

# CAPSTONE PROJECT

## *NUTRANO 2020 CITRUS OLEOCELLSIS DEFECT & WEATHER CORRELATE ANALYSIS*

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## I. INTRODUCTION

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### 1.1 Background

Nutrano Produce Group is an international fresh produce company in Australia, operate over 2000 hectares of farms and facilities in Queensland, Victoria, New South Wales and the Northern Territory, with more than 300 dedicated employees.



There are various fruit grow by Nutrano, including lemon, grapefruit, orange, banana, blueberry, mango and more. In the Northern Territory of Australia, there is a Eumaralla farm located in Katherine, grows tropical and citrus fruit. It has a packing capacity of 1,000 citrus cartons and 2,500 mango trays per hour which is also one of the biggest mango farms in NT.

## 1.2 Problem

Oleocellosis phenomenon in citrus fruit is characterized by greenish-brown areas on an orange or yellow background of the flavedo. This colour is the result of essential oil spillage into the subepidermal tissue between the oil glands, which prevents the usual differentiation of chloroplasts into chromoplasts.

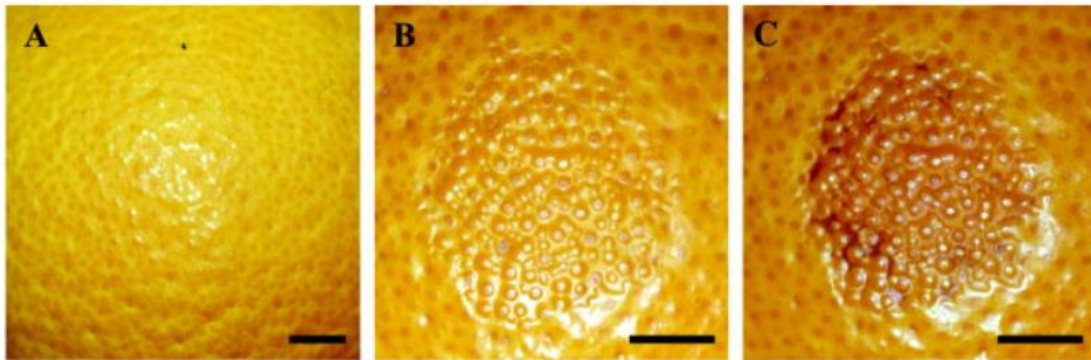


Photo 1. Citrus Oleocellosis

Since Nutrano citrus trials for oleocellosis, I found below:

- Katherine rainwater does not affect the oleocellosis directly.
- Sweaty hands do not affect the oleocellosis.
- The oleocellosis does not spread out after it sets.
- Gloves do not relate to the oleocellosis but may reduce the fruit stress.
- Physical pressures do affect oleocellosis.
- Oleocellosis defect may cause rot faster.

Now, I would like to know what relationship between weather condition: temperature, rainfall and humidity and how strongly correlated to oleocellosis.

## 1.3 Interest

This analysis is primary for minimizing the oleocellosis defect at the Katherine Farm during harvest. The topic would be interested for the citrus grower, stakeholder, and farmer or citrus related associations.

## II. DATA ACQUISITION

### 2.1 Data sources

A summary data provided from Nutrano Katherine Eumaralla Farm.

### 2.2 Data cleaning

There were two rows with 'NA' of the oleocellosis defect. In fact, there are many elements than the weather that could affect the fruit defect, even for the problem I may need more data, I could assume the average defect by the similar weather condition, but it also may impact the result by the small database which I removed the two data for less confusion.

### 2.2 Feature selection

There were 21 rows and 13 features in the data. Upon examining the meaning of each feature, it was clear that there was some redundancy in the features.

It is efficient productivity that multiple picking lots will be packed together as a batch, but how many percentages in a batch belongs to a picking lot is not related to the weather condition. For the report visualization and a better understanding, I decided to remove the features including [Batch\_Percentage] and [Bin\_Kg].

Picking_Date	Block	Bin_Qty	Batch	Temp	Var_Temp	Rainfall	Humidity	Oleo	Oleo_pieces	Sampled_pieces
27/11/19	LE1	24	1922	39	13	0	54	0.40%	6	2554
28/11/19	LE1	29	1922	40	16	2	69	0.40%	6	2554
29/11/19	LE1	39	1922	38	10	0	55	0.40%	6	2554
6/1/20	LE2	16	1934	36	11	0	68	2.50%	7	505
7/1/20	LE2	4	1934	37	13	0	72	2.50%	7	505
7/1/20	LE1	7	1933	37	13	0	72	1.30%	5	489
8/1/20	LE1	7	1935	36	11	50	74	1.40%	22	2633
9/1/20	LE1	24	1935	36	11	6	71	1.40%	22	2633
10/1/20	LE1	26	1935	37	11	9	77	1.40%	22	2633
28/1/20	LE1	17	1938	37	9	5	75	1.30%	4	548
29/1/20	LE1	8	1939	36	14	0	73	0.60%	3	1105
30/1/20	LE1	23	1939	36	9	12	71	0.60%	3	1105
31/1/20	LE1	21	1937	35	7	0	69	0.20%	1	898
3/2/20	LE1	16	1940	35	9	4	72	3.30%	10	641
3/2/20	LE2	5	1941	35	9	4	72	0.50%	3	976
4/2/20	LE2	15	1941	35	10	3	75	0.50%	3	976
5/2/20	LE2	14	1942	36	10	0	73	1.00%	3	671
6/2/20	LE2	9	1942	34	7	0	64	1.00%	3	671
12/2/20	LE1	4	1943	35	10	2	81	0.70%	3	866
13/2/20	LE1	10	1943	37	10	0	78	0.70%	3	866
14/2/20	LE1	12	1943	37	12	0	75	0.70%	3	866

Table 1. The dataset

# III. EXPLORATORY DATA ANALYSIS

## 3.1 Relationship between Oleocellosis and Weather Temperature

The weather was sweltering at Katherine during the citrus growing and harvesting. I assume that the maximum temperature may burst the cell by the harsh heat in Katherine.

The regression plot shows a weak negative correlation, and the Pearson indicator also shows the same result (Correlation Coefficient=-0.18 and P-value=0.41), the relationship between Oleocellosis and Temperature is faint. The box plot indicates the same as the higher temperature, the lower oleocellosis.

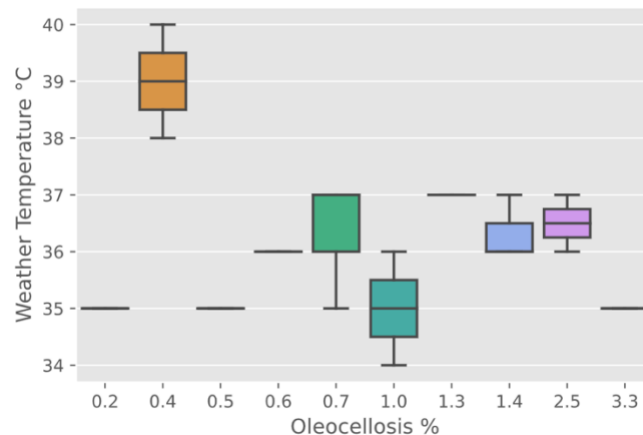


Figure 2. Box plot of Weather Tempreature feature

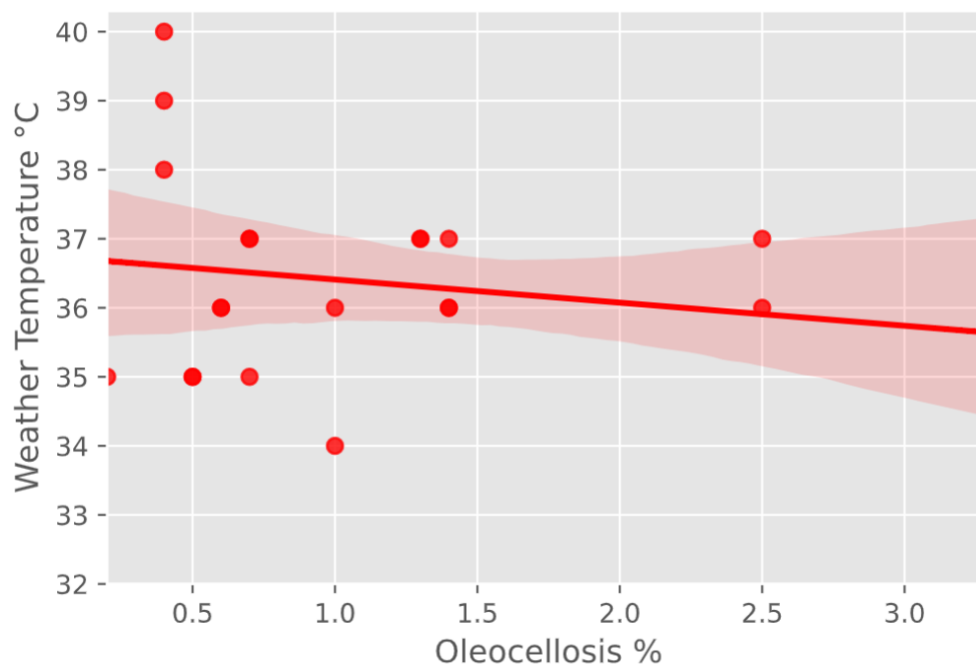


Figure 1. Regression plot of Correlation between Weather Temperature and Oleocellosis

### 3.2 Relationship between Oleocellosis and Variables of Temperature

How about the temperature variables? Does the temperature change affect the cells and relate to the Oleocellosis? The temperature variable is the temperature range in a day; in other words, the range is a minimum temperature subtracted from a maximum temperature of the day.

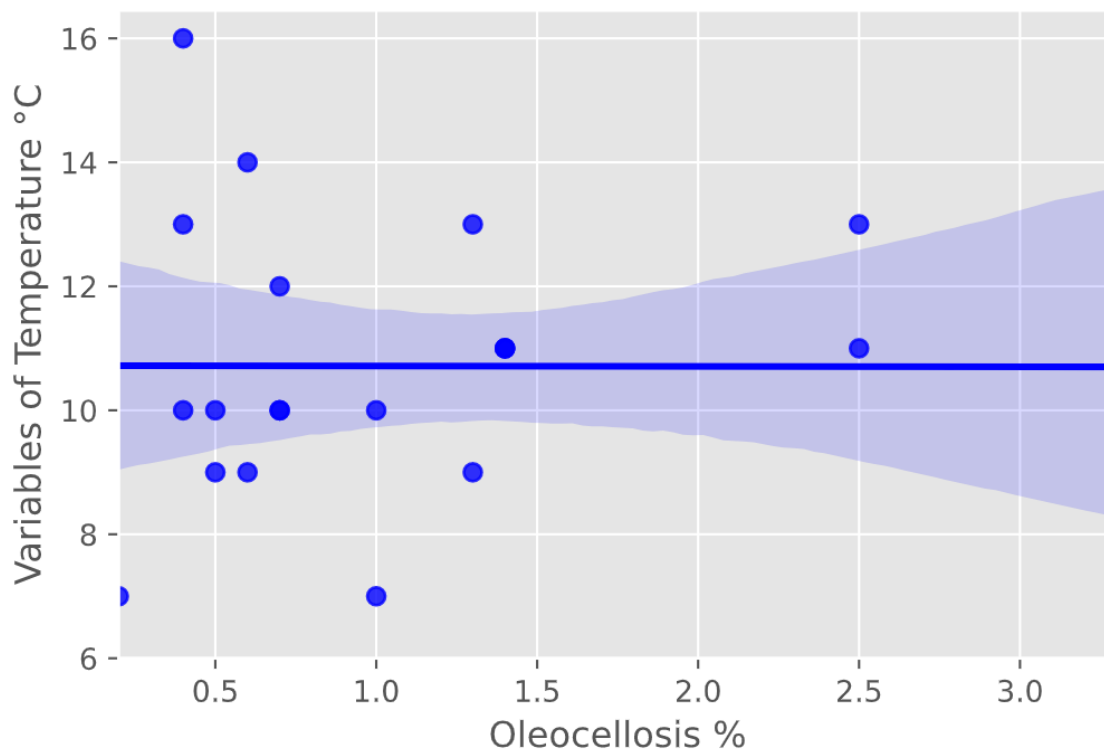


Figure 3. Regression plot of Correlation between Variables of Temperature and Oleocellosis

The regression plot shows none correlation, and the Pearson indicator also shows the same result (Correlation Coefficient close to 0 and P-value close to 1). There is no any relationship between Oleocellosis and Temperature Variables. The box plot presents an indistinct result.

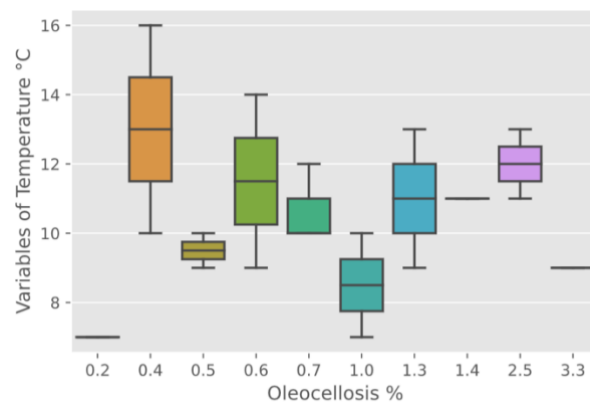


Figure 4. Box plot of Temperature Variables feature

### 3.3 Relationship between Oleocellosis and Rainfall

Refer to the temperature (3.1) and humidity (3.4), the weather of the citrus harvest time is scorching and humid, called a wet season. Envisage our skin pores when we are in a hot shower, we get better clean with the warm water, so the rain for the citrus may work the same that minimize the oil on the rind? or the warm water could explode cells or spread the burst oil on the rind?

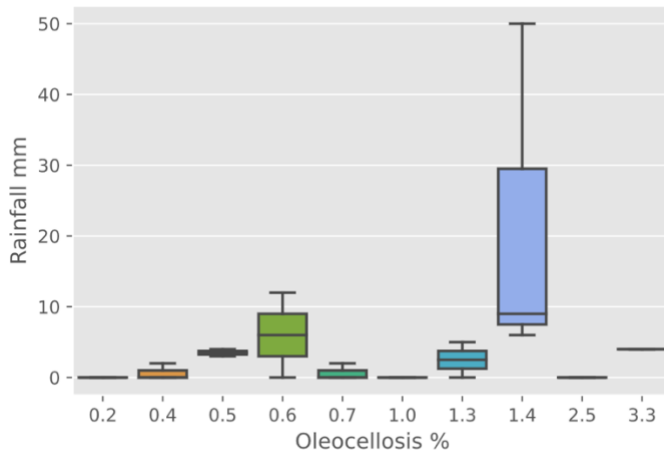


Figure 6. Box plot of Rainfall feature

The regression plot shows a weak positive correlation, and the Pearson indicator also shows the same result (Correlation Coefficient=0.10 and P-value=0.66). There is a weak relationship between Oleocellosis and Rain. The box plot indicates the same as more the rainfall may cause the higher

oleocellosis.

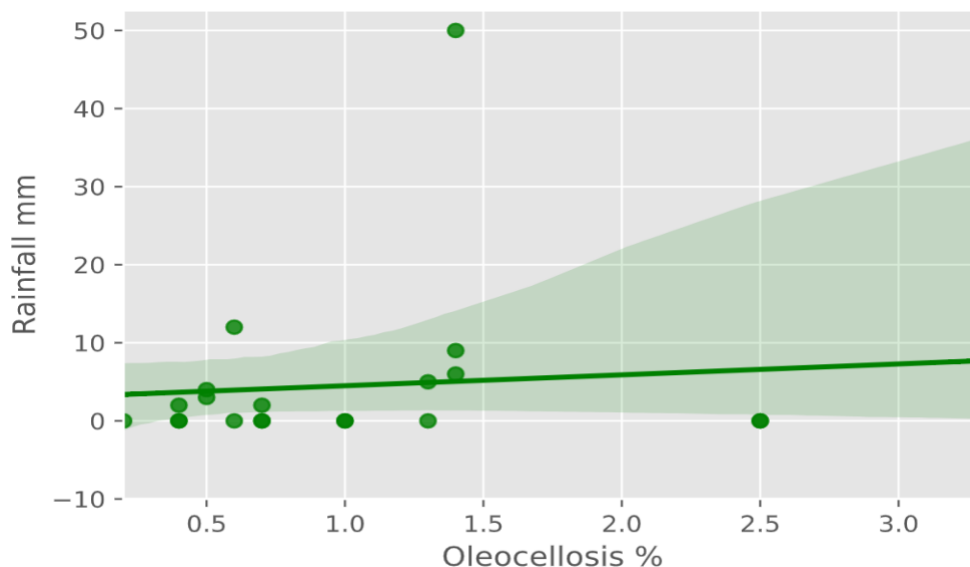


Figure 5. Regression plot of Correlation between Rainfall and Oleocellosis

### 3.4 Relationship between Oleocellosis and Humidity

There is no doubt that humidity and rain have a strong relationship, but just like the previous example that shower like rain, sauna just like the humidity, when our skin pores widely open because of the warm steaming air in the sauna, we can image there can be some reactions happened in between.

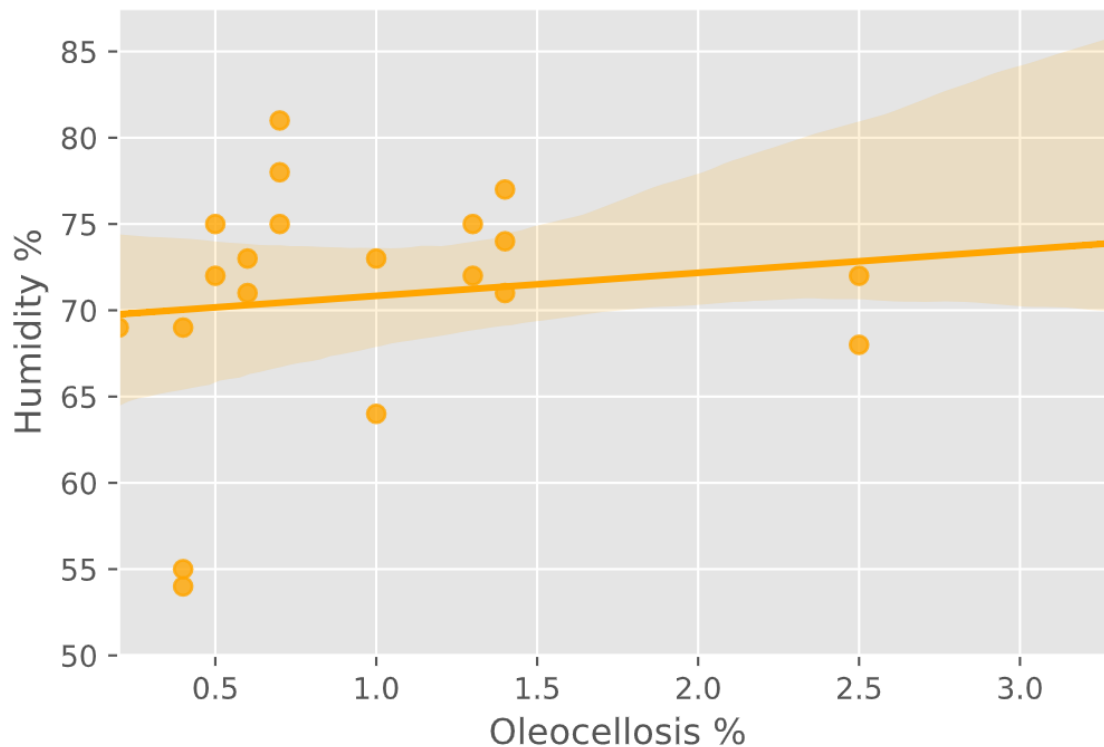


Figure 7. Regression plot of Correlation between Humidity and Oleocellosis

The regression plot shows a slightly weaker positive correlation than rainfall, making sense that there will be some similarity by the strong relationship between the two features. The Pearson indicator also shows the same result (Correlation Coefficient=0.16 and P-value=0.48). There is a weak relationship between Oleocellosis and Rain. The box plot indicates the same as higher humidity the worse oleocellosis.

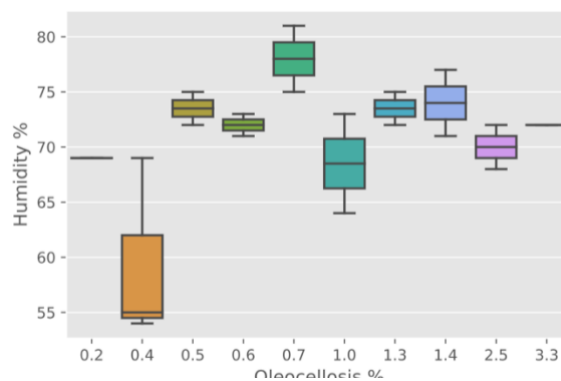


Figure 8. Box plot of Humidity feature

## IV. CONCLUSION SECTION

In this study, I analyzed the relationship between the weather and the citrus fruit defect of oleocellosis. I identified a weak relationship between temperature, rainfall and humidity to the problem; please refer the summary Table 2. One discovery the affection of temperature was developed opposite of the rainfall and humidity, which is very interesting for the citrus oleocellosis defect improvement. However, the datasets were quite small; I highly recommend collecting more data for further improvement and exploration.

Feature	Correlation Coefficient	P-value	Relationship	Box Plot
Weather Temperature	-0.18	0.41	WEAK negative correlation	HIGHER temperature the LOWER oleocellosis
Variables of Temperature	0.00	1.00	NO correlation	Similarity and Indistinctly
Rainfall	0.10	0.66	WEAK positive correlation	MORE rain HIGHER oleocellosis
Humidity	0.16	0.48	WEAKER positive correlation	HIGHER humidity WORSE oleocellosis

Table 2. Correlation summary

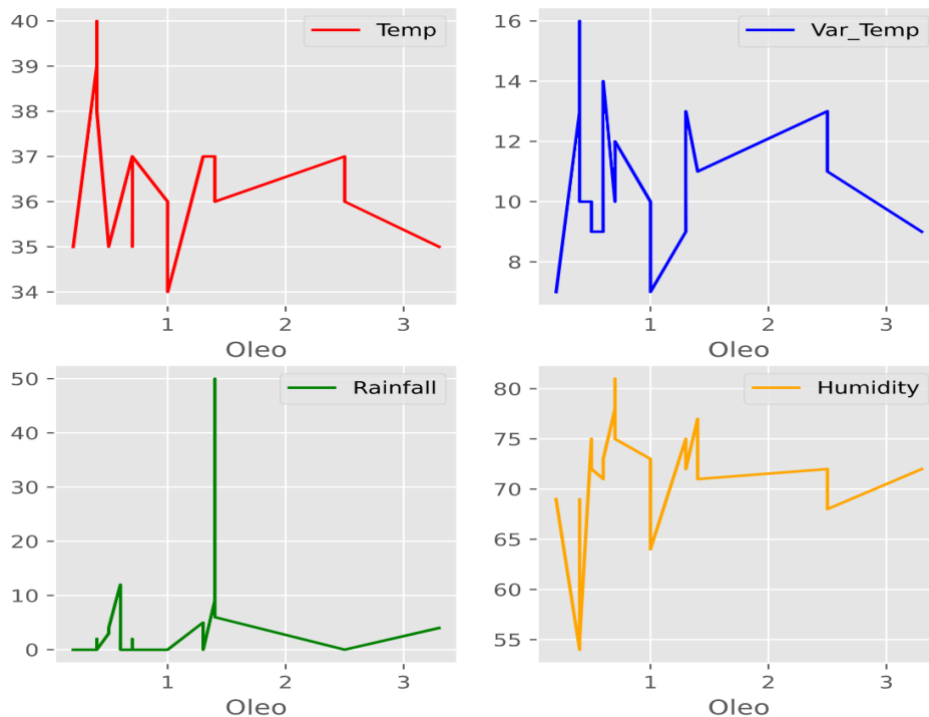


Figure 9. Multiple line plots between the Features and Oleocellosis



## V. CONCLUSION SECTION

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This report with a deeper analysis potential, because there were only 21 datasets from 2020. I knew some people might wonder that we could not change the weather condition. Especially, nature does their own works, why should we know the correlation because it helps develop solutions. Example: For the stakeholders, it may help them create a growth regulator for minimizing cell sensitivity. For the grower, it may help adjust the grow and harvest period for maximizing profit. Overall, I hope this report is helping.

## VI. REFERENCE

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Nutrano

<https://nutrano.com.au>

The Nature of Oleocellosis in Citrus Fruits

<https://www.journals.uchicago.edu/doi/abs/10.1086/337773?journalCode=botanicalgazette>

Citrus Oleocellosis

<https://www.ncbi.nlm.nih.gov>

Thank you for the reading, if any question please contact me, my email is  
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