Introduction to Pollination

Steve McArtney

Southeast Apple Specialist

NC STATE UNIVERSITY

COLLEGE OF AGRICULTURE & LIFE SCIENCES

ACADEMICS ▲ RESEARCH ▲ EXTENSION

The University of Georgia

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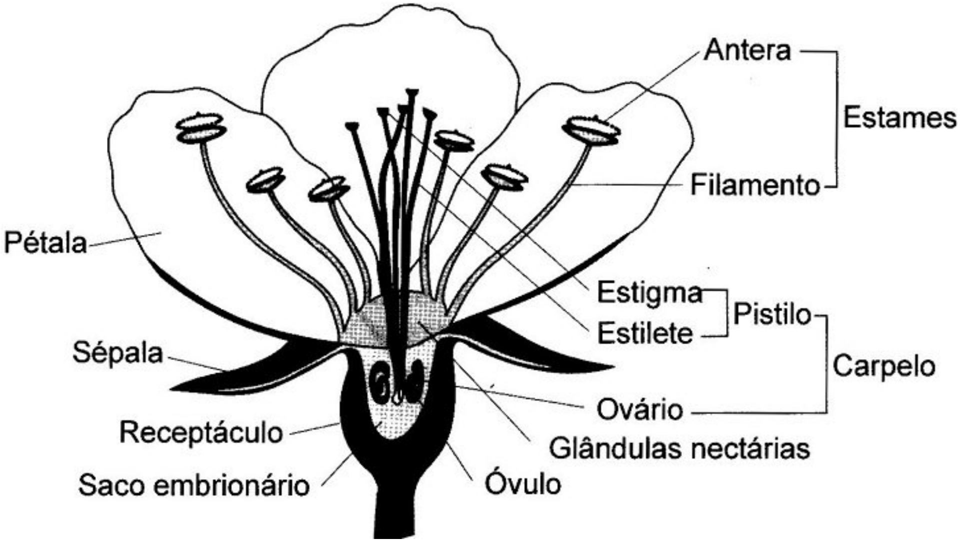
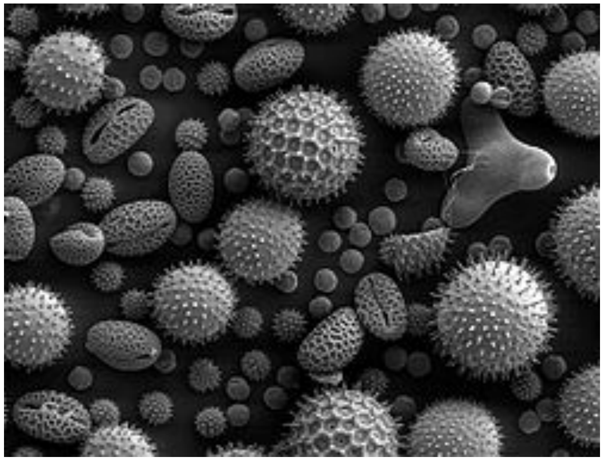
Sheffield et al (2005)


Antera
Estames
Filamento
Pétala
Estigma
Pistilo
Estilete
Sépala
Carpelo
Ovário
Receptáculo
Glândulas nectárias
Saco embrionário
Óvulo

Pollen Germination and Tube Growth



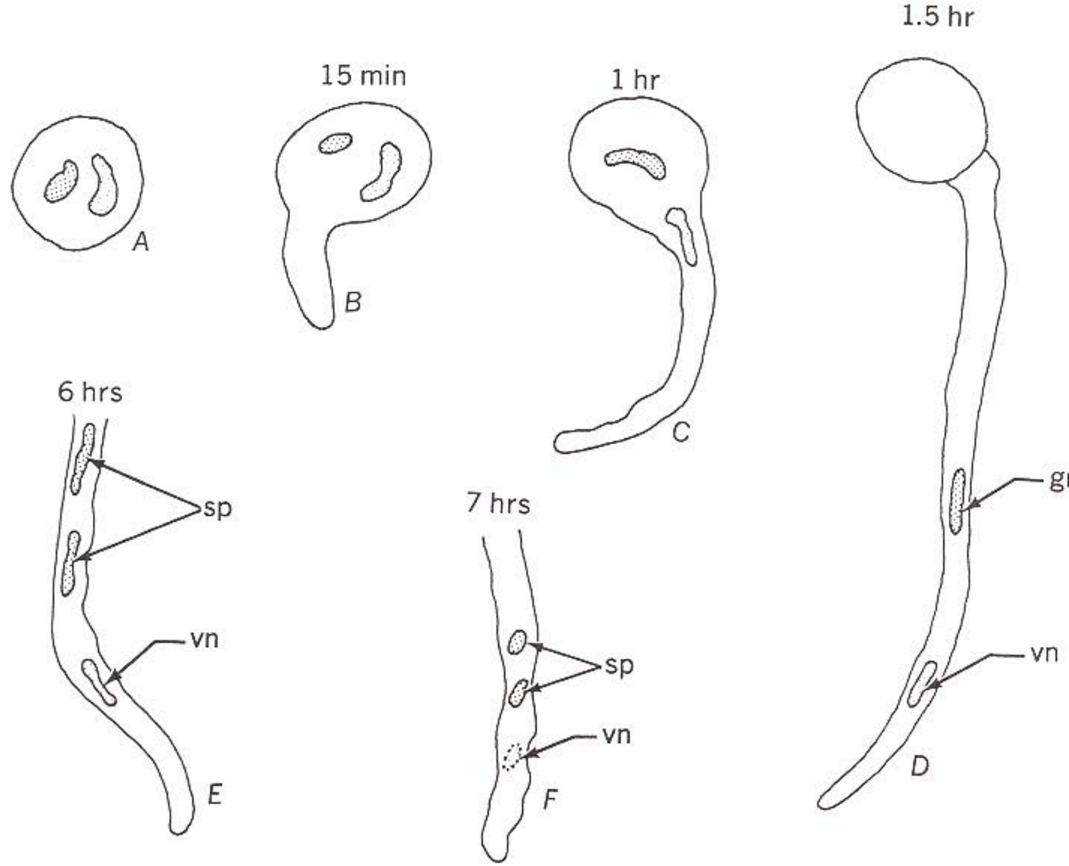
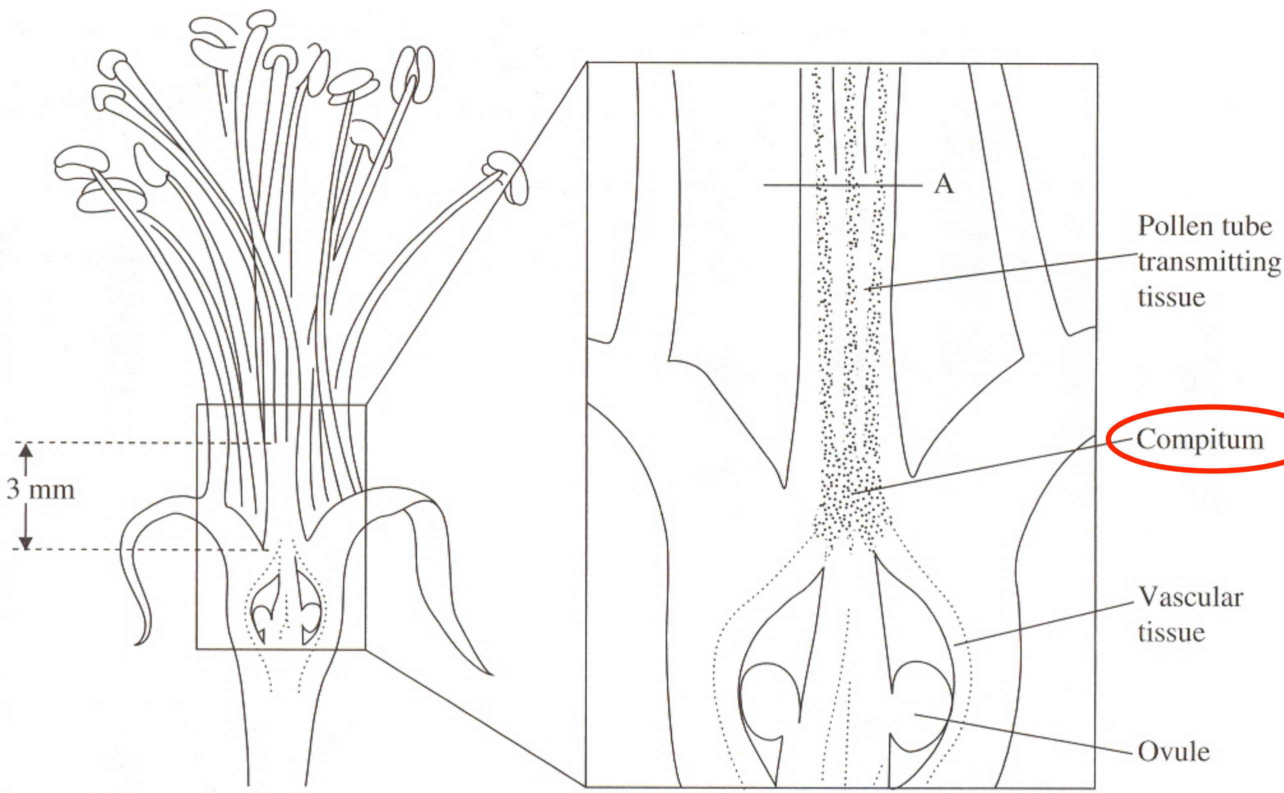


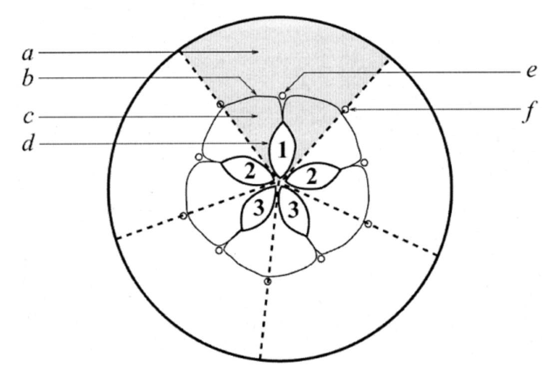
Figure 21.9 Germination of pollen grain of *Scilla* (monocotyledon) in vitro. Medium: 2% agar, 7% cane sugar, traces of sterile yeast. *A*, resting binucleate pollen grain, *B–E*, stages of germination at times after placement on medium indicated above the drawings. Only tips of the pollen tubes in *E* and *F*. The nuclei are compact at end of germination in *F*. Details: *gn*, generative nucleus; *sp*, sperm nucleus; *vn*, vegetative nucleus. (Adapted from R. A. Brink, *Amer. J. Bot.* 11:351–364, 1924.)

Source: Esau (1960)

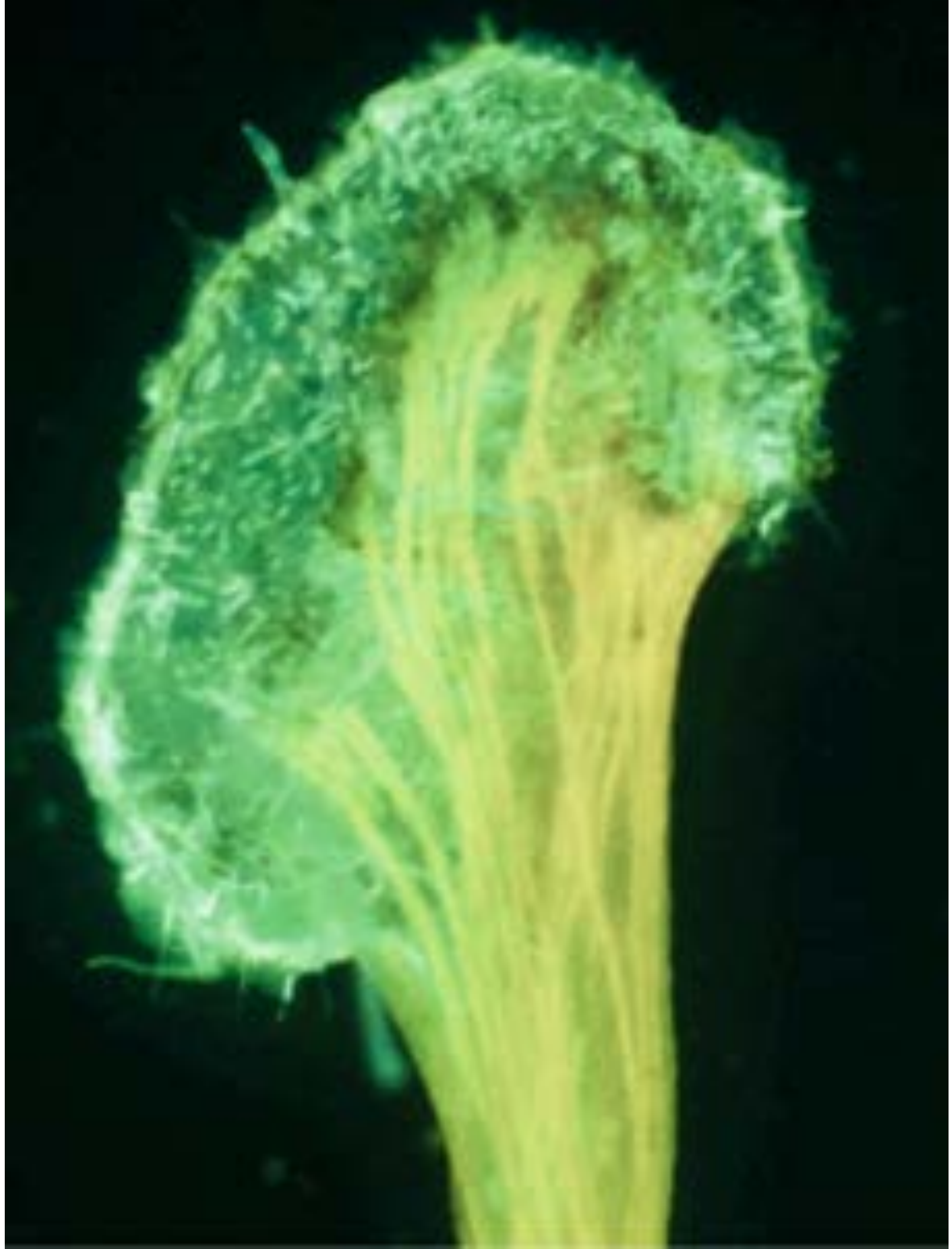
‘McIntosh’ Flowers Have Perfect Syncarpy

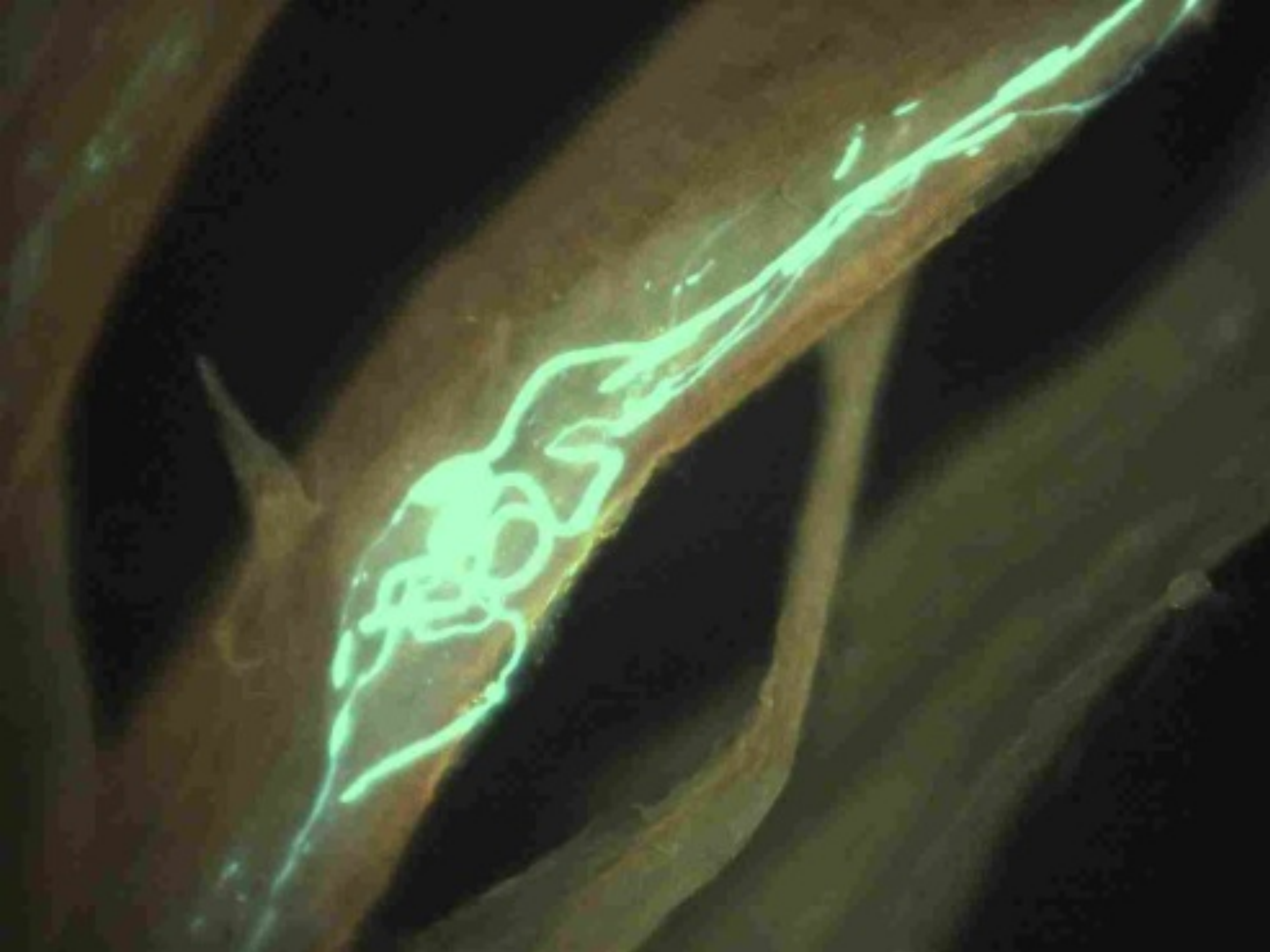
Source: Sheffield et al. (2005)





Source: Drazeta et al. (2004)





Effective pollination period is highly variable

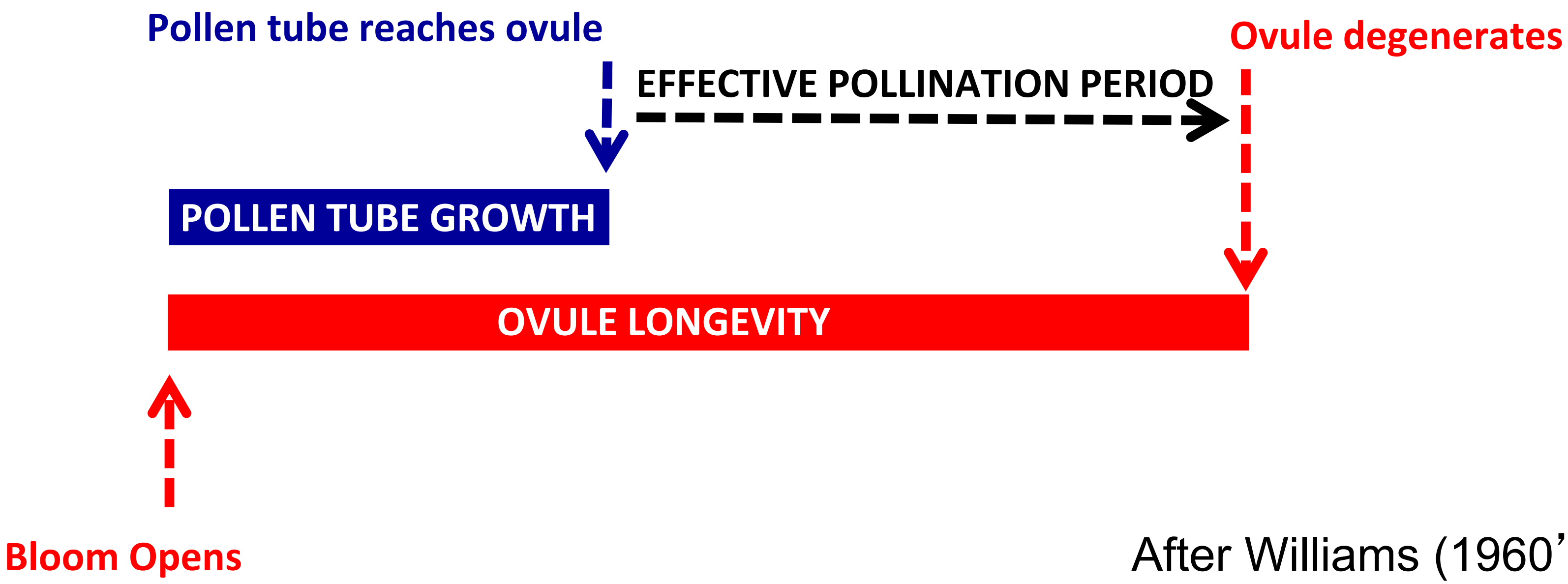
- 2-8 days in apple
- 2-11 days in pears
- 2-10 days in cherries

Factors Limiting the Effective Pollination Period

- Stigmatic receptivity
- Pollen tube growth
- Ovule longevity

High temperatures following pollination

- Increase the rate of pollen tube growth
- Shorten the period of stigma receptivity
- Hasten degeneration of the ovules



After Williams (1960's)

Pollen Tube Growth in Apple

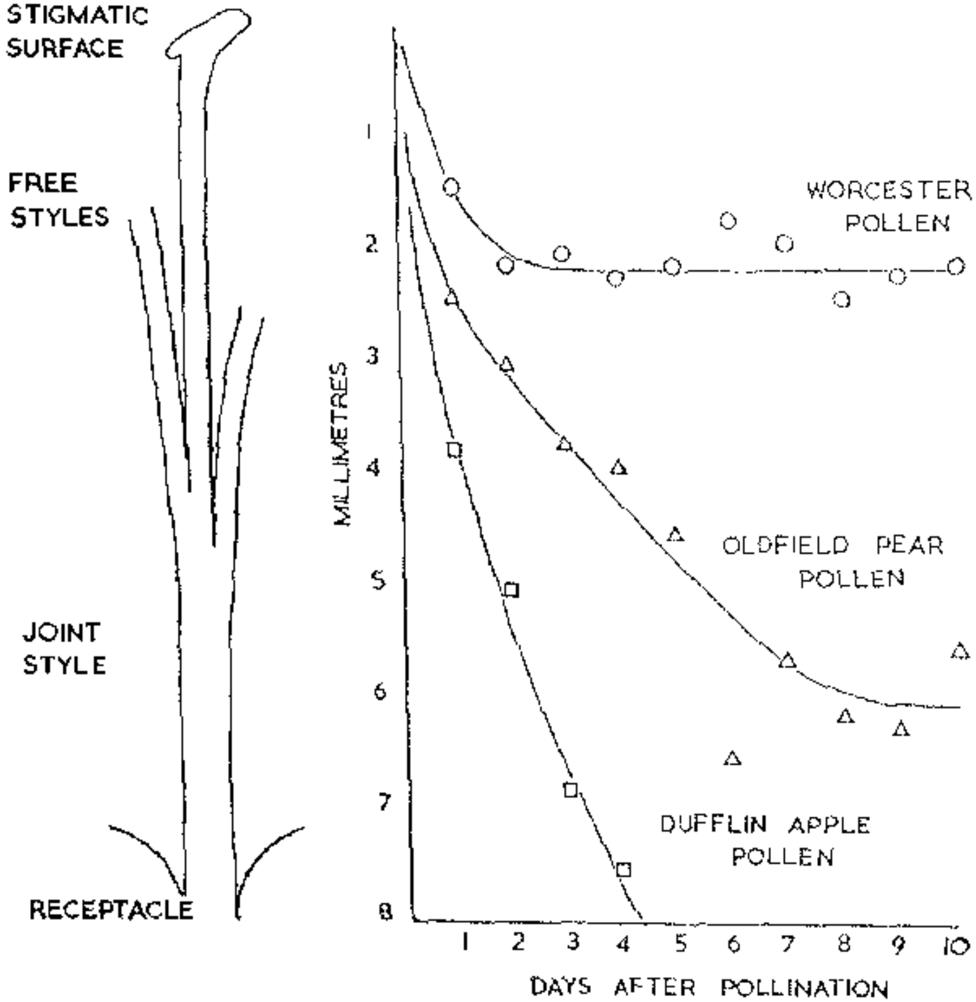


FIG. 1

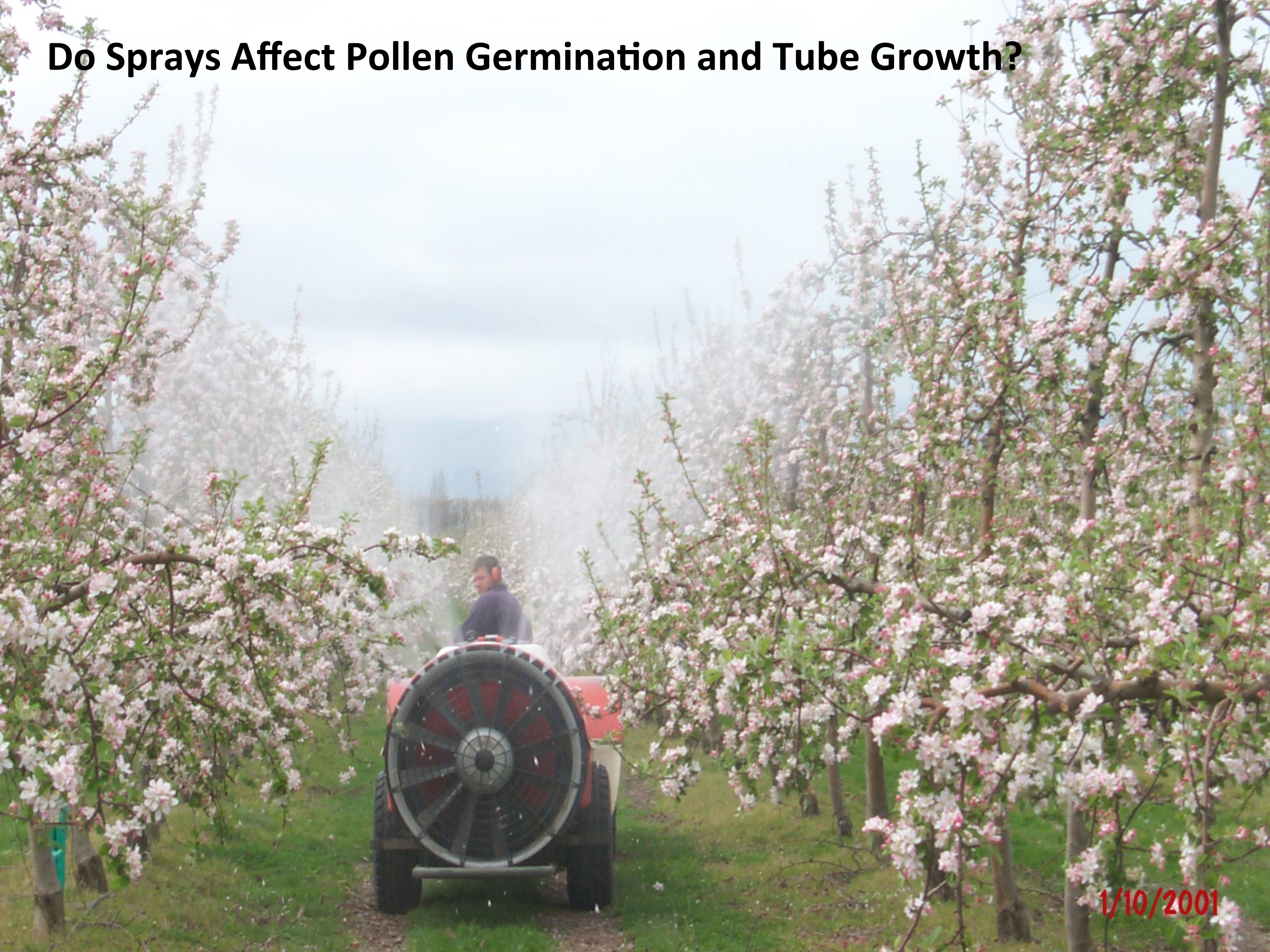
Pollen tube growth in styles of Worcester Pearmain.

Self-pollinated grains only penetrate a short distance down the style

Cross pollination with a diploid apple resulted in fertilization within 6-7 days

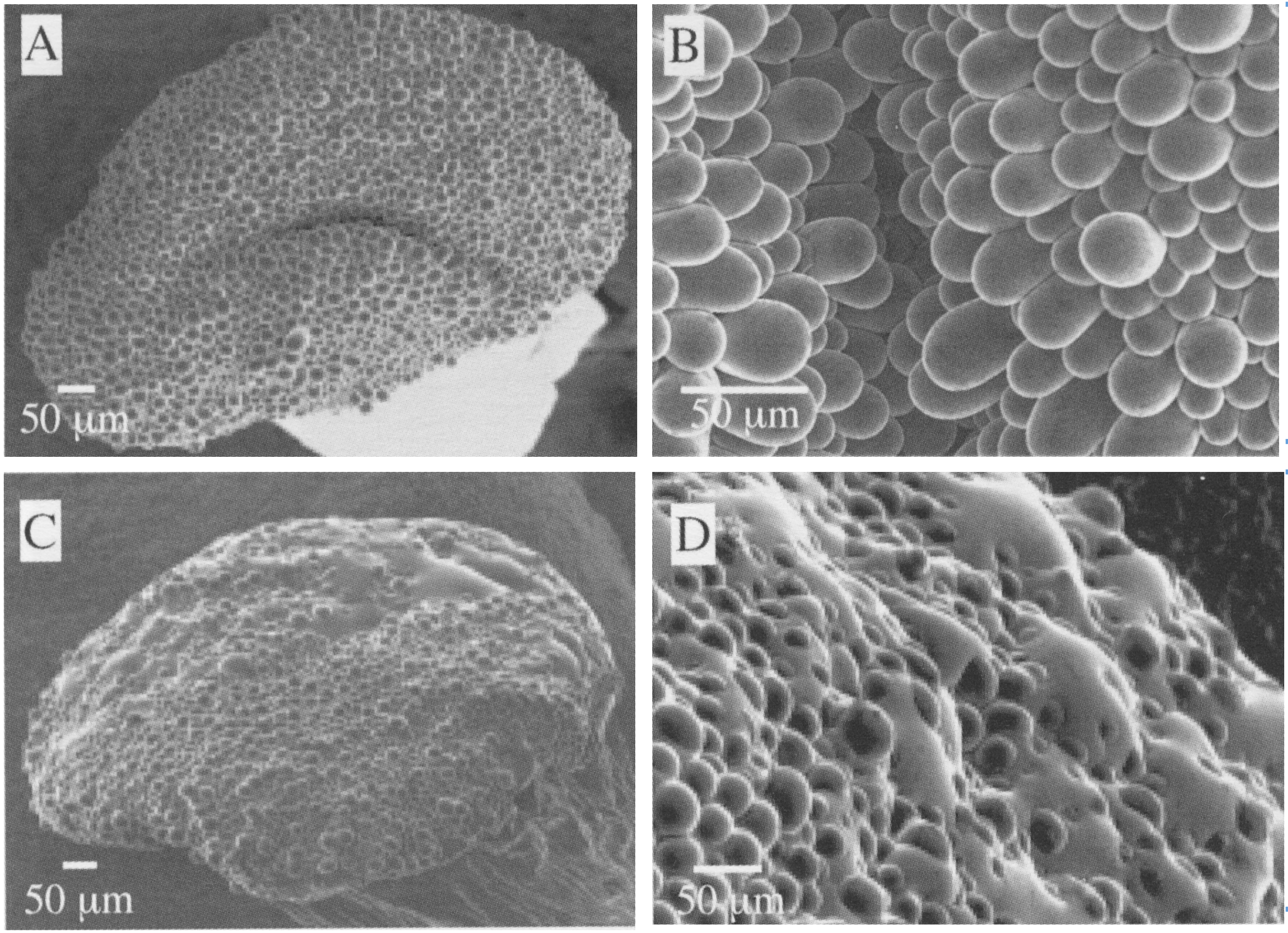
Williams, R.R. (1965)
Long Ashton
Potted trees on M.11
Mean temp. 11C/52F

Do Sprays Affect Pollen Germination and Tube Growth?



Stigmatic Receptivity

Effects of Azoxystrobin on the Stigmatic Surface of Almond Flowers



Water

Azoxystrobin

(source: Yi et al., 2003)

Fungicide Effects on Pollen Germination and Tube Growth

There is little information in apple apart from Captan and Streptomycin, but some of the commonly used fungicides in commercial apple production have been shown to severely inhibit pollen germination and tube growth <u>in other crops</u>

Fungicide Class	**Effect on pollen germination and growth**	**Products used on Apple**
Streptomycin	**Severe in walnut** [Polito et al., 2002]) None in apple [Yi et al., 2003])	
Strobilurins	**Severe in almond** (Azoxystrobin)	Pristine, Flint, Sovran
Dithiocarbamates	**Severe in almond** (Maneb, Ziram)	Mancozeb, Polyram, Metiram, Ferbam
Pyrimidine	**Severe in almond** (Cyprodinil)	Vangard, Scala
Dicarboximides	Variable	
Phthalimides	**Severe in almond** (Captan) Intermediate in apple (Captan)	Captan
Benzimidazoles	None in almond	Topsin M,
Azoles	Little or none in almond	

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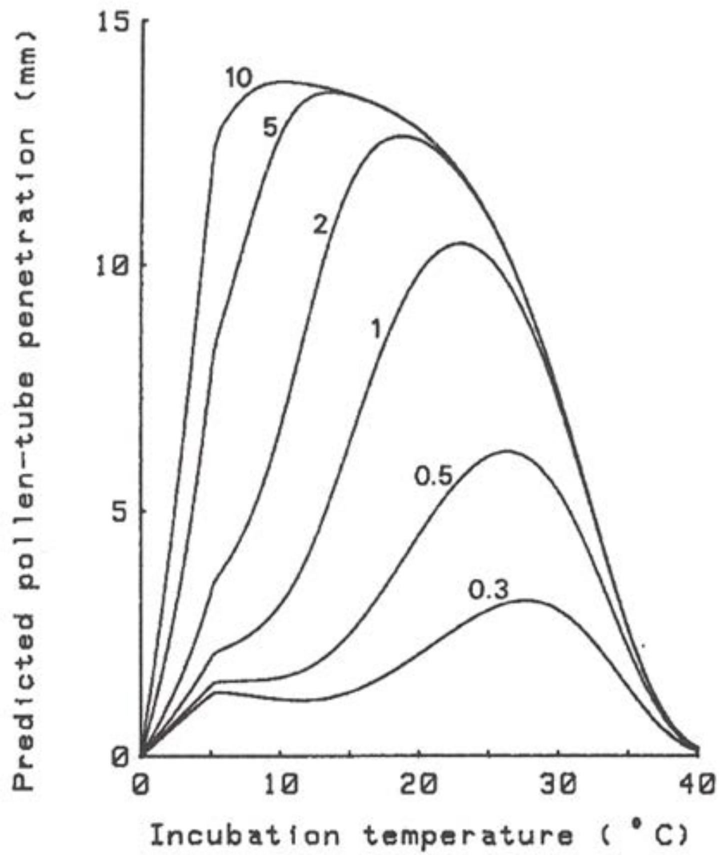
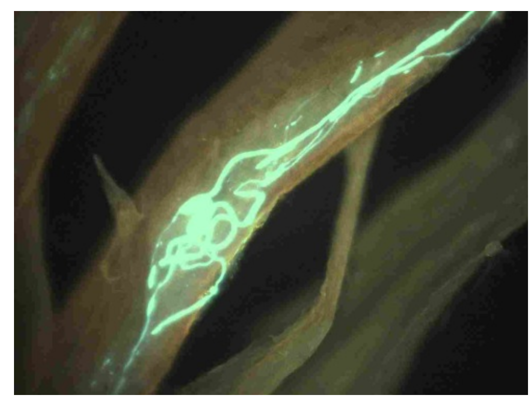
How does Temperature Affect Pollen Tube Growth?





Jefferies and Brain (1984)
Long Ashton
Detached 'Cox's Orange Pippin' flowers
Pollinated with cv. Baskatong

What is the Mode of Action of Lime Sulfur as a Bloom Thinner?

Inhibit fertilization or Create a Carbohydrate Stress by Inhibiting Photosynthesis?

- **LS applied at 3% to 'Braeburn'/M9 apple trees**
- **0,1,2,3 or 4 LS applications over the bloom period**
- **LS sprays applied three days apart**

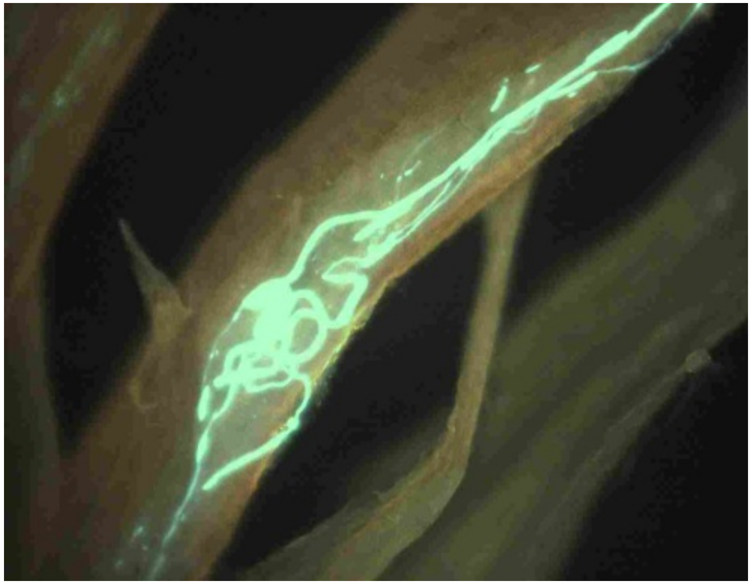
- **Flowers at full bloom at the first spray were tagged**
  - **Flowers removed 5 days later and the number of pollen tubes counted in each pistil**
  - **Percent flowers with limiting pollen tube numbers**

(<10/flower or none)

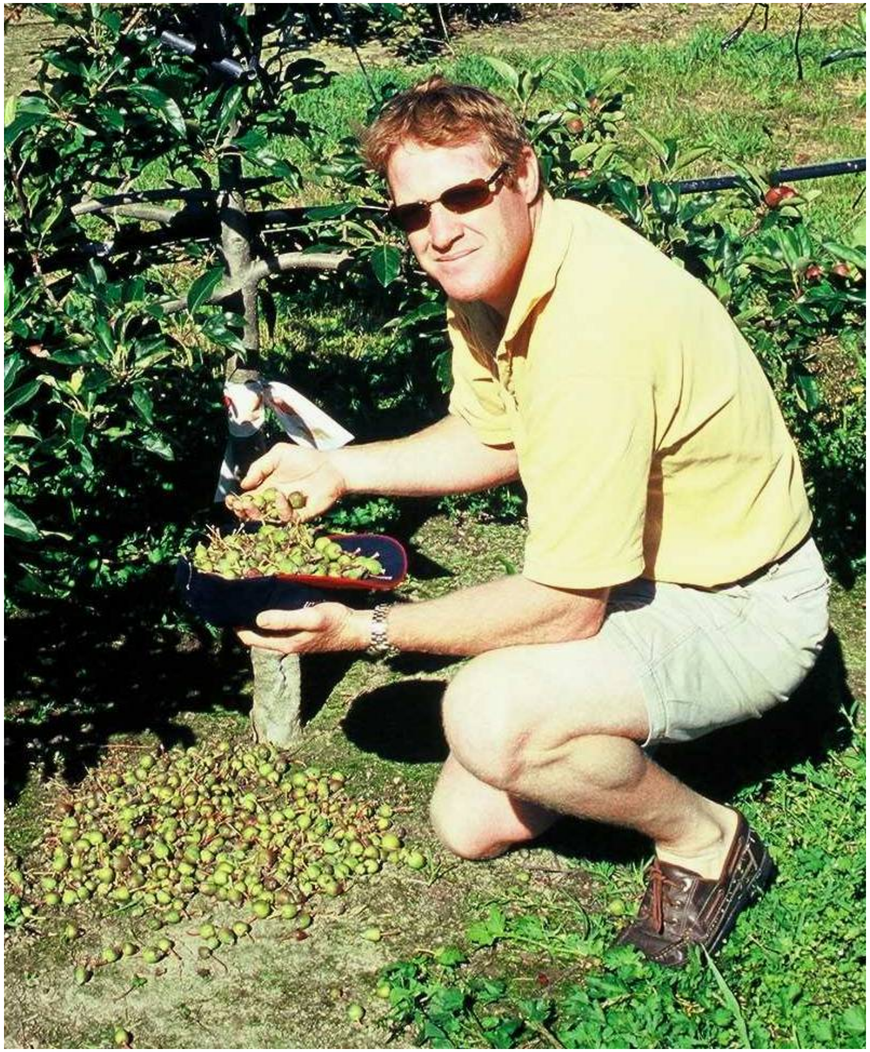
LS Reduced Pollen Tube Number Per Flower

(McArtney et al., 2006)

Treatment	Flowers with limiting No. of pollen tubes (%)	
	<10 tubes per flower	No tubes per flower
Control	9	2
Lime sulfur	64	27
P	0.003	0.006

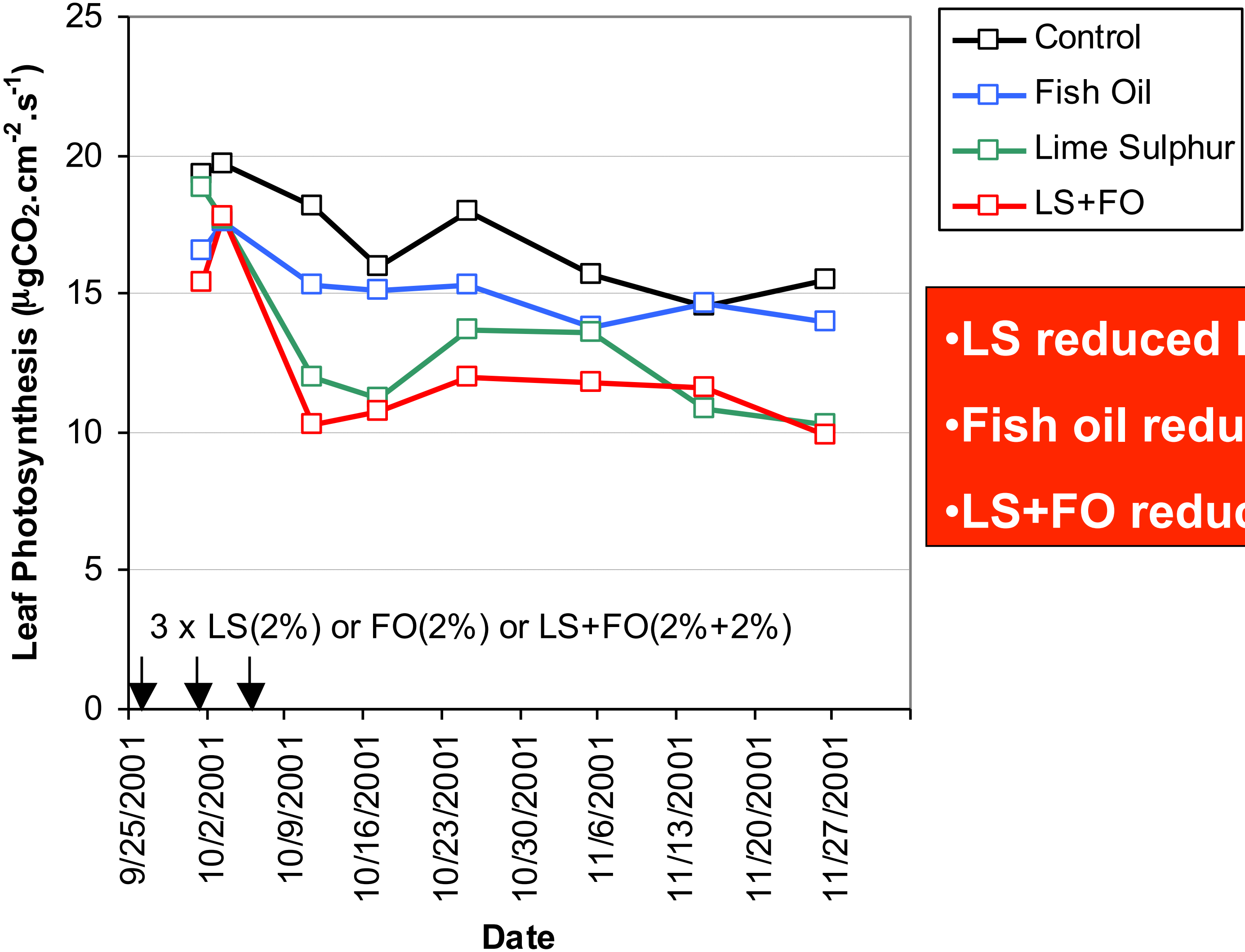


Reduced Photosynthesis Can Also Cause Fruit Drop



Lime Sufur and Fish Oil Reduce Leaf Photosynthesis

(McArtney et al., 2006)



- LS reduced Pn by 22%
- Fish oil reduced Pn by 11%
- LS+FO reduced Pn by 28%

Who Needs Seeds Anyway? The Use of Promalin as a Frost Rescue Treatment

Steve McArtney, Department of Horticultural Science, NCSU

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Using Promalin as a Frost Rescue Treatment

How Much Damage will 24°F cause at full bloom?

Table 1.
Critical spring temperatures for 10% and 90% kill of apple flower buds at various developmental stages. (Data are adapted from Washington State and Michigan sources).

Developmental Stage	Critical Temperature (°F)	
	10% Kill	90% Kill
Silver tip	15	2
Green tip	18	10
½ Inch green	23	15
Tight cluster	27	21
First pink	28	24
Full pink	28	25
First bloom	28	25
Full bloom	28	25
Post bloom	28	25


Untreated


Promalin®
Plant Growth Regulator

Promalin®
Plant Growth Regulator

Untreated

INDUCTION OF PARTHENOCARPIC GROWTH OF APPLE FRUITS WITH GIBBERELLINS A_3 AND A_4[1]

MARTIN J. BUKOVAC

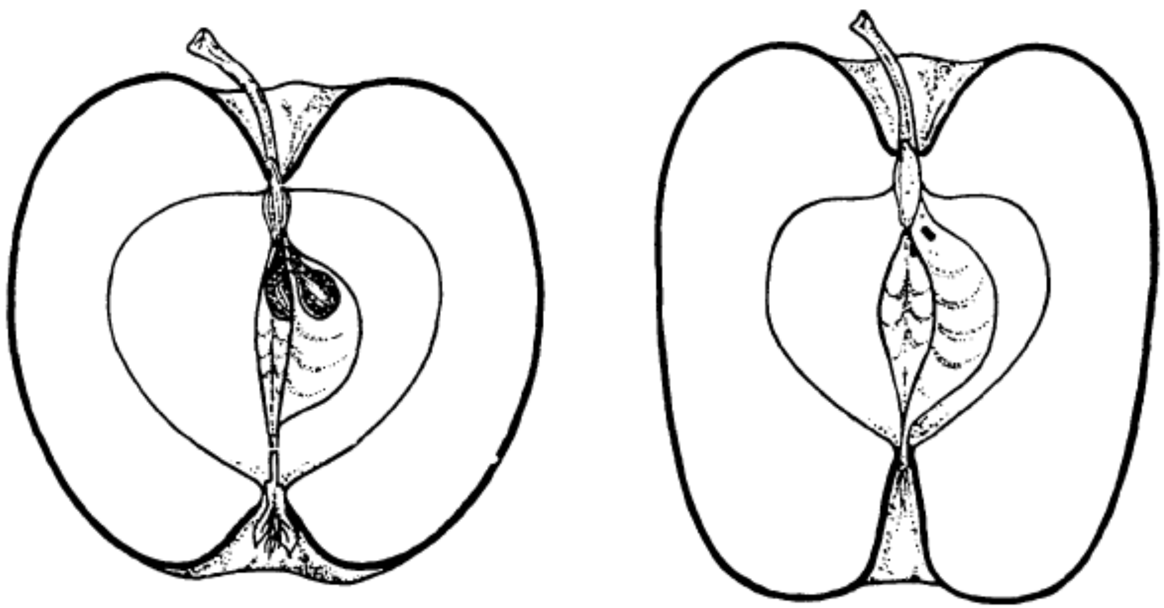

FIG. 2.—Schematic diagram of median longisections of seeded (*left*) and gibberellin A_4-induced parthenocarpic (*right*) apple fruit at maturity.

Source: *Botanical Gazette*, Vol. 124, No. 3 (Mar., 1963), pp. 191-195