OPT) and Mitigation Efforts

The results of observations and field studies of Observers of Plant Pest Organisms (POPT) of Southwest Aceh District during 2021-2022, detected the types of OPT that attacked farmers' rice plants in Susoh District were planthopper pests, planthopper bugs, brown walang stem borers and caterpillars with attack intensity average close to the economic threshold. Based on POPT recommendations, farmers are advised to do pspraying Decis 25 EC, Lindomin 865 SL and Regent 50 SC pesticides. The first spraying of the pesticide Lindomin 865 SL was carried out when the rice was between 7-10 days after planting (HST) and the second spraying when the land began to grow weeds. The spraying of Regent 50 SC pesticides was carried out intensively when paddy rice plants were attacked by stink bugs, brown bugs and stem borers. In addition to controlling plant pests, the use of this pesticide is also intended to strengthen the stems of paddy rice plants, because these types of pesticides contain growth regulators which make the roots of rice plants grow more. However, there are not a few farmers who do not mitigate by spraying against this OPT attack.

### 2.5. Lowland Rice Farming Costs

Cost analysis of lowland rice farming in the research location is all costs incurred by farmers to obtain harvested dry grain production (GKP) at the prevailing price. Farming costs include fixed costs, variable costs (raw materials and labor).

### 2.6. Fixed Cost of Farming

Fixed costs are costs incurred whose magnitude is always constant or fixed in number, not affected by the size of rice production. These fixed costs include costs of depreciation (depreciation) of farming equipment as shown in table 2 as follows:

**Table 1. Fixed Costs of Lowland Rice Farming in Susoh District - Kab. Southwest Aceh**

| Fixed Cost Components | Allocation of Depreciation Cost (Rp) Per Month |         |                        |         |
|-----------------------|--|---------|------------------------|---------|
|                       | Mitigating Farmers                             |         | Non-Mitigation Farmers |         |
|                       | Total  | Average | Total                  | Average |
| Sprayer               | 425,000  | 30,357  | 375,000                | 26,786  |
| Hoe                   | 70,278   | 5,020   | 73,333                 | 5,238   |
| Machete               | 41,667   | 2,976   | 30,000                 | 2,143   |
| Amount                | 536,945  | 38,353  | 478,333                | 34,167  |

Source: Primary Data (Processed, 2022)

Based on data from table 1 above, the total cost of depreciation of farming equipment in the category of farmers who mitigate OPT attacks is an average of Rp.38,353 per month or Rp. 134,235 per farmer per planting season, while in the group of farmers who do not mitigate OPT attacks, the average is Rp.34,146 per month or Rp119,511 per farmer per growing season.

## 2.7. Variable Cost of Farming

Variable costs are costs that are always changing depending on the production amount. The variable cost components calculated in paddy rice farming for the two sample farmer categories can be seen in the following table:

**Table 2. Variable Costs of Lowland Rice Farming in Susoh District, Kab. Southwest Aceh**

| Variable Cost Components | Variable Cost (Rp) |           |                        |           |
|--------------------------|--------------------|-----------|------------------------|-----------|
|                          | Mitigation Farmers |           | Non-Mitigation Farmers |           |
|                          | Total              | Average   | Total                  | Average   |
| Land lease               | 19,500,000         | 1,392,857 | 24,300,000             | 1,735,714 |
| Seed                     | 3,726,000          | 266,143   | 3,672,000              | 262,286   |
| Urea Fertilizer          | 2,853,000          | 203,786   | 2,763,000              | 197,357   |
| NPK fertilizer           | 2,829,000          | 202,071   | 2,622,000              | 187,286   |
| TSP Fertilizer           | 640,000            | 45,714    | 420,000                | 30,000    |
| KCL fertilizer           | 1,845,000          | 131,786   | 900,000                | 64,286    |
| Dencis Pesticides        | 1,267,200          | 90,514    | 1,267,200              | 90,514    |
| Lindomin Pesticides      | 433,125            | 30,938    | 0                      | 0         |
| Regent pesticides        | 403,920            | 28,851    | 0                      | 0         |
| Bag                      | 912,625            | 65,188    | 704,000                | 50,286    |
| Amount                   | 34,409,870         | 2,457,848 | 36,648,200             | 2,617,729 |

Source: Primary Data (Processed, 2022)

Based on the table 2 above is known amount variable cost of paddy rice farming in mitigating farmer category an average of IDR 2,457,848 per farmer per planting season and farmers in the non-mitigation category an average of IDR 2,617,729 per farmer per planting season. The most variable cost component incurred by mitigating farmers is the input cost of buying rice seeds to re-insert them in planting clusters attacked by pests. Spraying activities carried out by adapted and non-adapted farmers using Decis 25 EC pesticides are carried out when the rice plants are 15, 21, 30 days after planting and at 45 days after planting, where farmers who have a land area of 0.8 hectares need total pesticides as much as 120 ml and farmers who have a land area of 0.4 hectares as much as 64 ml.

## 2.8. Farm Labor Costs

In most farms most of the labor comes from the family. Farmers themselves are the family's contribution to production and usually do not value the money or wages paid to family members after they work. However, over time, many family members are reluctant to work in the agricultural sector due to factors such as being educated or choosing to work in other sectors, which requires farmers to employ workers outside their family. These conditions require farmers to incur labor costs to expedite their farming activities, as can be seen in Table 6 below:

ANALYSIS OF FARMERS' INCOME AFFECTED ATTACKS OF PLANT DISTURB ORGANISMS IN SUSOH DISTRICT SOUTHWEST ACEH DISTRICT

Sufriadi, Yossi Mardhiah, Aswin Nasution, Hasan Husein

**Table 3. The Cost of Labor for Rice Farming in the District of Susoh, Southwest Aceh Regency**

| Cost component<br>Labor | Mitigation Farmers |           | Non Mitigation Farmers |           |
|-------------------------|--------------------|-----------|------------------------|-----------|
|                         | Total              | Average   | Total                  | Average   |
| Soil Processing         | 17,325,000         | 1,237,500 | 17,325,000             | 1,237,500 |
| Seeding Seeds           | 1,450,000          | 103,571   | 1,450,000              | 103,571   |
| Seed Planting           | 10,680,000         | 762,857   | 10,080,000             | 720,000   |
| Fertilization           | 6,400,000          | 457,143   | 4,800,000              | 342,857   |
| Spraying                | 15,600,000         | 1,114,286 | 5,400,000              | 385,714   |
| Harvesting              | 7,425,000          | 530,357   | 7,425,000              | 530,357   |
| freight                 | 2,940,000          | 210,000   | 2,680,000              | 191,429   |
| Amount                  | 61,820,000         | 4,415,714 | 49,160,014             | 3,511,430 |

Source: Primary Data (Processed, 2022)

Based on Table 6 it can be seen that more labor costs are incurred by mitigating farmers compared to non-mitigating farmers. The total labor cost incurred by mitigating farmers is Rp61,820,000 with an average of Rp4,415,714 per farmer per planting season while non-mitigation farmers are Rp49,160,014 with an average of Rp3,511,430 per farmer per growing season.

## 2.9. Total Cost of Paddy Rice Farming

Based on the results data collection on fixed costs and variable costs as well as labor costs that have been taken into account, then with respect to the total costs of lowland rice farming for mitigating and non-mitigating farmers in Susoh District, Southwest Aceh District during the lowland rice planting season period can be seen in Table 7 as follows :

**Table 4. Total cost Lowland Rice Farming in Susoh District, Kab. Southwest Aceh**

| Total cost    | Adaptation Farmers |           | Non-Adapted Farmers |           |
|---------------|--------------------|-----------|---------------------|-----------|
|               | Total              | Average   | Total               | Average   |
| Fixed cost    | 536,944            | 38,353    | 478,333             | 34,167    |
| Variable Cost | 34,409,870         | 2,457,848 | 36,648,200          | 2,617,729 |
| Labor costs   | 61,820,000         | 4,415,714 | 49,160,014          | 3,511,430 |
| Amount        | 96,766,815         | 6,911,915 | 86,286,548          | 6,163,325 |

Source: Primary Data (2022)

Based on Table 7 it can be seen that the total cost of lowland rice farming incurred by farmers per planting season by mitigating farmers is IDR 96,766,815 with an average of IDR 6,911,915 per farmer per planting season. Meanwhile, the total costs incurred by non-mitigation farmers amounted to IDR 86,286,548 with an average of IDR 6,163,325 per farmer per planting season.

## 2.10. Rice Paddy Farming Acceptance

Acceptance of paddy rice cultivation, well on farmers who do mitigation and farmers who do not mitigate are the gross income of farming from the amount of dry milled grain (GKG) multiplied by the price per kilogram of GKG on the basis of market prices prevailing in Susoh District as detailed in Table 8 as follows:

**Table 5. Reception Lowland Rice Farming in Susoh District, Kab. Southwest Aceh**

| Acceptance Component | Adaptation Farmers |            | Non-Adapted Farmers |           |
|----------------------|--------------------|------------|---------------------|-----------|
|                      | Total              | Average    | Total               | Average   |
| Total GKG (Kg)       | 36,505             | 2,608      | 28,160              | 2011      |
| GKG Price (Rp)       | 4,500              | 4,500      | 4,500               | 4,500     |
| Revenue (IDR)        | 164,272,500        | 11,733,750 | 126,720,000         | 9,051,429 |

Source: Primary Data (2022)



Based on Table 8 it can be seen that the revenue received by mitigating farmers is Rp164,272,500 with an average of IDR 11,733,750 per farmer per planting season and non mitigating Rp. 126,720,000 with an average of Rp. 9,051,429 per farmer per planting season. The difference in revenue obtained between the mitigating farmers and non-mitigating farmers is IDR 2,682,321 per farmer per planting season. This is because the production yield (GKG) obtained by mitigating farmers is 36,505 Kg, which is 36,505 Kg greater than non-mitigating farmers, which is 28,160 Kg.

### 2.11. Lowland Rice Farming Income

Income in this case it is calculated from the difference between the total revenue and the total costs incurred by mitigating farmers and non-mitigating farmers. The income of the two categories of farmers who carry out mitigation and farmers who do not carry out mitigation are obtained as follows:

**Table 6. Income Sawah di Rice Farming, Susoh District, Kab. Southwest Aceh**

| Revenue Component | Adaptation Farmers |            | Non-Adapted Farmers |           |
|-------------------|--------------------|------------|---------------------|-----------|
|                   | Total              | Average    | Total               | Average   |
| Reception         | 164,272,500        | 11,733,750 | 126,720,000         | 9,051,429 |
| Total cost        | 96,766,815         | 6,911,915  | 86,286,548          | 6,163,325 |
| Income            | 67,505,685         | 4,821,835  | 40,433,452          | 2,888,104 |

Source: Primary Data (2022)

Based on Table 9 it can be seen that the income earned by farmers who carry out mitigation is Rp. 67,505,685 with an average of Rp. 4,821,835 per farmer per planting season and farmers who do not carry out mitigation in their farming activities amounting to Rp. 40,433,452 with an average of Rp. IDR 2,888,104 per farmer per planting season.

## 3. RESULTS OF DIFFERENCE TEST ANALYSIS

The results of statistical testing of independent sample t-test different tests using the SPSS20 application program at the level of confidence obtained the following output:  $\alpha = 0,05$

**Table 7. Differences in Income of Adapted Farmers and Non-Adapted Farmers in Susoh District, Southwest Aceh District**

| Group                  | Average      | T-Test | Sig   | Conclusion            |
|------------------------|--------------|--------|-------|-----------------------|
| Mitigation Farmers     | 4,821,834.79 | 4,056  | 0.000 | There is a difference |
| Non Mitigation Farmers | 2,888,103.86 |        |       |                       |

Source: Primary Data (Processed, 2022)

Results independent sample t-test different test analysis showed a T-test of  $4.056 > T\text{-Table } 2.46$  or a sig value.  $0.000 < 0.05$  with the decision-making criteria that  $H_0$  is rejected and  $H_a$  is accepted means that there is a difference in average income between farmers who do mitigation and those who do not do mitigation in Susoh District, Aceh Barat Daya District.

## 5. CONCLUSIONS

Based on the results of research that has been done it can be concluded that:

1. Mitigation of rice plant pest attacks in Susoh District, Southwest Aceh Regency as a result of extreme climate change (anomaly), causing some farmers to make the decision to spray decis 25 EC pesticides, Lindomin 865 SL and Regent 50 SC, while farmers who do not carry out mitigation only use decis 25 EC under normal conditions for early anticipation not used when pests and plant diseases occur.
2. The results of the independent statistical test sample t-test showed that there was a difference in the average income of lowland rice farming between farmers who mitigated and those who did not mitigate pest attacks. The average income of lowland rice farmers in Susoh District, Southwest Aceh Regency, which mitigates OPT attacks per planting season on an average cultivated area scale of 0.4 hectares, is IDR

*ANALYSIS OF FARMERS' INCOME AFFECTED ATTACKS OF PLANT DISTURB ORGANISMS IN SUSOH DISTRICT SOUTHWEST ACEH DISTRICT*

*Sufriadi, Yossi Mardhiah, Aswin Nasution, Hasan Husein*

4,821,835 or IDR 12,054,600 per hectare, while the average income is -the average farmer who does not mitigate OPT attacks per season on an average cultivated area of 0.4 hectares is IDR 2,888,104 or IDR 7,220,260 per farmer per hectare.

**REFERENCES**

- Dinas Pertanian Kabupaten Aceh Barat Daya (2021), Laporan Hasil Pengamatan Organisme Pengganggu Tanaman (OPT)
- Elsevier, (2009). *Climate Change*. Edited By Trevor M. Letcher. Radarweg 29, PO Box 211, 1000 AE Amsterdam, The Netherlands Linacre House, Jordan Hill, Oxford OX2 8DP, UK. First edition 200. Copyright © 2009 Elsevier B.V. All rights reserved
- Food Agriculture Organisation (FAO;2010). *World Agriculture Wacth*
- Food Agriculture Organisation (FAO;2019). *Agriculture and Climate Change, Challenges and Opportunities at The Global And Local Level Collaboration on Climate-Smart Agriculture*
- IPCC. (2007). *Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, (Core Writing Team, Pachauri, R.K and Reisinger, A. {eds.}). IPCC Geneva, Switzerland.
- Kerlinger, F& Lee, H. (2000). *Foundations of Behavioral Research*. Orlando, Harcourt College Publishers.
- Suratiah, K. (2015). *Ilmu Usahatani*. Jakarta : Penebar Swadaya.
- Soekartawi, (2006). *Ilmu Usaha Tani*. Penerbit: Rajawali Press.
- Lantarsih, R., S. Widodo, D.H. Darwanto, S.B. Lestari, dan S. Paramita. 2011. Sistem ketahanan pangan nasional: Kontribusi Ketersediaan Dan Konsumsi Energi Serta Optimalisasi Distribusi Beras. *Jurnal Analisis Kebijakan Pertanian* 9(1):33-51.
- Mandelson R, Dinar A, (2009). *Climate Change and Agriculture, An Economics Analysis Of Global Impact, Adatation and Distributional Effect*.By MPG Group,UK.
- Suratiah (2015), Faktor yang memperngaruhi usahatani dan pengertian usahatani padi. *Jurnal Agribisnis*.
- Syabbuddin, H., Las, I., Unadi, A., Runtunuwu, E., (2007), *Identifikasi dan Delineasi Kalender Tanam dan Pola Tanam Pada Lahan Sawah Terhadap Anomali Iklim di Pulau Jawa*, Laporan Akhir Penelitian pada Satuan Kerja Balai Penelitian Agroklimate dan Hidrologi, Balai Besar Litbang Sumberdaya Lahan Pertanian, Jakarta. Balitbang Pertanian Departemen Pertanian.
- Wiyono, S. 2010. *Perubahan Iklim dan Ledakan Hama dan Penyakit Tanaman*. Seminar Sehari Tentang Keanekaragaman Hayati di Tengah Perubahan Iklim. Institut Pertanian Bogor. pp. 1-10
- Zaenuddin Kabai (2015). *Analisis Pendapatan Petani Kelapa di Kecamatan Saliabu Kabupaten Talaud*. Skripsi, Universitas Sam Ratulangi Manado