Principles of Disease Control

Pathogen
- **Exclusion**: preventing the entrance of inoculum or establishment of a pathogen within an uninvaded area
- **Eradication**: reducing, eliminating or destroying inoculum at the source.

Host
- **Therapy**: curing diseased plants by use of chemicals (drugs), surgery or an altered environment (temperature, drainage).
- **Host resistance**: reducing efficiency of inoculum via host genetics

Environment
- **Protection**: reducing the efficiency of inoculum by interposing a barrier between host and the pathogen
- **Avoidance**: Avoiding disease by avoiding the pathogen or by altering the environment (outside and inside plant)

Eradication

reducing, eliminating or destroying inoculum at the source.

- Usually targeted at pathogens with monocyclic disease cycles
- The treatments are typically *harsh, but* commonly, an additional benefit is achieved (suppression of weeds, conservation of moisture)

Three examples of Eradication

- Fallow
- Thermal inactivation (heat)
- Chemical fumigation

Fallow is the practice of allowing a field to remain uncropped (and commonly, weed-free)

Purposes:

Reduce inoculum of plant pathogens on high value land (forest tree nursery)

Accumulate soil moisture and reduce pathogen populations (dryland wheat-summer fallow rotation in eastern Oregon)

Thermal inactivation with fire

Open field burning - crop debris is the fuel. Practiced in grass seed fields in PNW for control of ergot, blindseed disease, seed gall nematode Cost per $20 per acre.

Propane gas flaming – fire is fueled by propane gas. More even heat distribution than field burning. Used in to suppress disease in mint, blueberry, strawberry, grass seed. Experimented with in potato.

Thermal inactivation with steam

Pasteurization of soil: Heat soil with aerated steam – want to achieve a temperature of 82 C for 30 min. This kills nearly all plant pathogens but does not completely sterilize the soil.

Steaming media for pot culture

Moving bed steamer

Thermal inactivation with hot water

Used to eradicate bacterial pathogens from seed (or other propagation materials: budwood, scions, etc).

typical protocol:
50-52 C for
20 to 25 min

downside:
plant material can emerge from the treatment less vigorous

Thermal inactivation with sunlight

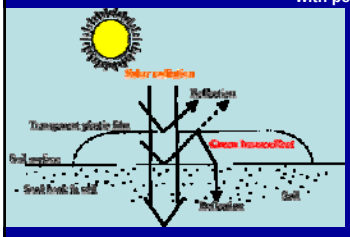
'Solarization' of a field in Israel

Solarization

Effective on soilborne pathogens: Verticillium wilt, nematodes, Fusarium wilt

Practiced in Israel, California, and Australia

Principally annual crops but some success with perennials such as pistachios, olives



Temperature °C

Soil depth

Treatment	5cm	15cm	30cm	45cm
no tarp	46	39	32	30
tarp	60	50	41	39

Viability of *Verticillium* propagules

Propagules per gram soil

Treatment	0-15cm	16-30cm
no tarp	87	49
tarp	5	0.3

Treatment is 95% efficacious

Works best:

- **Clear, thin plastic**
- **Wet soil**
- **Intense, summer sunshine**
- **Plastic on field 3-4 weeks**
- **Also controls weeds**

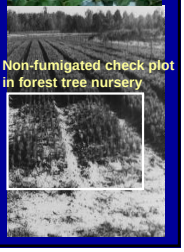
Eradication with soil fumigants

- Purpose: eradicate a spectrum of soil-borne diseases, nematodes and weed seeds.
- Primary uses (all preplant)

  high value food crops (strawberries, peppers, potato)

  nurseries, sod and cut flowers and bulbs

  orchard and vineyard replant situations



Non-fumigated check plot in forest tree nursery

Fumigants:

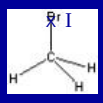
metam sodium – (Vapam) not a true fumigant, but in moist soil releases methyl isothiocyanate, which is a fumigant - very effective on fungi. Applied by shank injector, in irrigation water, or as granules – no tarp

1,3-dichloropropene – (Telone) excellent activity on nematodes, no tarp

chloropicrin - tear gas - kills nematodes and fungi-
usually mixed with methyl bromide as a warning agent – requires a plastic tarp

methyl bromide* – highly toxic, gaseous biocide – requires a licensed applicator and a plastic tarp.

* Use of methyl bromide is being phased out because it depletes ozone - methyl iodide (iodomethane) will take its place



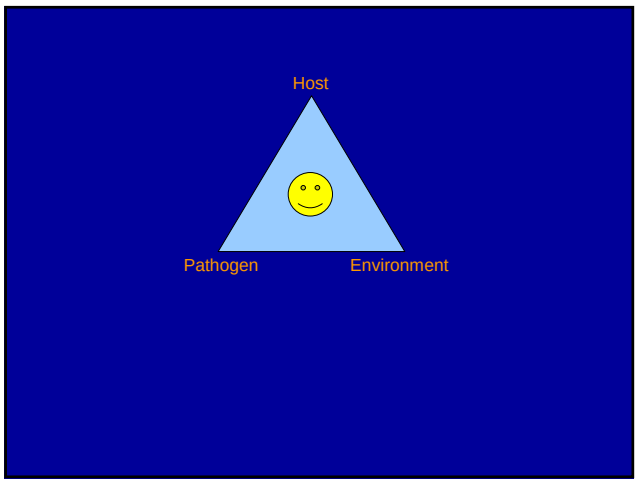
Fumigants work best:

light soils (sandy)
low organic matter
moderate temperatures
moist but not wet soil

Eradication with soil fumigants

Injection and tarping of soil fumigated with methyl bromide/chloropicrin

Chemigation of metam sodium


Host
Pathogen
Environment