



## PRODUCTION AND INCOME LOSSES OF SUGARCANE FARMERS AT SOUTHERN LEYTE, PHILIPPINES DUE TO CROP BURNING

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### Abstract:

Plantation fire is very detrimental to productivity, income, and soil properties. In the Philippines, the farmers in Southern Leyte are one of the sugarcane areas that openly practice open field burning. They usually burn the cane before harvesting hence, productivity is very low as compared to the Visayan average. However, statistics related to the area subjected to burning and its corresponding losses are seldom can be found. Hence, this study aims to determine the impact of cane burning in terms of losses in sugar production and the income of the farmers.

An actual survey was first done last 2016 as a benchmark and every year thereafter until 2019. The GPS instrument was utilized in measuring the actual area subjected to burning. For the succeeding year, data was gathered on the actual burned area in all localities. The data gathered were encoded in the excel format template and analysis was done using the SPSS software.

For the year 2019, average sugar production was "very highly productive from "less productive" for the last 3 years (2016 to 2018). The area subjected to burning was described as "very highly practiced" in 2016 reversing it to "very low practiced" in 2019. In terms of losses in sugar and income, the year 2016 was described as "very high losses" and "very low losses" in 2019.

Recommended that more studies should be conducted related to this subject, in order to contribute on the pool of knowledge related to the ill effect of burning especially on the environment.

**Keywords:** Sugarcane Burning, Productivity Loss, Income Loss, Sugarcane Farmers

## 1. INTRODUCTION

### 1.1. Background

One of the risks being experienced by sugarcane plantations in the Philippines is the occurrence of fire, either accidental or done intentionally. At this time there is no available data regarding the area coverage of sugarcane subjected to burning but not the area of Southern Leyte, the Philippines.

In the area of Southern Leyte, Philippines, the 2016 data showed that out of the 6,839.02 hectares planted to sugarcane around 5,054.78 hectares, or 73.91% of the total area were subjected to burning. The total village involved was 77 (68.38%) out of the 116 villages in the area. The benchmark data were gathered during the validation work of technicians from the end of February to June 2016. The gathering of data for the said practice will give comprehensive information to sugarcane farmers and other stakeholders that the continuous practice of burning will lower production and income.

Topping the list of the municipality that practice cane burning is Kananga with 94.00 percent, followed by Ormoc City with 80.00 percent. The tail-ender among the municipalities are Leyte and Villaba with 33.33 and 14.29 percent, respectively.

In terms of area planted to sugarcane, the Municipality of Capoocan has the widest area that was subject to burning with 100.00 percent, followed by Leyte and Albueria with 98.75 and 93.56 percent, respectively.

Plantation fire is very detrimental on the productivity, income, and soil properties:

In terms of productivity, burned cane if not milled within 3 days there will a rapid sugar inversion of sucrose. Sugar inversion results in the breakdown of sucrose into simple sugars, glucose, and fructose, which are used by plants to energize growth processes [1].

Fructose deteriorations similarly occur because of microbial action after canes are cut. The delay of milling from 3 to 15 days of burned cane but left standing on the field could reduce the sugar content by 0.20% to a maximum of 98.64%, respectively [1]. On the other hand, the latest research shows that delayed milling from 4 to 24 days of burned cane but left standing could reduce the sugar content by 9.24% to a maximum of 98.12% [8]. Furthermore, burned cane, which is not milled for 3-15 days, but cut and piled only on the field, can reduce production by 2.20% to as much as 99.99%, respectively [1].

Relatively reduction in production will directly affect the income of the farmer [1]. Aside from production the cane tops of 6-8 laksa per hectare, will not be available anymore. Said cane points can be utilized as planting materials for the establishment of new crops or replanting for ratoon crops if left fresh in the field. If not needed, these cane points can be sold to other farms, which will be added to the income to the farmer if the field was not subject to burning.

For the effect of burning on soil properties, burned areas usually had low organic matter. Un-burned cane trash if left to decompose on the field could produce as much as 10-15 tons of organic matter (OM) per hectare. High OM of not more than 9% (ideal range for sugarcane) can help reduce the use of nitrogenous organic fertilizer. Hence, it can reduce the cost of fertilizers. Other benefits of non-burning the cane trash is:

1. Reduction in in-field cultivation because only one-half of the area will be available for ridge busting, on-barring, off-barring, etc. These are some of the major cultivation operations.
2. Moisture can be conserved because the cane trash serves as mulching materials. Water is needed critically especially on the germination stage. The germination stage of the cane is within the first month after planting or stubble shaving of new plant or ratoon crop, respectively. Furthermore, the Survival of stool of ratoon crop is greater in non-burned areas.
3. Cost of weeding will be reduced too, only half of the area will be weeded. Area being mulch retard the growth of weeds because of the absence of sunlight.

The non-popular benefit of not burning trash is beneficial micro-organisms in the soil. Beneficial micro-organisms in sugarcane growing helps a lot especially on solubilizing of elements which makes them (the elements) available to the crop. Other (BMOs) helps in fixing nitrogen from the air. The fixed nitrogen can reduce the use of commercial nitrogenous fertilizers. [2].

### 1.2. Statement of the Problem

1.2.1. The general objective of this study is to determine the effect of burning the sugarcane crop in the area of Southern Leyte, Eastern Visayas, the Philippines for the years 2016 to 2019 in terms of the loss in productivity and income:

1.2.2. Specific objectives:

- 1.2.1.a. Determine the level of productivity based on average sugar production per hectare
- 1.2.1.b. Determine the level of burning practices of sugarcane farmers
- 1.2.1.c. Determine the frequency of seminars, the number of participants and farmers involved in one-on-one consultation conducted
- 1.2.1.d. Determine the projected reduction in sugar and amount loss of burned cane with delays in milling at 4 and 24 days

### 1.3. Statement of the Problem

One of the major crops being planted in the area of Southern Leyte is sugarcane. It is considered one of the important high-value crops of the area. For the year mentioned above, subjecting a planted area to burning is widely practiced by the farmers. Hence, this study aims to review the extent of sugarcane areas subjected to burning and its corresponding losses in production and income.

## 2. MATERIALS AND METHODS

### 2.1. Research Method

The primary data were retrieved from the data bank and reports prepared by the author. The analytical-descriptive method was used in this study. The method was purposive which focused on gathering the actual data of the sugarcane area that were subjected to burning and determining the corresponding losses in terms of production and monetary value at Southern Leyte, Eastern Visayas, the Philippines for the period 2017 to 2019.

### 2.2. Research Environment

The study was conducted in the 9 municipalities and a city at Southern Leyte of Eastern Visayas Region, Philippines. Specifically, the study covered the municipalities of Albuera, Capoocan, Kananga, Leyte, Matag-ob, Merida, Palompon, Tabango, Villaba and Ormoc City

**2.3. Respondents**

The respondents of the study were the sugarcane farmers whose areas were subject to burning.

**2.4. Research Instrument**

A GPS (global positioning system) instrument was used to measure the total area that was subjected to burning. The data gathered was processed and plotted on the existing map of the areas planted to sugarcane. Data were encoded on excel formatted for computation and secured in the database

**2.5. Data Gathering Procedure**

The researcher had personally administered the gathering of data for the period 2017 to 2019 with the assistance of the government agency Technical Personnel/Junior Agriculturist at the area of Southern Leyte, Eastern Visayas, Philippines. Upon retrieval of the primary data from the data bank, the researcher had analyzed the data using the Statistical Package for Social Sciences (SPSS) software under the close supervision and guidance of the statistician. Subsequently, tables were prepared for easier interpretation.

**2.6. Statistical Tool**

In the analysis of data, the following statistical tools were used in accordance with the nature of the specific problems raise and their corresponding hypotheses.

Frequency and percentage were used to describe the level of reduction in the production and level of income for the area at Southern Leyte, the Philippines that were subjected to burning. The description was determined using the Likert’s scale.

**3.RESULTS AND DISCUSSION**

**Area planted and level of productivity**

Table 1 shows the total area planted and the level of productivity in Southern Leyte for the years 2016 to 2019. For the year 2016, the area planted was 6,839, 2017 was 7,000, 2018 it was 6,800 hectares same as in 2019, respectively.

Average sugar production is described as “less productive” for the years 2016 (85.46LKG), and “moderate productive” for 2017 (93.98 LKG). For 2018 and 2019, it’s “highly productive” with average sugar production of 96.15 and 96.35 LKG, respectively

**Table 1. Area Planted (ha) and Level of Productivity of Southern Leyte for the Year 2016 to 2019.**

| Year | Planted (hectare) | Area | Average Production Hectare (LKG) | Sugar per | Description         |
|------|-------------------|------|----------------------------------|-----------|---------------------|
| 2016 | 6,839             |      | 85.46                            |           | Less Productive     |
| 2017 | 7,000             |      | 93.98                            |           | Moderate Productive |
| 2018 | 6,800             |      | 96.15                            |           | Highly Productive   |
| 2019 | 6,800             |      | 96.35                            |           | Highly Productive   |

**Level of the burning practice of sugarcane**

The area that was subjected to burning for sugarcane areas at Southern Leyte is shown in Table 2. A descending trend in terms of the area subjected to burning is very transparent for the years 2016 to 2019. The total area subjected to burning for 2016 is 73.91%, and describe as “very highly practiced.” For the year 2017, the area subjected is 50.00% and describe, as “highly practiced” while for 2018 it is 35.00% and described as “low practiced”, respectively. The farmers had further reduced their burned area to only 15.00% in 2019, which is described as “very low practiced.”

Relative to the results, Oñal (2018) had found out in his study that majority of the sugarcane farmers that continuously burned their thrash after harvesting have low production [5].

**Table 2. Level of the Burning Practice of Sugarcane at Southern Leyte, the Philippines for the Year 2016 to 2019.**

| Year | Area Planted (ha) | Area (ha) Subjected to Burning | Percent of Area Subjected to Burning | Description           |
|------|-------------------|--------------------------------|--------------------------------------|-----------------------|
| 2016 | 6,839             | 5,054.78                       | 73.91                                | Very Highly Practiced |
| 2017 | 7,000             | 3,500.00                       | 50.00                                | Highly Practiced      |
| 2018 | 6,800             | 2,380.00                       | 35.00                                | Low Practiced         |
| 2019 | 6,800             | 1,020.00                       | 15.00                                | Very Low Practiced    |

**Frequency of seminars, the number of participants and farmers involved in a one-on-one consultation**

Table 3 shows the frequency of seminars conducted, the number of participants as well as the farmers involved in a one-on-one consultation, which was done at Northern Cebu for the years 2016 to 2019.

The conduct of the seminars and the one-on-one consultation were the strategies designed and implemented by the group of the author. The primary aim is to enhance the advocacy in order to lessen the practice of burning and hopefully to increase their productivity.

There were 7 seminars conducted for the years 2017 (23.33%) and 12 seminars for 2018 (40.00%). For the year 2019 on the other hand, 11 seminars (36.67%) were conducted. The seminars conducted for the above-mentioned years were described as "very frequent."

Relatively the number of participants that had attended the seminars were as follows: for the year 2017, 315 farmers (26.35%) had attended; 2018, 444 participants (37.00%); and, 441 farmers (36.75%) had attended for the year 2019, respectively. The number of participants attended was described as "very highly extent."

Hand in hand with the seminars conducted, one-on-one consultation with the farmers was also done as the second strategy. Still, the aim is to convince farmers to reduce the burning practice. For 2017, there were 92 farmers (17.62%), that had avail the consultation and was described as "highly extent." In the year 2018, 200 farmers (38.31%) had availed the services, and there were 231 farmers (44.07%) in 2019. For both latter years, the result was described as "very highly extent."

Relative to the result, the study of Cerbo (2009) indicates that Agrarian Reform Beneficiaries' (ARBs) standard of living were alleviated after they attended the Outreach Program for Sugarcane Industry (OPSI) seminars [3]. Their standard of living were alleviated because of the increase in sugar production, family income, and net profit per hectare.

Generally, extension service has a limited scope of coverage. Hence, extension officers should propagate new farming methods, and because farmers have the last say, agricultural extension officers must always consult and work closely with them. Extension officers should encourage farmers to adopt new, improved methods of farming using a variety of methods to reach the farmers [4]. The best method though is through personal contact with farmers on their farm or farm visits (Mandallos, 2014).

**Table 3. Frequency of Seminars Conducted, a Number of Participants and Farmers Involved in One-on-One Consultation Conducted at Southern Leyte, the Philippines for the year 2016 to 2019.**

| Year   | Frequency    | Percentage    | Description        |
|--|--------------|---------------|--------------------|
| <b>Seminar Conducted</b>                           |              |               |                    |
| 2017   | 7            | 23.33         | Very Frequent      |
| 2018   | 12           | 40.00         | Very Frequent      |
| 2019   | 11           | 36.67         | Very Frequent      |
| <b>Total</b>                                       | <b>30</b>    | <b>100.00</b> |                    |
| <b>Number of Participants</b>                      |              |               |                    |
| 2017   | 315          | 26.25         | Very Highly Extent |
| 2018   | 444          | 37.00         | Very Highly Extent |
| 2019   | 441          | 36.75         | Very Highly Extent |
| <b>Total</b>                                       | <b>1,200</b> | <b>100.00</b> |                    |
| <b>Farmers Involved in one-on-one Consultation</b> |              |               |                    |
| 2017   | 92           | 17.62         | Highly Extent      |
| 2018   | 200          | 38.31         | Very Highly Extent |
| 2019   | 231          | 44.07         | Very Highly Extent |
| <b>Total</b>                                       | <b>522</b>   | <b>100.00</b> |                    |

**Level of losses in sugar production at 4 and 24 days delay in milling of burned cane**

Using the Formula No. 1 as designed by the author, total losses in terms of percentages for both 4-days and 24-days delay in milling were as follows; for 2016, it is 38.82% (very high losses), 2017, it is 30.03% (high losses), 2018, it is 21.09% (moderate losses), and for 2019 it is 9.06% (very low losses). The decreasing trend in production losses is clearly indicated in the table.

Old literature by Wiedenfeld (2009) shows that soil organic matter content after three years had increased by green harvesting compared to burning prior to harvest [9]. Harvesting green compared to burning caused a 20% reduction in yield in the 2<sup>nd</sup> ratoon and a slight reduction in crop growth but an 8% increase in sucrose content in the 3<sup>rd</sup> ratoon crop. While the effects due to green harvesting on soil properties and crop growth were relatively minor, the residue remaining on the soil presents considerable challenges in cultivation, weed control, and irrigation.

The study of Sandhu *et al.* (2013) on the harvesting of green (un-burnt) and burned cane [7]. They explained that the air and soil temperature are microclimatic factors, which control sugarcane emergence and growth and may be significantly affected by the harvest method.

The result indicated that young shoots that emerged from green cane harvested fields may suffer frost damage and delayed growth when air temperatures are near or below freezing. In addition, transient increases in soil temperatures following burning were smaller than normal seasonal variations in soil temperatures, suggesting that burning has minimal impact on soil micro-flora and fauna within the 2- to 10-cm soil profile range.

Relative study on burning done by the group of Rachid (2013) in Brazil this time on the effect on the population of beneficial micro-organisms (BMOs) on the soil [6]. Nineteen different phyla were identified, with Acidobacteria (≈35%), Proteobacteria (≈24%), and Actinobacteria (≈21%) being the most abundant.

Results show that significant structural changes of the community were observed with burnt cane management having a greater impact than green cane management on local soil communities.

**Table 4. The Level of Losses in Sugar Production (LKG) at 4 and 24 days Delay in Milling at Southern Leyte, the Philippines for the Year 2016 to 2019.**

| Year                 | Total Reduction in Production (LKG) | Percentage    | Description      |
|----------------------|-------------------------------------|---------------|------------------|
| <b>4-days delay</b>  |                                     |               |                  |
| 2016                 | 39,915                              | 39.82         | Very High Losses |
| 2017                 | 30,102                              | 30.03         | High Losses      |
| 2018                 | 21,145                              | 21.09         | Moderate Losses  |
| 2019                 | 9,081                               | 9.06          | Very Low Losses  |
| <b>Total</b>         | <b>100,242</b>                      | <b>100.00</b> |                  |
| <b>24-days delay</b> |                                     |               |                  |
| 2016                 | 423,860                             | 39.82         | Very High Losses |
| 2017                 | 319,655                             | 30.63         | High Losses      |
| 2018                 | 224,535                             | 21.09         | Moderate Losses  |
| 2019                 | 96,430                              | 9.08          | Very Low Losses  |
| <b>Total</b>         | <b>1,064,480</b>                    | <b>100.00</b> |                  |

\*Projected loss [8]

**Formula:** (Source: Authors' design)

$$P_l = a_s \times p_a \quad (1)$$

$P_l$  - Production loss  
 $a_s$  - area subjected to burning  
 $p_a$  - average production

**Level of losses in the amount due to 4 and 24 days delay in milling of burned cane**

Relative to Table 4, the next table (Table 5) shows the level of losses in income at 4 and 24 days of delay milling. The tables show that with the same percentages of losses as follows: for 2016 the income losses are described as "very high losses; for 2017, it is described as "high losses; for 2018, it is described as "moderate losses"; and, for 2019, it is described as "very low losses." The decreasing trend is very transparent on the gathered as further shown in Table 5.

Formula No. 2 designed by the author is used in the computation of total losses in income.

**Table 5. The Level of Losses in the Amount (in USD) at 4 and 24 days in Delay Milling at Southern Leyte, the Philippines for the Year 2016 to 2019.**

| Year                 | Total Reduction in Income (in million USD) | Percentage    | Description      |
|----------------------|--|---------------|------------------|
| <b>4-days delay</b>  |  |               |                  |
| 2016                 | 1.197                                      | 39.82         | Very High Losses |
| 2017                 | 0.903                                      | 30.03         | High Losses      |
| 2018                 | 0.634                                      | 21.09         | Moderate Losses  |
| 2019                 | 0.272                                      | 9.06          | Very Low Losses  |
| <b>Total</b>         | <b>3.006</b>                               | <b>100.00</b> |                  |
| <b>24-days delay</b> |  |               |                  |
| 2016                 | 12.716                                     | 39.82         | Very High Losses |
| 2017                 | 9.590                                      | 30.03         | High Losses      |
| 2018                 | 6.736                                      | 21.09         | Moderate Losses  |
| 2019                 | 2.893                                      | 9.06          | Very Low Losses  |
| <b>Total</b>         | <b>31.935</b>                              | <b>100.00</b> |                  |

Average Sugar Price: 30 USD/LKg (Conversion: Php 50.00 per 1 USD)

**Formula:** (Source: Authors' design)

$$A_l = P_l \times f_l \times s_p \quad (2)$$

$A_l$  - amount loss

$P_l$  - production loss

$f_l$  - factor loss (9.24% or 98.12%)

$s_p$  - sugar price

## 4. CONCLUSIONS AND RECOMMENDATIONS

### 4.1. CONCLUSIONS

1. The average sugar production was highly productive in 2018 and 2019 from less productive for the year 2016.
2. The practice of cane burning had tremendously changed from very highly practiced in 2016 to very low practiced in 2019.
3. The conduct of seminars was done very frequent for 2016-2019 and for one-on-one it was very highly frequent done for 2018 and 2019
4. Losses in production and income had tremendously decreased which was from very high losses in 2016 to very low losses in 2019

### 4.2. RECOMMENDATIONS

1. The government should increase its efforts in conducting the advocacy on the wrong effect of cane burning including the trashes after the harvest
2. The local government units (LGUs) should implement fully the RA 9003 a law to protect the environment
3. Farmers organizations should assist the government in the advocacy and implementation of policies to encourage their members to avoid burning the crops and residues at the farm
4. Farmers should appreciate the benefits of green farming.

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