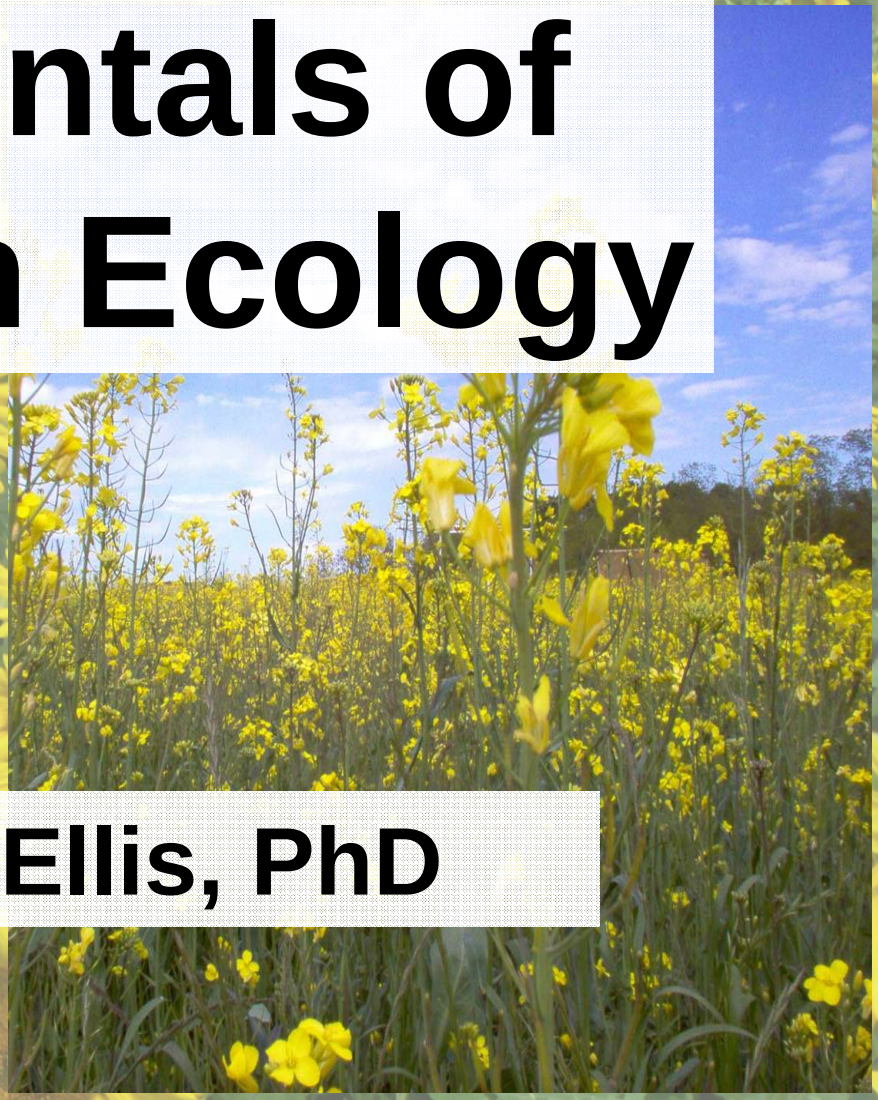
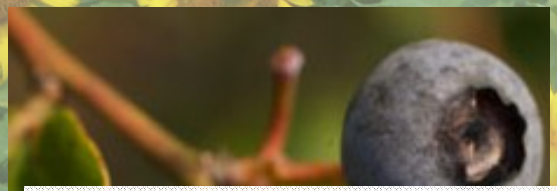
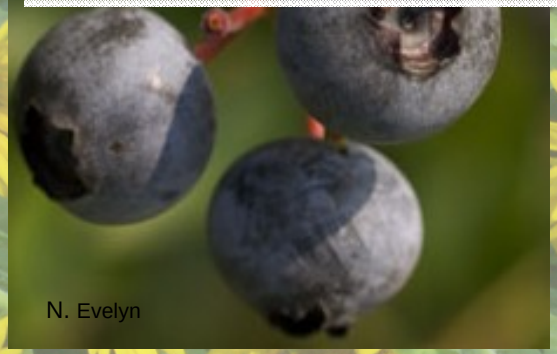
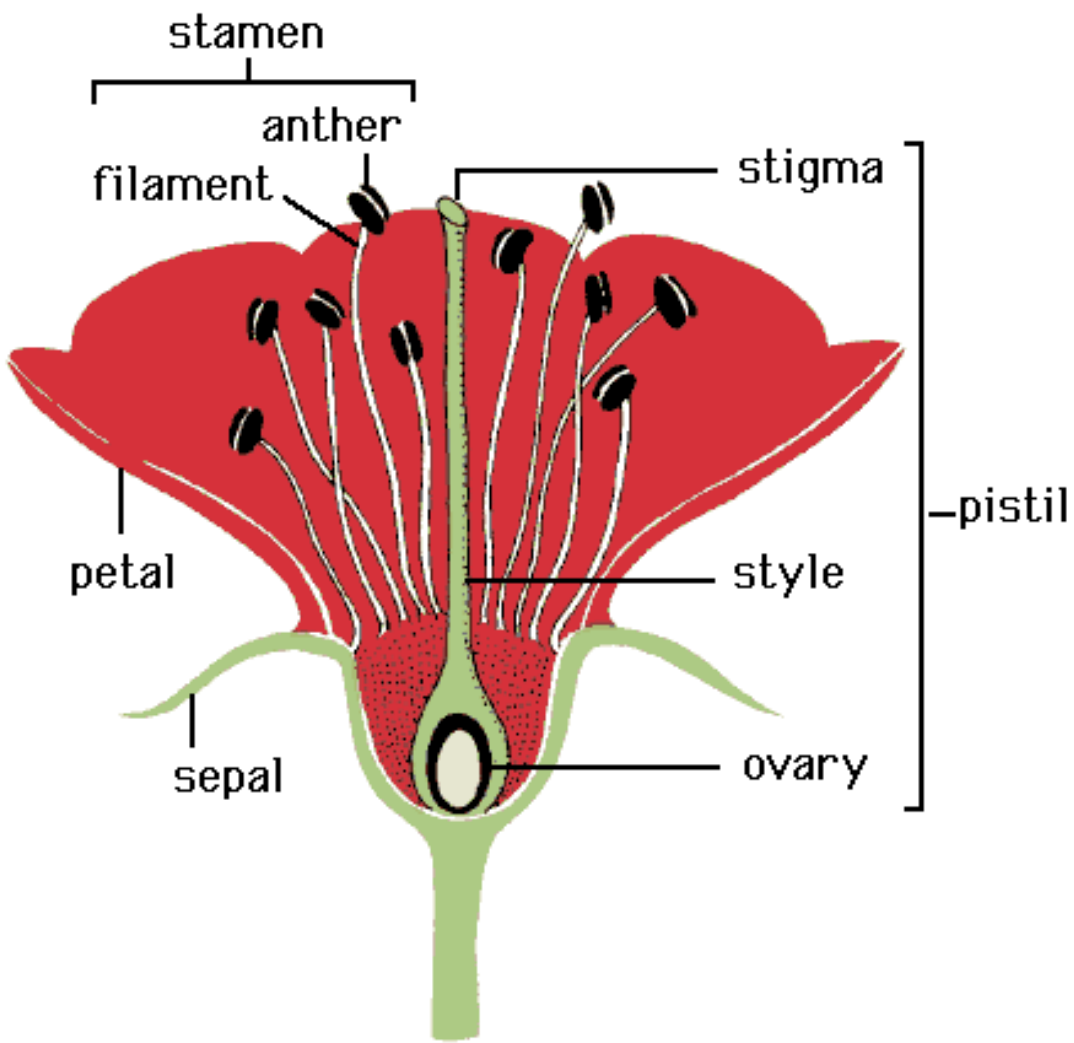
Fundamentals of Pollination Ecology





Amanda M. Ellis, PhD





http://www.agen.ufl.edu/~chyn/age2062/lect/lect_15/22_62.GIF

A perfect flower contains both stamens (male parts) and pistil (female parts).

An imperfect flower contains only male or female parts.

Inflorescence- an arrangement of flowers on a stem

Floret – one flower

Types of fruits

- **Berry- fleshy outer wall surrounding one or more fairly small seeds**
- **Pome- fleshy outer wall surrounding a tough core with seeds**
- **Drupe (stone)- fleshy outer wall surrounding one stony seed**
- **Aggregrate- many pistils develop together as a single mass**

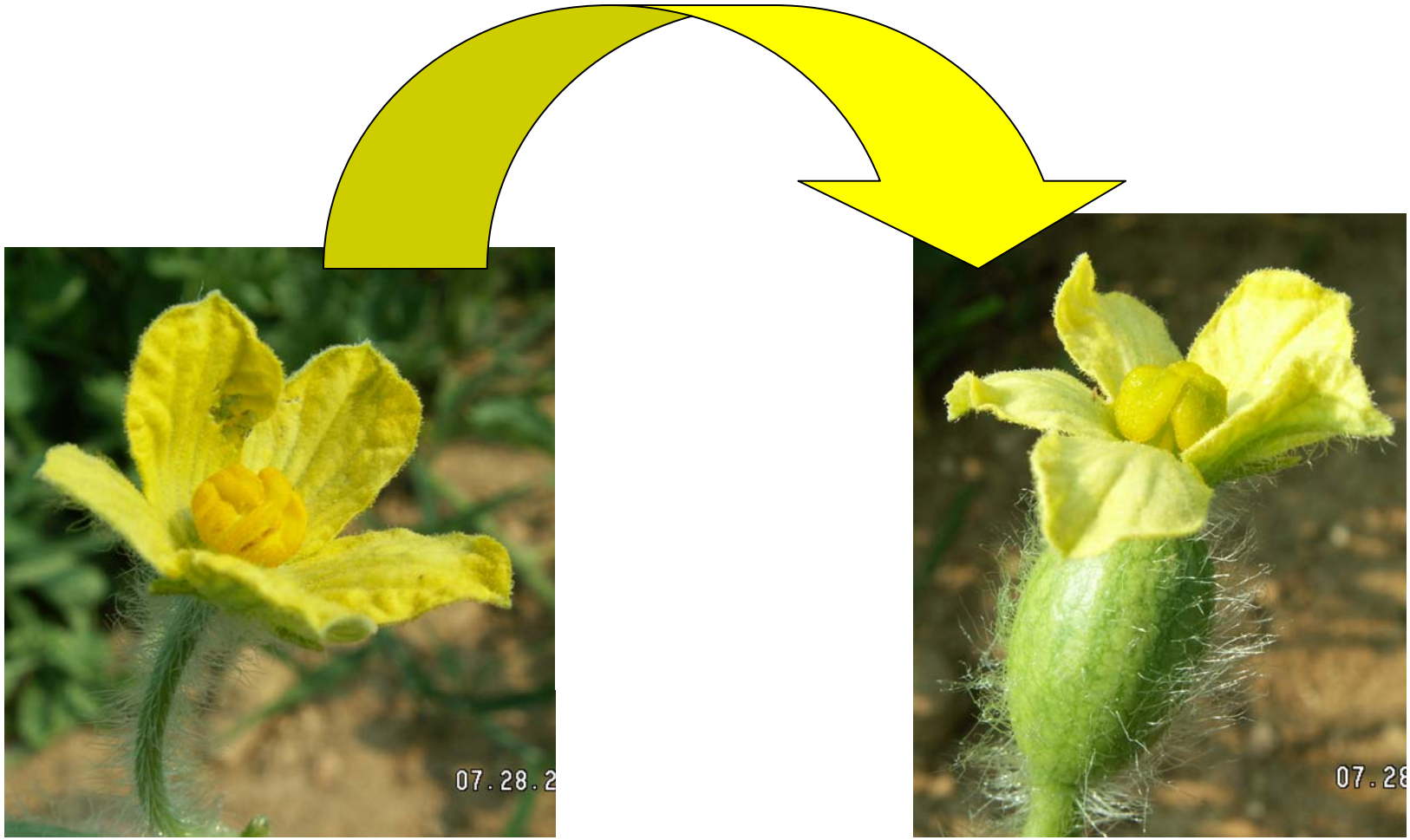
<u>Monoecious</u> – plants that have both male and female flowers on the same plant

<u>Dioecious</u> – plants that have only one sex of flower on the same plant

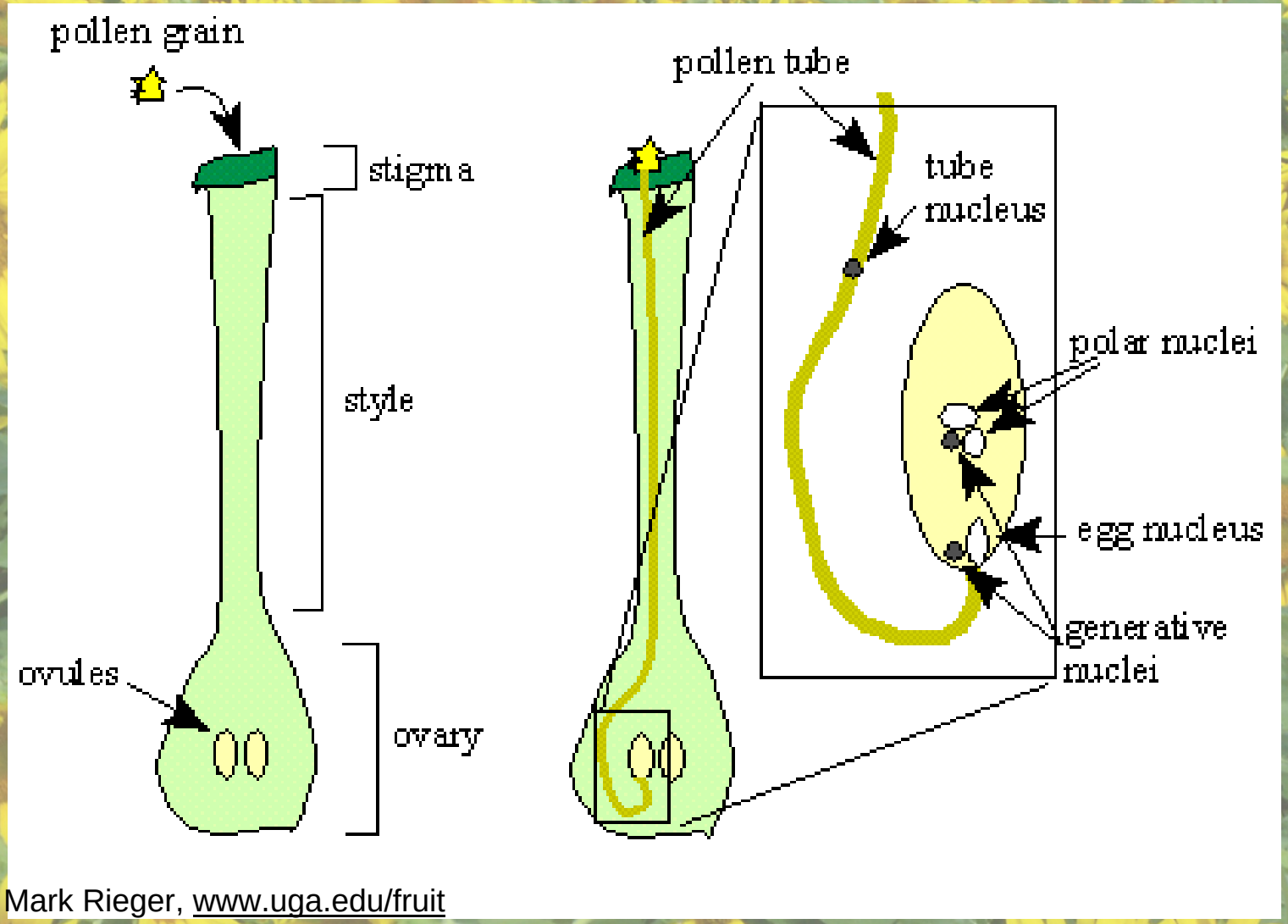
www.texasbeyondhistory.net

planthttp://www.tarleton.edu/~range/Sanderson%20Pictures/02073%20harvest%20persimmon.jpg

Pollination – the transfer of pollen from the anthers of a flower to the stigma of the same or different flower



Fertilization- when male genetic material passes down the pollen tube and reaches an ovule

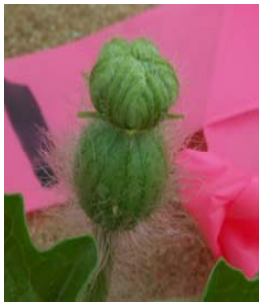


Mark Rieger, www.uga.edu/fruit

Flower receptivity:

1 day

July 20



July 19

7 days

Fruit Set

- **May require multiple pollination events**
- **Example: It takes 24 bee visits to sufficiently pollinate a seedless watermelon flower and form quality fruit.**

How does pollination occur?

- Wind

- Mechanical transfer (usually insects)

Wind Pollinated Plants

- Produce many small pollen grains
- Don’t disperse well, occur in stands
- Advantage – does not require a pollinator

Mechanical Transfer

Types of Pollinators:

Birds

Insects

Bees

Butterflies

Beetles

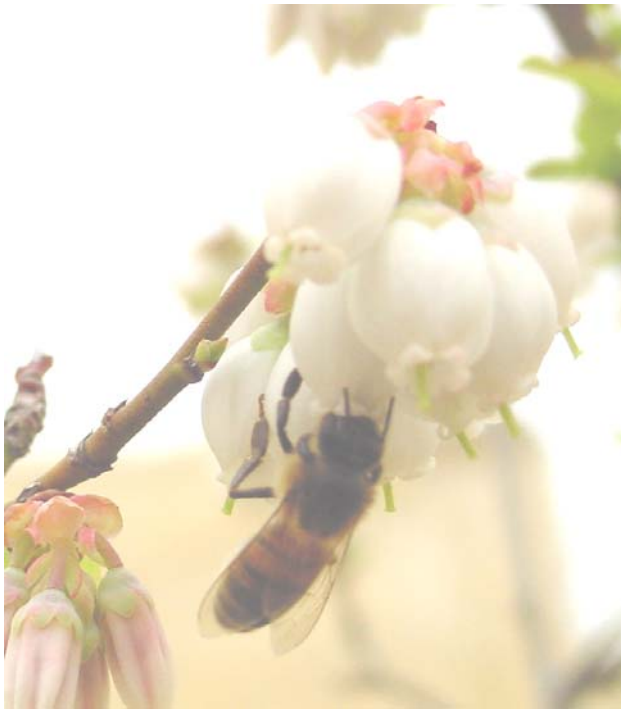
Bugs

Flies

Bats

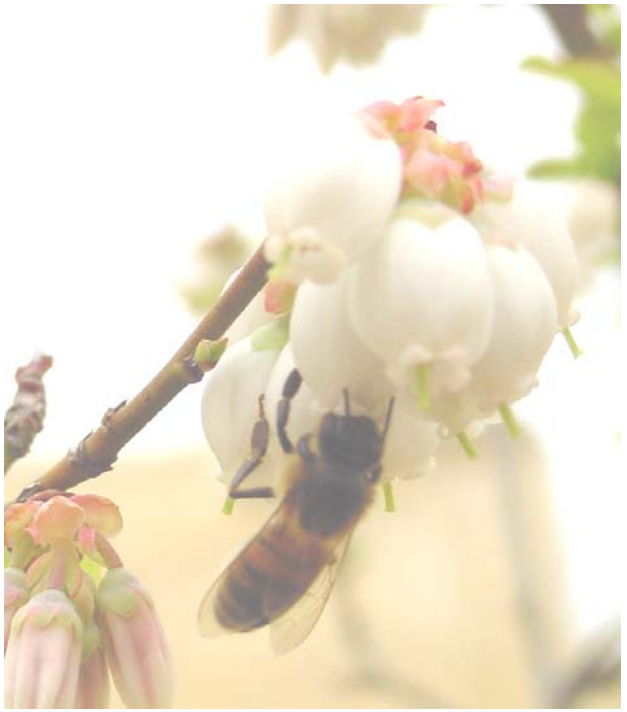
Insect Pollinated Plants

- **Mutualistic relationship between the plant and the pollinator– produce rewards**
- **Have nectaries**
- **Produce less pollen and**
- **have larger pollen grains**



Insect Pollinated Plants

- **Mutualistic relationship between the plant and the pollinator– produce rewards**
- **Have nectaries**
- **Produce less pollen and**
- **have larger pollen grains**



Pollinator Rewards

- Pollen – lipid, starch, or proteins
- Nectar – sugar solution

- BOTTOM LINE: The plant must provide adequate rewards to promote foraging by the pollinators but not so large a reward that it discourages movement to other flowers.

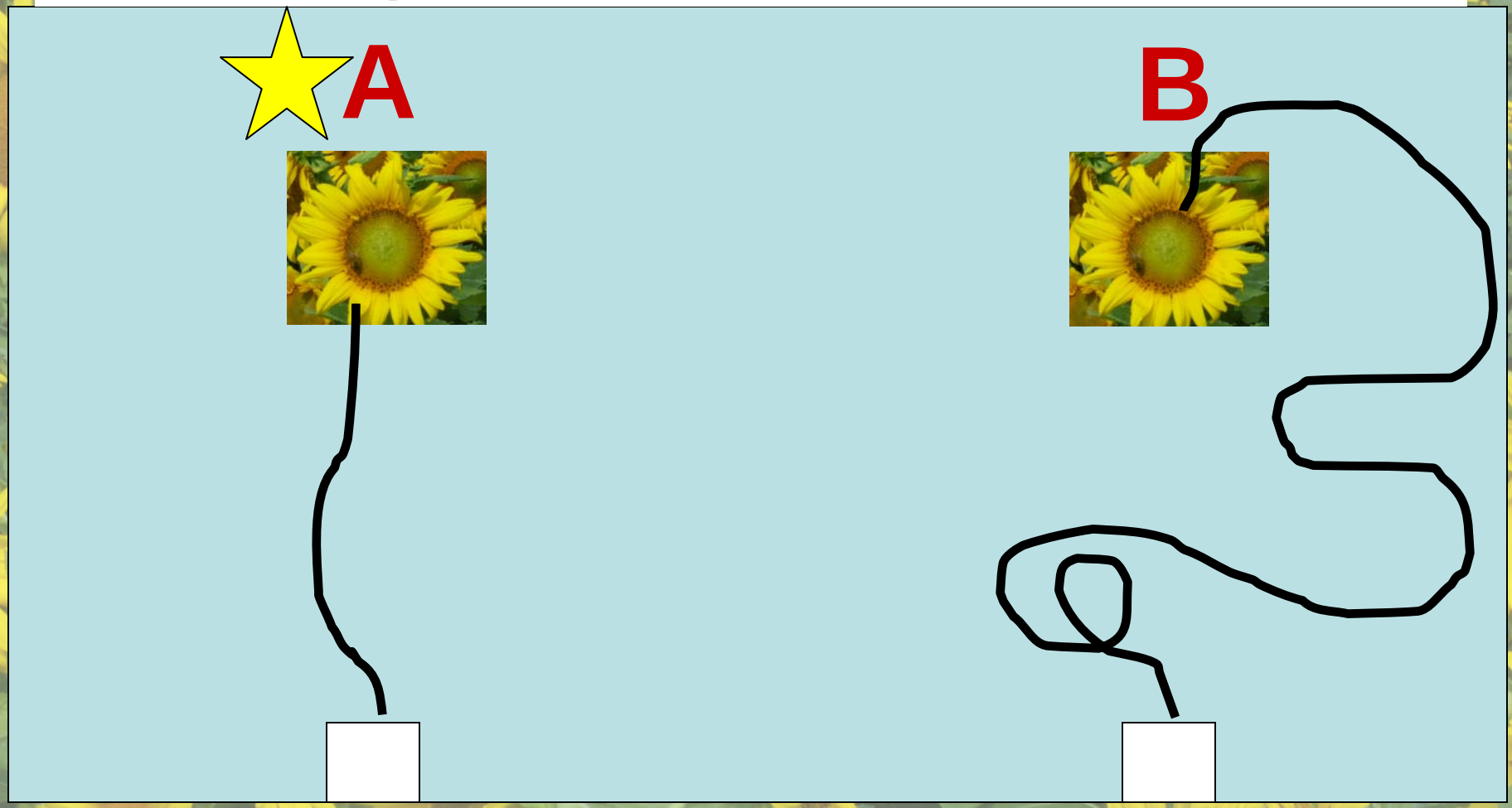
Why seek rewards?

Foraging Energetics

intake energy – output energy = Net energy gain

Output Energy

- **Distance, Discrimination Time, and Handling Time**



Intake Energy

- **Quality of rewards**

A “good” pollinator

Delaplane and Mayer 2000

- **Carries a high percentage of donor pollen.**
- **Visits a high percentage of receptive stigmas.**
- **Visits pollen-donor and pollen-receiver flowers successively.**
- **Covers stigmatic surfaces.**
- **Works rapidly.**
- **Works long hours.**

Why are honey bees good pollinators?

- Large numbers
- Generalists

Minimum hive strength standards

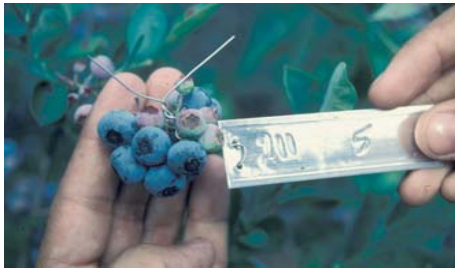
- Bees blanket tops of 6-10 frames.
- Brood fills 4-6 frames, preferably young brood.
- Queenright
- No uncontrolled diseases or parasites

Plant Terms

- **Self-sterility – plants that require pollen from a different plant or even a different variety**
- **Cross-pollination – the transfer of pollen from flowers of one plant to the flowers of a different plant or different variety**
- **Pollenizer – variety interplanted within main variety to provide cross-pollination**

Cross Pollination Benefits

- **Higher % Fruit Set**



÷

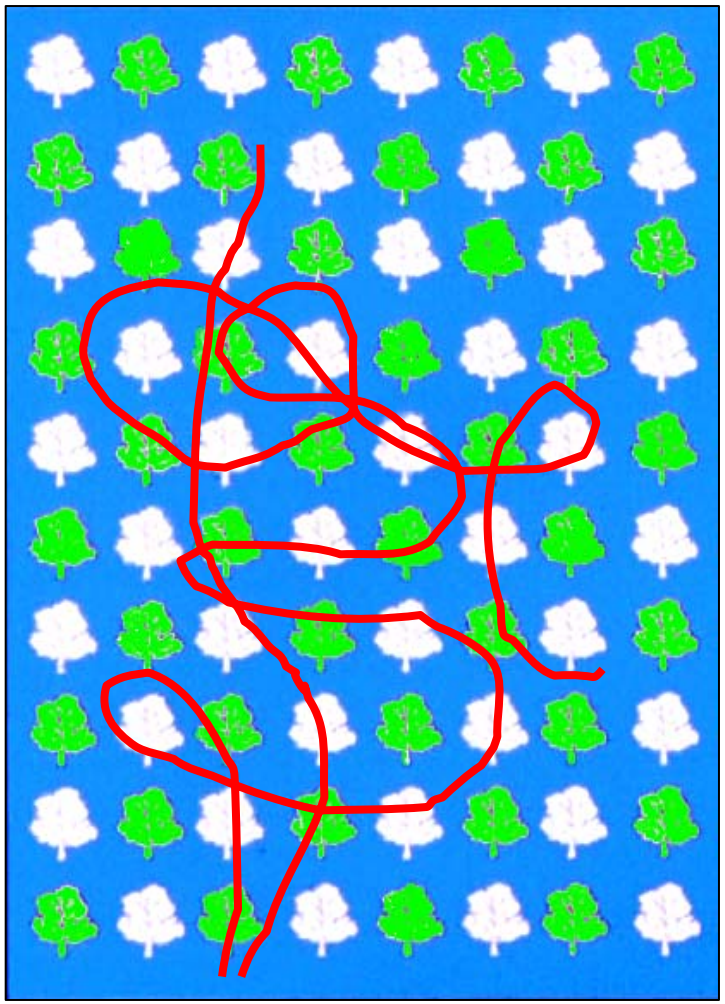
% fruit-set

- **Larger Fruit**

Choosing Varieties

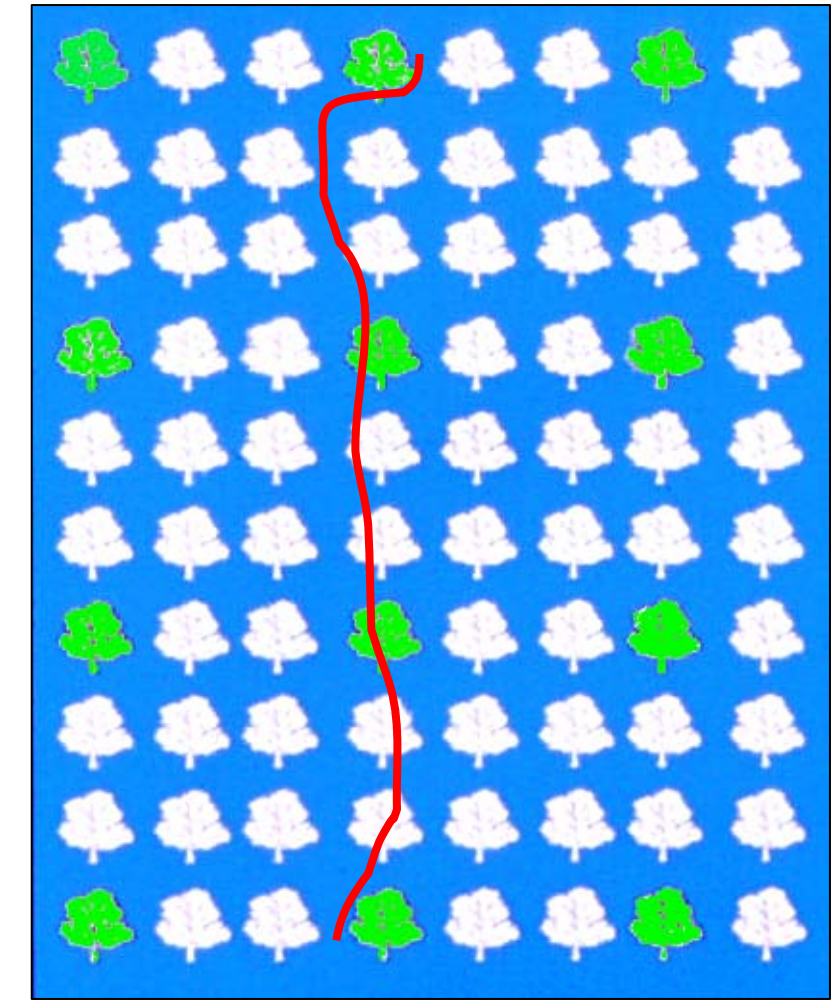
- Do your homework!
- Choose varieties that will bloom at the same time
- Examples: Blueberries –Premier and Climax; Seedless Watermelons – Sugar Heart and Crimson Sweet

Every other tree is a pollenizer



Main Variety Pollenizer

Every third tree in every third row is a pollenizer



Main Variety Pollenizer

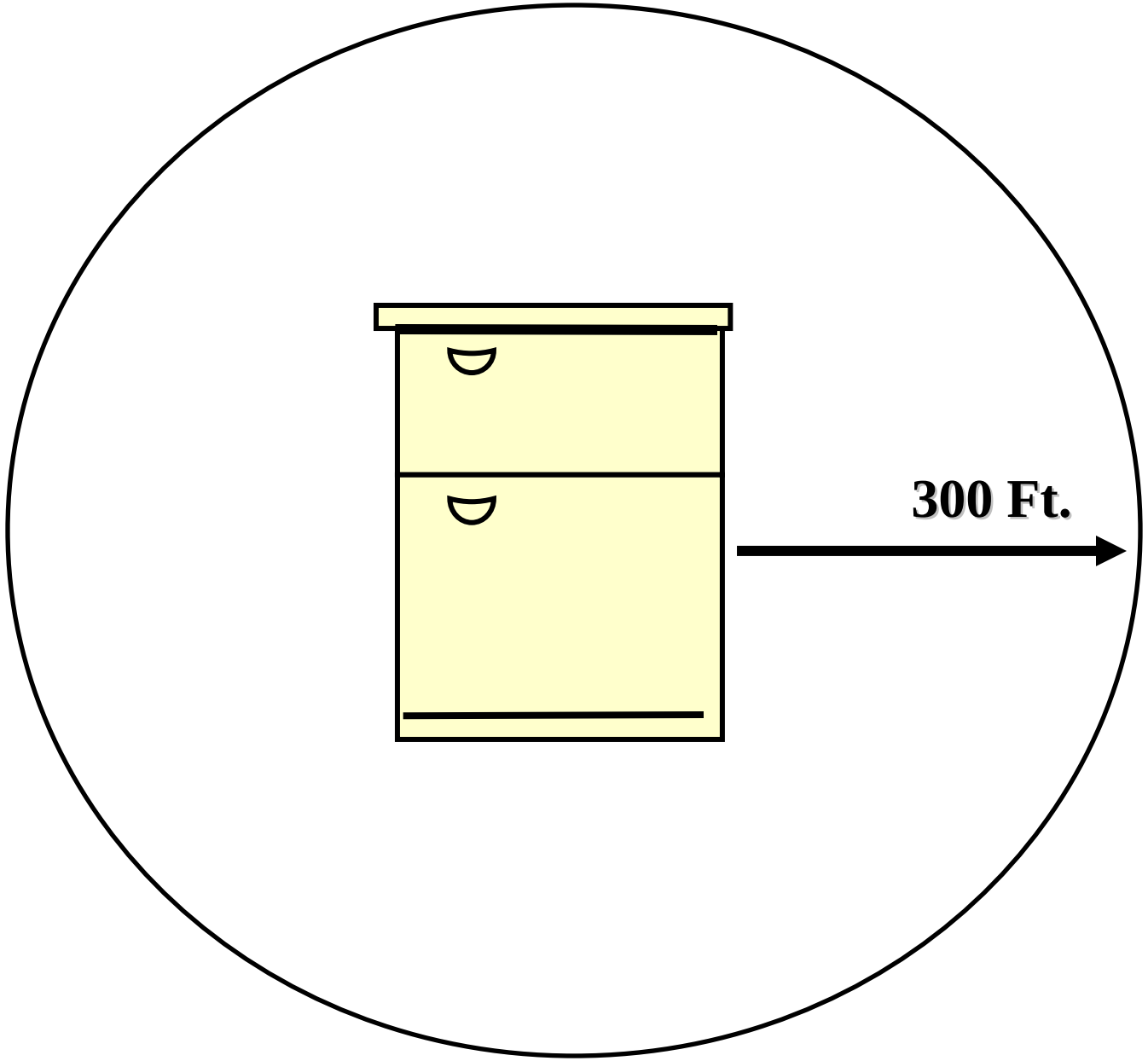
P T T P T T P
P T T P T T P
P T T P T T P
P T T P T T P
P T T P T T P
P T T P T T P
P T T P T T P
P T T P T T P
P T T P T T P

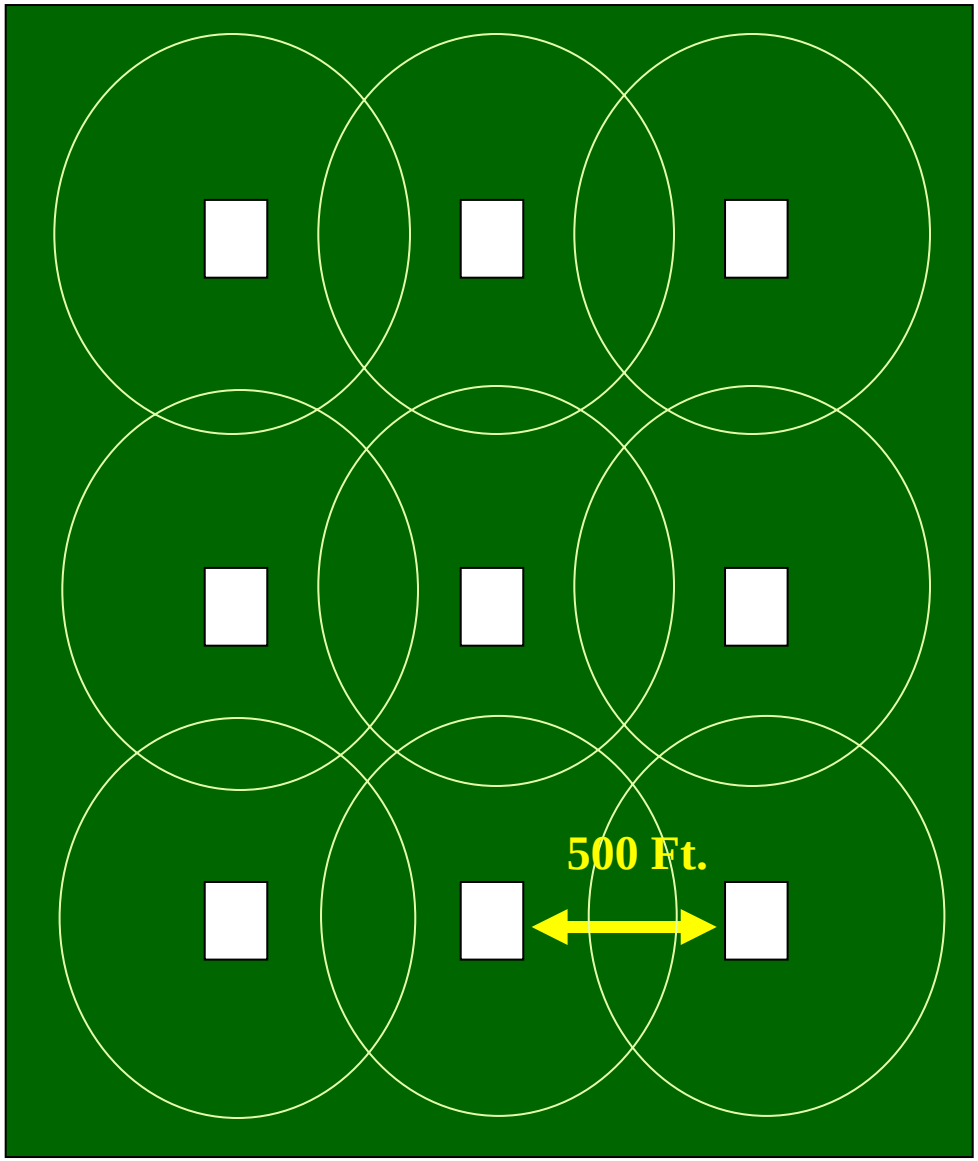
Think about hive placement

Hive Placement

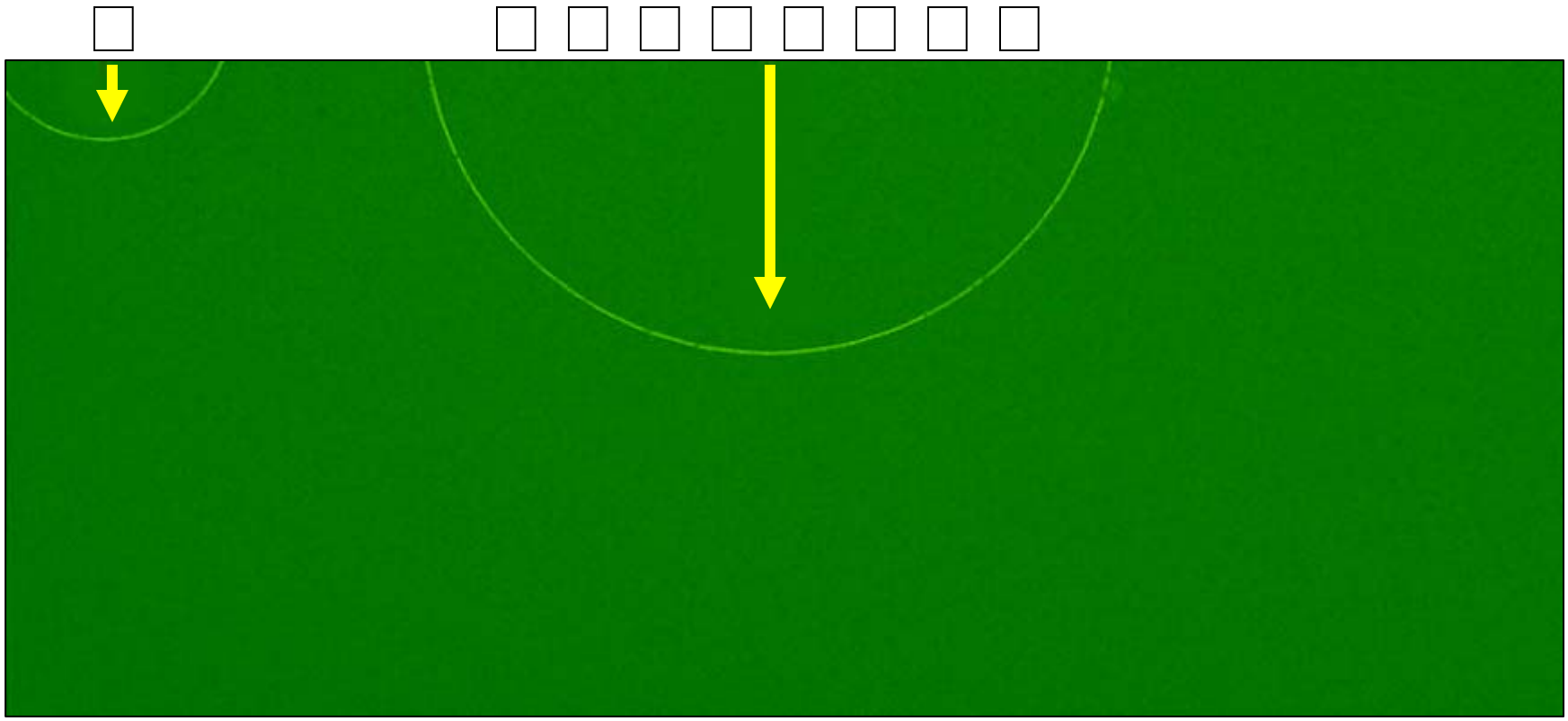
- Have hives as close as possible to the crop of interest
  - Higher number of bees visiting the crop
  - Larger amount of pollen collected
  - Increased crop yield
- Orientate hives so they are exposed to early morning sun
- Place hives on high ground
- Protect hives from strong winds
- Locate hives away from farm workers, pedestrians, livestock, dwellings, and irrigation valves

Remember foraging energetics!




500 Ft.

Competition increases coverage



Timing:

1) Honey bees that are inexperienced at foraging in an area generally perform best.

2) Move hives into the crop after it has already begun flowering a little.

Recommended Bee Densities:

- **Factors to consider:**
  - **The attractiveness of the crop**
  - **The population density of non-managed bees**
  - **The abundance of competing natural nectar sources**
  - **Strength and location of bee hives**
  - **Weather**
  - **The grower's experience**

Stocking Recommendations:

- **Goal is to use the minimum hive density that provides a maximum crop yield.**

- K. S. Delaplane and D. F. Mayer. 2000. Crop Pollination by Bees.

- J. B. Free. 1993. Insect Pollination of Crops.

- S. E. McGregor. 1976. Insect Pollination of Cultivated Crop Plants. Agriculture Handbook No. 496. USDA

Example Stocking Rates:
Literature Averages (hives per acres)

- **Almond – 2.5**
- **Blueberry – 3**
- **Cantaloupe – 1.8**
- **Cranberry – 3**
- **Cucumber – 2.2**
- **Squash, Pumpkin, & Gourd – 1.5**
- **Watermelon – 1.8**

Honey Bee Attractants:

- **Products designed to increase bee visitation**
  - **Pheromones**
  - **Sugar-based solutions**
- **Most have had a doubtful performance record**