

**HOS 4341**

**HOS 6932**

**Reproductive Growth**  
**Fruit Set and Development**

# Fruit Set and Development

- For most fruits - pollination and fertilization and seed development are a pre-requisite
- Some fruits develop without fertilization --- Parthenocarpy (e.g. some Citrus, Bartlett pear, banana)
- Pollination may or may not occur
- Not all seedless fruit are parthenocarpic - embryo abortion - Thompson Seedless Grapes. Fertilization occurs but embryo dies
- Therefore seedless fruit due to:
  - 1. Parthenocarpy
  - 2. Embryo abortion
- Fruit Set - Vague terminology - processes which must occur for a flower (ovary + access tissue) to persist and grow into a fruit

# Fruit Set and Development



- **Parthenocarpic fruit in Wild Parsnips**
- **No embryo or endosperm**
- **Occurs at 20%**
- **Role in defense?**
- **Parthenocarpic fruit preferred over normal fruit by parsnip webworm**

# **Fruit Set and Development**

- **Accompanied by petal wilting and abscission - Petal Fall; Shedding of anthers**
- **In most fruit crops, natural flower/fruit drop occurs**
- **Extent varies with species**
  - Green pepper - 60% drop**
  - Peach - 75%**
  - Apple, catalpa, white oak - 95%**
  - Citrus - 99%**

# **Fruit Set and Development**

- **After Petal Fall - 1st drop occurs - Unfertilized Flowers**
- **After this, may be 2 or 3 more drops depending on species e.g. strawberry, pear, mango**
- **These subsequent drops due to embryo abortion Reason for abortion unclear**
- **Competition for resources among developing fruits?**
- **Depends on**
  - 1) **avail of inorganic nutrients, water, CHO and**
  - 2) **distance of flower/fruit from source**

# **Petal Fall Important stage for pest management**



**Cornus flower at petal fall**



**Apple sprayed with streptomycin after petal fall**

# Effect of GA on fruit set

**Table 1** Effects of GA<sub>3</sub> concentration and GA<sub>4+7</sub> on fruit set and quality of 'Braeburn' in the year of application (1991).

Treatment	Fruit set <sup>a</sup>	Mean fruit weight <sup>b</sup> (g)	Seed number <sup>b</sup>		Fruit shape <sup>b</sup> (l:d ratio)
			Fully developed	Aborted	
Control	324	159.3	4.91	0.55	0.93
GA <sub>4+7</sub> (150 ppm)	349	161.8	5.21	0.63	0.97
GA <sub>3</sub> (10 ppm)	331	161.6	5.11	0.48	0.93
GA <sub>3</sub> (33 ppm)	350	160.3	4.47	0.60	0.95
GA <sub>3</sub> (100 ppm)	357	154.6	4.47	0.61	0.95
GA <sub>3</sub> (330 ppm)	339	163.7	4.37	0.80	0.98
SED	48.6	10.12	0.437	0.169	0.017

<sup>a</sup>Data collected from two subsample limbs/tree (number of fruitlets set/100 flower clusters).

<sup>b</sup>Data collected from a subsample of 15 fruit/tree.

# Factors that limit Fruit Set

- Under good pollination conditions, upper limit to FS usually determined by resources (CHO, N)
- Carbohydrates have a positive effect on fruit set and nitrogen has a negative effect
- In general, proportion of pollinated flowers that set fruit decreases as number of poll flowers increases
- i.e. Higher initial Fruit Set → more fruitlet abscission

# Effect of Sucrose on Fruit set

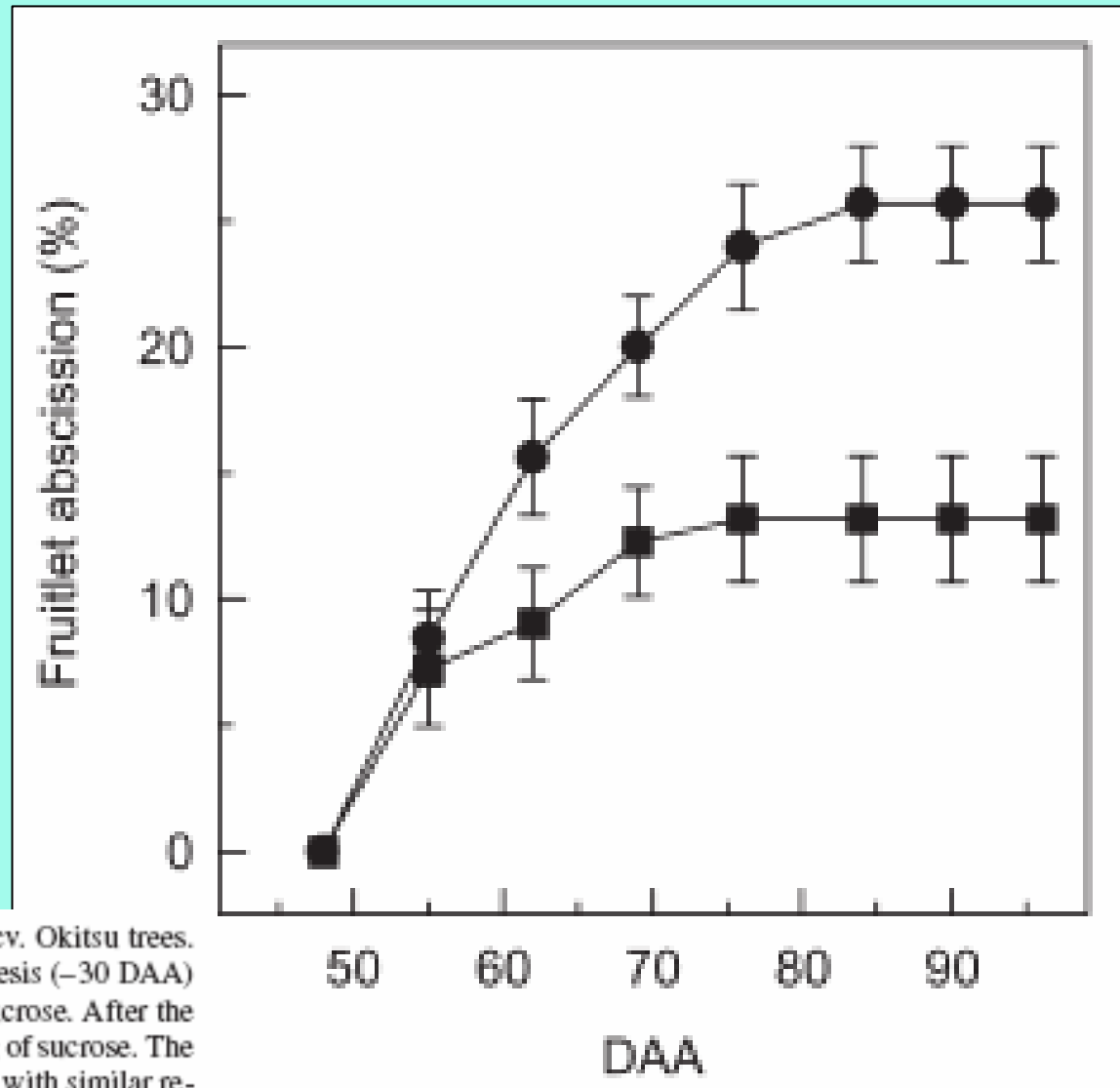


Figure 1. Effect of sucrose on fruitlet abscission in cv. Okitsu trees. The sucrose treatment started at 30 days before anthesis (-30 DAA) and consisted of continuous injections of 292 mM sucrose. After the June drop, each tree had absorbed a minimum of 30 g of sucrose. The experiment was repeated in four consecutive seasons with similar results. Data are means ( $n \geq 5$  trees with at least 100 tagged fruitlets per tree)  $\pm$  SE. Symbols: ● = control; and ■ = sucrose.

# Evidence for resource (CHO) limitation

- Competition between Reproductive structures
- There is a temporal decline in Fruit Set
- Experiment with Catalpa - each flower in inflorescence is capable of setting fruit if its the only flower poll on that inflorescence. When 3 flowers poll, last flower to be pollinated less likely to set fruit → resource limitation
- Temporal decline in Fruit Set happens in herbaceous species e.g. tomato, kidney bean, soybean
- Thus, FS is inhibited by development of young fruits. → Resource limitation
- Also, flower bud development inhibited by young fruits in herbaceous plants that initiate flowers and set fruit along a continuum. e.g. tomato, melon, snapdragon, many annual flowering plants

# Resource limitation

- As the number of flowers is decreased to 75%, fruit set increases to almost 50%
- *Cornus sanguinea*

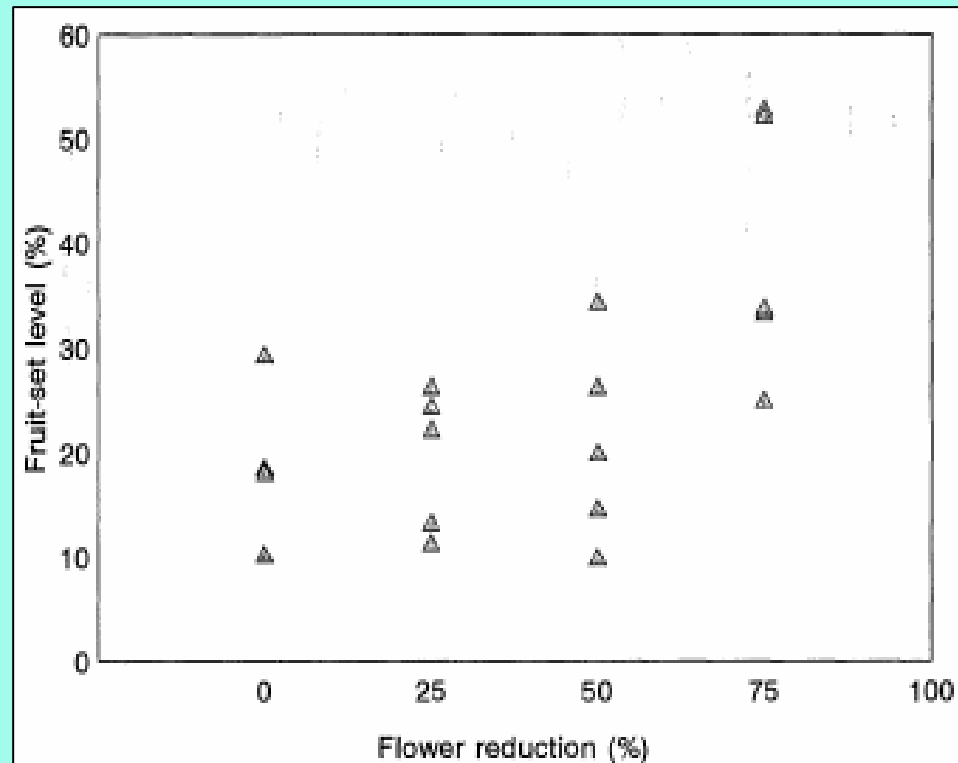


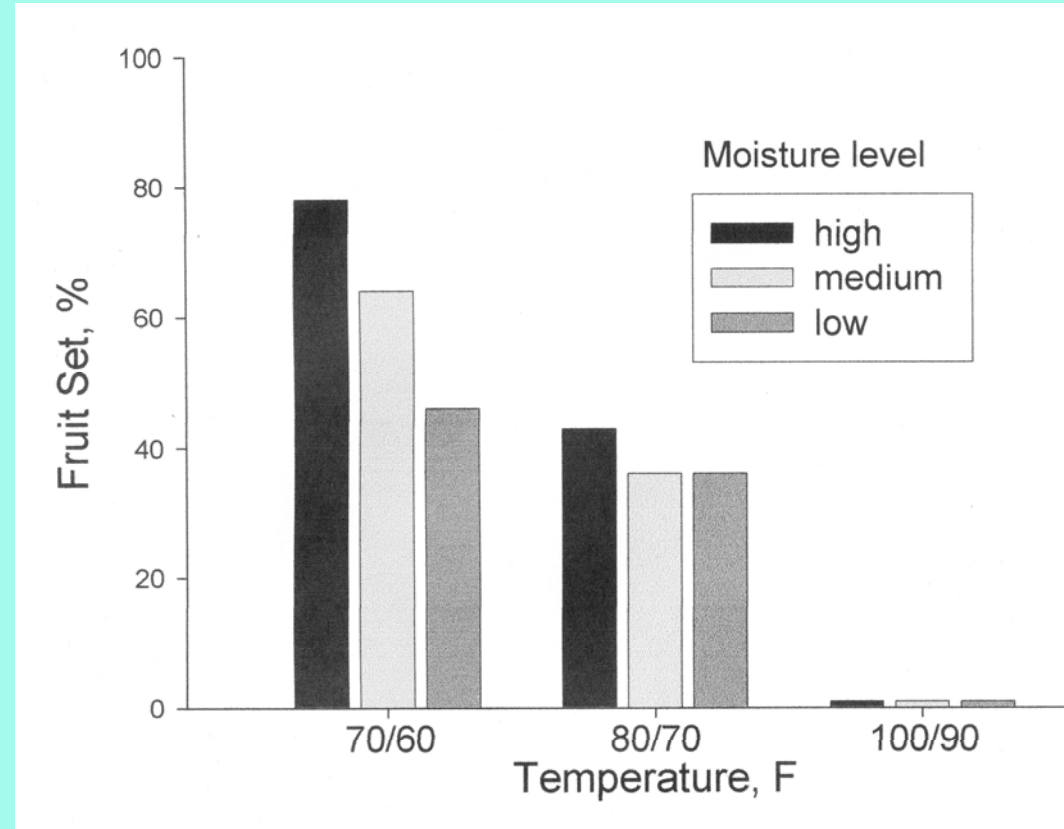
Fig. 3. Percentage fruit set (with respect to number of flowers remaining after reduction) for treated umbels of plants on which zero, one, two, or three subumbels have been removed *before* fertilization; each point corresponds to one plant.

# Reproductive vs Vegetative

- **Apple, Fruit Set increases if growing shoot tips are removed**
- **If resource limitation responsible for flower/fruit abscission, then resource enrichment or deprivation would affect FS. Shown in many crops via fertilization with N, CHO manipulation**
- **In many deciduous orchards, strong correlation between leaf area and fruit drop**
- **For example reduction in leaf area available for photosynthesis (defoliation, shading) decreases resources avail and decreases Fruit Set**
- **NPK fertilizer just after pollination decreases fruit drop in pea, coffee, apple, pear**
- **Ringling - increases FS in that branch**

# Factors Preventing good Fruit Set

- Air temperature should be between 60 and 80° F
- Drought stress makes the situation worse



**Fig. 3. Effect of temperature and soil moisture level on pepper fruit set. Data from Cochran, 1936.**

**Table 1. Shading effects on pepper fruit set and yield. Data from a field experiment, Ithaca, 1994.**

<b>Variety</b>	<b>Flower and bud loss, %</b>		<b>Yield, bushels/acre</b>	
	<b>Unshaded</b>	<b>Shaded</b>	<b>Unshaded</b>	<b>Shaded</b>
<b>Ace</b>	<b>13</b>	<b>44</b>	<b>789</b>	<b>786</b>
<b>North Star</b>	<b>37</b>	<b>86</b>	<b>696</b>	<b>586</b>
<b>Mayatta</b>	<b>46</b>	<b>97</b>	<b>717</b>	<b>309</b>
<b>Merlin</b>	<b>46</b>	<b>95</b>	<b>530</b>	<b>306</b>
<b>Shamrock</b>	<b>68</b>	<b>95</b>	<b>411</b>	<b>149</b>
<b>Camelot</b>	<b>55</b>	<b>99</b>	<b>306</b>	<b>101</b>

# Fruit Set Priorities

**Large fruits**>>**small fruits**>**flowers**>**small buds**

retained

dropped

Survival strategy is to complete the life cycle with at least a few offspring (seeds), and not to waste energy on extra flowers and buds