Tropical and Subtropical Fruits

Department of Horticulture
College of Agriculture
Isfahan University of Technology

Pineapple

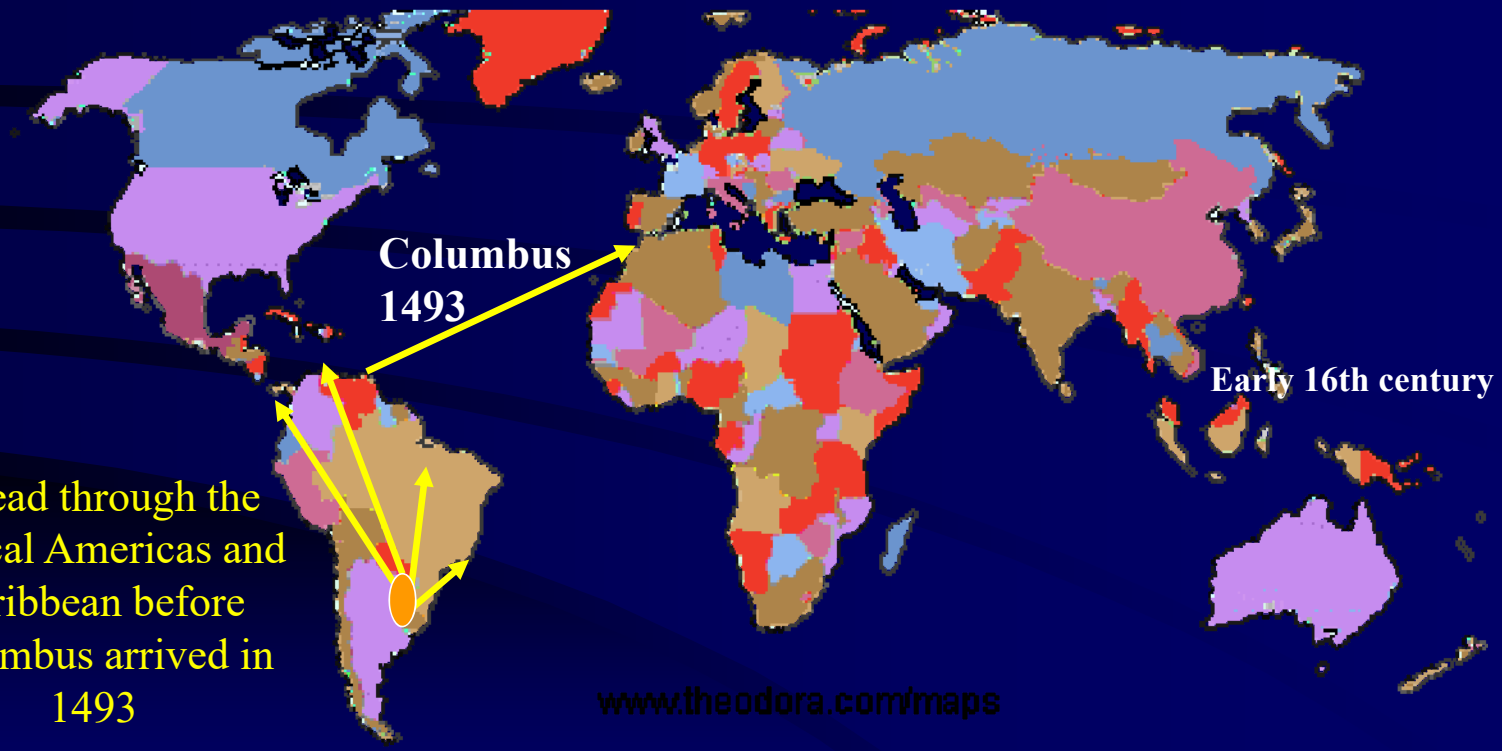
Family: Bromeliaceae

Genus: *Ananas*

Species: *comosus*

Ananas comosus (A. sativus)

Origin


Columbus
1493
Early 16th century
Spread through the tropical Americas and Caribbean before Columbus arrived in 1493
www.theodora.com/maps

Tropical Fruit Production

Crop	Production (1000s mt)
Banana	72,167
Plantains	25,309
Mangoes	28,730
Pineapple	15,723
Papaya	5,878

Pineapple Production

Region	1,000s mt	%
Africa	2,620	17%
Asia	8,347	53%
Americas	4,756	30%
Total	15,723	

Pineapple Production

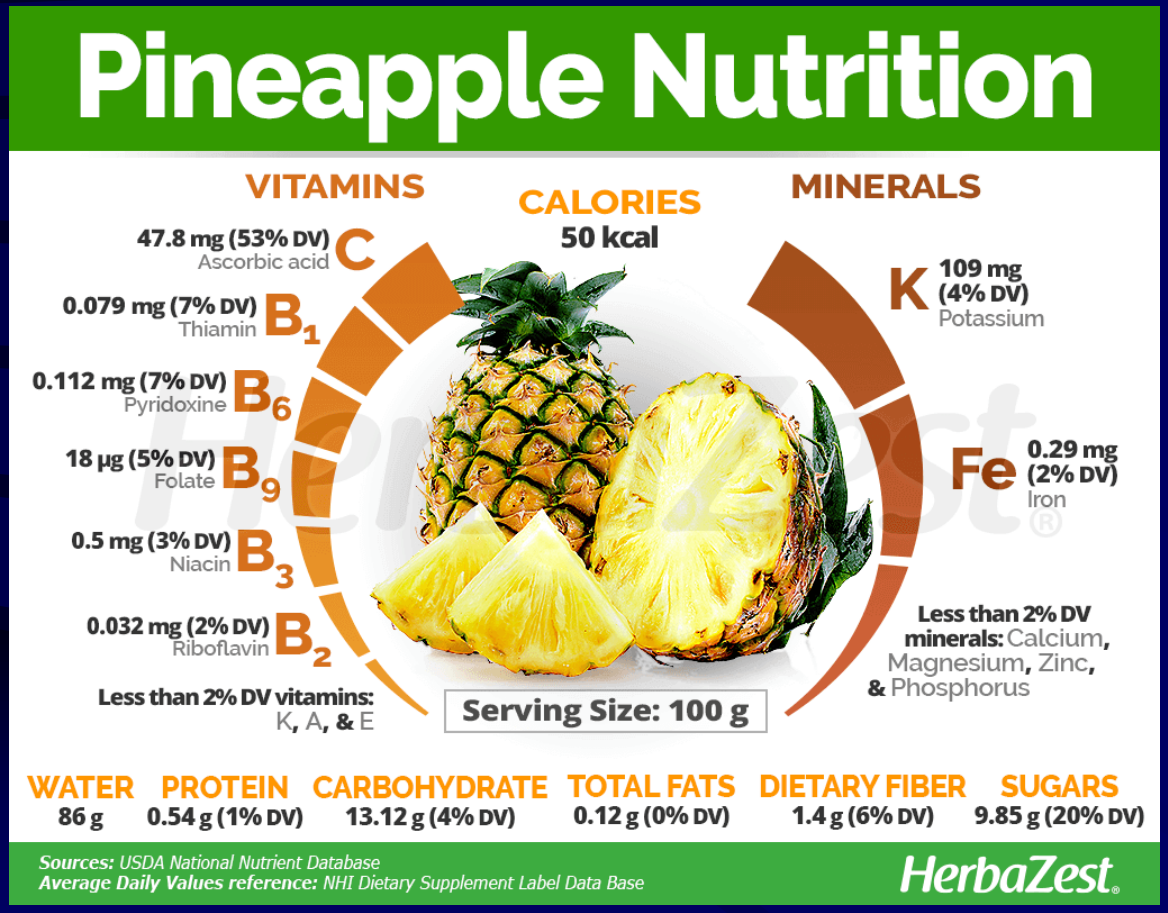
Region	Major producing countries (1,000s mt)
Africa	Nigeria (880), Kenya (606), Ivory Coast (241), Congo (193), South Africa (164)
Asia	Thailand (2,081), China (1,249), India (1,073), Philippines (1,605), Indonesia (431)
Americas	Brazil (1,370), Costa Rica (956), Mexico (578), Colombia (331), Venezuela (321), Ecuador (202)

Pineapple Production and Yield

Region	Mt/ha
Africa	12.1
Asia	19.5
Americas	22.0

1	Area	Item	Year	Unit	Value
2	Costa Rica	Pineapple	2021	tonnes	2938334
3	Indonesia	Pineapple	2021	tonnes	2886417
4	Philippine	Pineapple	2021	tonnes	2860202
5	Brazil	Pineapple	2021	tonnes	2317554
6	China, ma	Pineapple	2021	tonnes	1899000
7	Thailand	Pineapple	2021	tonnes	1800558
8	India	Pineapple	2021	tonnes	1799000
9	Nigeria	Pineapple	2021	tonnes	1541980
10	Mexico	Pineapple	2021	tonnes	1271521
11	Colombia	Pineapple	2021	tonnes	927050
12	Viet Nam	Pineapple	2021	tonnes	726129.6
13	Ghana	Pineapple	2021	tonnes	668093.2
14	Angola	Pineapple	2021	tonnes	663263
15	Peru	Pineapple	2021	tonnes	588175.2
16	Venezuel	Pineapple	2021	tonnes	478521.3
17	Dominicar	Pineapple	2021	tonnes	443226.3
18	Benin	Pineapple	2021	tonnes	406220
19	China, Tai	Pineapple	2021	tonnes	402836
20	United Re	Pineapple	2021	tonnes	372178.9
21	Guatemal	Pineapple	2021	tonnes	370863.3
22	Malawi	Pineapple	2021	tonnes	334071.1
23	Malaysia	Pineapple	2021	tonnes	323047.1

Nutritional Values



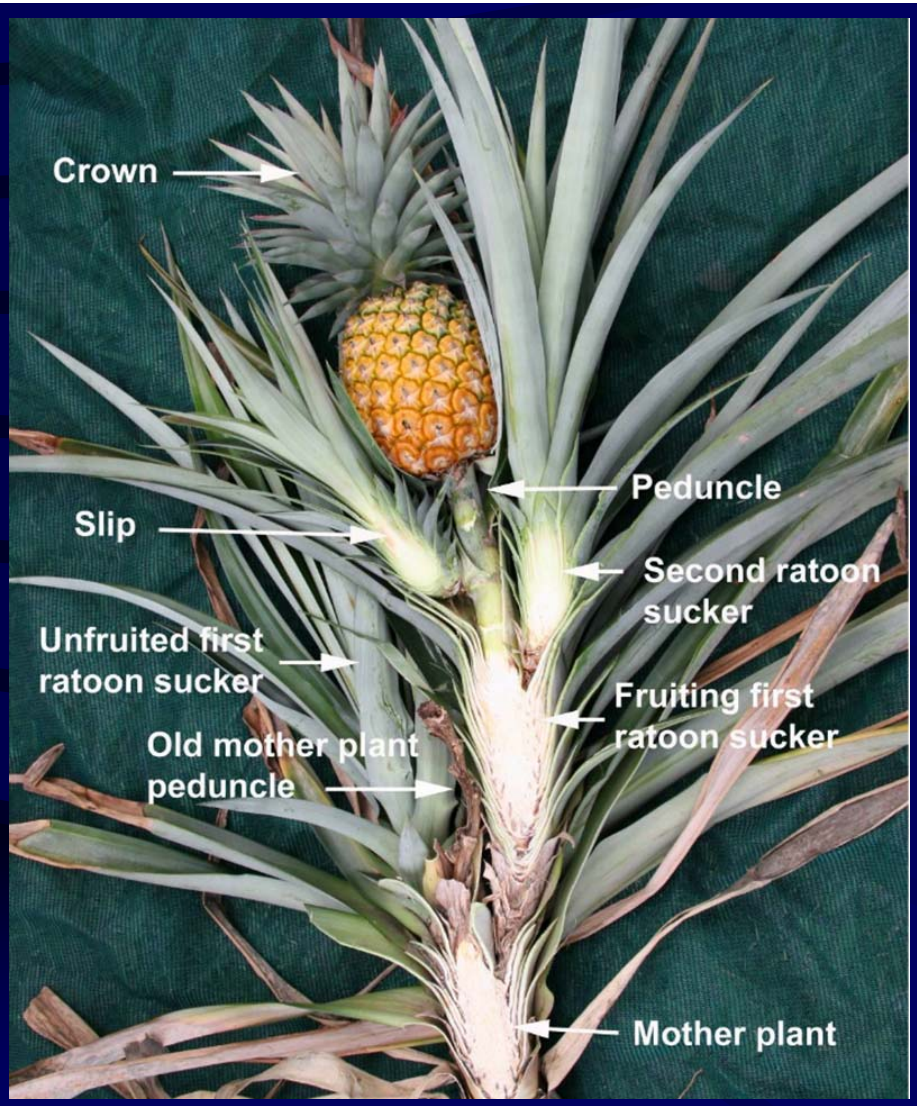
Monocotyledon

Herbaceous

Perennial

Monocarp

Rosette



Flower description

- Inflorescence
  - → 100-200 flowers
- Flower
  - → Perfect with floral bract
  - → Three fleshy sepals and petals (Perianth)
  - → Six stamens
  - → Inferior ovary with 3 carples

Flower description

- **Inflorescence**
  - **100-200 flowers**
- **Flower**
  - **Perfect with floral bract**
  - **Three fleshy sepals and petals**
  - **Six stamens**
  - **Inferior ovary with 3 locules**

Flower description

- **Commercial clones are self incompatible**
  - **Set parthenocarpically**
    - **Only one cultivar planted in a field**
  - **Pollinated by hummingbirds**
    - **Can produce seed if cross pollinated**

Flower Induction

Pollination and Fruit set

Commercial cultivars are self incompatible

→Set parthenocarpically

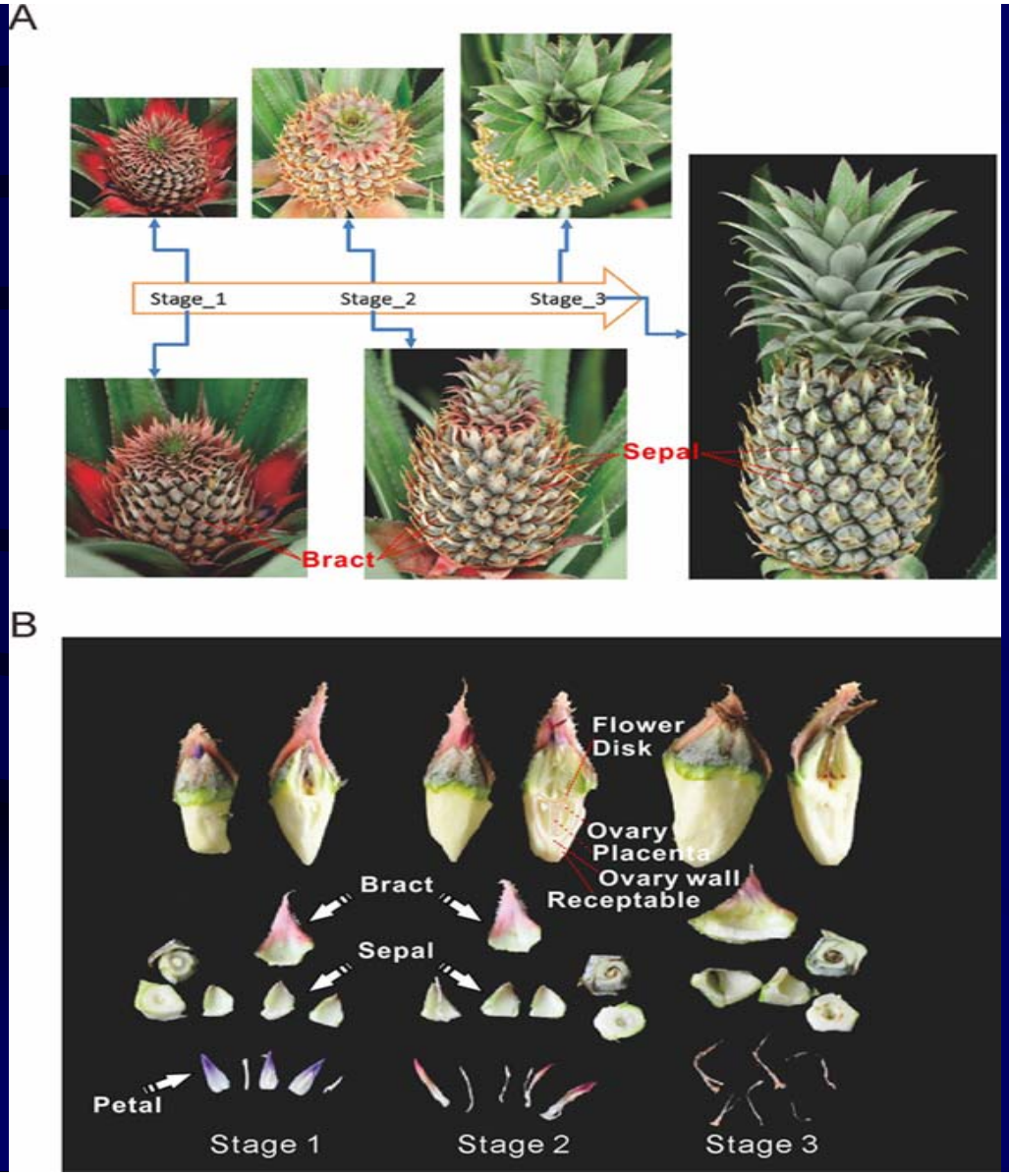
- Only one cultivar planted in a field

→Pollinated by hummingbirds

- Can produce seed if cross pollinated

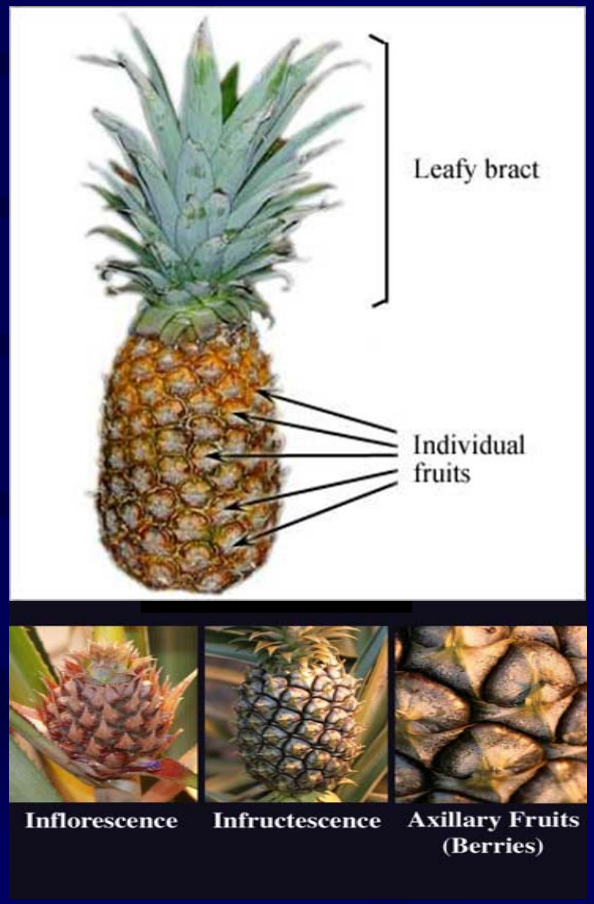
Flowering and Forcing

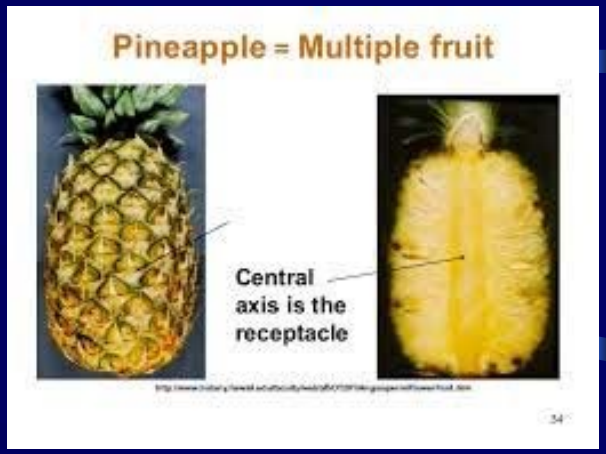
- Flowering: 11 -12 after planting, at least 40 leaves
- Monocarp
- Forcing: Auxin (IAA, NAA) and Ethephon (Ethlylene-releasing compound)

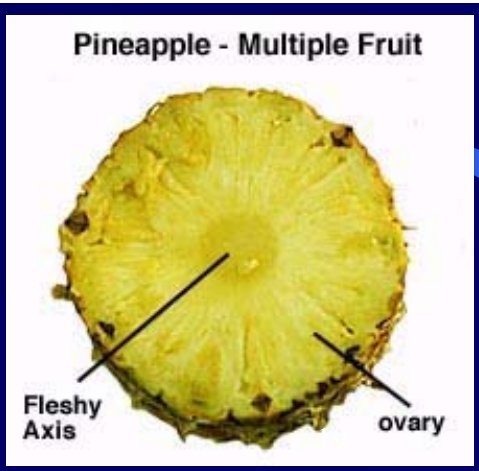

A
Stage_1
Stage_2
Stage_3
Bract
Sepal
B
Flower
Disk
Ovary
Placenta
Ovary wall
Receptable
Bract
Sepal
Petal
Stage 1
Stage 2
Stage 3

Fruit Description

- Terminal Fruit
- Crown - leafy apical shoot
- Multiple fruit
  - →White to Yellow flesh
  - →10-18% brix
  - →0.5 - 1.6% acidity







Pineapple is a Multiple Fruit

- Many flowers on one inflorescence
- Multiple fruit
  - Fusion of berry-like fruitlets
  - Bases of sepals and bracts

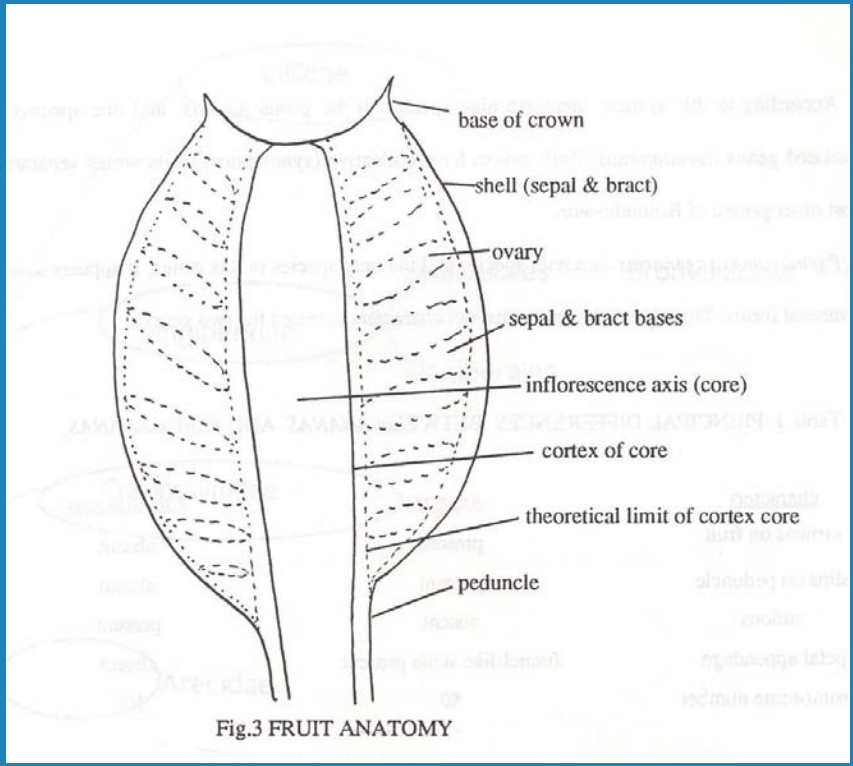


Fig.3 FRUIT ANATOMY

Soil

- Sandyloam
- Acid soil, pH 5.5 to 6.0
- Good drainage
- Fertility
  - Best production at high fertility
  - Tolerates low fertility
- High Organic matter and potassium desirable for best yields

Temperature

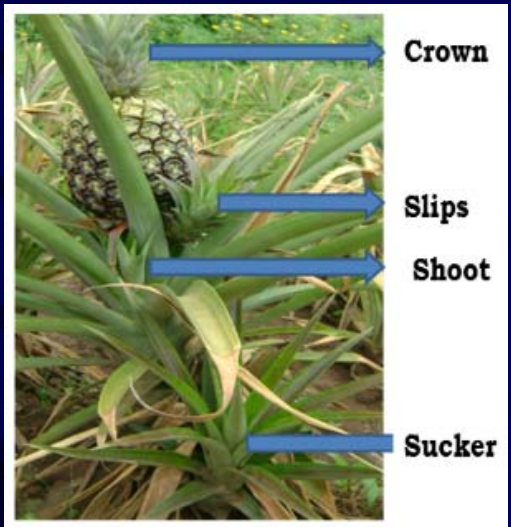
- Average yearly temperature
  - →18-26 °C
- Poor growth
  - →Below 13-15 °C
  - →Above 35 °C
- Optimum growth conditions
  - →Cool nights with sunny days
  - →Day temp 21 – 30 °C

Adaptation: Rain

- Drought tolerant plant
  - Leaf adaptations
  - CAM type plant
- Grown in range of rain conditions
  - 24” (600 mm) - works well if even distribution
  - 150” (3600 mm) per year

Propagation (Vegetative Propagation)

- Ground Sucker
- Shoot or sucker
- Slip
- Crown



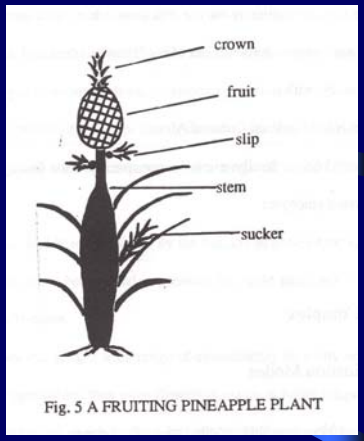
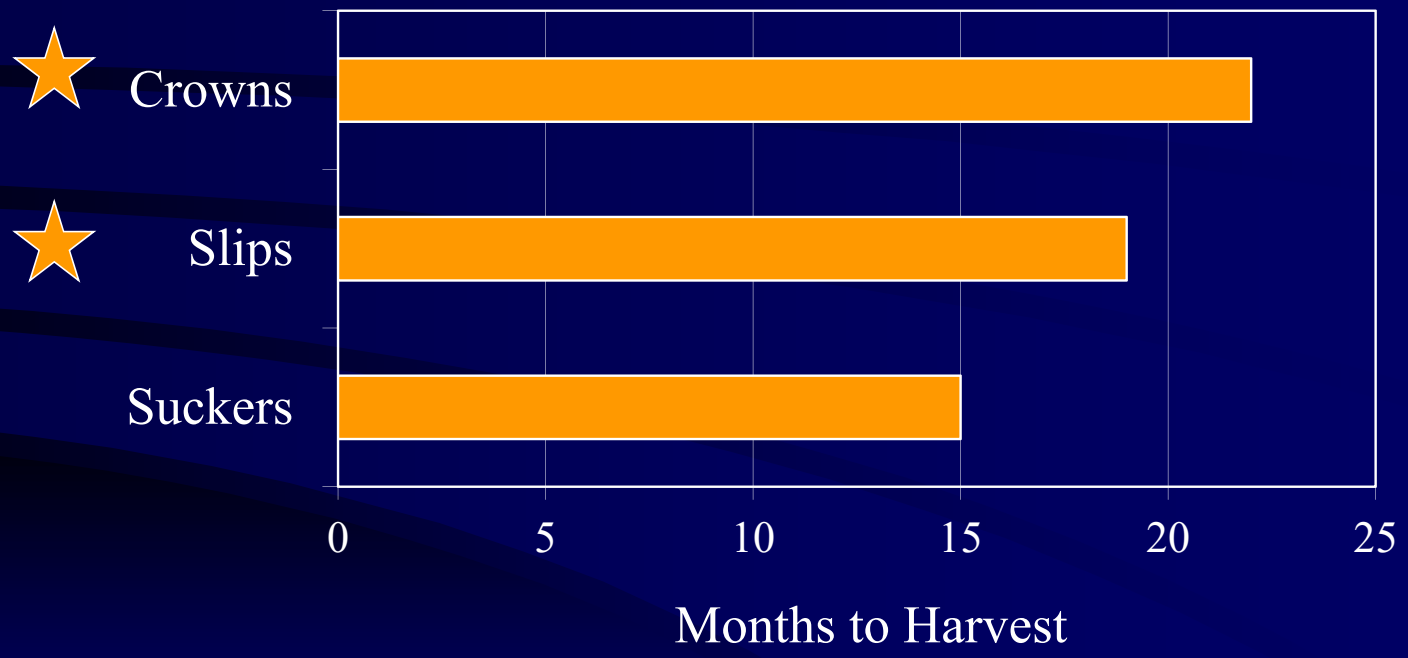


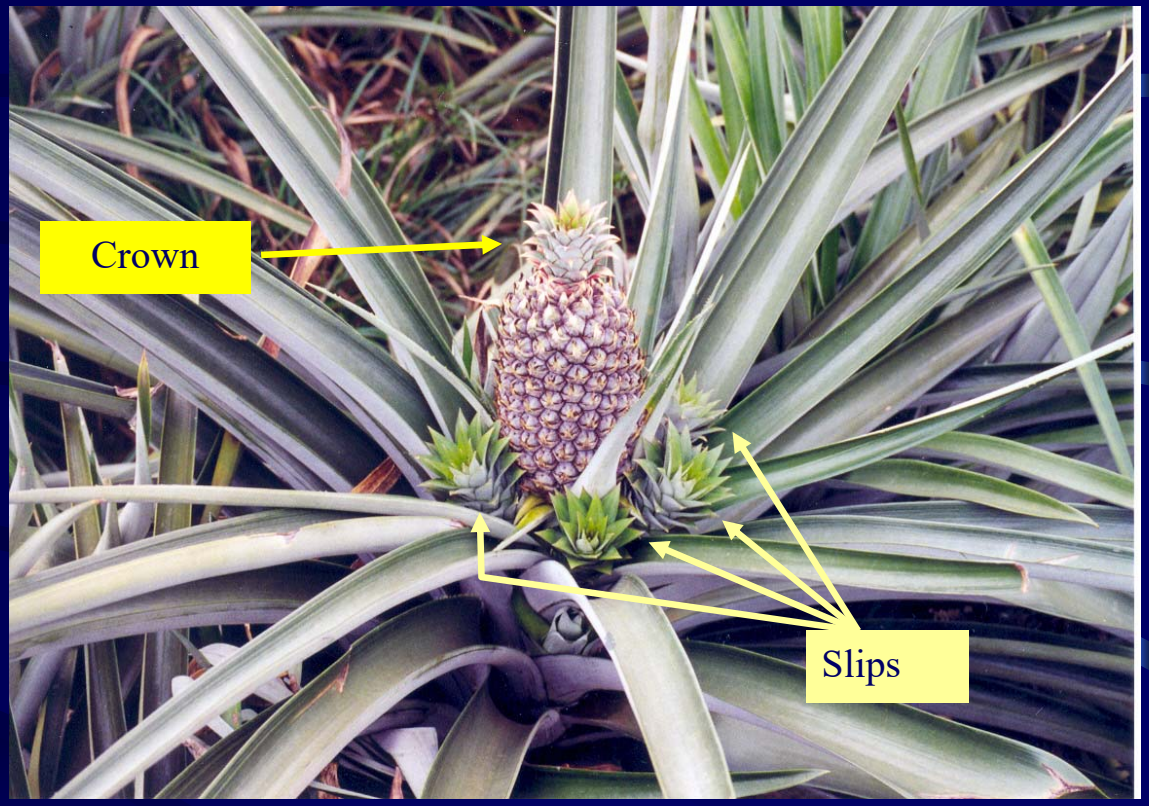
Fig. 5 A FRUITING PINEAPPLE PLANT

Time to Harvest varies with Planting Material



Sucker

Crown



Propagation - Crowns

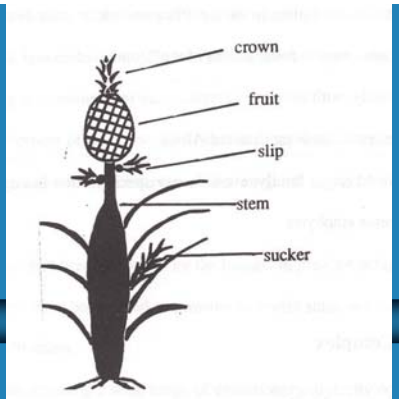


Fig. 5 A FRUITING PINEAPPLE PLANT

- Crowns preferred
  - Preformed roots and good reserves
  - Best grade by weight to reduce variability
- Cannery byproduct
  - Twisted off at fruit harvest time
  - Dried or dipped in fungicide
  - Trimmed, weighed
  - Better roots than slips
- Fresh pineapples marketed with crowns

Pineapple Crowns for Planting

Propagation - Slips

- Rudimentary fruit with crown
  - From axis of leaves on fruit stalk
  - Curved at base -
    - Visible when fruit 1/2 developed
- After harvesting the fruit
  - Allow to develop another 4-5 months
- Storage
  - Can store for 1 year up side down in sun
  - Best yield if plant within 1 month

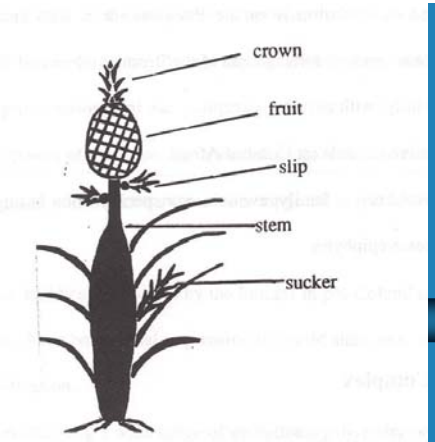
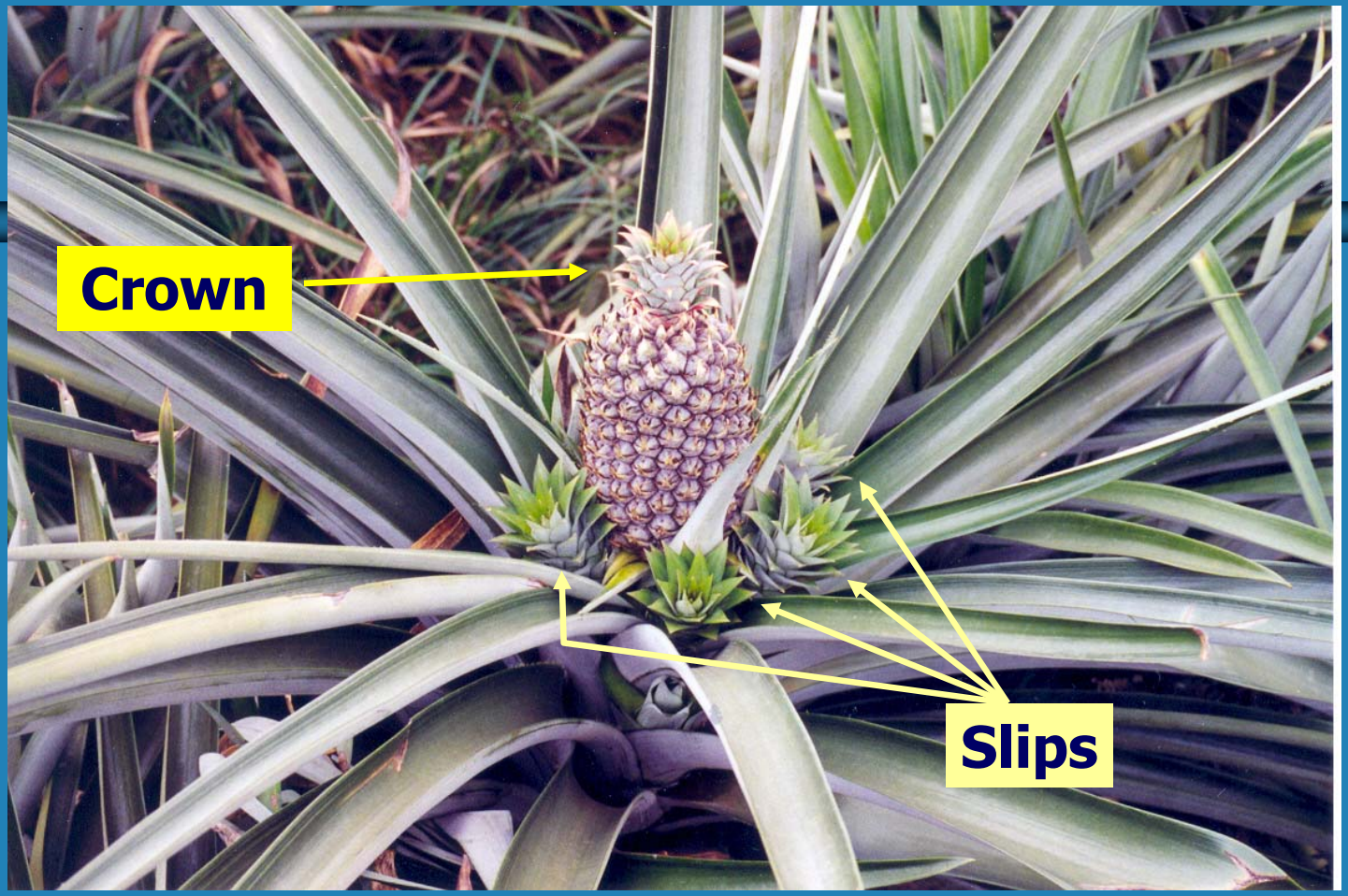


Fig. 5 A FRUITING PINEAPPLE PLANT



Slips allowed to develop 4-5 months after fruit harvest before using

Propagation - Suckers

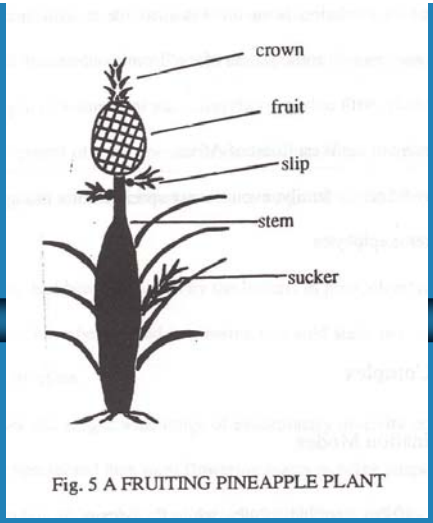


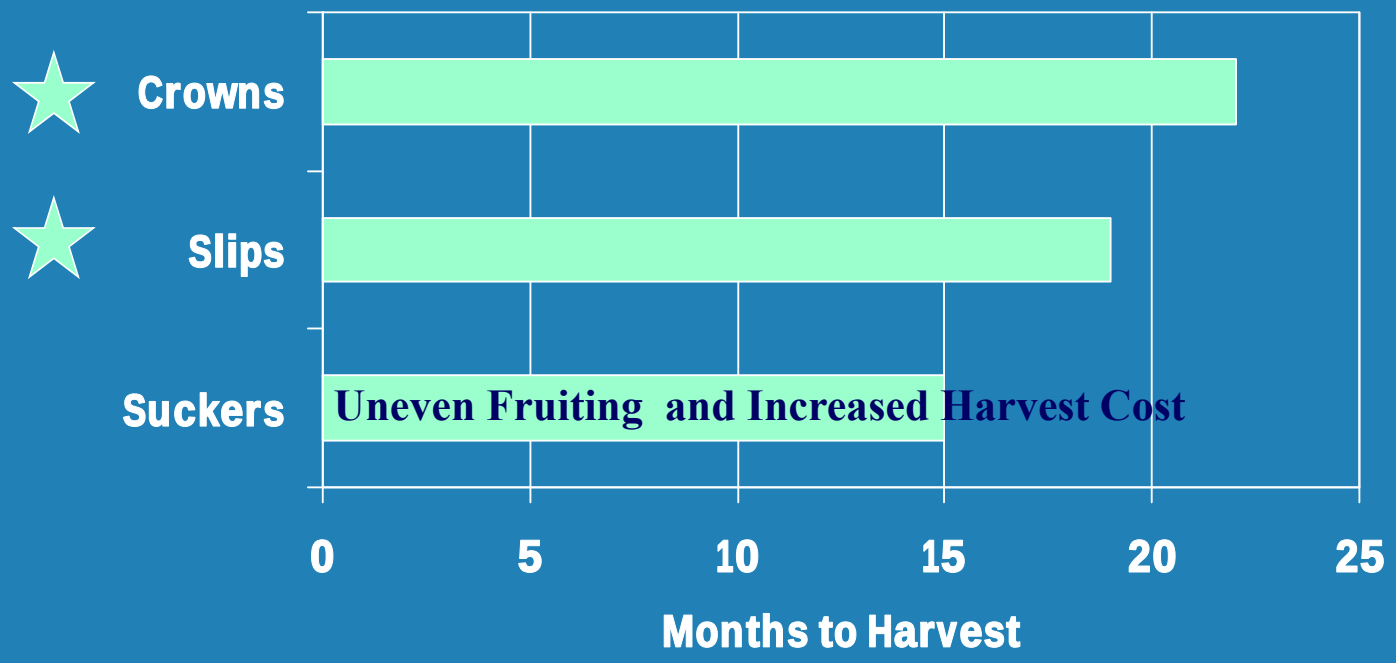
Fig. 5 A FRUITING PINEAPPLE PLANT

- From axillary buds on stem
  - Begin to grow during floral differentiation
- Cut from stem after fruit harvest

- Larger than crowns/slips when collected
  - Floral precocity → uneven harvest

Sucker versus a Crown

Time to Harvest varies with Planting Material



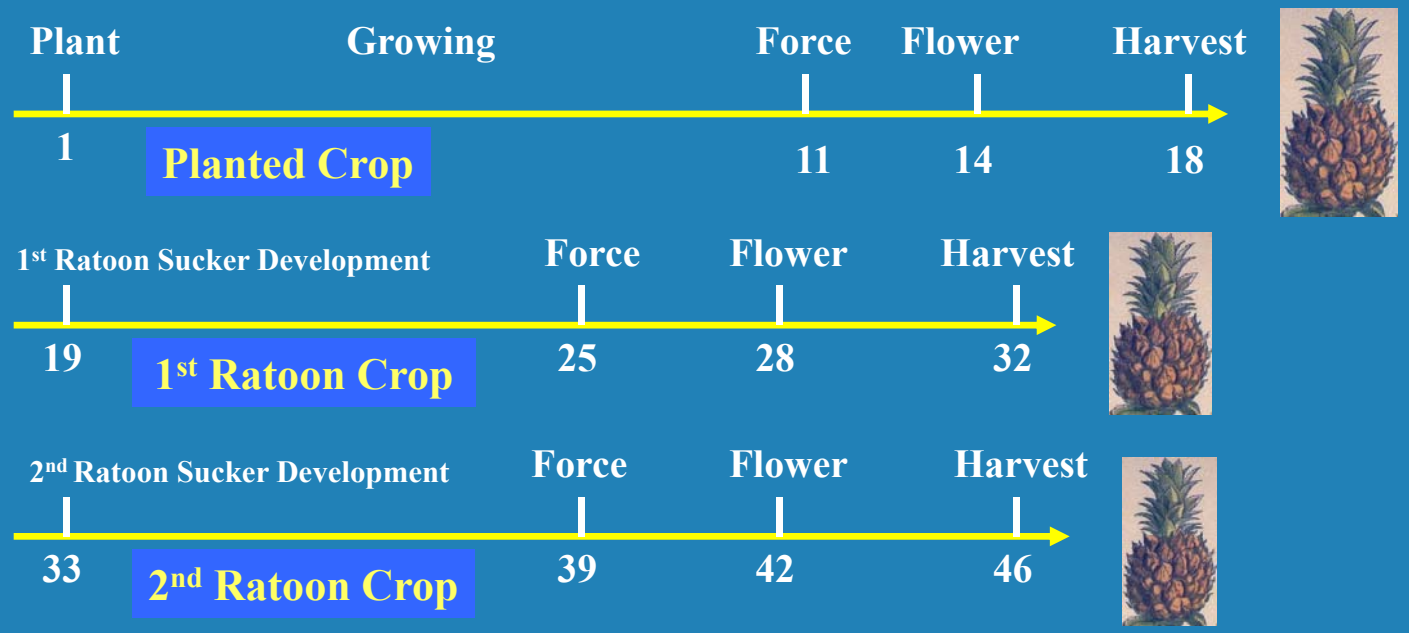
Up side Down Propagation Material

Drying in the sun

Tropical Horticulture - Texas A&M University

Growing Cycle - 3 harvests

Hawaii - 20-22 degrees north



Crop Cycle

- Planted year round
  - Forced 9 - 13 mos later
- Plant crop duration
  - In Hawaii (20-22 degrees north)
    - 15-20 months
  - More tropical areas where warmer
    - 11 - 14 months

Ratoon Crop

- Forced 5-7 months post plant harvest
- Ratoon fruits
  - Smaller
  - Sweeter, less acidic, more aromatic
- Second ratoon crop possible if
  - Soil is fertile and low nematode

Smaller Fruit Size with Each Crop

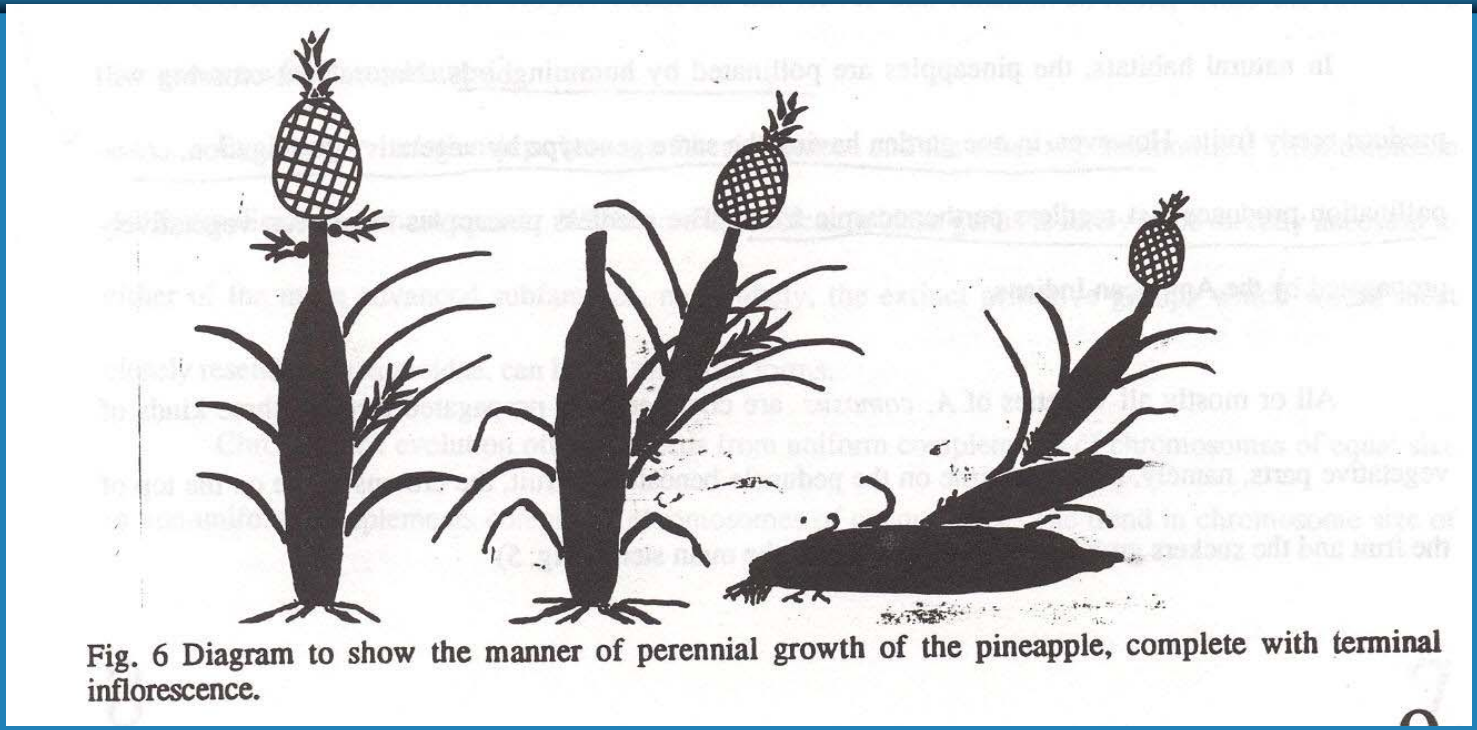
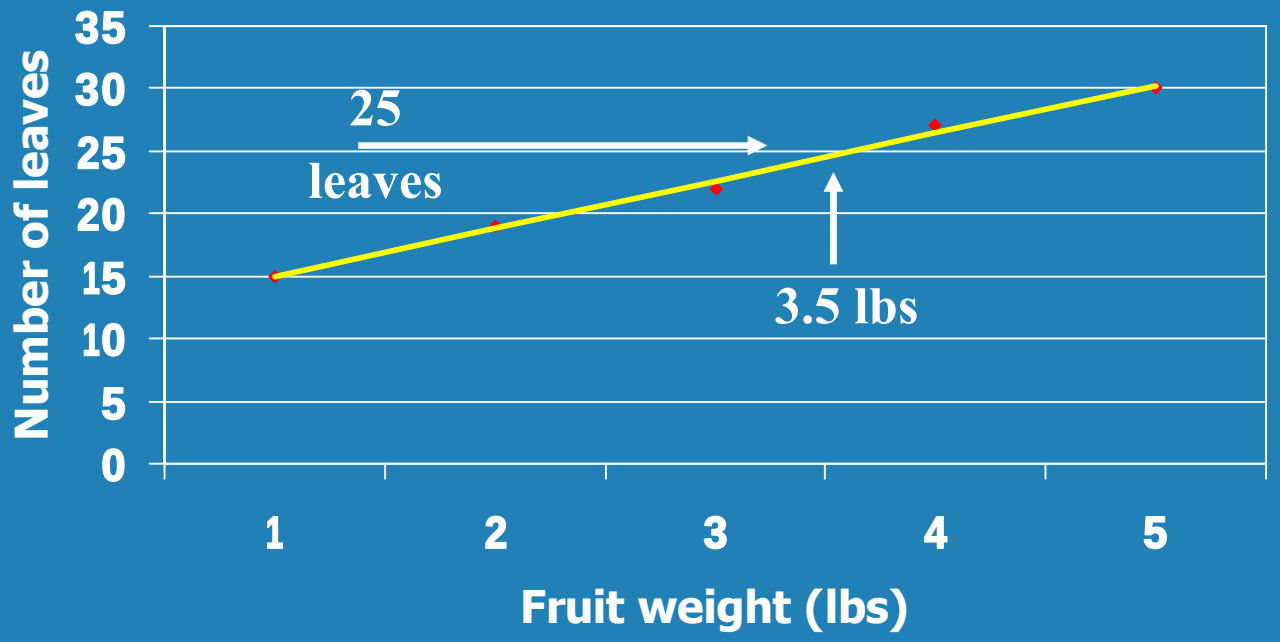


Fig. 6 Diagram to show the manner of perennial growth of the pineapple, complete with terminal inflorescence.

Forcing

- Ethephon
  - Ethlylene-releasing compound
  - Most common growth hormone used
- Why force?
  - Uniformity
  - Regulate harvest
- Forcing easier if:
  - Done near normal flowering time
  - Lower N & less vigor
  - Cool temp (< 24^{o}C night temps)

Pineapple fruit size is related to size of plant at time of flower induction



'Smooth Cayenne' fruit wt = plant wt at time of flowering

Planting

- Traditional system:15000-20000 plant/hec.
- Double rows: 90×60×25 cm Plant density (53000 plant/hec.)

Planting

- Double rows
  - Pineapple for processor
  - 122 x 60 x 28 cm (4 x 2 x 1 ft)
- Plant density regulate fruit size
  - Canning, 58,700/ha
  - Fresh, 75,000/ha
    - Fruit size decrease by 300 gm (0.7 lbs)

Cultural Care in Hawaii
(Not equatorial climate)

- Fumigate/fertilize preplant
- Black plastic mulch
  - Nematicides under poly
  - Increases soil temp in rooting zone
  - Conserves moisture and weeds
- Drip irrigation

Ratoon Crop

Forced 5-7 months post plant harvest

Ratoon fruits

- Smaller
- Sweeter, less acidic, more aromatic

Second ratoon crop possible if

- Soil is fertile and low nematode

Fertilizer

1 hectare (40 t): 123 kg N, 33 kg P, 308 kg K

Nutrient requirements

- High N, K, Fe
- Low requirement of P and Ca

Smaller Fruit Size with Each Crop

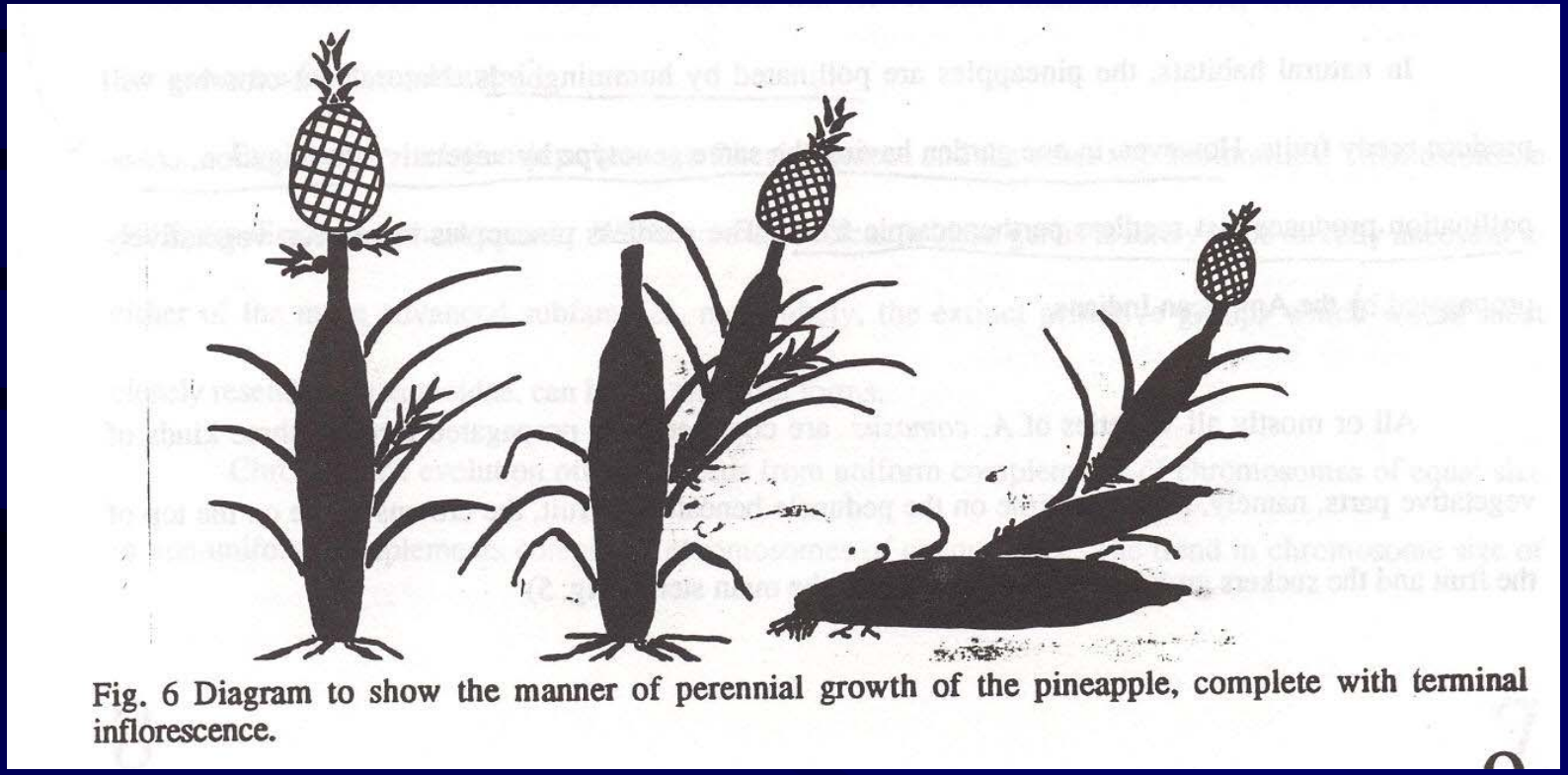
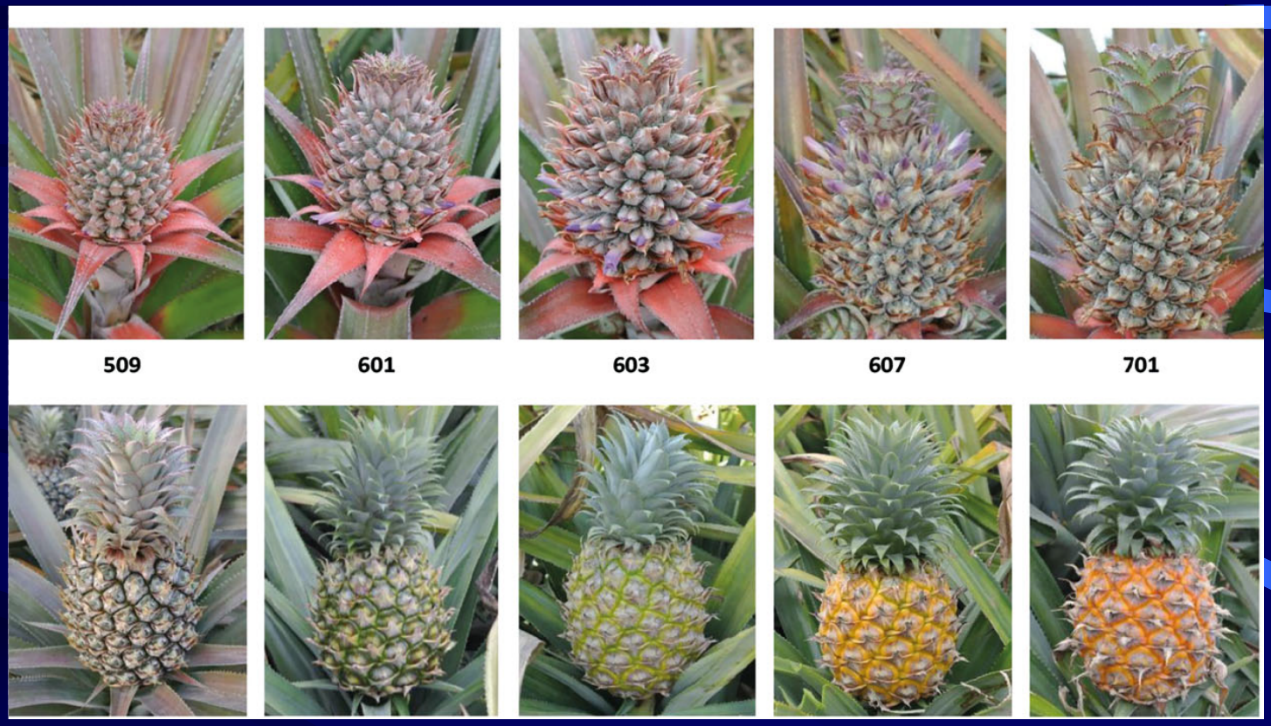


Fig. 6 Diagram to show the manner of perennial growth of the pineapple, complete with terminal inflorescence.

Fruit Growth and Development

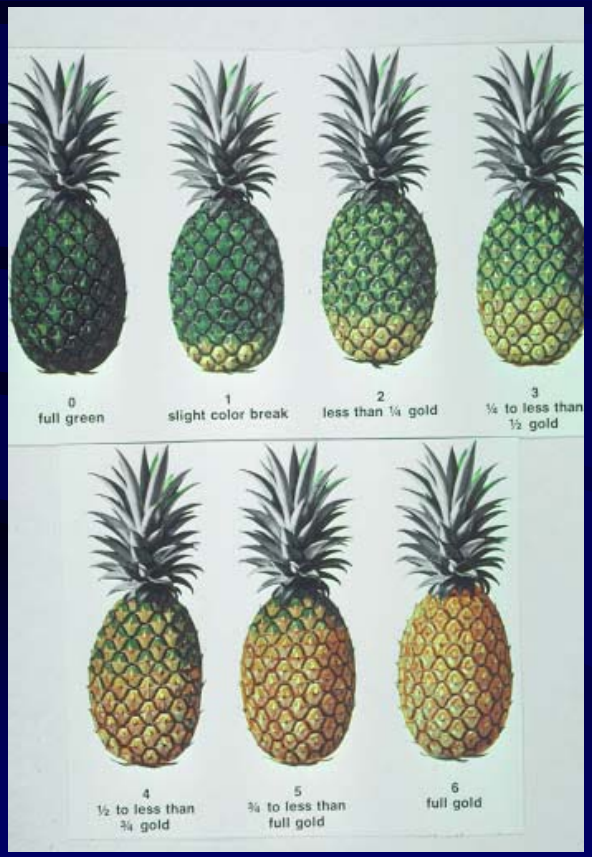
Sigmoid

Pre-maturation: 0-120 days
Early mature: 120-150 days
Late mature: 150-160 days
Ripe:165



Pineapple Harvest

Harvest as shell color changes from green to yellow at base



Pineapple Harvest

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