A COMPARATIVE STUDY ON THE SWEETNESS OF MANGOES IN DIFFERENT MANGO-GROWING-AREA IN THE PROVINCE OF ILOILO

A research paper submitted to

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In fulfillment of the requirements in Science

Research II

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ABSTRACT

This study was conducted with the primary objective of comparing the sweetness of mango fruits in different mango growing areas in the Province of Iloilo.

Mangoes tested were gathered from the following towns: Barotac Viejo, Guimbal, Miag-ao, San Dionesio, San Joaquin, Alimodian, Leon and Tubungan. Some fruits were gathered using a net while others were freshly picked from their trees. The degree of sweetness was obtained using refractometer, a device that measures sugar content of fruits and vegetables in degrees known as "Brix".

Results showed that the sweetness of mangoes in the eight municipalities ranged from 15.772 to 21.412 Brix. mangoes gathered from Leon have a sweetness of equivalent to 21.412 Brix. The excellent degree brix reading of fruits from the municipality of Leon shows that this town produces the sweetest mango fruit.

This research paper entitled "A COMPARATIVE STUDY OF THE SWEETNESS OF MANGOES IN DIFFERENT MANGO-GROWING AREAS IN THE PROVINCE OF ILOILO" submitted by Erle Joyce Lope and Ester Estapon in fulfillment of the requirements in Science Research II has been examined and recommend for acceptance and approval.

2/28/02
Date

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This research paper is accepted and approved in fulfillment of the requirements in Science Research II.

Date

Prof. Rebecca V. Yandog
PSHSWV Director

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Chapter I

INTRODUCTION

A. Background of the Study

Mango has been a part of every Filipino's diet, being the national fruit of the country. This is one of the many commercial crops, which helps a lot in uplifting the economy of our country. The fruit has a great potential for export and people who engaged in mango business considered it profitable. The fruit is mainly eaten as fresh commodity as well as processed products. Buyers would tend to buy sweet and nutritious mango fruits and buy less if otherwise.

In different mango-growing areas, the researchers determined which mango growing area produces the sweetest mango fruit.

B. Statement of the Problem

This paper answered the following questions:

1. Is there any difference on the degree of sweetness of mangoes in different mango growing areas in the Province of Iloilo?

2. Which mango-growing-area in the Province of Iloilo produces the sweetest mango fruit?

C. Objectives of the Study

This study was conducted with the following objectives:

1. to compare the sweetness of mango fruits from different areas in the Province of Iloilo; and
2. to determine which mango growing area in the Province of Iloilo produces the sweetest mango fruit.

D. Hypothesis of the Study

It was hypothesized that there is a significant difference among the sweetness of mango fruits from different mango growing areas in the Province of Iloilo.

E. Significance of the Study

Mangoes are essential in the Filipino diet. As we all know, the consumers usually choose to buy sweet and nutritious mango fruits. Aside from this, people engaged in mango business will be able to determine and sell or use mango fruits that are sweet and has a high nutritional

content. Through this, the consumers would be assured to have fresh, sweet, and nutritious mango fruits. This study gave the producers as well as the consumers the knowledge in which place should we choose to buy mango fruits

Since this is the first study conducted concerning on the sweetness of mango fruits in different areas in the Province of Iloilo, this could serve as a guide on future researchers. This could possibly encourage them in conducting more researches regarding this.

F. Definition of Terms

sucrose- any one of the group of carbohydrates including cane sugar, milk sugar, maltose, etc., having the common composition $C_{12}H_{22}O_{11}$

commodity- something bought and sold

refractometer- any instrument for measuring indices of refraction

extract- to draw or pull out of by force

puree- a thick pulp, usually of vegetables, boiled and strained

dehydrate- to deprived of water

immunity- exemption from contagion or infection or from liability to suffer from epidemic or endemic disease

G. Scope and Limitation

This study was conducted to compare the sweetness of mangoes from different mango growing area in the Province of Iloilo. Places outside the Province of Iloilo were not included in the study. Also, this study focuses on the comparison of the sweetness of mango fruits.

Chapter II

REVIEW OF RELATED LITERATURE

A. Mango

Mangifera indica L., one of the most celebrated of tropical fruits, is a member of the family Anacardiaceae.

The mango tree is erect, 30 to 100ft(roughly 10-30m) high, with a broad, rounded canopy which may, with age, attain 100 to 125ft(30-38m) in width, or a more upright, oval, relatively slender crown. While the mango fruits have great variation in the form, size, color and quality of the fruits. They may be nearly round, oval, ovoid-oblong, or somewhat kidney-shaped, often with a break at the apex, and are usually more or less lop-sided. The Provincial Planning Development Office Province of Guimaras recorded that these fruits range from 2½ to 10 in (6.25-25cm) in length and from a few ounces to 4 to 5 lbs.(1.8-2.26kg). The skin is leathery, waxy, smooth, fairly thick, aromatic and ranges from light-or dark-green to clear yellow, yellow-orange, yellow and reddish-pink, or more or less blushed with bright-or dark-red or purple-red, with fine yellow greenish or reddish dots, and thin or thick whitish, gray or purplish bloom, when fully ripe. Some have "turpentine" odor and flavor, while others are richly and pleasantly

fragrant. The flesh ranges from pale-yellow to deep orange. It is essentially peach-like but much more fibrous (in some seedlings excessively so-actually "stringy"); is extremely juicy, with a flavor range from very sweet to subacid to tart. There is a single, longitudinally ribbed, pale yellowish-white, somewhat woody stone, flattened, oval or kidney-shaped, sometimes rather elongated. It may have along one side a beard of short or long fibers clinging to the flesh cavity, or it may be nearly fiberless and free. Within the stone is the starchy seed, monoembryonic (usually single-sprouting) or polyembryonic (usually producing more than one seedling.

The mango tree is not too particular as to soil type, providing it has a good drainage. Rich, deep loam certainly contributes to maximum growth, but if the soil is too rich and moist and too well fertilized, the tree will respond vegetatively but will be deficient in flowering and fruiting. The mango performs very well in Sand, gravel, and even ooloitic limestone.

Mangoes normally reach maturity in 4 to 5 months from flowering fruits of "smudged" trees ripen several months before those of untreated trees. Experts in the Philippines

have demonstrated that "Carabao" mangos sprayed with ethephon (200 ppm) 54 days after full bloom can be harvested 2 weeks later at recommended minimum maturity (Provincial Planning Development Office, 1996-2001). The fruits will be larger and heavier eventhough harvested 2 weeks before untreated fruits. If sprayed at 68 days after full bloom and harvested 2 weeks after spraying, there will be an improvement in quality in regard to soluble solids and titratable acidity. When the mango is full-grown and ready for picking, the stem will snap easily with a slight pull. If a strong pull is necessary, the fruit is still somewhat immature and should not be harvested. The more or less red types of mangos, an additional indication of maturity are the development of a purplish-red blush at the base of the fruit. Falling causes bruising and spoiling. When low fruits are harvested with clippers, it is desirable to leave a 4-inch (10cm) stem to avoid the spurt of milky/resinous sap that exudes if the stem is initially cut close. Washing the fruits immediately after harvest is essential, as the sap, which leaks from the stem, bums the skin of the fruit making black lesions, which lead, to rotting. (Provincial Planning Development Office, Province of Iloilo, 1996-2001)

B. Refractometer

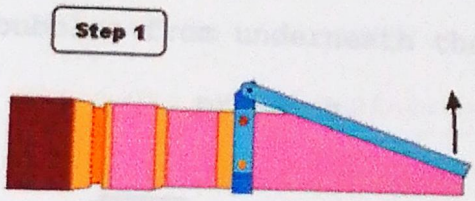
Refractometer is a device used to measure the nutritional content of food. This device is a wonderful aid to both consumers and farmers. Consumers can use the refractometer to maximize the nutritional content of the food they purchase. Farmers can use the refractometer to grow healthier crops that resist insects and disease, thereby making the use of toxic chemicals in agriculture unnecessary. This device works on the principle of light bending when it passes from air into water. Due to dissolved sugars, minerals and other nutrients in fruit and vegetable juices, they are denser than water and bend light more. The amount light bends is measured in degrees "Brix". There are values of degrees Brix for each fruit and vegetable ranging from poor to excellent. According to Gupter (1990), the excellent level generally gives the plant immunity to disease and insects, and creates health in animals and people. These plants also have increased frost resistance, and improved storability because they will dehydrate rather than rot.

Use of a refractometer leads to organic farming, because a high Brix level in plants creates increased resistance to disease and pests, reducing the need for

pesticides and other chemicals (Gautam, 1994). Also, Thapa reported that the most effective means to increase Brix readings is to add nutrients such as trace minerals and humus to the soil (1994). Soil with high humus content has a structure, which holds moisture, helping plants through drought, resisting erosion, and reducing run-off after storms and in the spring. Unlike chemical agriculture which destroys soil, organic farming has as its basis the care and nourishing of the soil. By demanding excellent Brix readings, consumers will establish both sustainable agriculture and superior health.

HOW TO USE A REFRACTOMETER TO TEST BRIX LEVELS

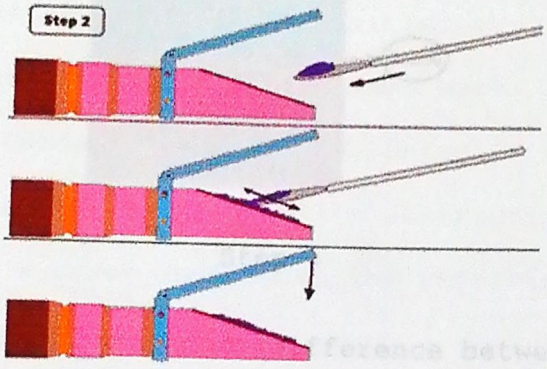
Brix is the measure of % sugar in a given sample. The instrument, which is used to measure Brix, is called a refractometer.



Step 1

Expose the refractometer-measuring surface by lifting the surface cover. Inspect the surface to ensure it is clean.

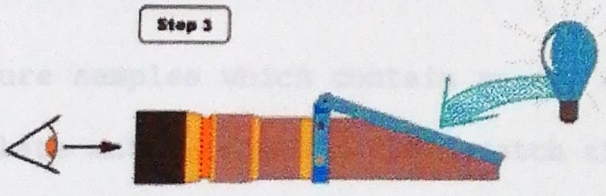
If needed, clean the surface by spraying it with distilled water, and wiping it dry with a kimwipe or delicate cloth. Be careful not to scratch the measuring surface.



Step 2

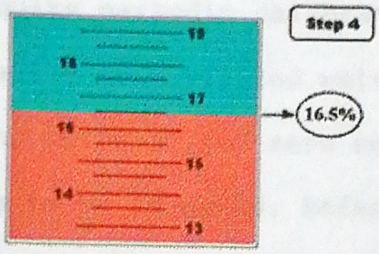
Carefully place a drop of the sample being measured onto the measuring surface. Use a rubber spatula or rod if possible (metal may scratch the prism surface and impair readings).

Spread the sample in a thin and even layer over the measuring surface. Replace the surface cover. Remove any trapped air bubbles from underneath the cover by gently pressing.



Step 3

Look through the eyepiece while holding the refractometer up to a light source.



Step 4

Read where the contrast line (difference between light and dark areas) crosses the scale. Record the Brix value.

Brix: The reading is taken through the refractometer eyepiece. A light source is needed to illuminate the scale (step 3). The value is read at the point where the contrast line crosses the scale (step 4).

Note:

* If the sample is very opaque it may be necessary to measure the juice/syrup from the sample. To do these simply place a drop of the sample onto a piece of filter paper and press the juice/syrup onto the measuring surface.

* Do not measure samples which contain seeds, grains, or other particulate matter which could scratch the measuring

surface. To measure such samples, filter out the juice/syrup as described above.

* Refractometers require periodic calibration. This is done by taking a Brix reading on distilled water. The contrast line should cross the scale at the zero mark. If it does not, the scale needs to be adjusted. Refer to the specific refractometer manual for calibration instructions (in most cases, there is a screw located on the refractometer body which will adjust the scale).

• Clean the refractometer after each measurement using distilled water. Dry it carefully using delicate cloth.

C. Brix

Within a given species of plant, the crop with a higher refractive index will have a higher sugar content, higher mineral content, higher protein content and a greater specific gravity or density. This adds up to a sweeter tasting, more minerally nutritious food (maximum nutritional value) with a lower nitrate and water content and better storage characteristics and it will produce more alcohol from fermented sugars and be more resistant to insects, thus resulting in decreased insecticide usage. Thapa (1993) reported that for resistance to insects,

maintain a Brix of 12 or higher in the juice of the leaves of any plant because crops above this value are usually not bothered by insects or diseases, so the produce will be fit for human and animal consumption according to the law of natural selection. Also if an item reads greater than 12, and if the distinction be between the two colors in the field of view is unclear and difficult to pinpoint, it is an indication that this relatively high in calcium, a desirable condition. Crops with a higher sugar content will have a lower freezing point & therefore be less prone to frost damage (Shrestha, 1992).

C. Topography of the Province of Iloilo

In Iloilo, mango is one the fruit that Ilonggos love to eat. Mango is also one of the tropical fruit that our place produces. The topography, climate and rainfall, soil types, water resources of a particular place affect the production of mangoes.

Research and Statistics Section reported that the topography of Iloilo varies from flat lands to rolling hills to mountain peaks and ranges (2001). A chain of mountains runs from the southwest to the Northwest portion along the border between Iloilo and Antique. Almost one-third of the entire province is considered flat, with a

slope of zero to three percent, which is dominant among the northern and southern coastal towns. About one-fourth of the total area ranges from 8.1-15% especially in the central municipalities or those near the mountains that separates Iloilo from other provinces of Panay. The municipalities along these mountain ranges have a slope of more than 35%.

The province of Iloilo has a combination of Type I and type III climate (Research and Statistics Section, 2001). Dry from December to June and wet from July to November for the municipalities of San Joaquin, Miag-ao, Guimbal, Tubungan, Igbaras, Tigbauan, Oton, Leon, Alimodian, San Miguel, Maasin, Sta. Barbara, Cabatuan, and parts of Janiuay, New Lucena, Zarraga, Leganes, and Iloilo City, as well as parts of Pototan and Dingle. The towns of Dumangas, Barotac Nuevo, Anilao, Barotac Viejo, Banate, Ajuy, Sara, Lemery, Concepcion, San Dionisio, Batad, Balasan, Estancia, Carles, parts of the municipalities of Pototan and Dingle, and clusters of islands of the northeastern part of Iloilo have no very pronounced maximum rain period, with dry season only from the first to third months.

There are 18 different types of soil in the province of Iloilo based on their genetic and morphological

characteristics. Generally, the province's soil is fertile which is suitable to most types of agricultural crops (Iloilo Provincial Planning Development Office, 1996-2001). Predominance of loam classification makes it conducive to farming.

Chapter III

METHODOLOGY

A. Materials

- Refractometer
- Knife
- Tissue paper
- Labelling material
- Distilled water

B. Gathering of Mangoes

This study was conducted to determine which mango-growing area in the Province of Iloilo produces the sweetest mango fruit. Different mangoes were collected from different areas namely Balasan, Banate, Sara, Guimbal, Tubungan, San Joaquin, Pototan, New Lucena, Cabatuan, Sta. Barbara, Leon, Tigbauan. At least five mango fruits were collected from each town. Fruits that are 118-120 days were gathered and were tested after five to seven days. All sample fruits tested should attain 100% yellow in color to have the needed degree of ripeness.

C. Experimental Proper

Testing was conducted at the Philippine Science High School Western Visayas Campus' laboratory. Fruit samples were sliced into five parts. Then, the fruit juice was extracted from each test fruit. Small amount of fruit juice was dropped on the refractometer's lens. Refractometer was viewed for the reading. The reading of the sweetness of the fruit was monitored and recorded. There are five readings per fruit sample. The fruit extract was then wiped out of the glass of the refractometer. The instrument was again prepared for the next fruit sample.

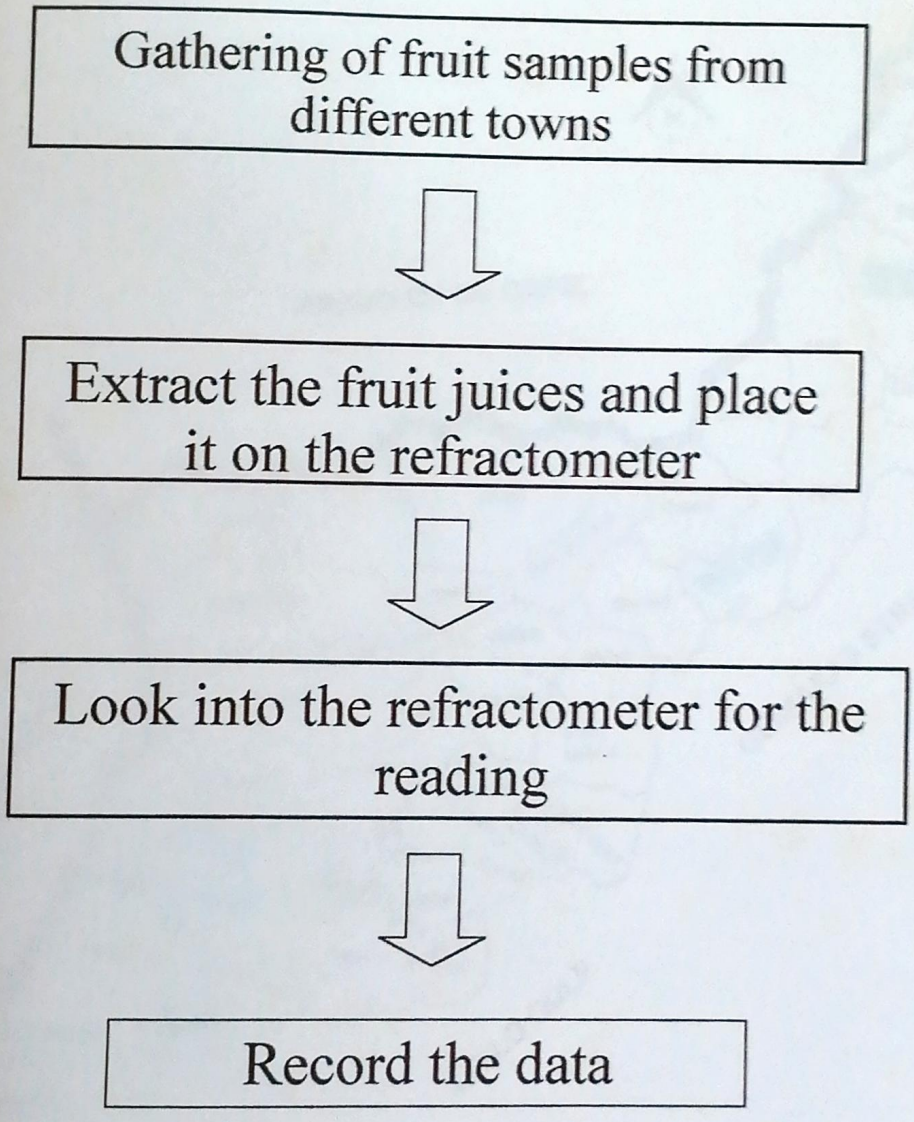


Figure 1. A flowchart of the procedures followed during the experiment

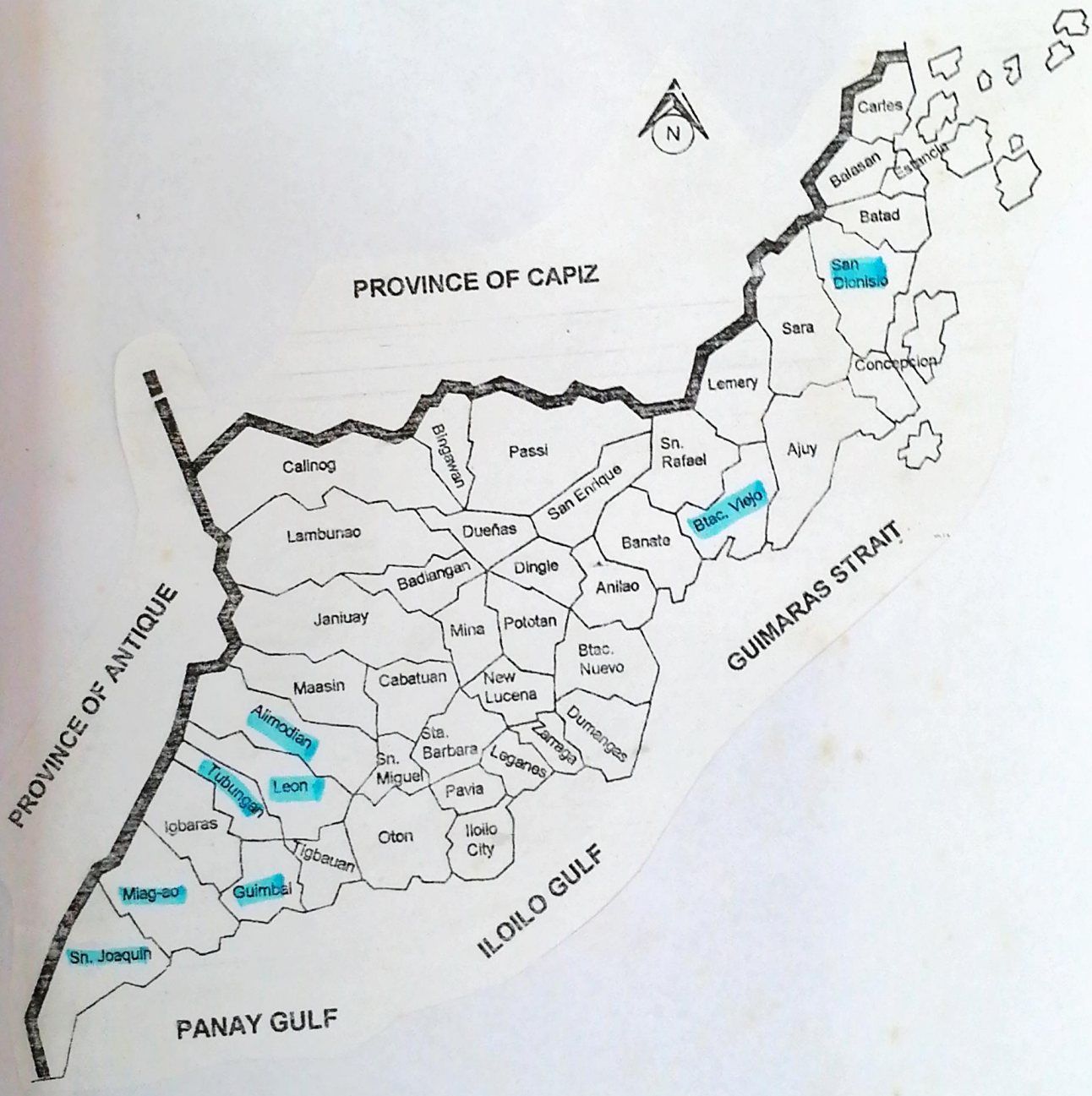


Figure 2. Map of the Province of Iloilo we used during the gathering of fruit samples.

Plate 1. Gathering of mango fruits to be tested.

Plate 2. Wait for the ripening of the mango fruit.

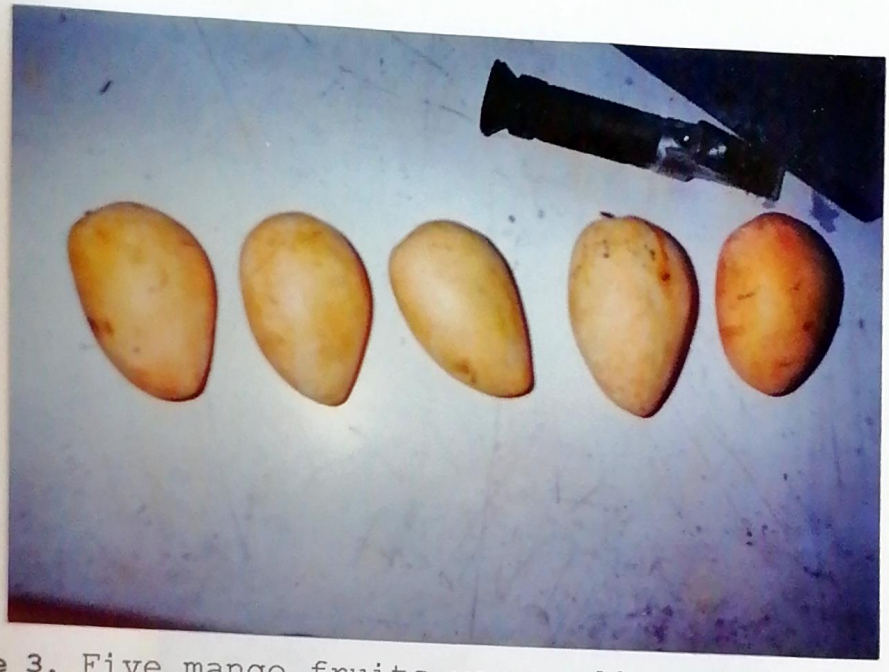


Plate 3. Five mango fruits were collected from each town.

Plate 4. The fruit juice was extrated and dropped into the refratometer.

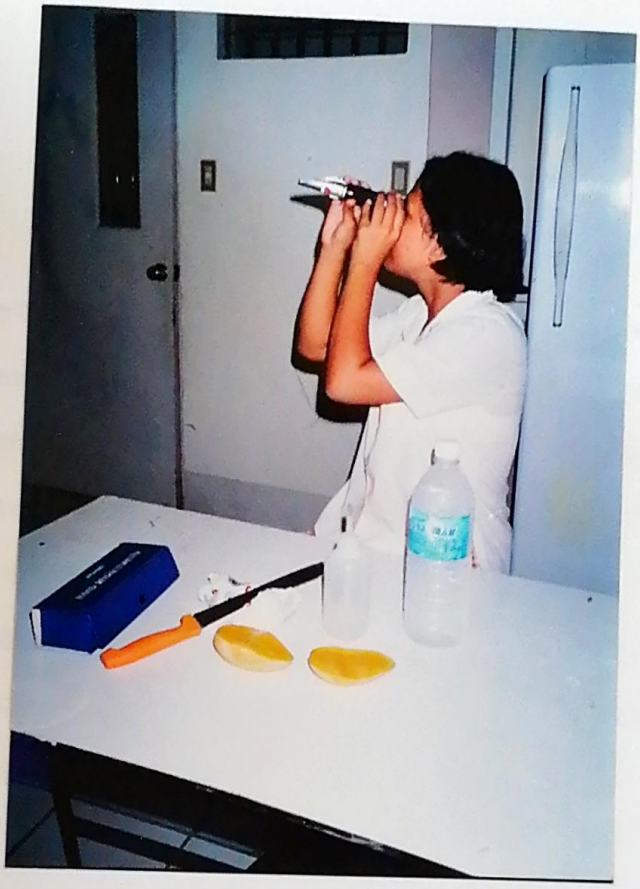


Plate 5. Look into the refractometer for the reading.

Chapter IV

RESULTS AND DISCUSSION

A. Results

This study tried to compare and determine which mango growing areas in the province of Iloilo produces the sweetest mango fruit. The results were obtained by using a hand refractometer (Brix) which determines the concentration of sucrose dissolved in water.

The table below shows the data and results. Values presented are means of twenty-five trials on five fruit samples.

Table 1. Comparative study of the sweetness of mango from eight different towns in terms of Brix. Values are means of twenty-five determinations.

Sample (towns)	Mean (brix)
Barotac Viejo	20.688
Guimbal	17.472
Miag-ao	19.384
San Dionesio	15.772

San Joaquin	17.558
Alimodian	18.46
Leon	21.412
Tubungan	16.66

It is determined, by looking at the table, that the mango fruits from Leon are the sweetest mango fruit, which has a reading of 21.412 Brix. It is followed by mango fruits from Barotac Viejo that have a value of 20.688 Brix. Next is from the town of Miag-ao that has a reading of 19.384 Brix, while Alimodian has a reading of 18.46 Brix. San Joaquin's mango fruits have a value of 17.558 while that of Guimbal has a value of 17.472 Brix. Mango fruits from Tubungan has a value equivalent to 16.66 Brix. while San Dionesio produces the least sweet mangoes among the eight towns which has a reading of 15.772 Brix.

B. Discussion

Studies also reveal that high level of Brix, such as that of Leon, gives the plant immunity to disease and insects, creates health in animals and people due to greater nutritional content. The fruits also have increased frost resistance, and improved storability because they will dehydrate rather than decay (Gupter, 1990).

Chapter V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

A. Summary

Using the hand refractometer, it was found out that there is indeed a significant difference on the degree of sweetness of the mango fruits in the different mango growing areas in the Province of Iloilo. Based on the results, Leon produces the sweetest mango fruit as compared to seven other towns. Mango fruits from this place has a sweetness of 23.412 Brix. This also indicates that these fruits have high nutritional content.

B. Conclusions

Comparing the differences of the sweetness of mango fruits through the means, the researchers concluded that Leon's mango fruits is the sweetest of all. In addition, these were also the most nutritious mango fruit in the Province of Iloilo. Indeed, there is a difference in the sweetness of mango fruits harvested from different locations. It is assumed that the management plays an important role in order to have an excellent Brix reading.

C. Recommendations

It is recommended that for the betterment of this study, the researchers must know all the factors that may affect the mango fruits. Environmental conditions of a particular place can greatly affect the fruits. It is also recommended that we must ask the person in charge of taking good care of the mango fruits to know their techniques in the fruits. Fertilizers used can also affect the degree of sweetness of the fruit. The harvesting process and the age of the mango fruit to be harvested is also important to consider in doing this study.

APPENDICES

Table 2. Results in degree Brix obtained from Barotac Viejo using the refractometer, a devise used to measure the nutritional content of food.

Samples	1	2	3	4	5
S1	21.4	21.5	22	20.2	20
S2	20.6	19.5	20.2	20.7	20.5
S3	21.2	20	20.8	21.1	21
S4	21.8	21	21.1	20.1	20.8
S5	20.6	20.8	19.8	20	20.3

Table 3. Results in degree Brix obtained from Guimbal

Samples	1	2	3	4	5
S1	16.4	15.8	16.1	16	16.2
S2	18.2	18.5	19.4	19	18.7
S3	15.6	15	15.8	15.2	14.9
S4	17.9	17	17	17.9	18.6
S5	19.9	19.8	19	18	21

Table 4. Results in degree Brix obtained from Miag-ao

Samples	1	2	3	4	5
S1	18.3	18.2	18.6	19.2	18
S2	19.3	18.8	19.2	18.6	18.9
S3	20.3	20	19.8	18.1	17
S4	19.4	19.8	20.3	21	20.5
S5	21	20.8	19.2	20	20.3

Table 5. Results in degree Brix obtained from San Dionesio

Samples	1	2	3	4	5
S1	15.6	16	15	16.1	16
S2	15.6	16.4	16	15.2	16.2

S3	17	15.4	16.6	14.6	15.8
S4	15.6	15	16.4	16	17
S5	16.4	15.2	16	16	16.2

Table 6. Results in degree Brix obtained from San Joaquin

Samples	1	2	3	4	5
S1	18.2	17.8	17.3	18.5	16.9
S2	16.8	17.5	17.3	18	18.2
S3	17	17.2	18.1	16.6	17
S4	17.7	18	18	18.1	17.9
S5	16.6	17.1	18	18.2	17.7

Table 7. Results in degree Brix obtained from Alimodian

Samples	1	2	3	4	5
S1	20.3	20	20.5	21	20.8
S2	19	19.3	20	18.7	20.1
S3	18.2	17.8	17.1	16.5	18
S4	17.8	17.6	16	17.1	16.5
S5	18.2	17	17.7	18.1	18.2

Table 8. Results in degree Brix obtained from Leon

Samples	1	2	3	4	5
S1	21.5	21.4	22	20.5	21
S2	21	20	20.6	20.7	21
S3	21.1	20.5	20.7	21.3	21.6
S4	21.5	21	20.3	21.5	20.7
S5	20.7	22.1	19.6	20	20.5

Table 9. Results in degree Brix obtained from Tubungan

Samples	1	2	3	4	5
S1	16.5	17	17.1	16.8	16.1
S2	17.1	17.5	17.1	16.9	17.3
S3	17.9	18	18.3	17.9	17.5
S4	15.4	16	15.1	15.1	15.9
S5	16.4	16.9	16.8	17	16.2

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