Successful Vegetable Seed Germination and Growth

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Germination: The breaking of dormancy

The growth of the embryo and its penetration of the seed coat

Break down of barriers
Abrasion of seed coat
Decomposition of seed coat
Cracking of seed coat (fire)

Change in physical state - rehydration

Destruction and dilution of inhibitors
Light, temperature, water

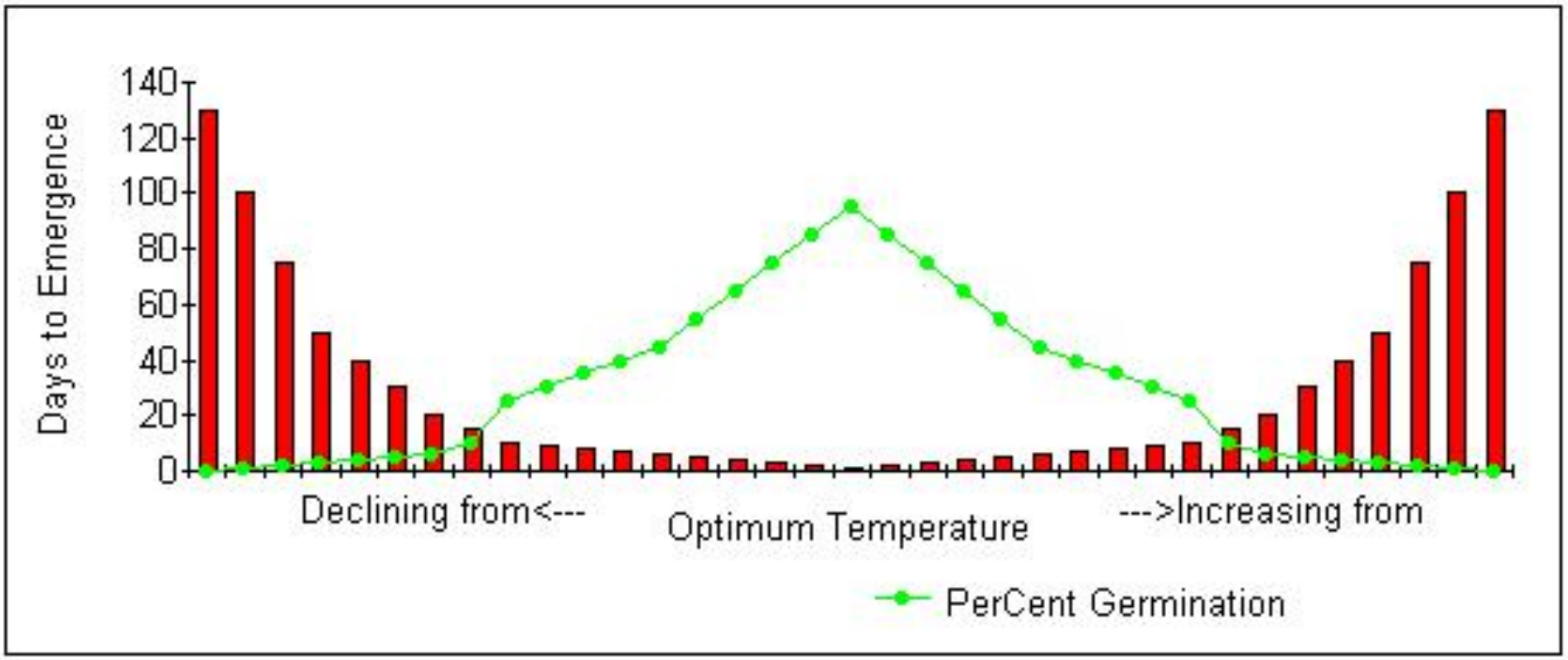
Production of **growth promoters**

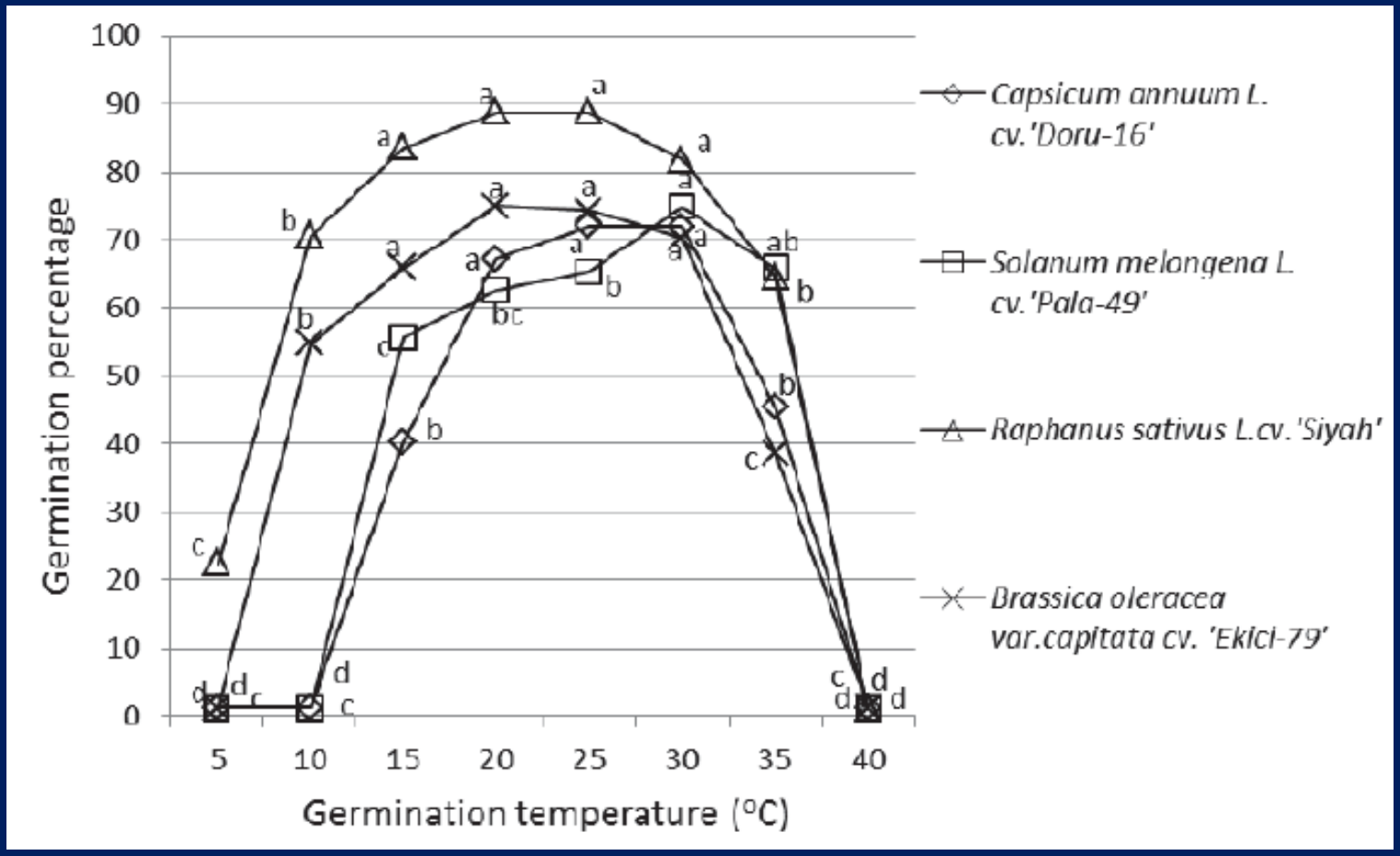

LETTUCE
LT456 PACKET $3
SLOBOLT
LOOSE-LEAF LETTUCE
WT 4 GRAMS / 199
$1.29
NET WT.
600 MG
MARTHA STEWART everyday
'SWEET'
basil
GROWERS & IMPORTERS OF QUALITY SEEDS
NICHOLS GARDEN NURSERY
PEPPERS
'FAT'N SASSY hybrid
CARROTS
CR284 PACKET $2.45
FLAKKEE TROFEO
WINTER HARVEST
WT 5 GRAMS / 1999
POLE BEANS
Kentucky Blue Pole
POLE BEAN
BN128
Packet / 2 ounces
Packed for 2000 – $2.00

Successful Vegetable Seed Germination

- Temperature, Water, Oxygen and Light
- Germination Chambers
- In-ground/media germination
- Managing early seedling growth
- Pre-transplant management of seedlings

Seed germination has an optimal temperature – a temperature when germination is highest. As temperatures increase or decrease from the optimal temperature, the percent seed germination will decrease.




Germination percentage
100
90
80
70
60
50
40
30
20
10
0
5
10
15
20
25
30
35
40
Germination temperature (°C)
Capsicum annuum L. cv.'Doru-16'
Solanum melongena L. cv.'Pala-49'
Raphanus sativus L.cv.'Siyah'
Brassica oleracea var.capitata cv. 'Ekici-79'

Optimal Temperatures for Seed Germination

Optimum

70°F (21°C)	75°F (24°C)	80°F (26.7°C)	85°F (29.4°C)	95°F (35°C)
Celery	Asparagus	Bean, lima	Bean, snap	Cucumber
Parsnip	Endive	Carrot	Beet	Muskmelon
Spinach	Lettuce	Cauliflower	Broccoli	Okra
	Pea	Onion	Cabbage	Pumpkin
		Radish	Eggplant	Squash
		Tomato	Parsley	Watermelon
		Turnip	Pepper	
			Sweet corn	
			Swiss chard	

Maximum

75°F (24°C)	85°F (29.4°C)	95°F (35°C)		105°F (40.6°C)	
Celery	Bean, lima	Asparagus	Eggplant	Cucumber	Squash
Endive	Parsnip	Bean, snap	Onion	Muskmelon	Sweet corn
Lettuce	Pea	Beet	Parsley	Okra	Turnip
Spinach		Broccoli	Pepper	Pumpkin	Watermelon
		Cabbage	Radish		
		Carrot	Swiss chard		
		Cauliflower	Tomato		

Percent germination at varying temperatures (numbers in parenthesis are days to germination)

Crop	32	41	50	59	68	77	86	95	104
Snap Beans	0	0	1	97 (16)	90 (11)	**97 (8)**	47(6)	39 (6)	0
Beets/Chard	0	53 (42)	72 (17)	88 (10)	90 (6)	**97 (5)**	89 (5)	35 (5)	0
Cucumber	0	0	0	95 (13)	99 (6)	**99 (4)**	**99 (3)**	**99 (3)**	49
Eggplant	0	0	0	0	21 (13)	53 (8)	**60 (5)**	0	0
Lettuce	98 (49)	98 (15)	98 (7)	**99 (4)**	**99 (3)**	**99 (2)**	12 (3)	0	0
Onions	90 (136)	98 (31)	98 (13)	98 (7)	**99 (5)**	**97 (4)**	91 (4)	73 (13)	2
Pepper	0	0	1	70 (25)	96 (13)	**98 (8)**	**95 (8)**	70 (9)	0
Spinach	83 (63)	96 (23)	**91 (12)**	**82 (7)**	52 (6)	28 (5)	32 (6)	0	0

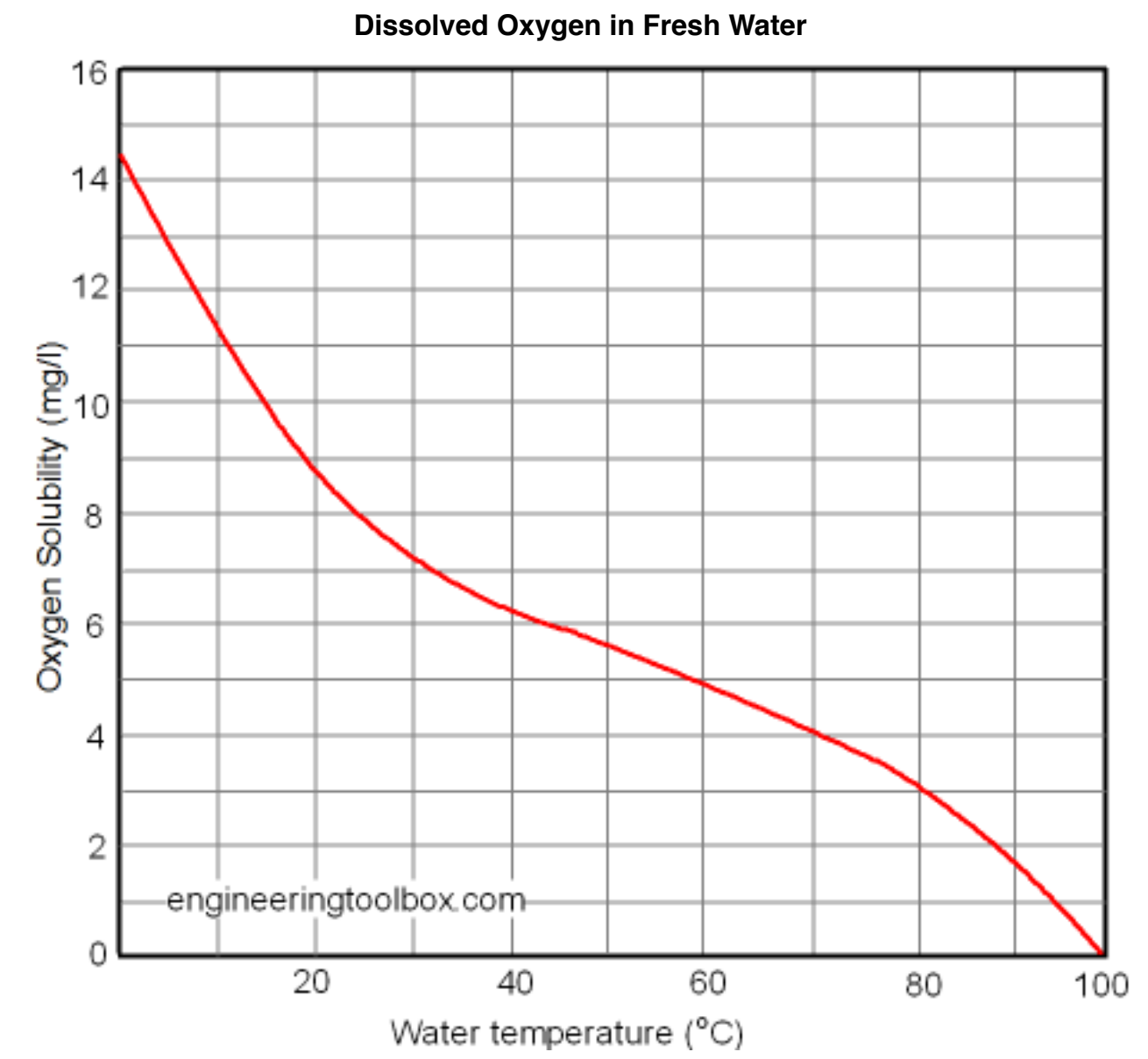
Water/Oxygen

Table 1. The effect of container size and medium compaction on air and water.

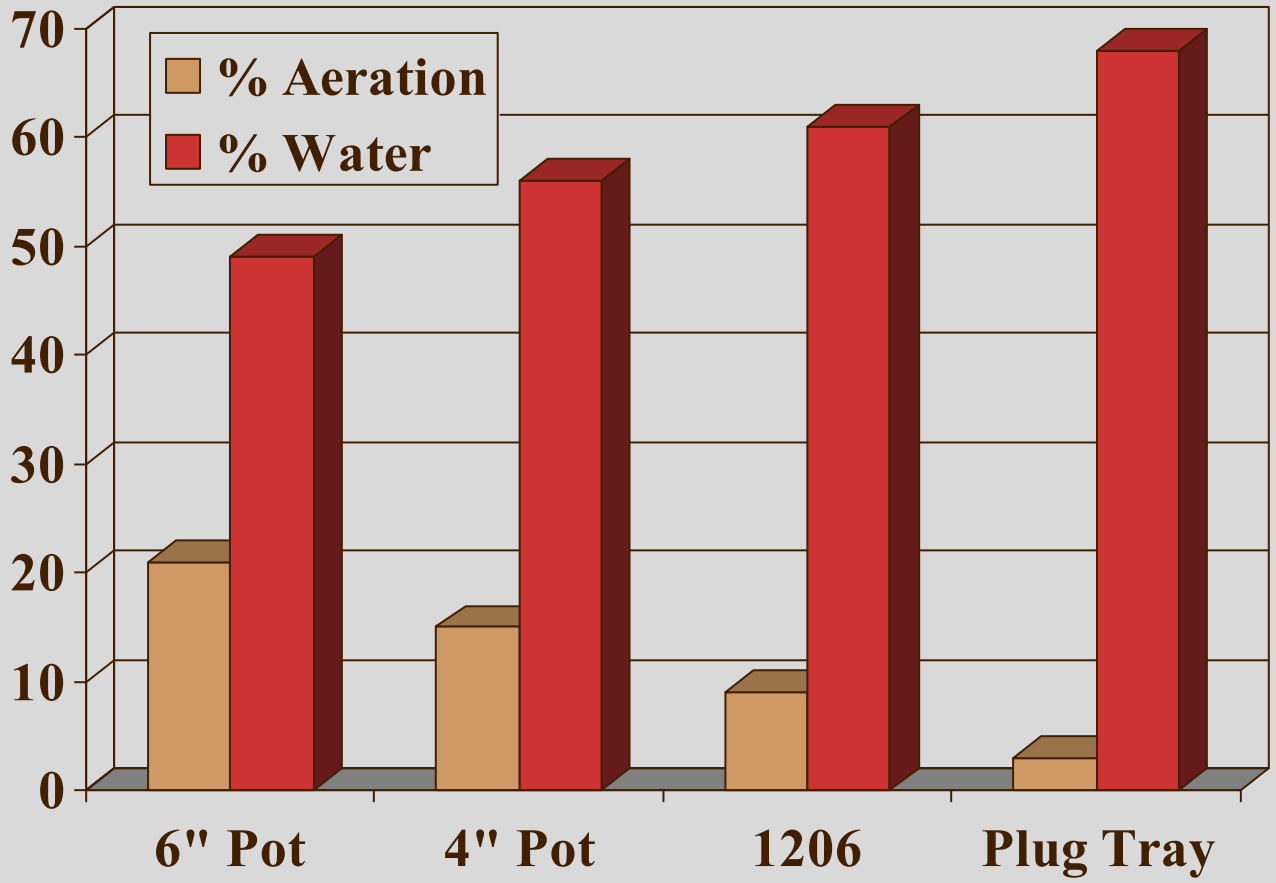
Degree of Compaction	Container Size		
	4-inch	6-inch	1 gallon
Light compaction			
Available water	52	48	45
Air space	19	23	25
Medium compaction			
Available water	53	50	48
Unavailable water	21	23	24
Air space	12	17	22
Heavy compaction			
Available water	49	45	42
Unavailable water	29	31	28
Air space	8	12	19

A 2:1 v/v bark:sand medium was used for this example.

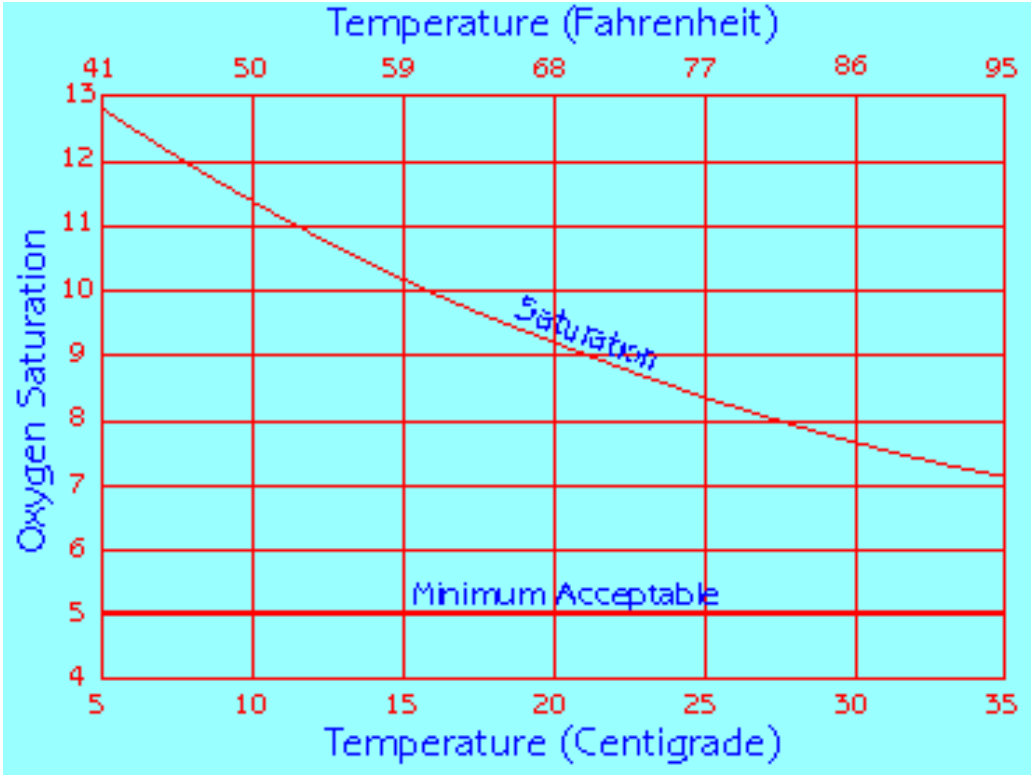
Oxygen availability

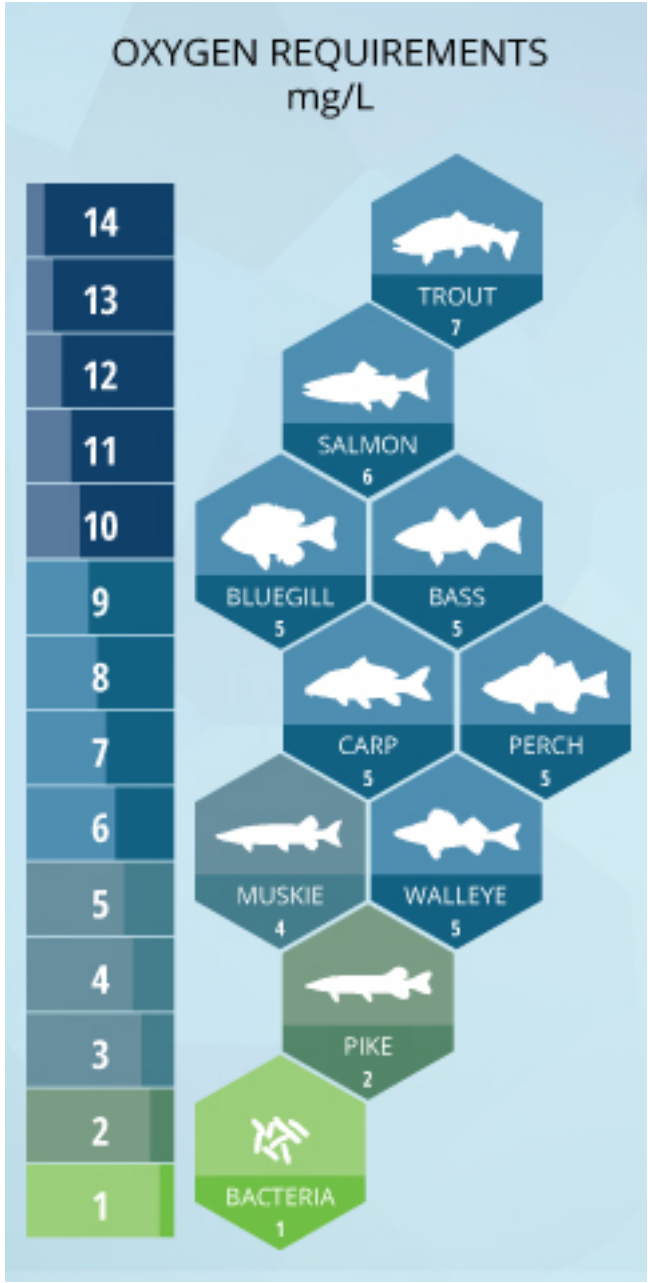


Container Depth Versus Aeration



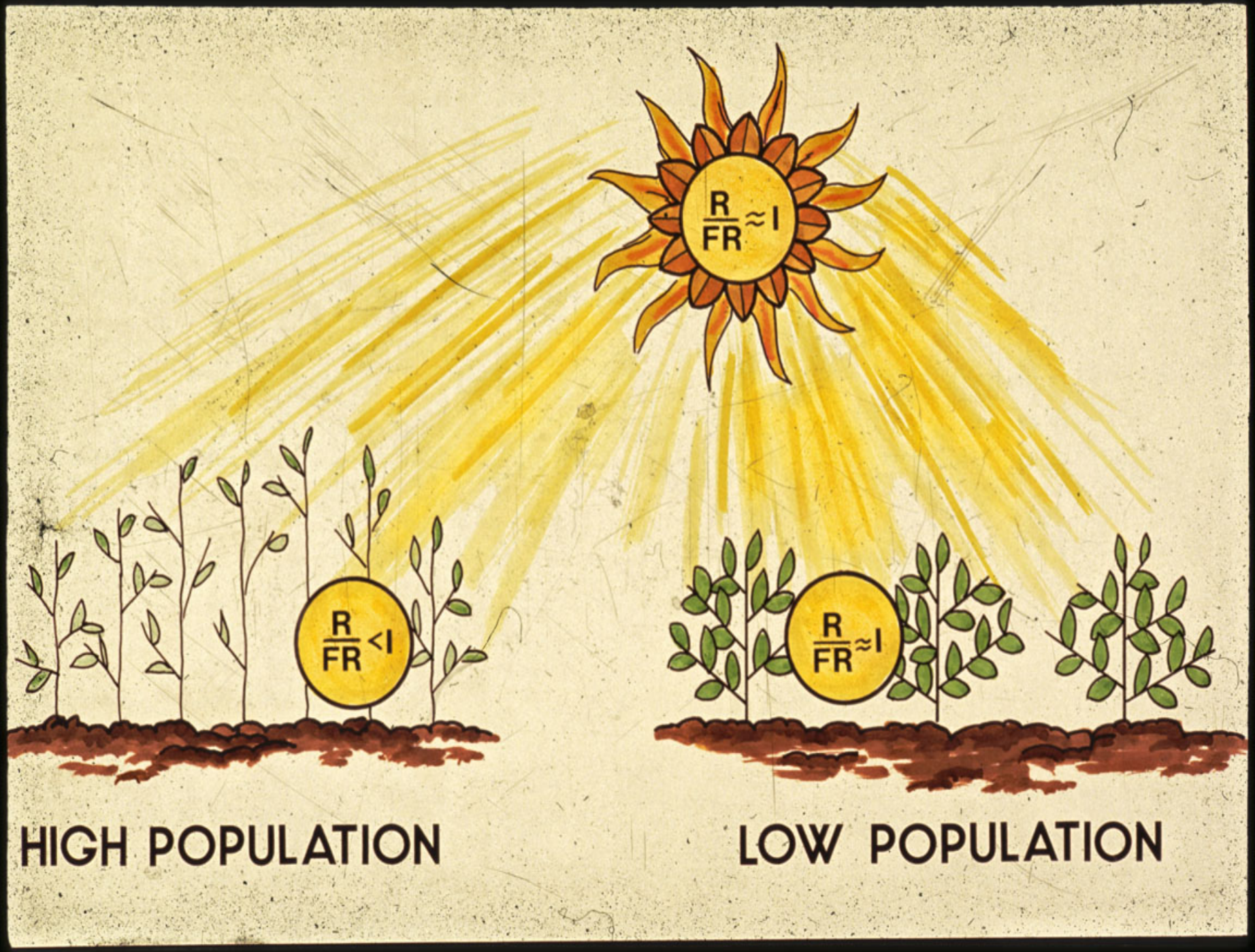
The warmer the water, the less oxygen it will hold.
Fish will deplete the oxygen quicker as the water warms up.



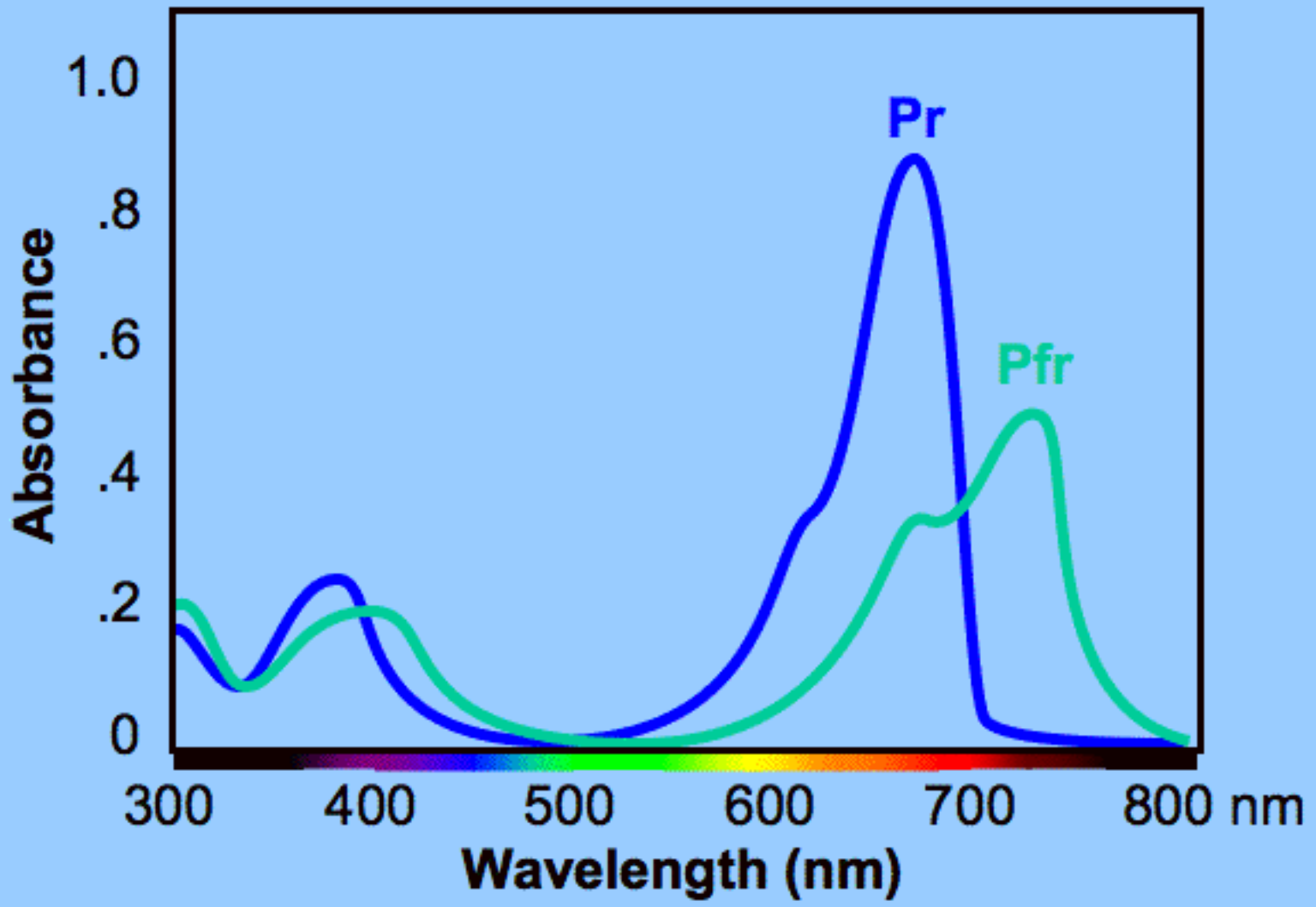


Minimum dissolved oxygen requirements of freshwater fish

Light and Temperature Fluctuations


R/FR≈1
R/FR<1
R/FR≈1
HIGH POPULATION
LOW POPULATION

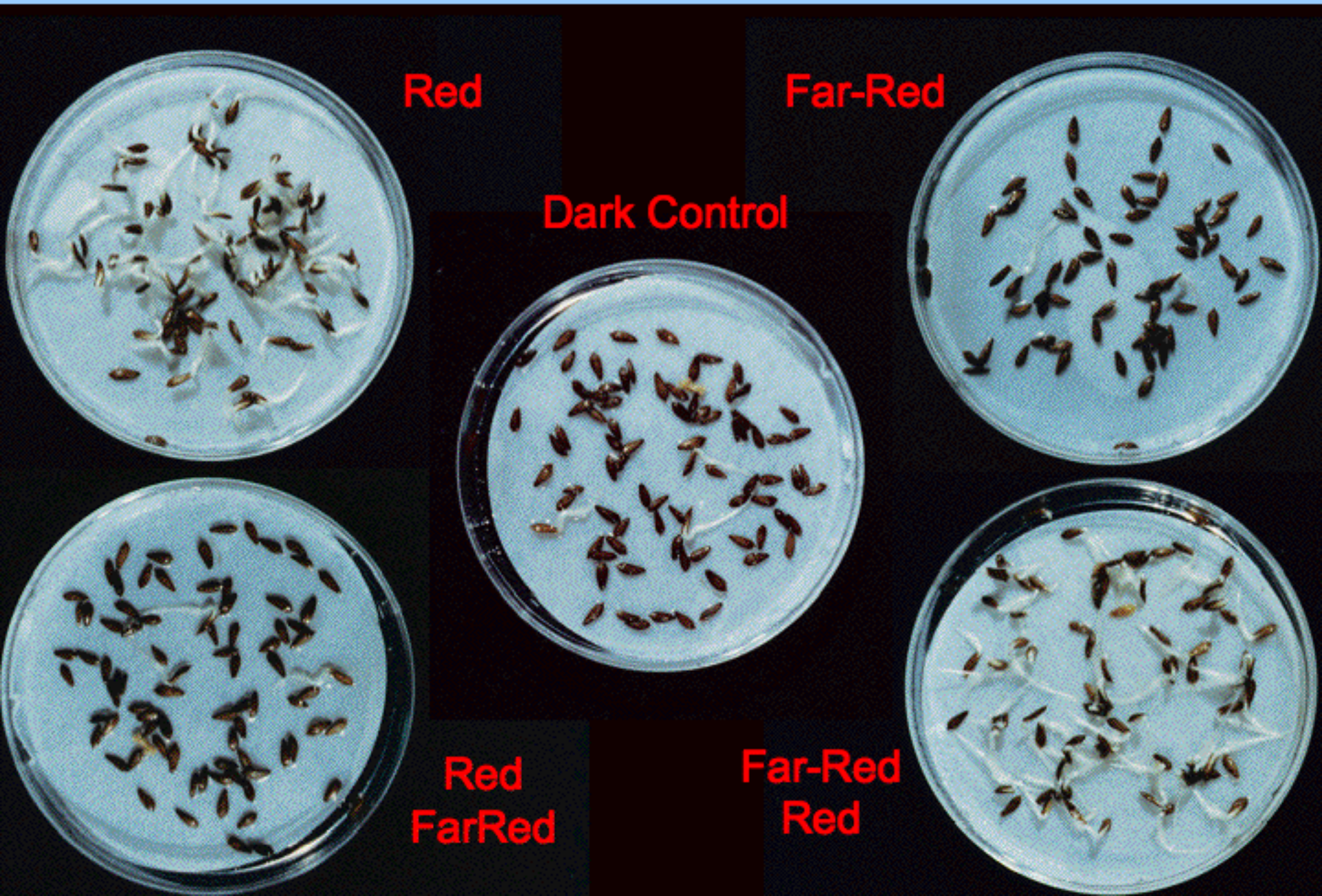
The absorption spectra of the two forms of phytochrome



The Pr form of phytochrome absorbs red light

The Pfr form of phytochrome absorbs far-red light

Lettuce Seed Germination Responds to Light



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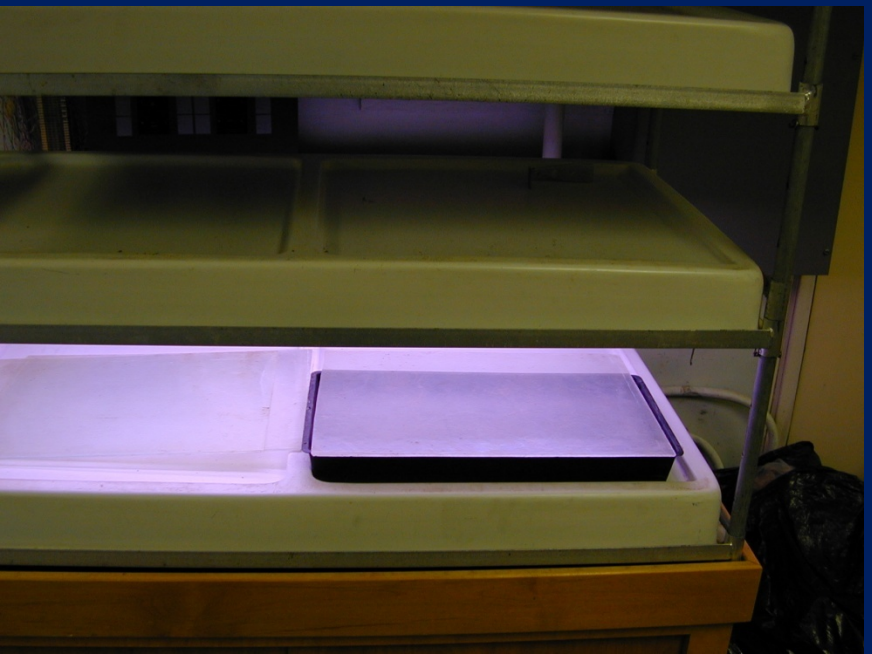
Kenton

Germination Chamber

- Temperature
  - Heating pad (tray), small electric heater (room)
- Water
  - Mist/Soak tray, Humidifier/Tray cover, vermiculite cap
- Oxygen
  - High media porosity, air exchanges, not overwatering
- Light
  - Fluorescent lamps or red LEDs. Do not use incandescent lamps! Do not cover light requiring seed much! Temperature fluctuations may be beneficial.

Light systems

- Avoid incandescent
- 'Cool white' fluorescent



- Hang lights low
- Remove covers after germination

Priming seed

"convinces" seed that moisture conditions o.k.

4 hours is usually sufficient to imbibe seed

Discard water

Not beans/corn!


Tomato seed
Non-primed
Primed