

UNIVERSITY OF THE PHILIPPINES LOS BAÑOS  
INSTITUTE OF COMPUTER SCIENCE

# iTALONG: A Mobile Application for Measuring Eggplant Leaf Dimension using Image Processing

Presented by Maria Teresa L. Pagtanahan

# INTRODUCTION

## EGGPLANT



# INTRODUCTION

## EGGPLANT

First 20 commonly consumed foods and % household consumption in 2008.

Food item	Frequency/ day	% consuming household
1. Rice	2.7	94.7
2. Sugar	1.3	81.1
3. Salt, coarse	1.5	70.5
4. Coconut oil	1.0	64.9
5. Instant coffee	1.1	62.5
6. Garlic	1.1	41.4
7. Breads, including pan de sal	1.4	38.3
8. Onion	1.1	37.8
9. Chicken eggs	1.2	36.4
10. Soy sauce	1.0	30.8
11. Coffee creamer	1.1	24.8
12. Tomato	1.1	24.1
13. Powdered milk, filled	1.1	20.6
14. String beans (sitao)	1.1	20.5
15. Noodles i.e. bihon, etc.	1.3	20.5
<b>16. Eggplant (talong)</b>	<b>1.1</b>	<b>19.1</b>
17. Chocolate milk drink, powder	2.1	18.7
18. Softdrinks	1.5	17.8
19. Instant noodles	1.1	17.5
20. Carrots	1.3	16.3

### Volume of Production (metric tons)

#### Eggplant

<b>Eggplant</b>	<b>235,626</b>
Squash Fruit	214,147
Tomato	210,720
Cabbage	123,080
Onion (mature bulb)	122,594
Stringbeans	117,201
Ampalaya Fruit	87,460
Bottle Gourd/Upo	79,978
Swamp Cabbage/Kangkong	69,649
Carrots	65,987
Pechay, Chinese	50,745
Pechay, Native	46,658
Lady's finger/Okra	30,529

### Area of Production (hectares)

<b>Eggplant</b>	<b>21,038.21</b>
Tomato	10,157.44
Stringbeans	13,754.21
Onion	12,987.73
Squash Fruit	12,901.86
Ampalaya	10,526.07
Cabbage	8,017.89
Bottle gourd/Upo	7,301.55
Pechay, Native	7,155.77
Swamp cabbage/Kangkong	6,425.12
Carrots	4,607.00
Ginger	3,831.48
Lady's finger/Okra	3,688.20
Pechay, Chinese	3,601.38

# INTRODUCTION

## EGGPLANT FRUIT-AND-SHOOT BORER



# INTRODUCTION

## LEAF HOPPER



# INTRODUCTION

## INSTITUTE OF PLANT BREEDING, UPLB



### Development of Improved Eggplant Varieties with New Plant Defense Genes for Multiple Insect Resistance Using Innovative Technologies

**DESIREE M. HAUTEA, Ph.D. Res. Prof. 12**  
**Project Leader / IPB-CAFS**

**Lead Implementing Agency:** University of the Philippines Los Baños (IPB/ICS)  
**Co- Implementing Agency:** University of the Philippines Diliman (NIMBB)  
**Collaborating Agencies:** Univ. of Tsukuba; SEARCA  
**Source of Funds:** PCAARRD-GIA  
**Duration:** July 1, 2019 to June 30, 2020 (Year 2 of 5 Years)  
**As approved Year 2 Budget:** PhP 11,013,923.16 (UPLB); PhP 2,702,490.60 (UPD)  
**Proposed Year 3 Budget:** PhP 4,379,925.60 (UPLB); PhP 854,995.60  
**Total Approved Budget:** PhP 36,688,412.61  
**UPLB Counterpart Budget:** PhP 7,745,768



# INTRODUCTION

## EGGPLANT CHARACTERIZATION



NPGRL CHARACTERIZATION DATA SHEET

ACC. / PHL NO. \_\_\_\_\_

PLOT NO. \_\_\_\_\_

Crop: EGGPLANT Sowing Date: \_\_\_\_\_  
Trpiting Date: \_\_\_\_\_

PHL No: \_\_\_\_\_  
Species: \_\_\_\_\_  
Location: \_\_\_\_\_

**A. SEEDLING DATA**

1. Number of days to 50% germination \_\_\_\_\_

*Descriptor Numbers 2-7  
Data to be taken at 7-10 days from sowing or when first true leaves have emerged.*

2. Anthocyanin coloration of hypocotyl \_\_\_\_\_

0 Absent  
1 Present

3. Intensity of anthocyanin coloration of hypocotyls \_\_\_\_\_

1 Very weak  
3 Weak  
5 Intermediate  
7 Strong  
9 Very strong

4. Cotyledonous leaf color \_\_\_\_\_

3 Green                    5 Light violet  
7 Violet                    9 Mixture

5. Cotyledonous leaf length (mm) \_\_\_\_\_

6. Cotyledonous leaf width (mm) \_\_\_\_\_

7. Cotyledon length/width ratio \_\_\_\_\_

**B. VEGETATIVE DATA**

1. Plant growth habit \_\_\_\_\_  
*(To be taken when majority of plants have flowers buds)*

3 Upright  
5 Intermediate  
7 Prostrate  
9 Mixture

2. Plant height (in cm, at flowering stage)  
*To be taken from base of plant to tip of last emerging shoot* \_\_\_\_\_

3. Plant breadth (cm, at flowering stage)  
*To be taken at widest breadth of canopy* \_\_\_\_\_

4. Plant branching  
*(Number of primary branches per plant)* \_\_\_\_\_

1 Very weak (2)  
3 Weak (5)  
5 Intermediate (10)  
7 Strong (20)  
9 Very strong (>30)

5. Stem anthocyanin coloration \_\_\_\_\_

0 Absent  
1 Present

6. Stem intensity of anthocyanin coloration \_\_\_\_\_

1 Very weak  
3 Weak  
5 Intermediate  
7 Strong  
9 Very strong

7. Stem pubescence \_\_\_\_\_

3 Weak  
5 Medium  
7 Strong

**Leaf Data : Descriptors 8-18**  
*Mature leaf sample to be taken at primary stem, middle portion or at 3<sup>rd</sup> to 4<sup>th</sup> node from tip of stem.*

8. Petiole color \_\_\_\_\_

1 Green  
3 Greenish purple  
5 Purple  
7 Dark purple  
9 Dark brown  
11 Mixture

# INTRODUCTION

## LIMITATIONS

## LEAF DIMENSION



iTALONG



for measuring eggplant leaf  
dimension

START

**MAIN OBJECTIVE**  
**TO AUTOMATE THE MEASURING**  
**OF THE LEAF DIMENSION**

iTALONG

**ADD ENTRY**



Add a single entry per character

**SEARCH ENTRY**



Search a single entry, View all entries

**EXPORT RECORDS**

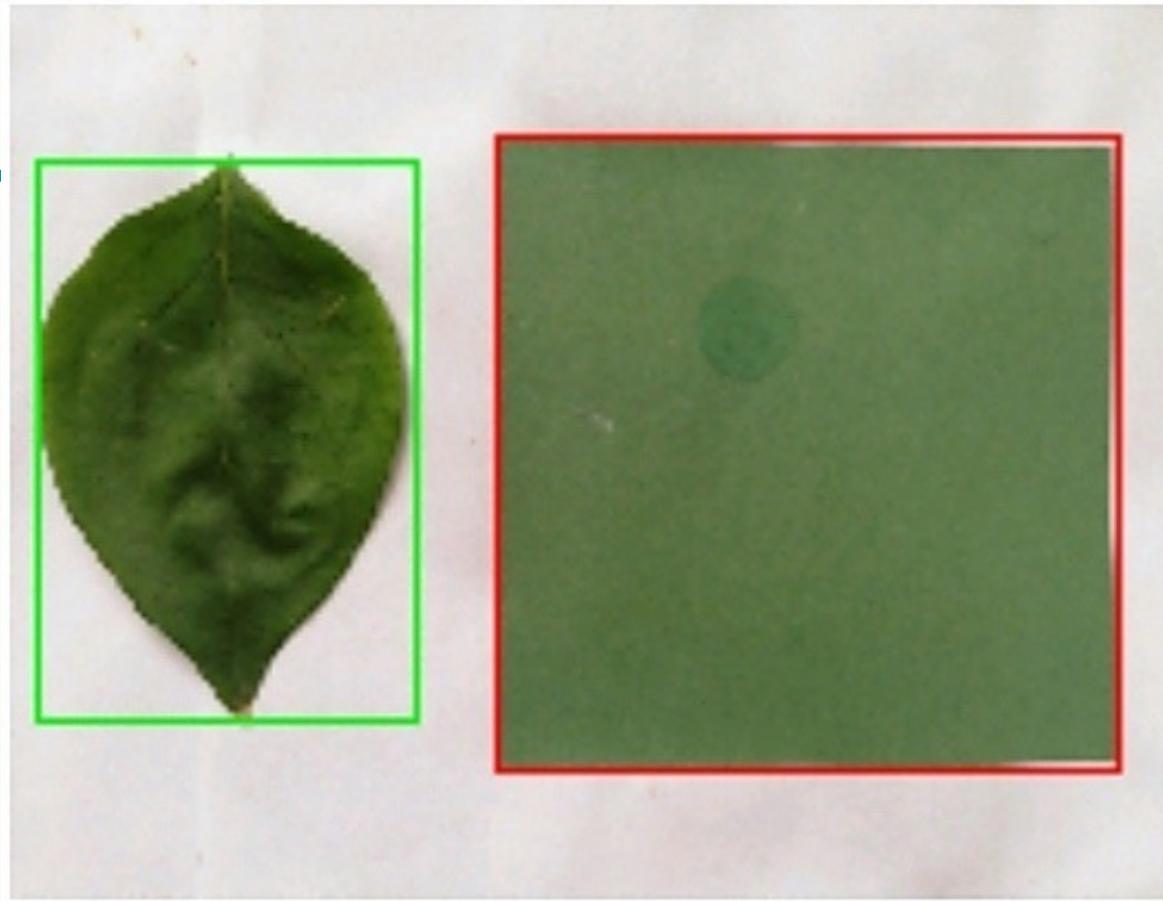


Outputs .csv file

**CLEAR ALL RECORDS**



**SPECIFIC OBJECTIVES  
ANDROID APP**



## SPECIFIC OBJECTIVES

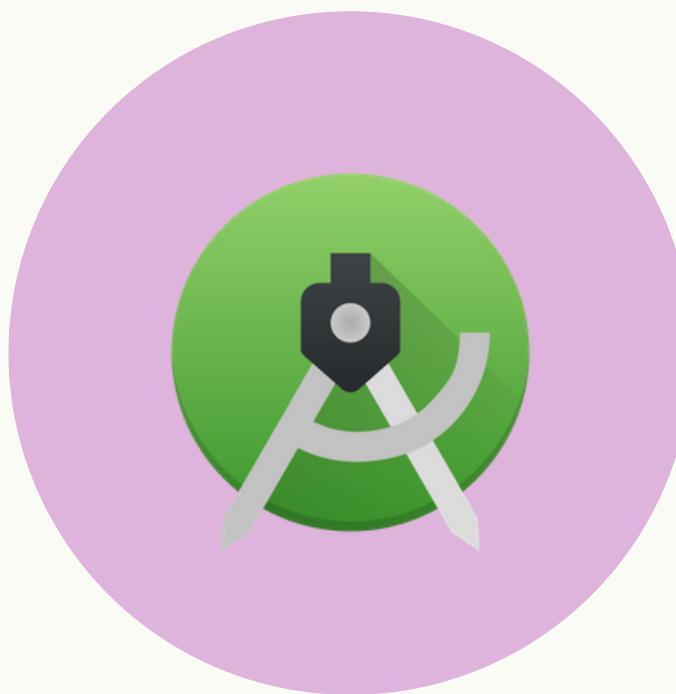
### IMAGE PROCESSING



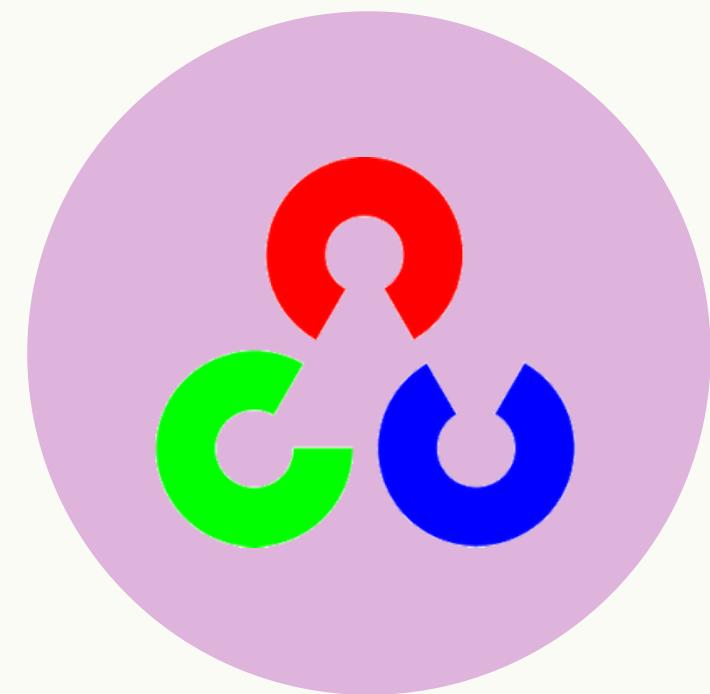
# SPECIFIC OBJECTIVES

## TEST & VERIFY

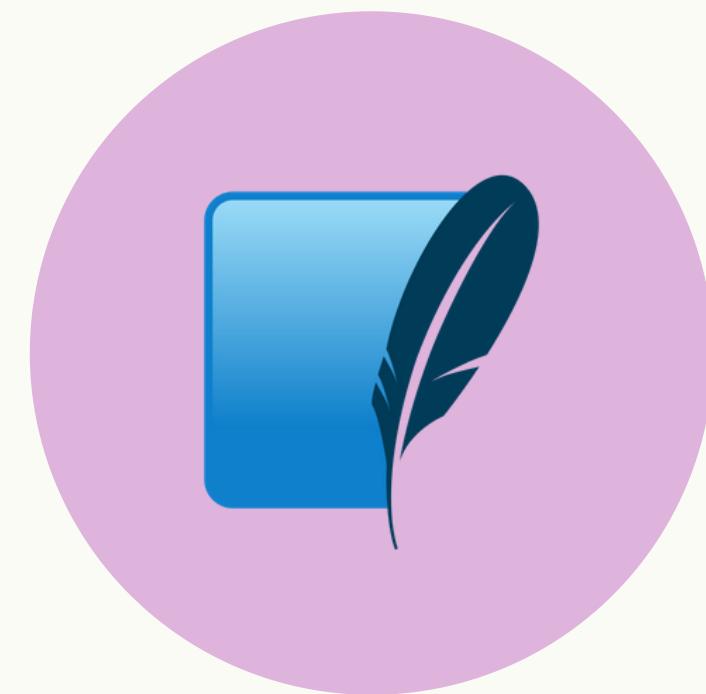
# MATERIALS & METHODOLOGY



Android Studio



OpenCV

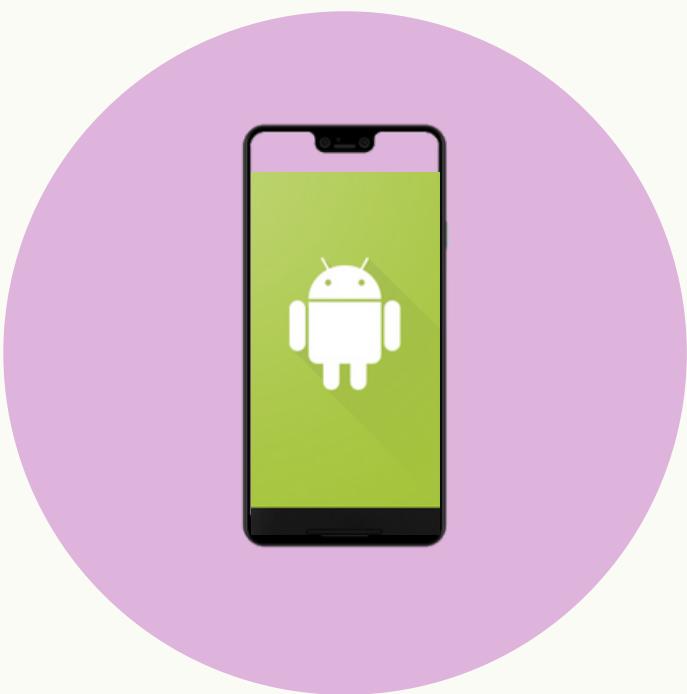


SQLite

# MATERIALS & METHODOLOGY



Laptop

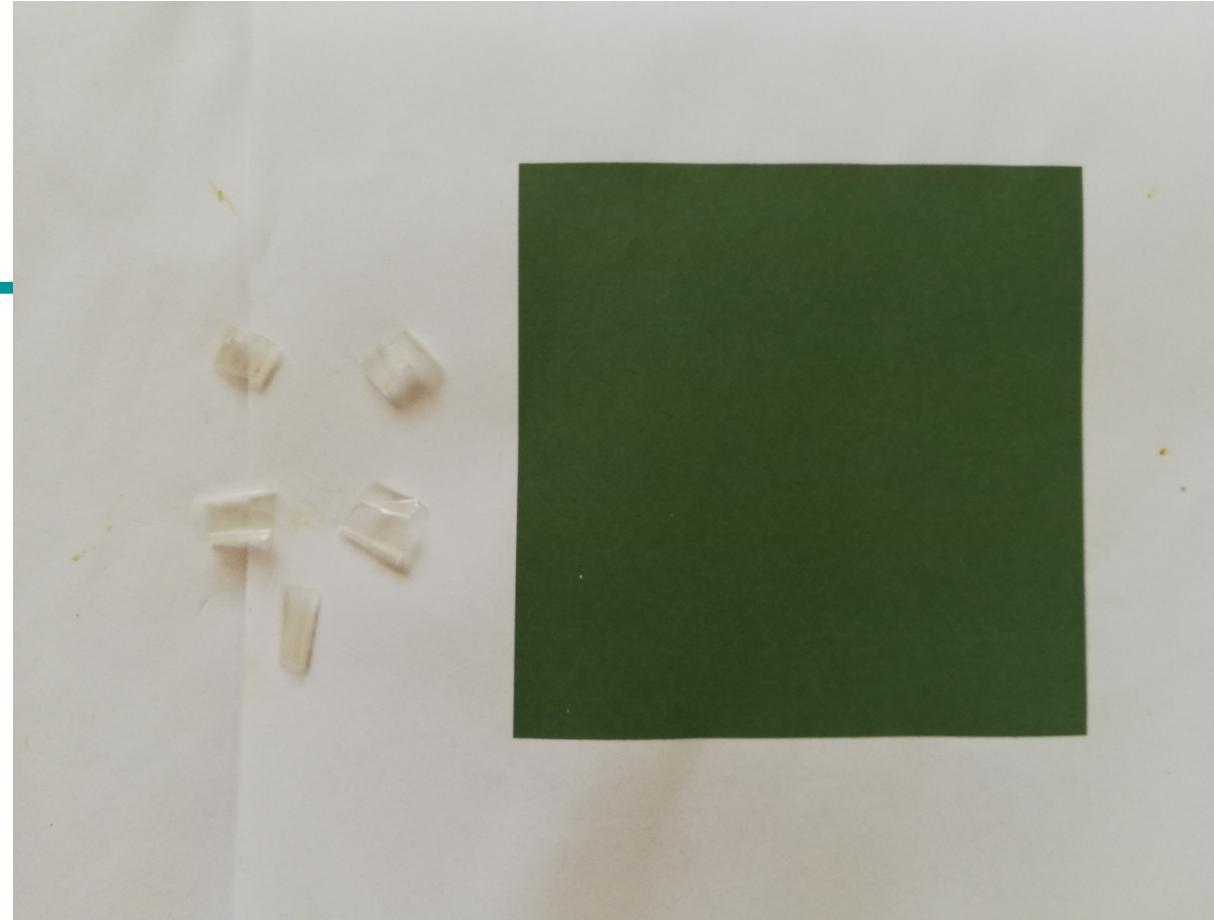


Android device

# MATERIALS & METHODOLOGY

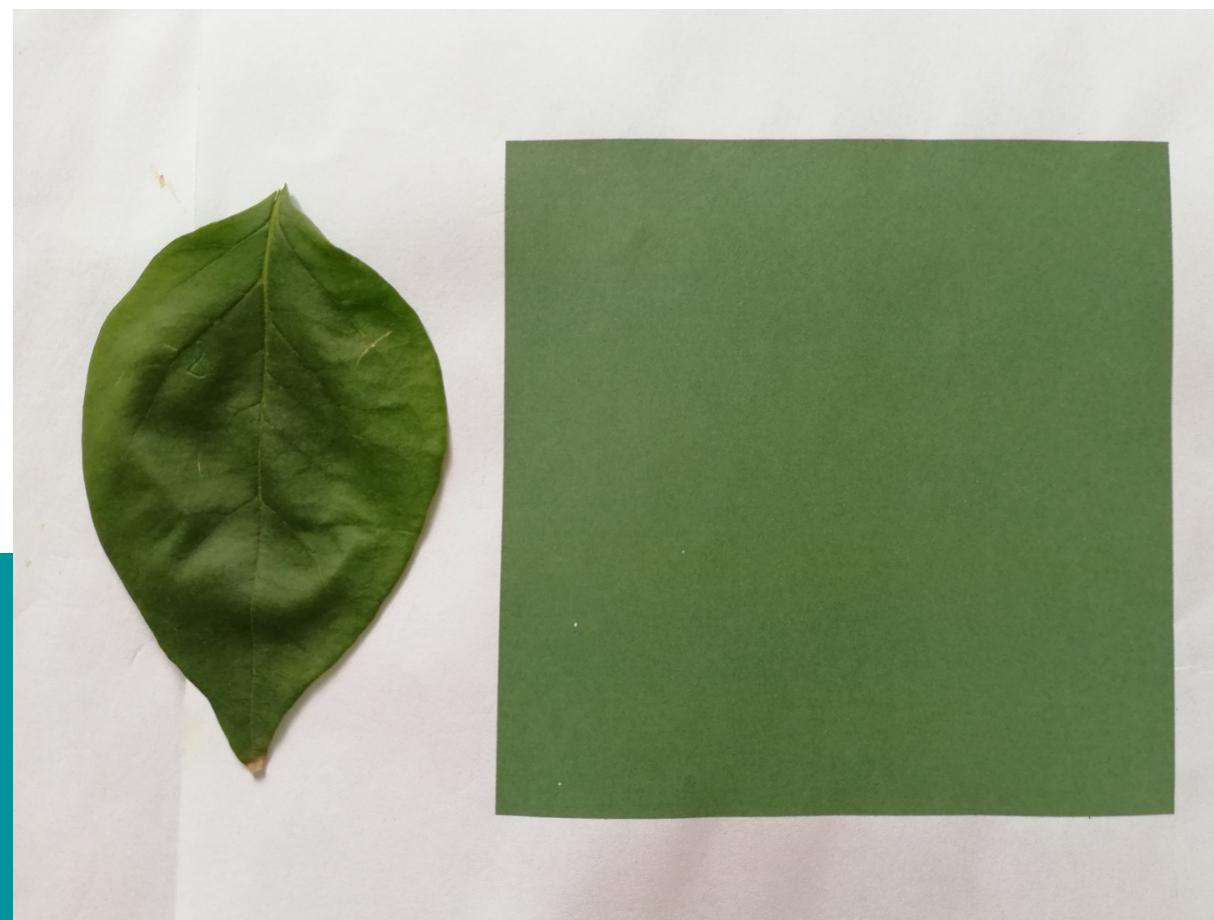
## IMAGE CAPTURE

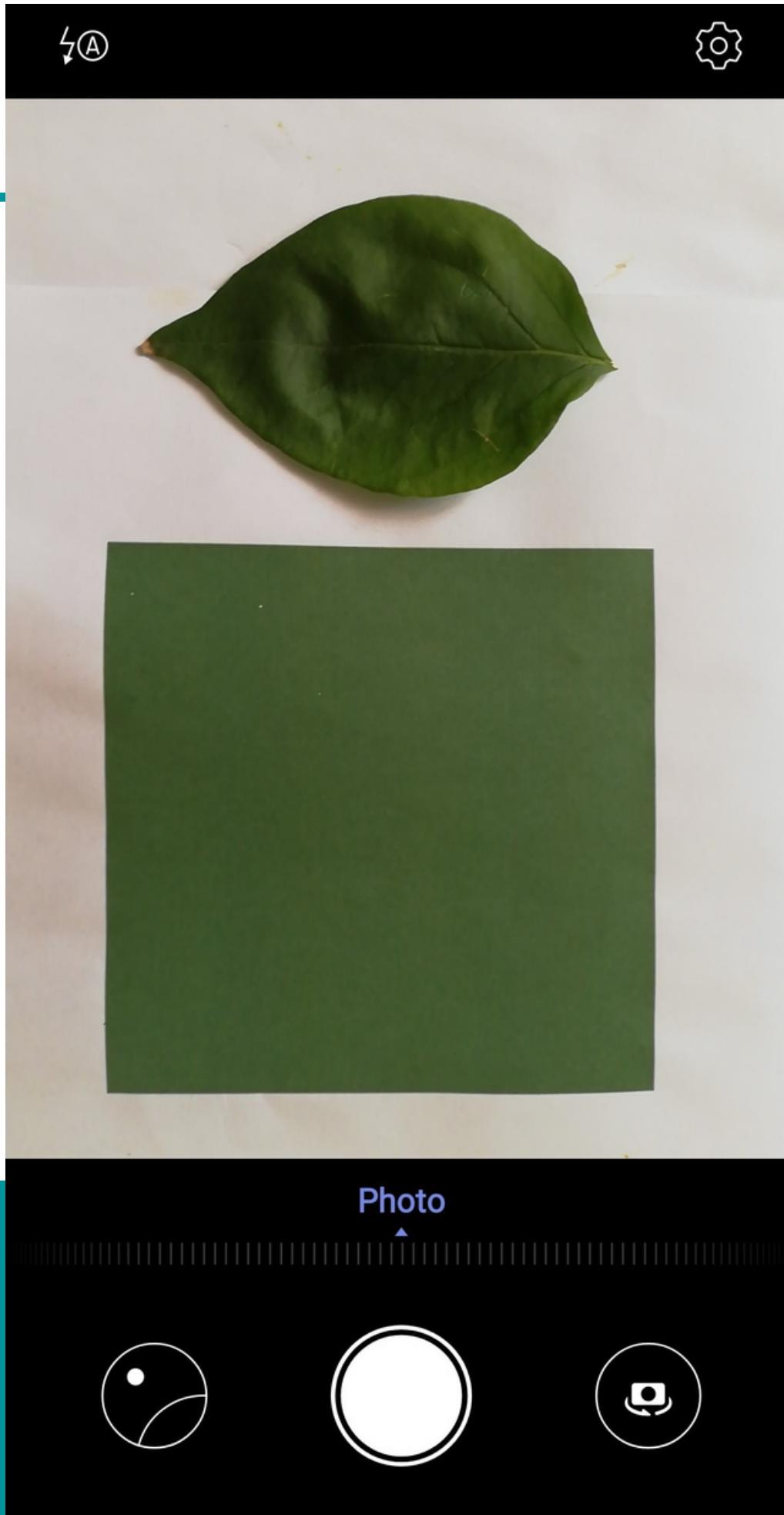




# MATERIALS & METHODOLOGY

## IMAGE CAPTURE



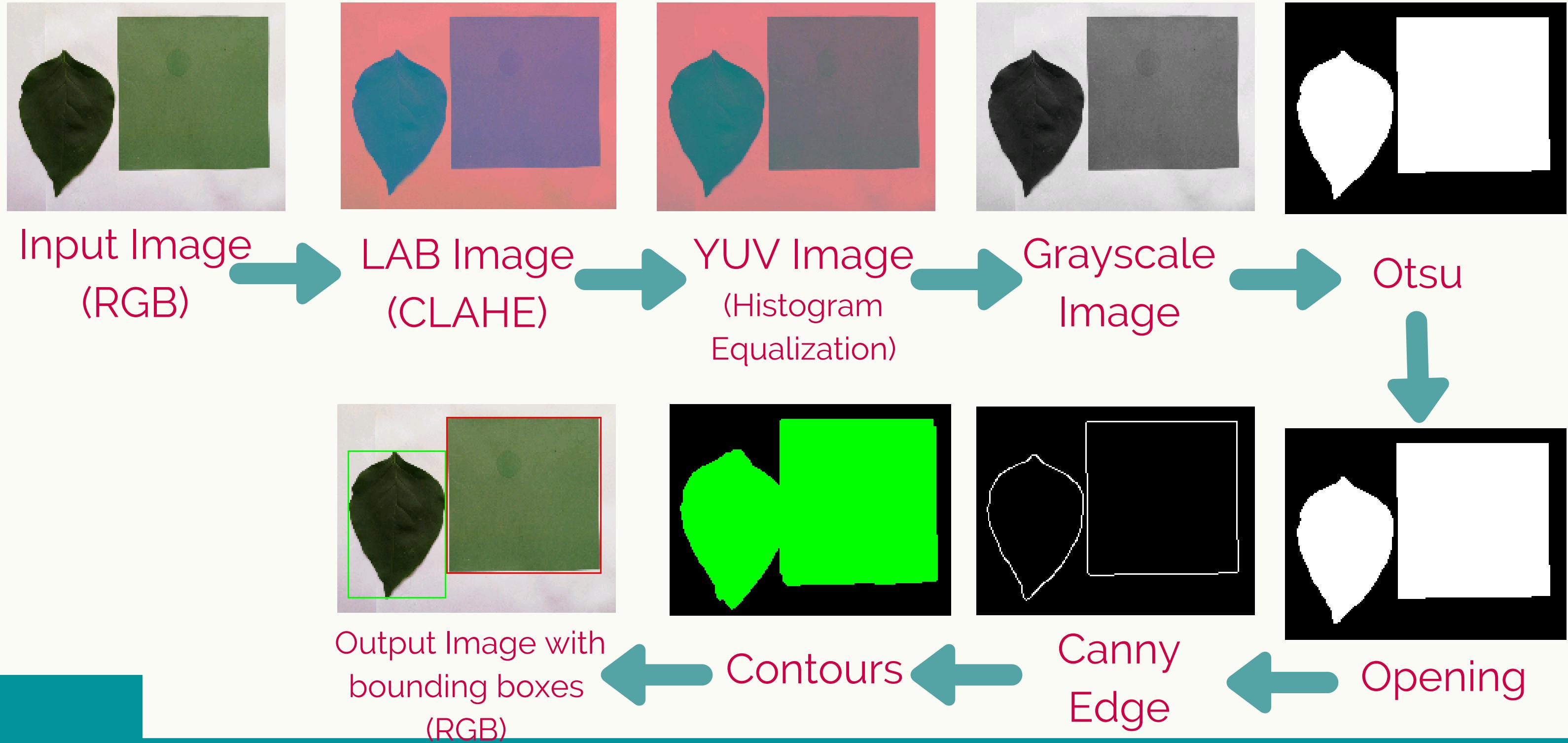


# MATERIALS & METHODOLOGY

## IMAGE CAPTURE

# MATERIALS & METHODOLOGY

## IMAGE PROCESSING



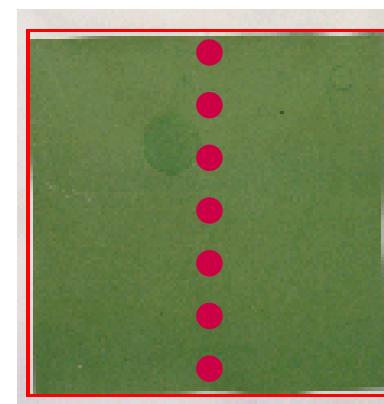
width or  
height  
of bounding  
box of leaf in  
**px**

x 10.16 cm

width of  
bounding box  
of square in  
**px**

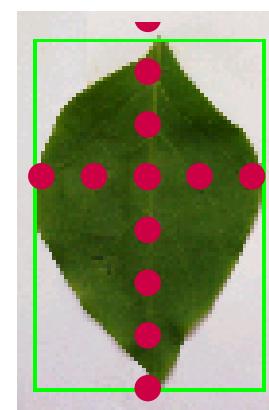
# MATERIALS & METHODOLOGY

## COMPUTATION OF DIMENSION



**px**

=



**px**



**cm**

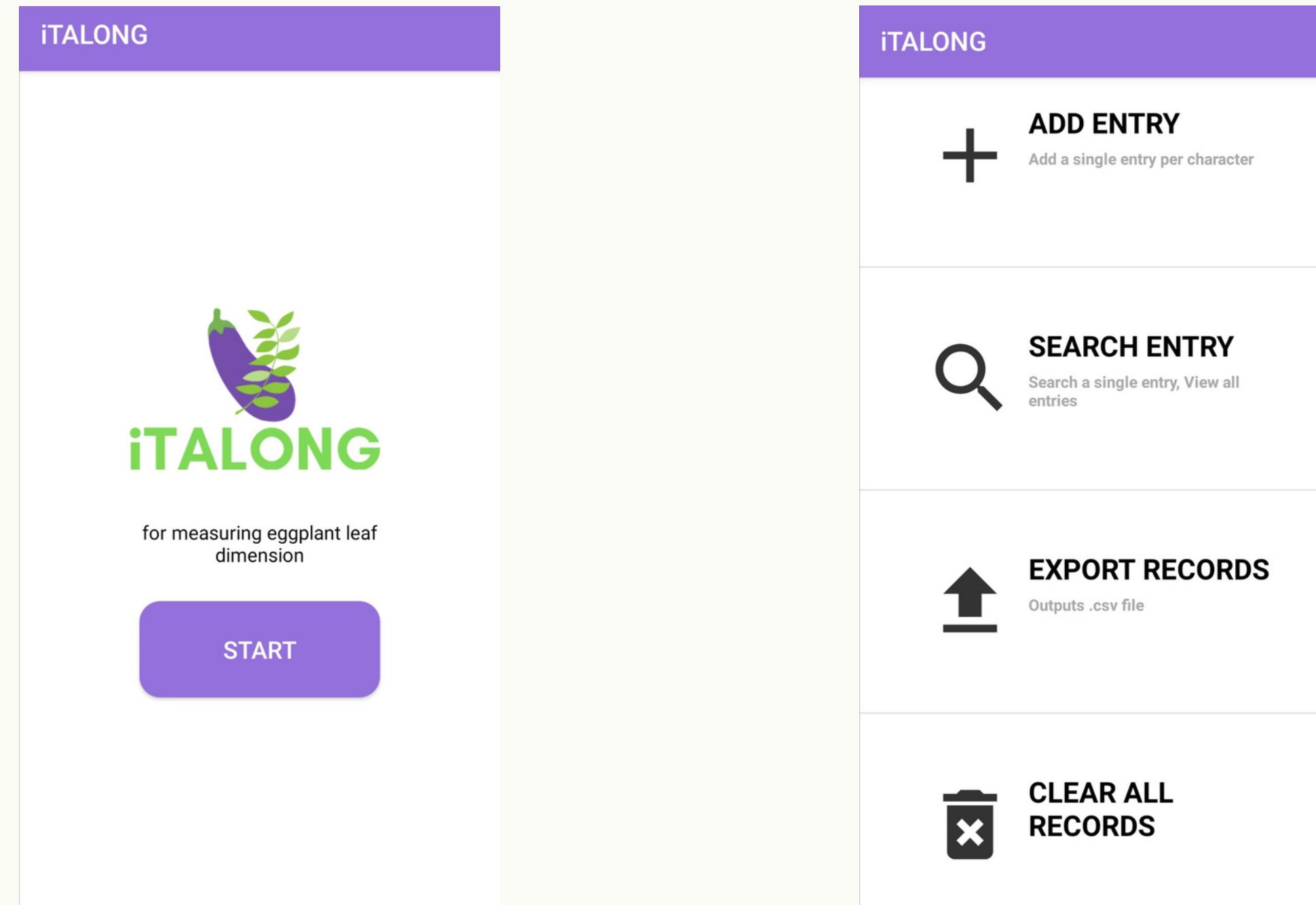


if the  
difference  
between the  
two set of  
observation is  
zero

**MATERIALS &  
METHODOLOGY**  
**TESTING**  
**paired t-test**

# MATERIALS & METHODOLOGY

## FLOW OF THE SYSTEM



# MATERIALS & METHODOLOGY

## FLOW OF THE SYSTEM

iTALONG

MENU > ADD ENTRY > DIMENSION

ENTER THE FOLLOWING:

Enter Plot No.

Enter Accession No.

Enter Plant I.D.

OK

BACK

iTALONG

LEAF DIMENSION

BACK



iTALONG

RESULT

Width: 6.0 cm  
Height: 8.7 cm

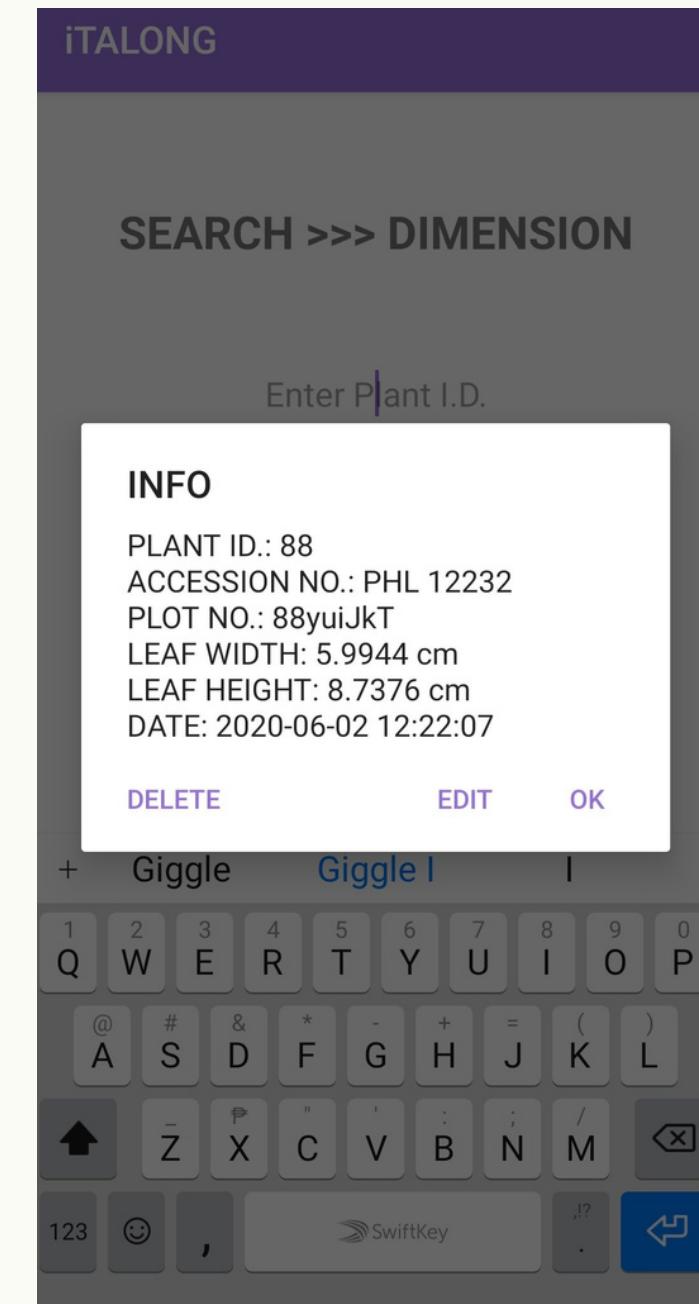
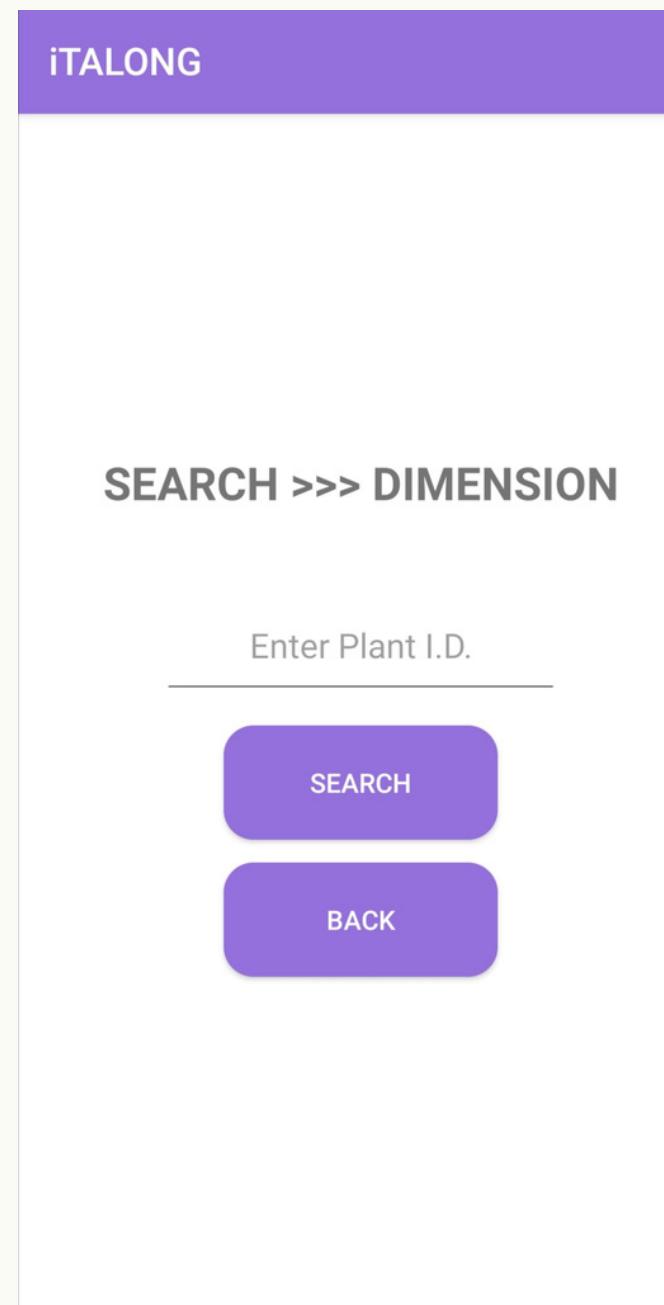
SAVE

RETAKE IMAGE

BACK

# MATERIALS & METHODOLOGY

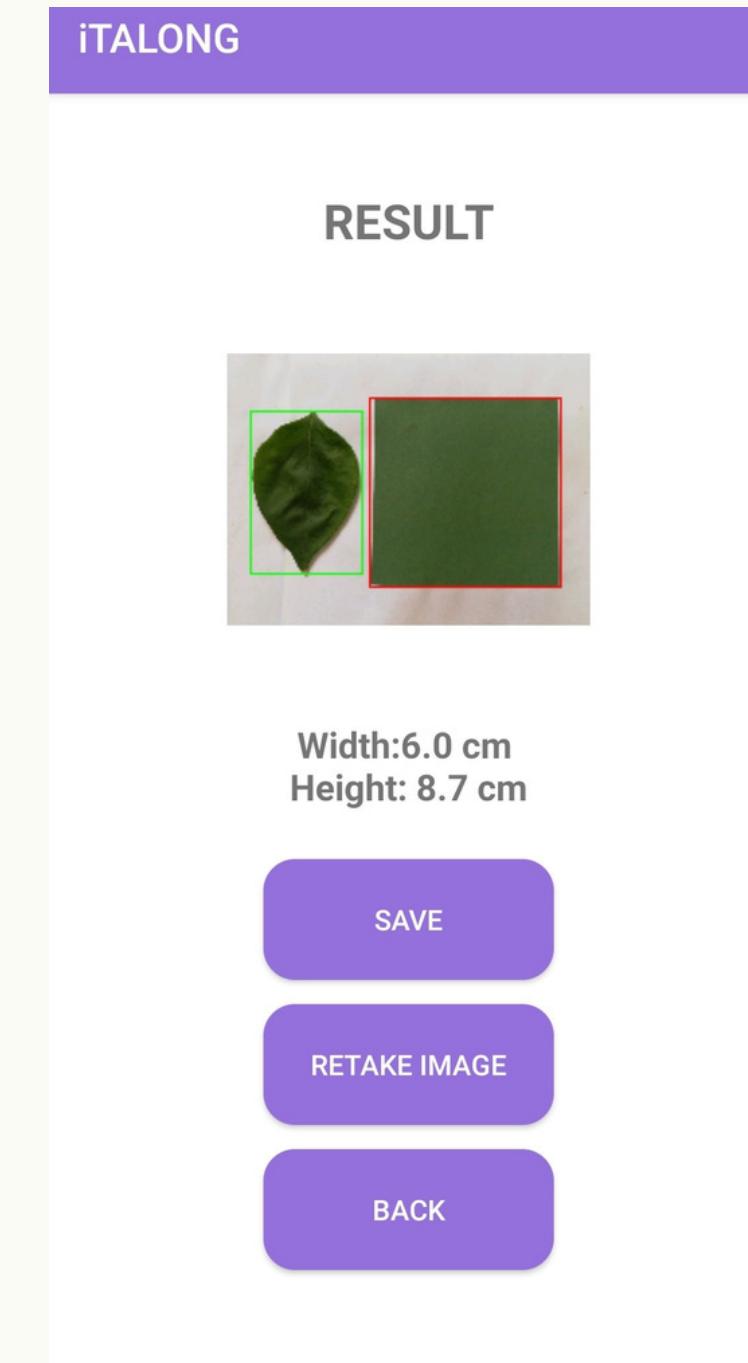
## FLOW OF THE SYSTEM



PLANT I.D.: 1
ACCESSION NO.: PHL 12058
PLOT NO.: 1
WIDTH: 5.13131
HEIGHT: 7.69697
DATE: 2020-06-02 11:34:14
PLANT I.D.: 2
ACCESSION NO.: Black Beauty (Yates)
PLOT NO.: 2
WIDTH: 6.2992
HEIGHT: 10.2616
DATE: 2020-06-02 11:35:21
PLANT I.D.: 3
ACCESSION NO.: GB 55372
PLOT NO.: 3
WIDTH: 6.2602
HEIGHT: 9.23636
DATE: 2020-06-02 11:36:00
PLANT I.D.: 4
ACCESSION NO.: MAYUMI
PLOT NO.: 4
WIDTH: 6.87596
HEIGHT: 10.3653
DATE: 2020-06-02 11:36:40
PLANT I.D.: 5
ACCESSION NO.: PHL 12157
PLOT NO.: 5
WIDTH: 5.6896
HEIGHT: 8.4328
DATE: 2020-06-02 11:37:20
PLANT I.D.: 6
ACCESSION NO.: GB 55454

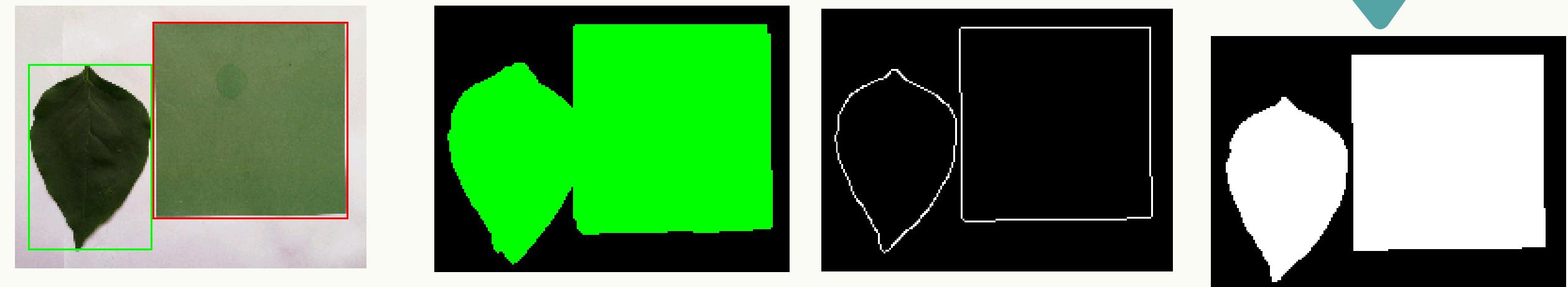
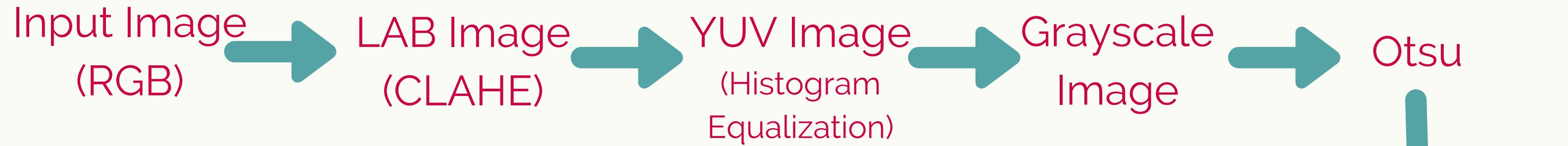
# RESULTS & DISCUSSION

APP



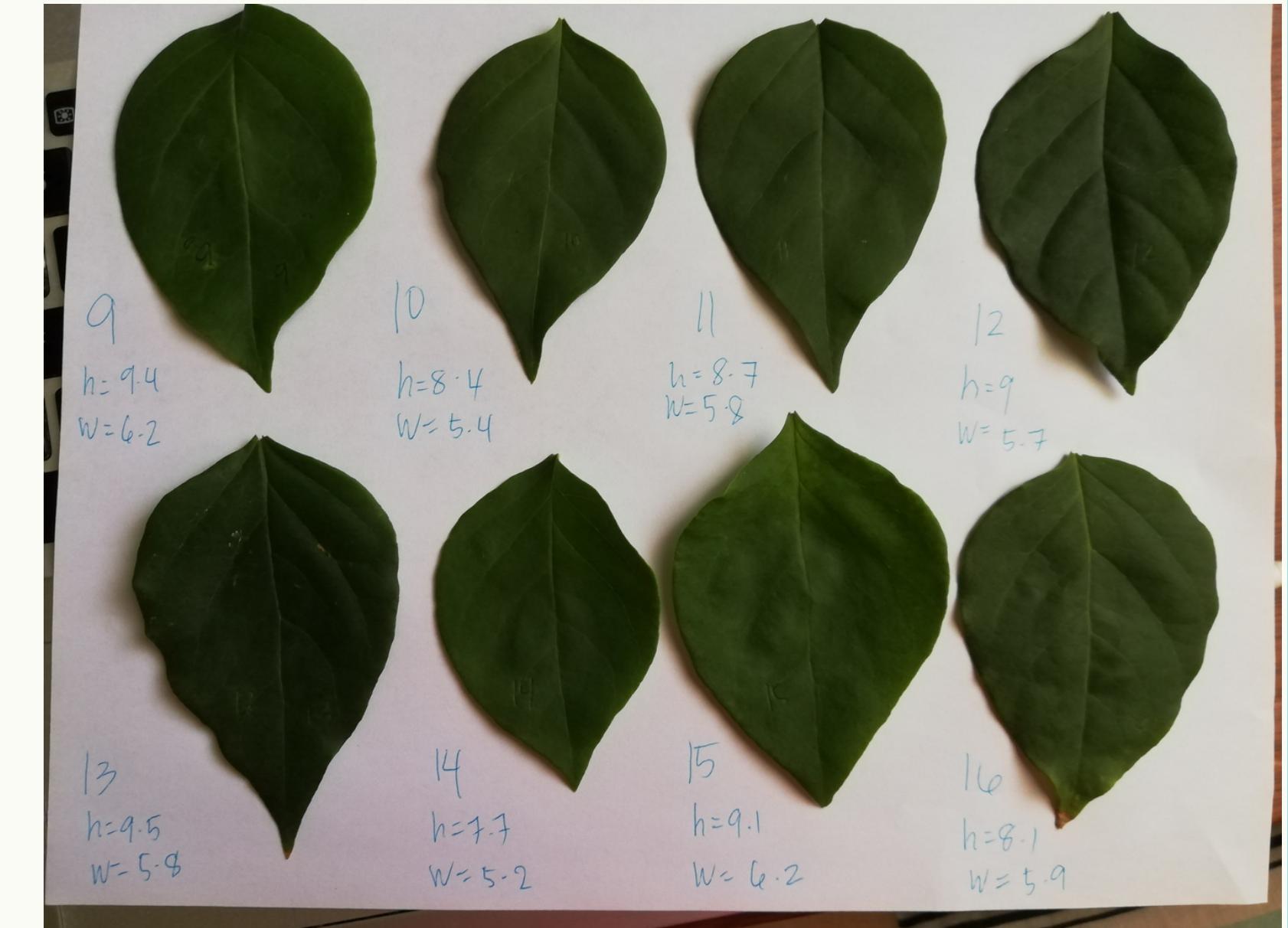
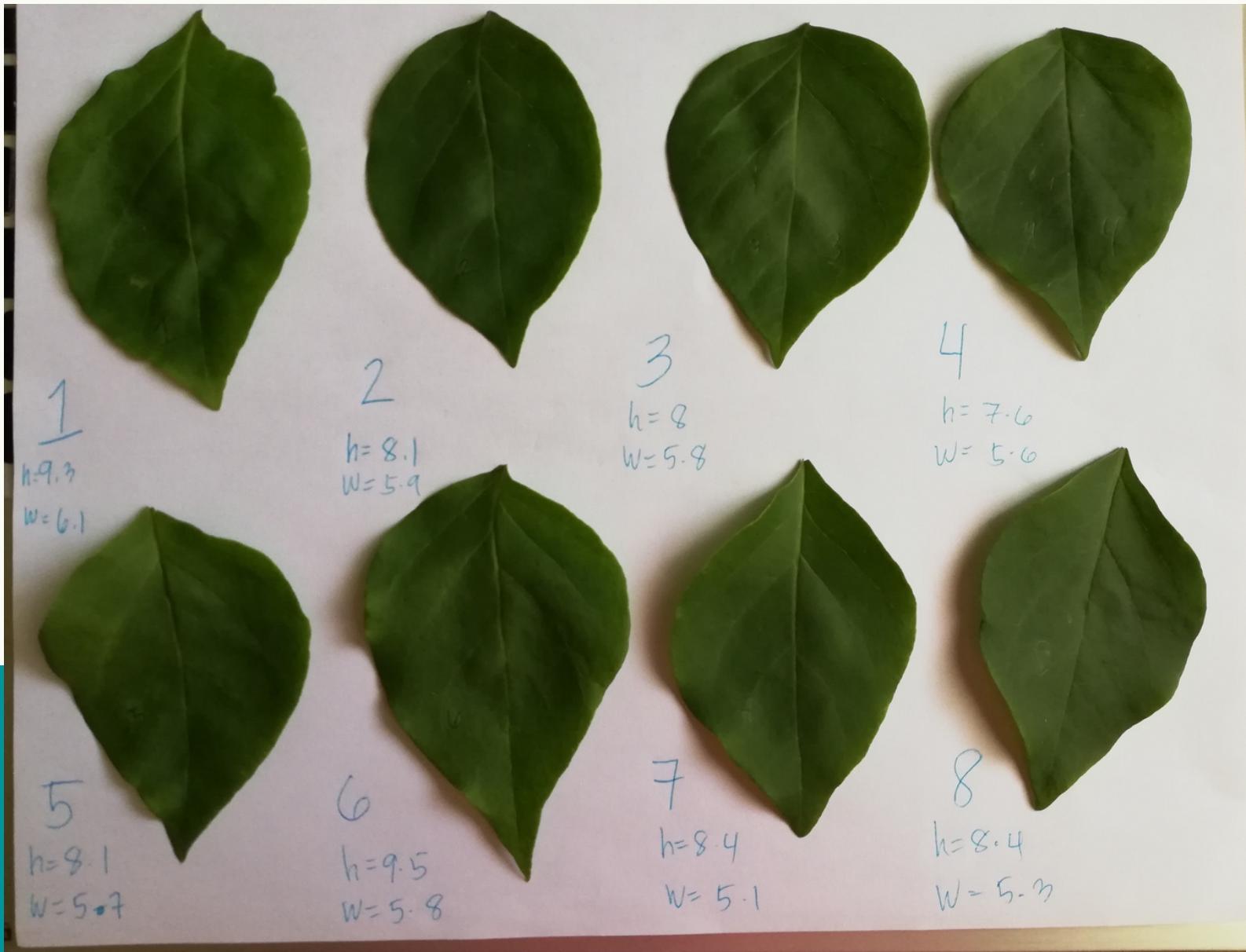
# RESULTS & DISCUSSION

## IMAGE PROCESSING



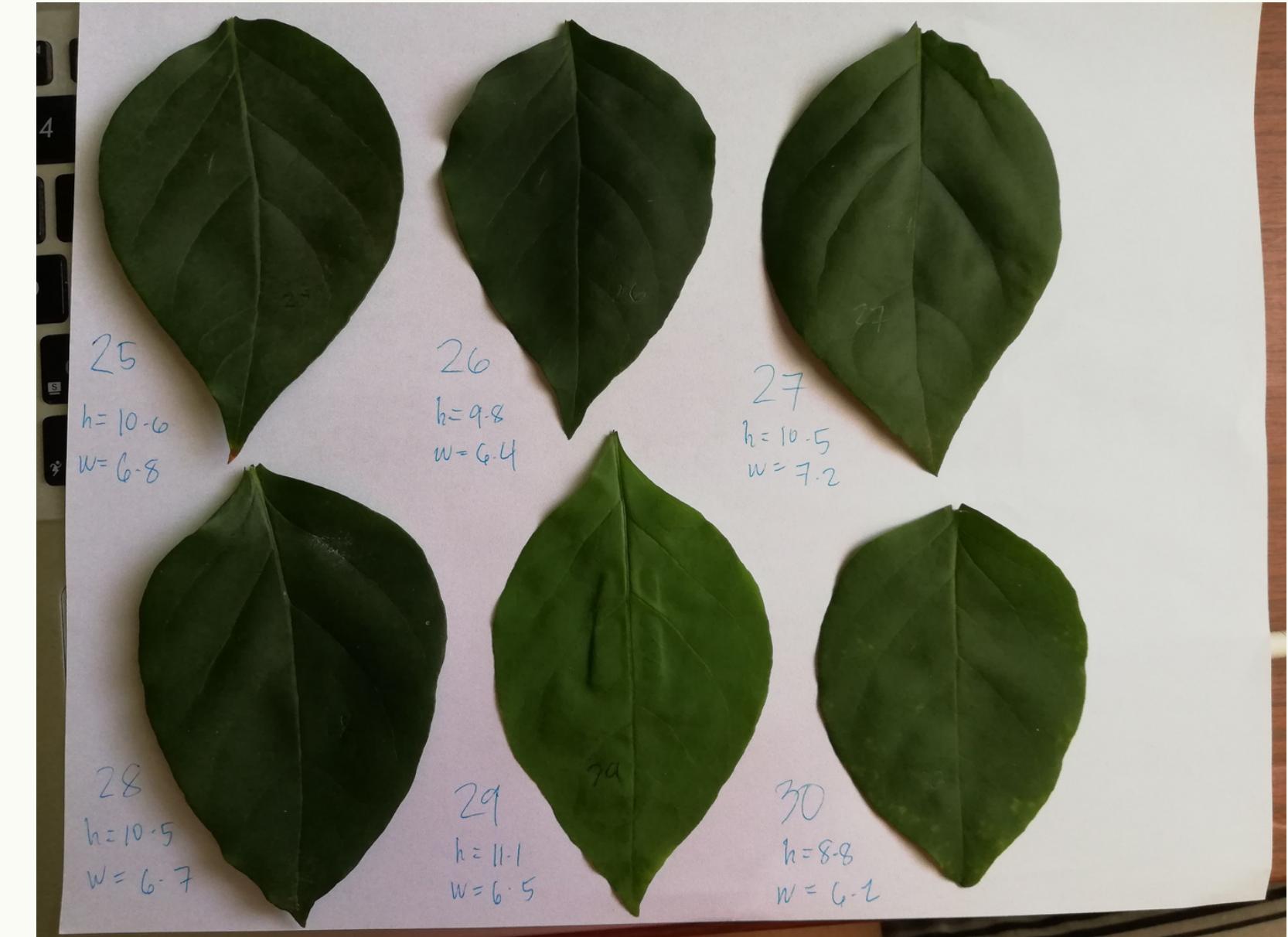
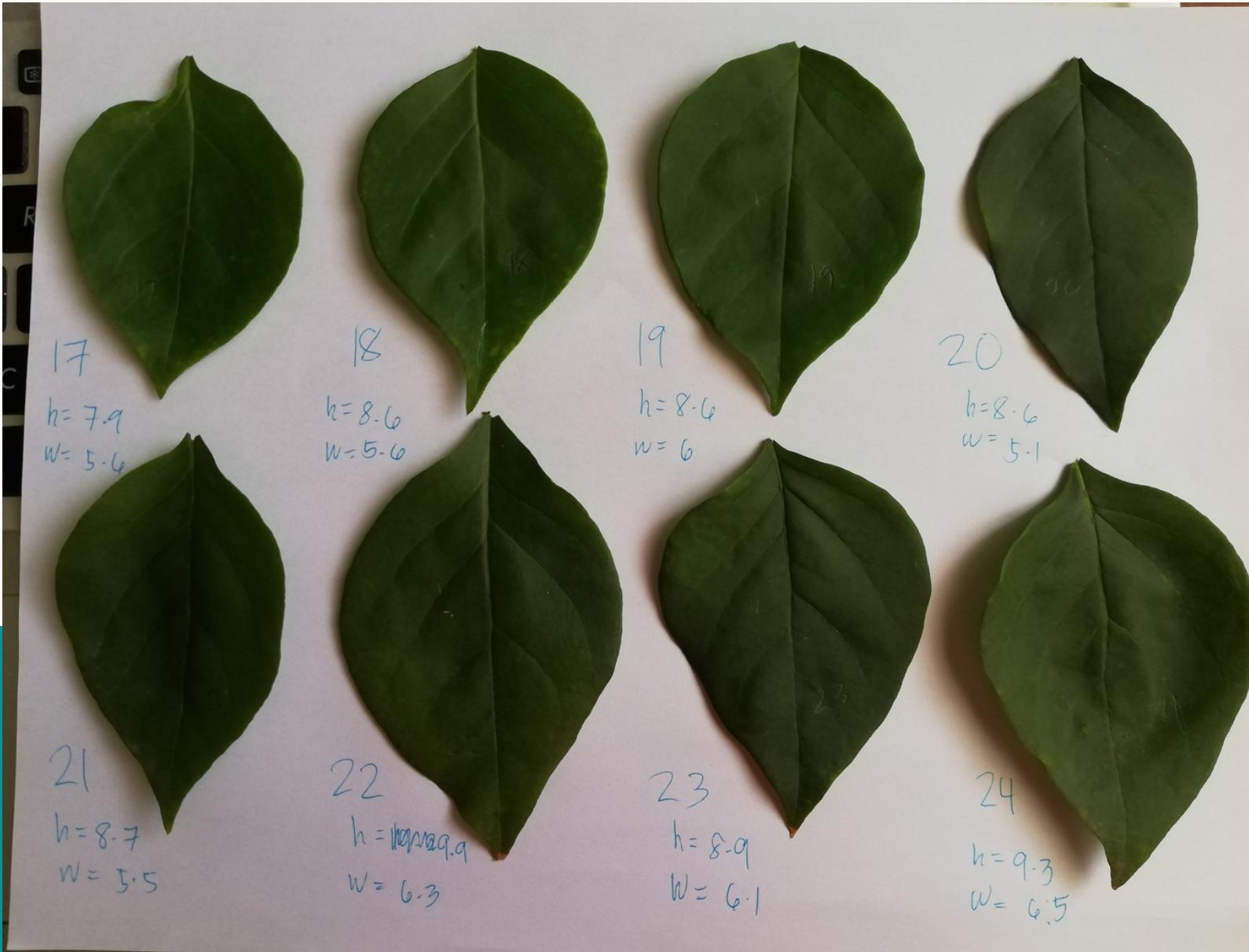
# RESULTS & DISCUSSION

## MANUAL MEASURING



# RESULTS & DISCUSSION

## MANUAL MEASURING



# RESULTS & DISCUSSION

plantID	width	height
1	6.1	9.3
2	5.9	8.1
3	5.8	8
4	5.6	7.6
5	5.7	8.1
6	5.8	9.5
7	5.1	8.4
8	8.4	5.3
9	9.4	6.2
10	5.4	8.4

plantID	width	height
11	5.8	8.7
12	5.7	9
13	5.8	9.5
14	5.2	7.7
15	6.2	9.1
16	5.9	8.1
17	5.6	7.9
18	5.6	8.6
19	6	8.6
20	5.1	8.6

## MANUAL MEASURING

plantID	width	height
21	5.5	8.7
22	6.3	9.9
23	6.1	8.9
24	6.5	9.3
25	6.8	10.5
26	6.4	9.8
27	7.2	10.5
28	6.7	10.5
29	6.5	11.1
30	6.2	8.8

# RESULTS & DISCUSSION

## AUTOMATED MEASURING

plantID	accession	plotNo	width	height
D1	D1	D1	5.92667	8.74889
D2	D2	D2	5.50729	7.78617
D3	D3	D3	5.92667	7.80815
D4	D4	D4	5.35214	7.52929
D5	D5	D5	5.60224	7.78617
D6	D6	D6	5.98714	9.07143
D7	D7	D7	5.44945	8.31273
D8	D8	D8	5.27538	8.30385
D9	D9	D9	6.07701	9.11551
D10	D10	D10	5.31738	8.07103

plantID	accession	plotNo	width	height
D11	D11	D11	5.73128	8.42325
D12	D12	D12	5.76649	8.78703
D13	D13	D13	5.91845	9.37087
D14	D14	D14	5.3219	7.64419
D15	D15	D15	6.15758	8.92848
D16	D16	D16	5.88211	8.28842
D17	D17	D17	5.64444	7.81538
D18	D18	D18	5.57451	8.18195
D19	D19	D19	6.00364	8.40509
D20	D20	D20	5.12577	8.4209

# RESULTS & DISCUSSION

## AUTOMATED MEASURING

plantID	accession	plotNo	width	height
D21	D21	D21	5.26815	8.74889
D22	D22	D22	6.17196	9.78019
D23	D23	D23	6.15462	8.59692
D24	D24	D24	6.26692	9.40037
D25	D25	D25	6.63921	10.3612
D26	D26	D26	6.42189	9.68075
D27	D27	D27	6.83664	10.3499
D28	D28	D28	6.70757	10.2586
D29	D29	D29	6.25231	10.6485
D30	D30	D30	5.98206	8.7357

# RESULTS & DISCUSSION

LOWEST PERCENT  
ERROR  
(WIDTH)

plantID	ACTUAL (cm)	COMPUTED (cm)	PERCENT ERROR
16	5.9	5.8821	0.3032
19	6	6.0036	0.061
28	6.7	6.7076	0.113

# RESULTS & DISCUSSION

**LOWEST PERCENT  
ERROR  
(LENGTH)**

plantID	ACTUAL (cm)	COMPUTED (cm)	PERCENT ERROR
14	7.7	7.6442	0.7248
21	8.7	8.7489	0.562
30	8.8	8.7357	0.7307

### T-VALUE (WIDTH)

**1.94**

critical value = 2.05

$1.94 < 2.05$  ; Accept  $H_0$

### T-VALUE (LENGTH)

**6.31**

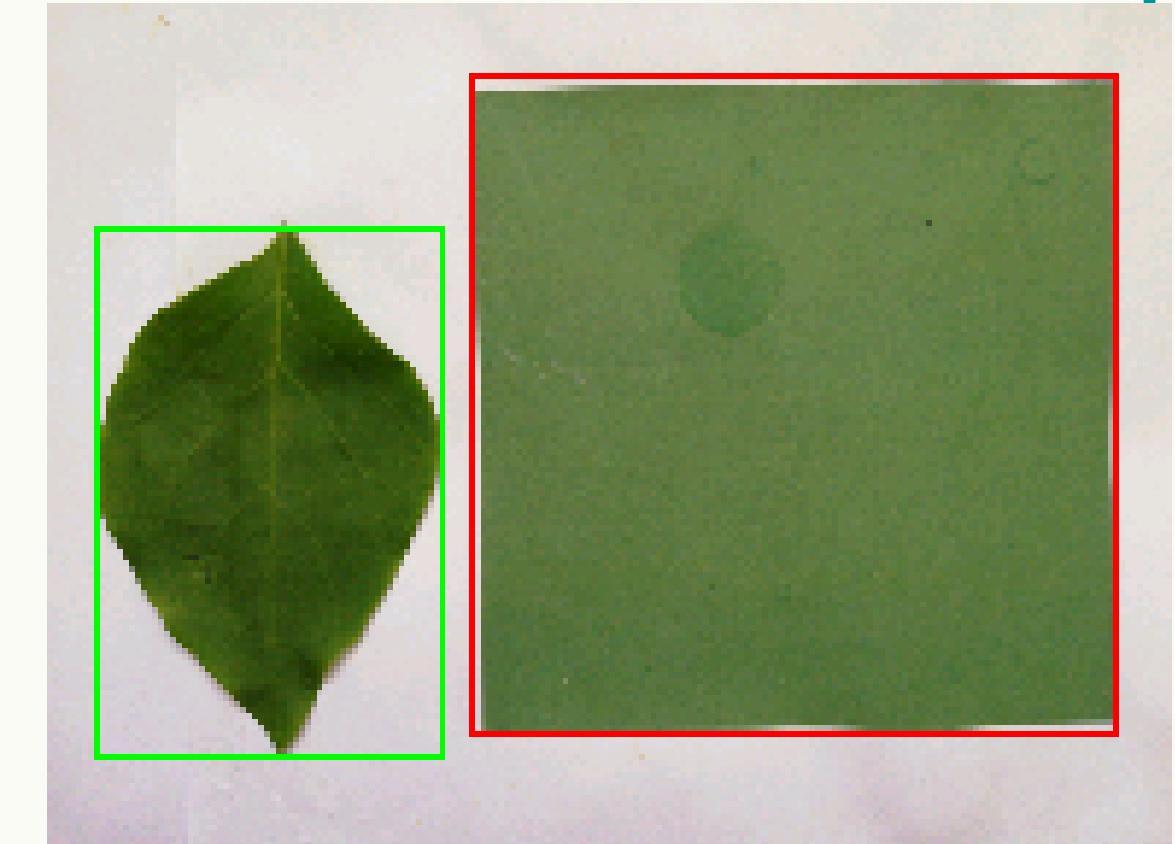
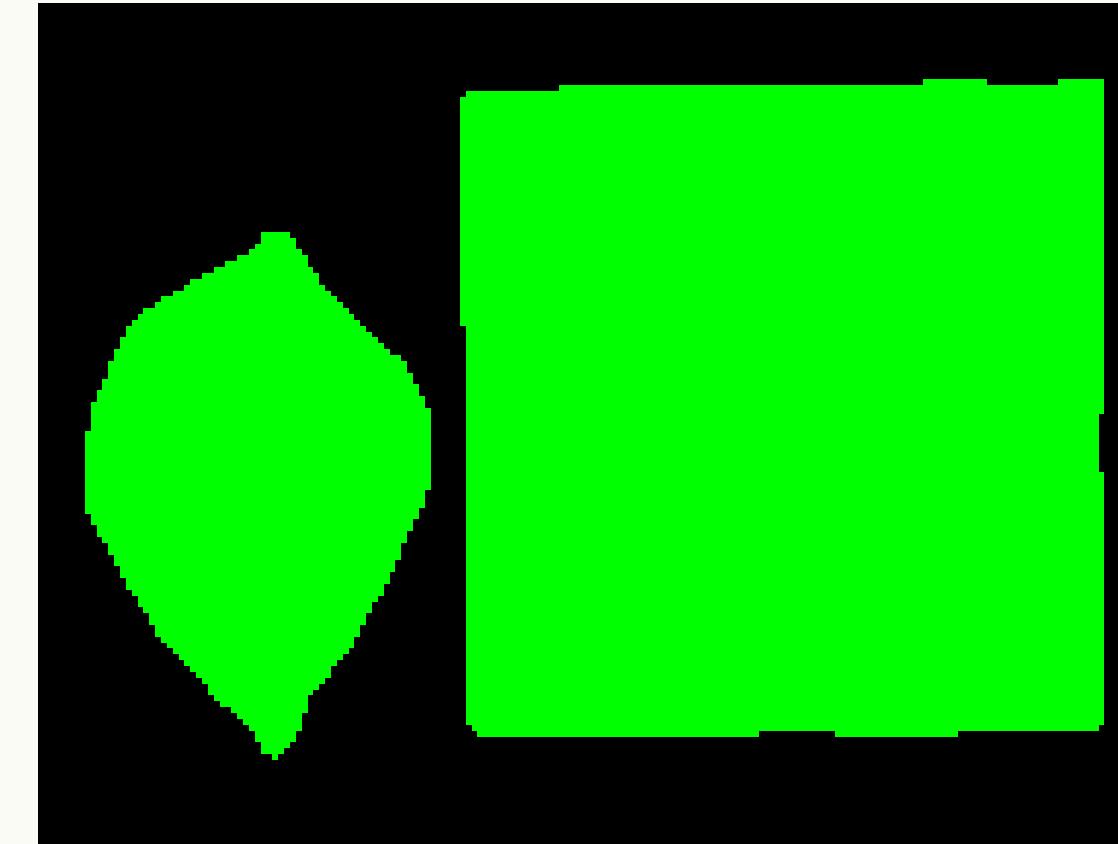
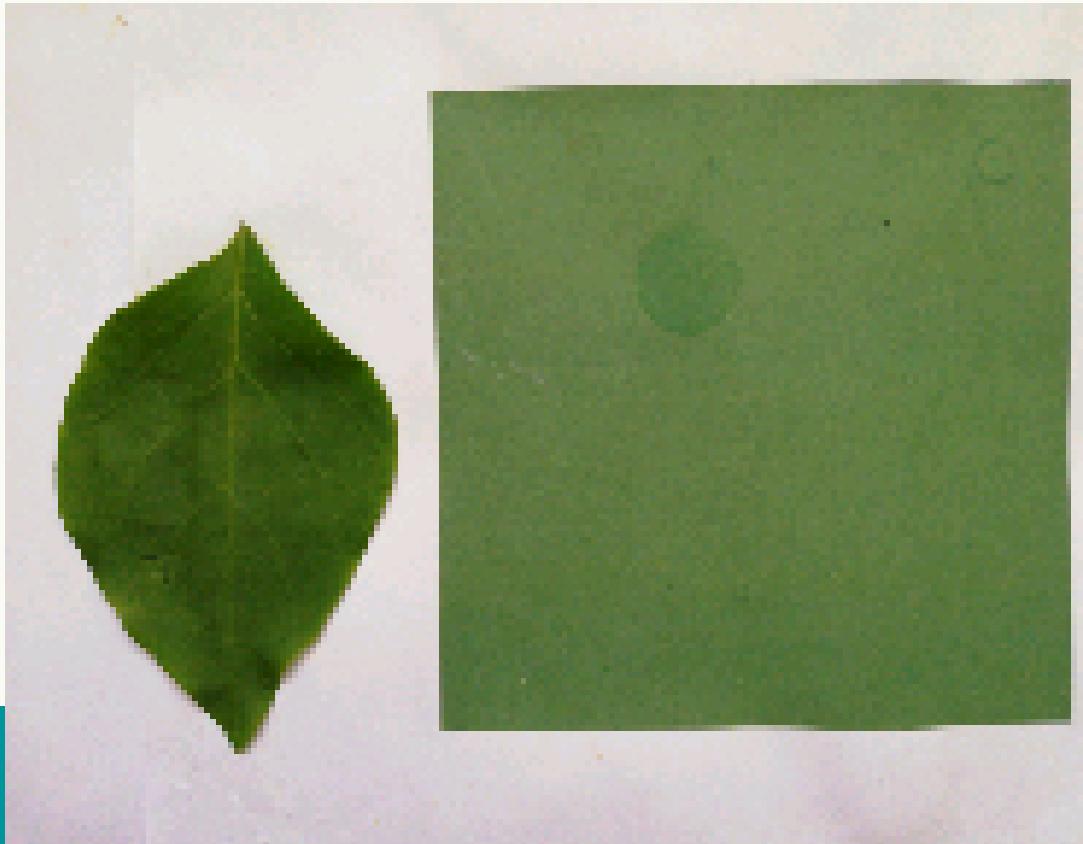
critical value = 2.05

$6.31 > 2.05$  ; Reject  $H_0$

\*ERROR IN MEASURING  
LENGTH IS ONLY AT  
2.34% ON THE AVERAGE

# RESULTS & DISCUSSION

ERRORS ENCOUNTERED  
(WIDTH)  
highest error at 6.85%



Alignment of objects

$M = 5.1$

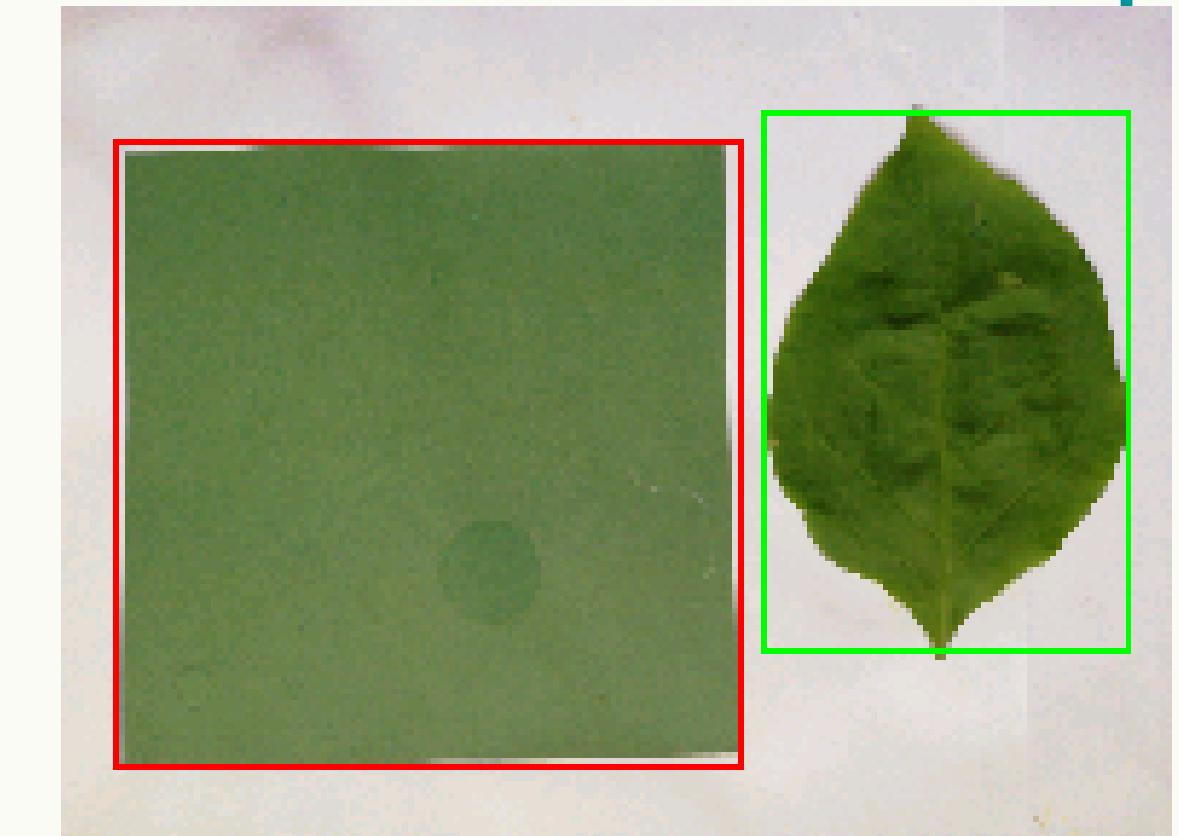
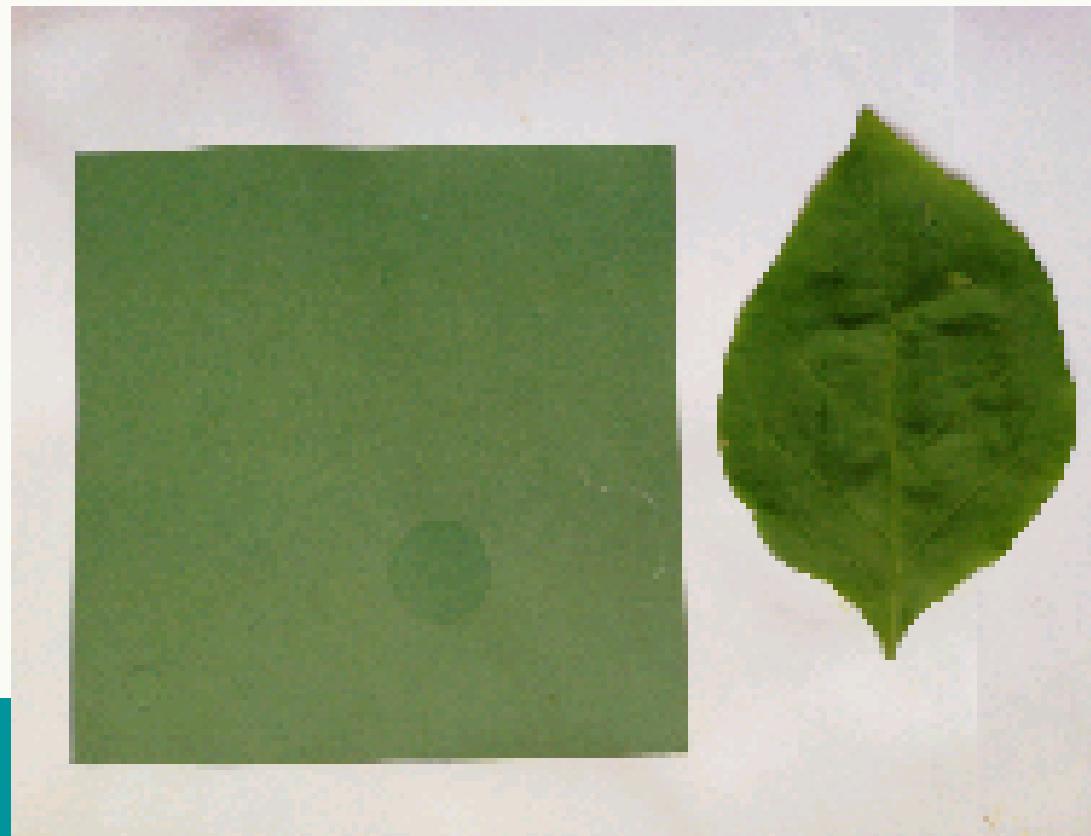
Creases on background

$A = 5.5$

# RESULTS & DISCUSSION

## ERRORS ENCOUNTERED (LENGTH)

highest error at 5.9%



Parts were mistaken as noise

$$\begin{aligned} M &= 9.3 \\ A &= 8.7 \end{aligned}$$

# CONCLUSION & FUTURE WORK

iTALONG

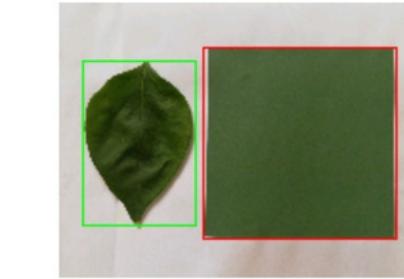


for measuring eggplant leaf dimension

START

iTALONG

RESULT



Width:6.0 cm  
Height: 8.7 cm

SAVE

RETAKE IMAGE

BACK

FEASIBLE

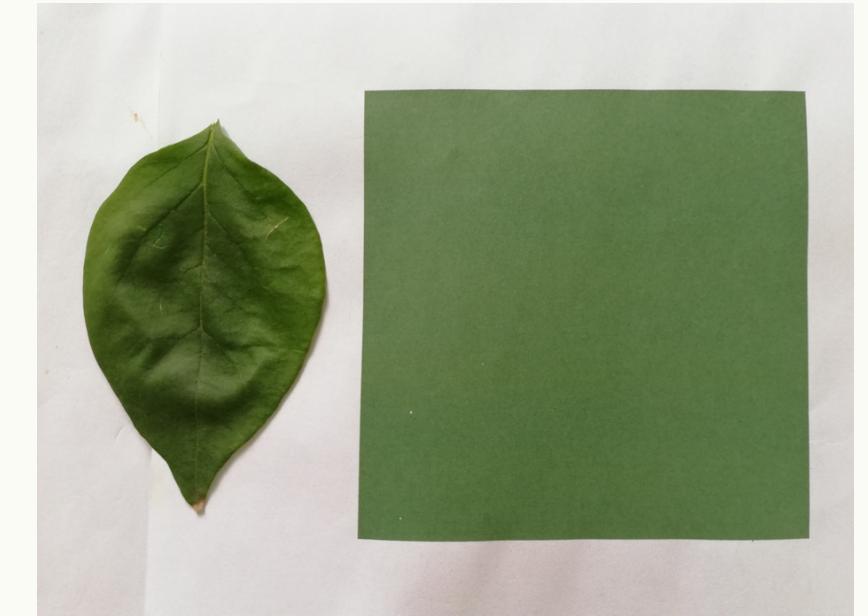
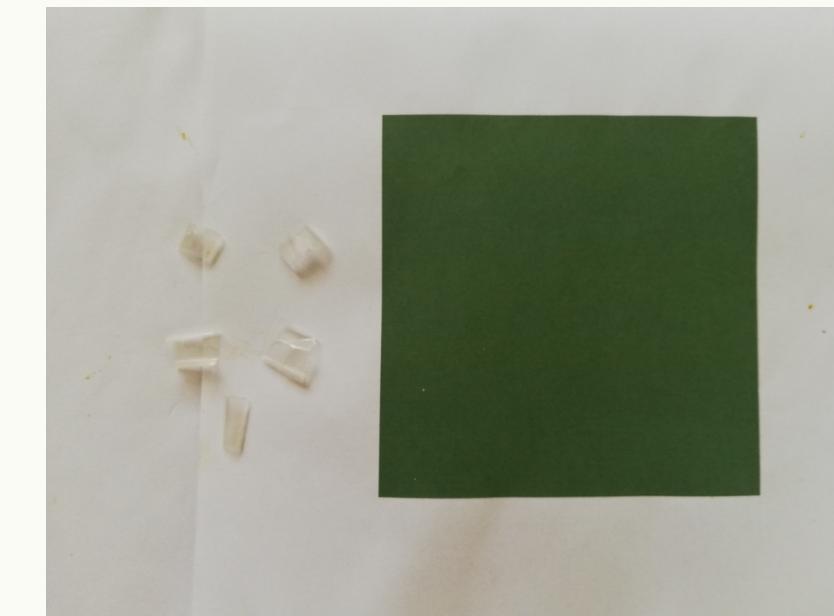
# CONCLUSION & FUTURE WORK

NON-DESTRUCTIVE

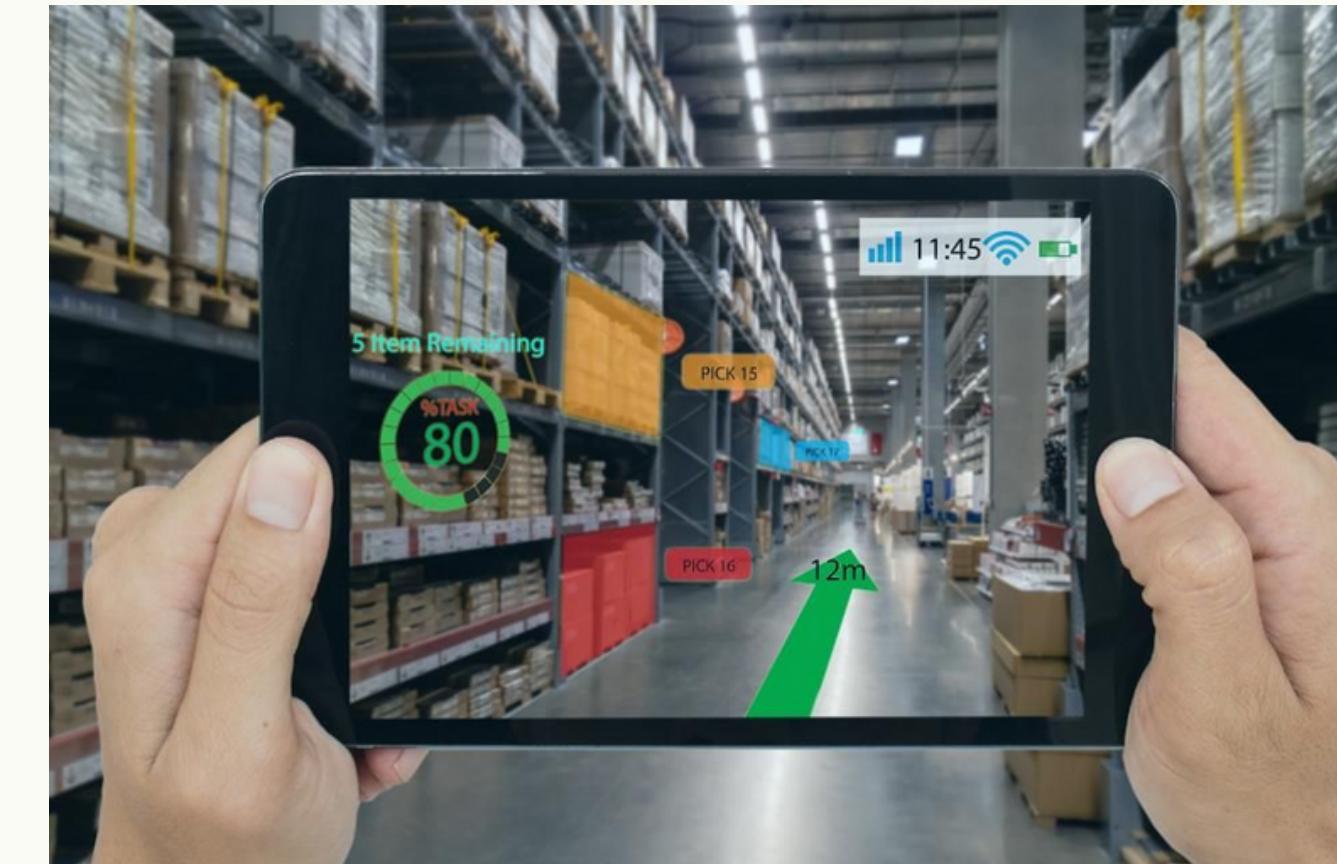


# CONCLUSION & FUTURE WORK

CHANGE IMAGE CAPTURE  
SETUP



# CONCLUSION & FUTURE WORK



## AR TECHNOLOGY

# CONCLUSION & FUTURE WORK



EXTEND THE MODULES

**THANK YOU!**