The Physiology of the Strawberry Plant

Effects of Temperature and Daylength on Plant Growth and Development

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USDA-SARE Project LNE-20-395-34268

Empowering Northeastern Strawberry Growers with Flower Mapping

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Getting from this ....

or this ...

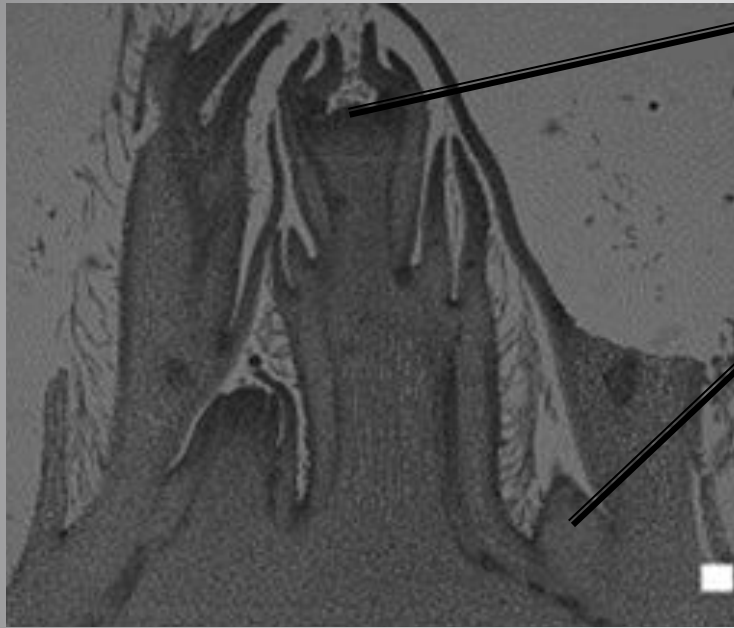# *to this…*

It all comes down to the *Meristem*

What is a meristem?

- Groups of cells where growth takes place

- Cells divide and take on different functions to produce new organs like leaves or flowers.

- Meristems develop differently depending on where they are located.
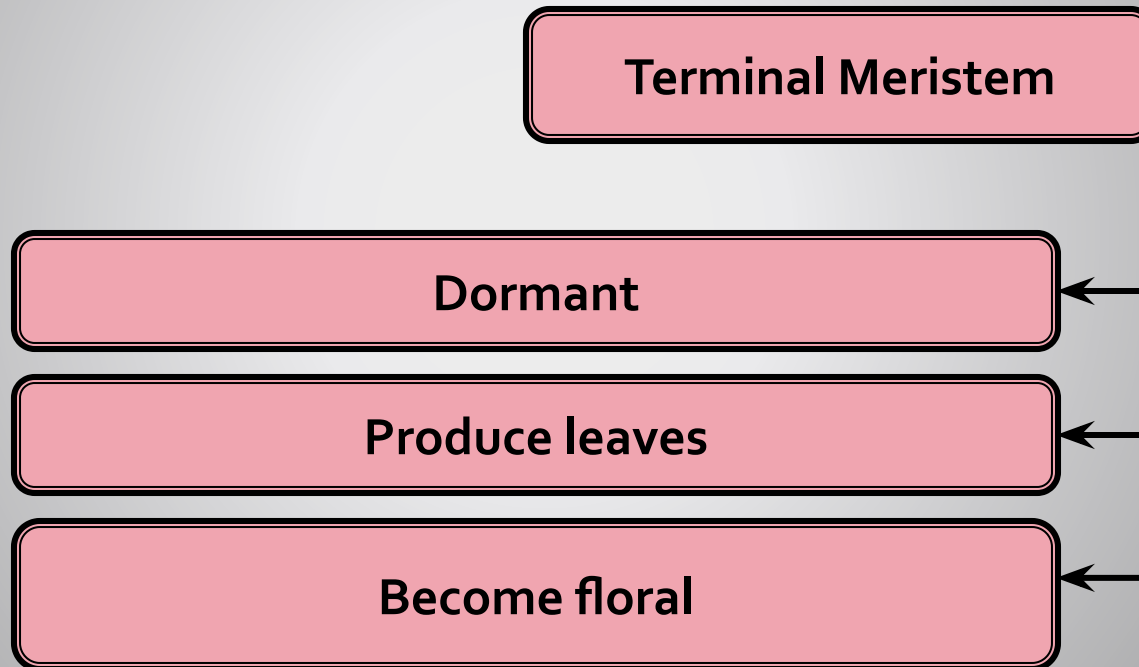
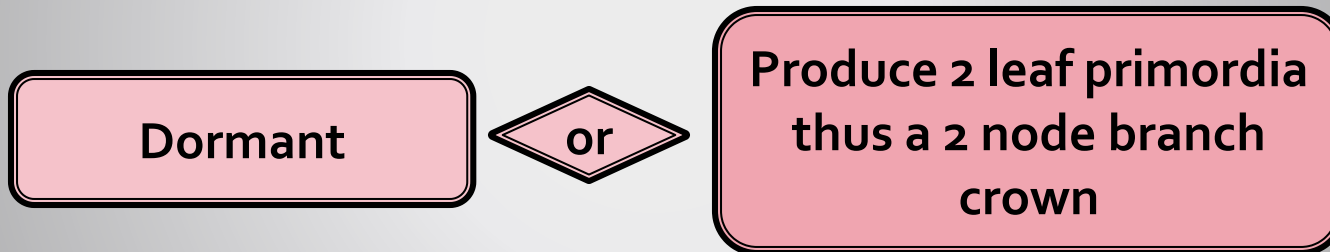# Two important types of strawberry meristems

Terminal

Axillary

Terminal meristem

(One per crown)

Axillary meristem fates:

(Many per crown, one in each leaf axil)

Dormant **or** Produce 2 leaf primordia thus a 2 node branch crown

Axillary meristem fates:

(Many per crown, one in each leaf axil)

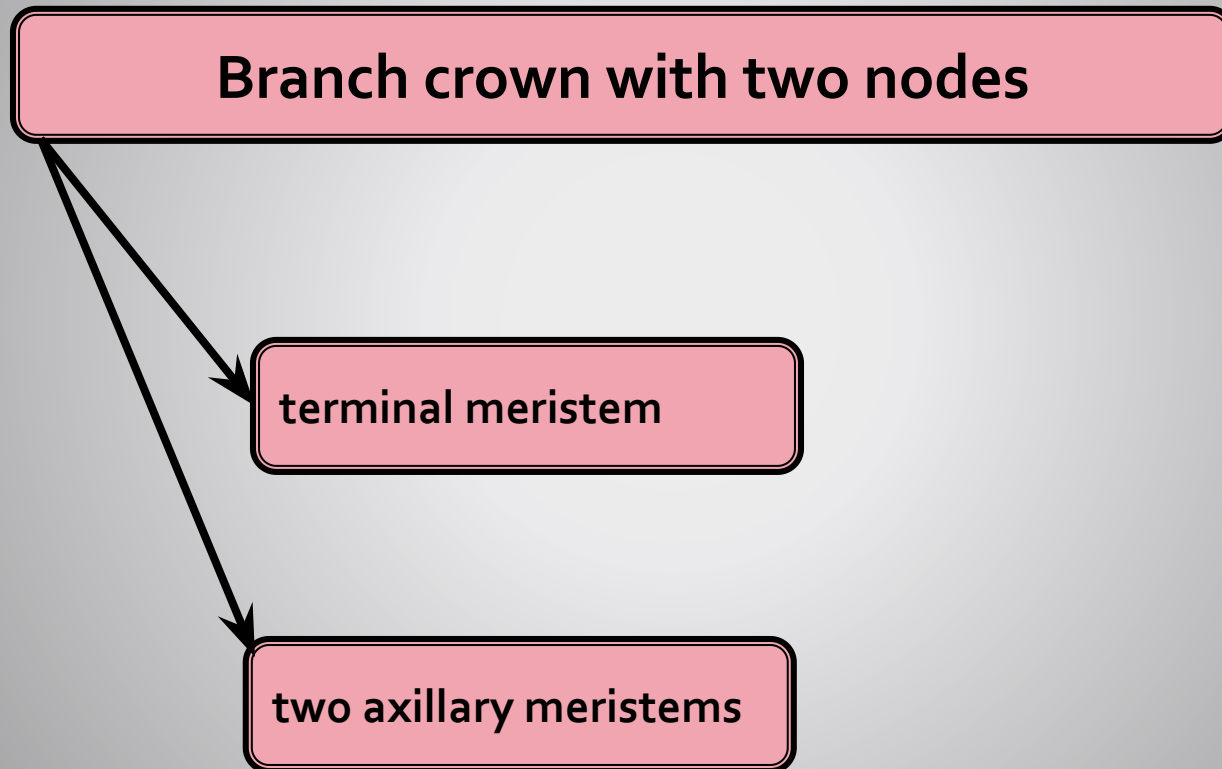**2 node branch crown**

Dormant

Both internodes elongate = runner

Neither internode elongates = branch crown with two nodes

Axillary meristem fates:

(Many per crown, one in each leaf axil)

Branch crown with two nodes

terminal meristem

two axillary meristems

Axillary meristem fates:

(Many per crown, one in each leaf axil)

Branch crown with two nodes

terminal meristem

remain dormant

produce an inflorescence

produce more leaves and then an inflorescence

two axillary meristems

Axillary meristem fates:

(Many per crown, one in each leaf axil)

Branch crown with two nodes

terminal meristem
- remain dormant
- produce an inflorescence
- produce more leaves and then an inflorescence

two axillary meristems
- Dormant
- Produce 2 node branch crown

Axillary meristem fates:

(Many per crown, one in each leaf axil)

Branch crown with two nodes

terminal meristem

- remain dormant
- produce an inflorescence
- produce more leaves and then an inflorescence

two axillary meristems

- Dormant
- Produce 2 node branch crown
  - Dormant
  - Runner
  - 2 node branch crown

Active axillary meristems

- Process of branching can continue to produce a plant with many branched crowns
  - Each branched crown has terminal and axillary meristems which can
    - Become a runner
    - Become a branch crown with 2 or more nodes

- Ideally want a plant with a main crown and 5 or 6 branches

- FLOWERS always from a terminal meristem
  - they may appear axillary due to the short nature of a 2 node branch crown

So what controls the development of the meristems?

Strawberry Flowering Physiology

Genetics

- Type of cultivar
  - Junebearer
  - Everbearer
  - Day-neutral

Environment

- Photoperiod
- Temperature

Strawberry Flowering Physiology

Genetics

- Type of cultivar
  - ~~Junebearer~~
  - ~~Everbearer~~
  - ~~Day-neutral~~

Environment

- Photoperiod
- Temperature

Strawberry Flowering Physiology

Genetics

- Type of cultivar
  - Short-day
  - Long-day

Environment

- Photoperiod
- Temperature

Strawberry Flowering Physiology

Stages
- Induction
- Initiation
- Differentiation
- Development

Short-day cultivars

FBI = daylength **shorter than** a defined critical value.

Critical value decreases as temperature increases.

Development under **long days.**

SD + warm temps = semi-dormant / dormant.

   (Dormancy not due to SD + cool temps!)

   Must be removed with chilling (or LD).

After chilling, SD cvs won't initiate more FB's

Long-day cultivars

FBI = daylength **longer than** a defined critical value.

Development also LD.

Critical value increases as temperature increases.

SD + warm temps = semi-dormant / dormant.

(Dormancy not due to SD + cool temps!)

Must be removed with chilling (or LD).

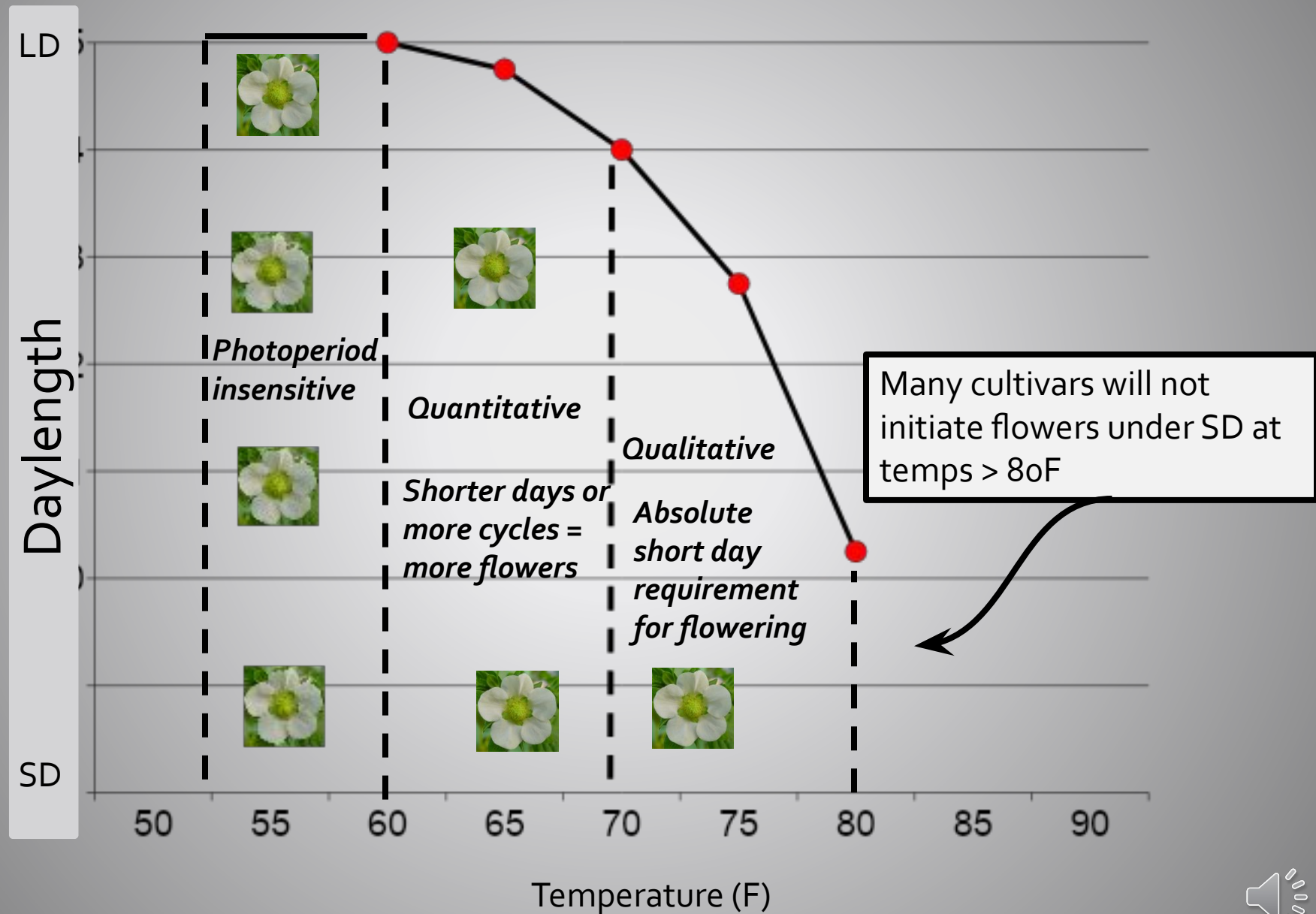# Both types of cultivars:

Quantitative (dimmer switch)
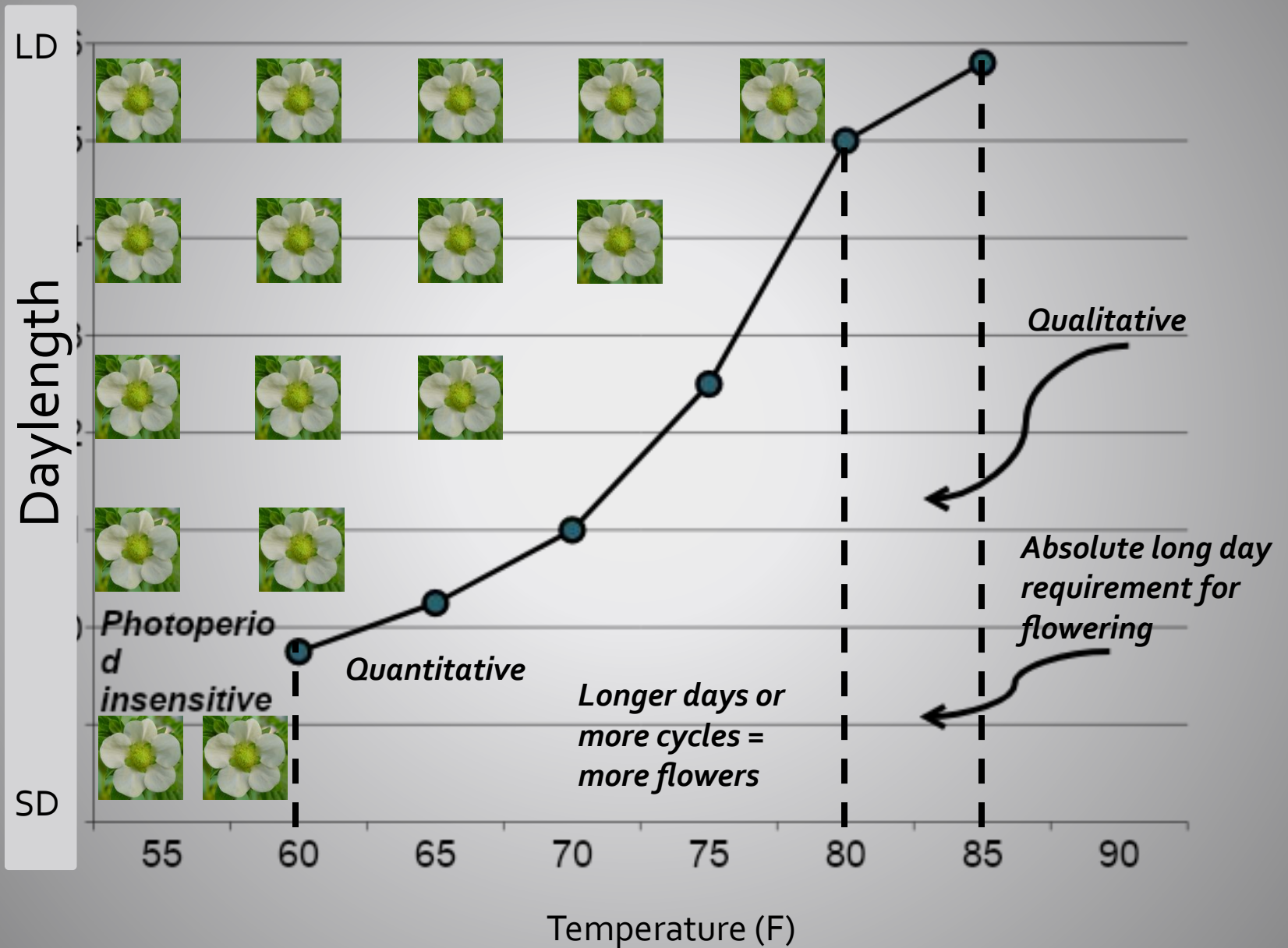
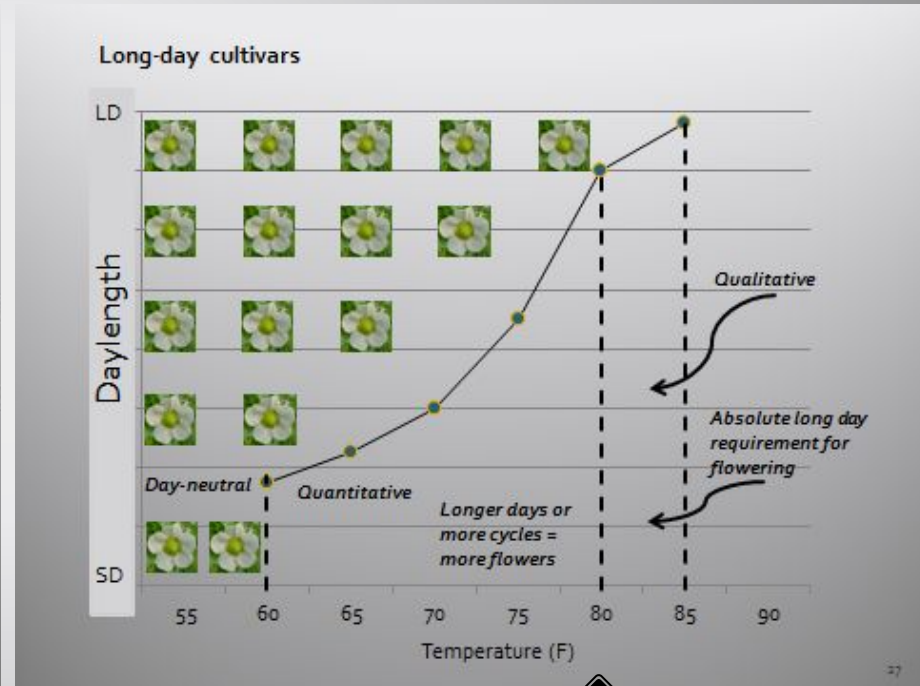**and**

Qualitative (on/off switch)

responses to photoperiod.

Short-day cultivars

Photoperiod insensitive

Quantitative

Shorter days or more cycles = more flowers

Qualitative

Absolute short day requirement for flowering

Many cultivars will not initiate flowers under SD at temps > 8oF

Daylength (y-axis, LD to SD)

Temperature (F) — 50, 55, 60, 65, 70, 75, 80, 85, 90
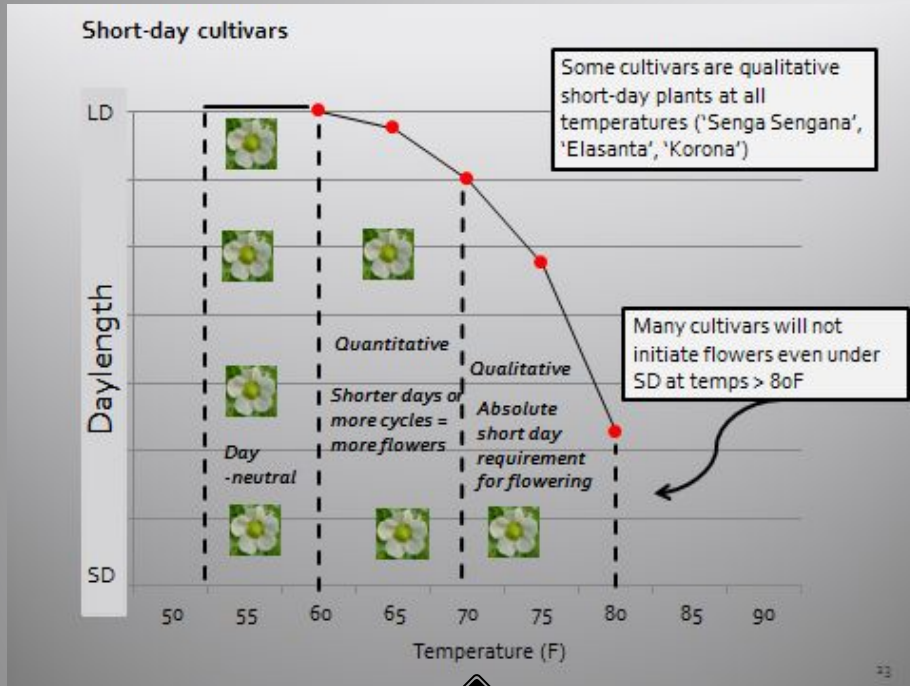
Long-day cultivars

Short-day vs long-day cultivars

Temperatures where they switch to qualitative responses much different

Other responses to photoperiod

- Runner production
  - LD + high T = runners for SD cultivars
  - SD + high T = runners for LD cultivars.

- Branch crown formation
  - SD cvs
    - Days too short for runners
    - Too long for FBI
  - LD cvs
    - Days too long for runners
    - Too short for FBI

Flower initiation and runner production are antagonistic in both types

SHORT –DAY TYPES

- Flowers initiated under SHORT days
- Runners produced under LONG days

LONG-DAY TYPES

- Flowers initiated under LONG days
- Runners produced under SHORT days

Strawberry Flowering Physiology

WHY IS IT SO COMPLICATED????

GENETICS - OCTOPLOID

PRODUCTION SYSTEM
X
CULTIVAR
X
PLANT TYPE, PLANT SOURCE & PLANT AGE
X
PHOTOPERIOD X TEMPERATURE X # OF CYCLES DURING PROPAGATION
X
PLANT HISTORY
X
PLANTING DATE

So what should I do to maximize productivity ????

Keys to success

Know your:

- **PRODUCTION SYSTEM**
- **CULTIVARS**
- **PLANT TYPE, SOURCE AND HISTORY**
- **SKILL LEVEL**