Orchard Floor Management

I. General

Objective: Reduce competition between weeds, sod, or cover crop and trees, without compacting the soil or otherwise damaging the trees.

Secondary objective - In IPM, manage herbaceous plants on floor to support populations of beneficial insects, or inhibit the impact of disease organisms affecting the crop.

Weed = "plant out of place"; could be any species.

- compete with trees for water and nutrients, & sometimes light if tall weeds like Johnsongrass, or vines which spread over canopy.

- provide "safe haven" for voles, rabbits that may girdle the tree or chew on roots.

- May encourage foot rot, crown gall, burr knots, etc., by maintaining a high RH at trunk.

II. Types of weeds.

a. Annuals - complete life cycle in less than 1 year:

1. Summer annuals - seed germinates in spring, grows vegetatively in summer, produces seed and dies in fall. e.g., crabgrass, pigweed

2. Winter annuals - seed germinates in fall and winter, grows vegetatively in winter and spring, produces seed and dies in early summer. e.g., Virginia pepperweed, henbit.

b. Biennials - Grow vegetatively one year, overwinter, produce seed and die in the 2nd year.

e.g., wild carrot, common mullein

c. Perennials - Persist longer than 2 years, reproducing vegetatively and by seed.

1. Simple perennials - reproduce only by seed

e.g., dandelion, curly dock

2. Creeping perennials - reproduce by seed and by stolons, rhizomes, tubers, bulbs or corms.

e.g., bermudagrass, nutsedge

Weeds also classified as **grasses, broad-leaved, or vines**; this is important since some herbicides are selective for one of these types.

- 2,4-D for broad-leaved weeds

- Sethoxydim for grasses

III. Control techniques - mechanical, biological, chemical.

A. Mechanical - cultivation and mowing

1. Cultivation - Orchard floor disced to . 20 cm (8 inches) up to 5 times per year; more in rainy climates or in irrigated orchards (flood or sprinkler).

- May injure roots, decrease tree growth, decrease longevity. In citrus, discing done frequently and often reduces growth of trees, weakens. However, studies on sandy soils indicate no differences in tree size through 3 years in peach.

- May expose weed seeds that otherwise would not have germinated, or vegetatively propagate perennials through rhizome or tuber dispersal.

- May disseminate soil born pests faster than they could move themselves; nematodes, root rots.

+ Best for frost protection (avoidance); orchards with moist, compact, weed-free floors radiate heat to trees at night and can be a few degrees C warmer than orchards with high weeds.

+ Decreases consumptive use (ET) of orchard and may be necessary in nonirrigated orchards/vineyards in arid climates. Frequently done in mediterranean climates due to low rainfall and lack of soil erosion potential.

2. Mowing - done 5-6 times per year in warm temperate regions, less in cool climates. Best to choose a slow-growing sod species that does not spread by rhizomes or stolons - i.e., fescue.

Usually supplement mowing with **herbicide strips** beneath tree canopies. However, recent research shows a ***desirable*** inhibition of vegetative growth of mature trees with trunk-to-trunk sod; decreases pruning costs without decreasing fruit size in peach. Growth reduction may be accountable mostly to nitrogen competition, not water.

- Can be more expensive than herbicide, due to more frequent use and repairs, high labor costs.

- Sod can increase orchard water use as much as 20%.

- Mowing near trees results in trunk damage often.

B. Biological.

1. Animals. Grazing animals usually prohibited in orchards due to problems of pesticide ingestion and fecal contamination of crop. Also, they eat fruits and tree foliage often!

Water buffalo, manatees, and certain fish (white amur - carp) can eat large quantities of weeds in irrigation canals (S.E. Florida).

2. Insects. This area not yet exploited.

- Lantana lace bug destroys lantana in Florida citrus, but ornamentalists stop release of insects since lantana is used as a landscape plant.

3. Microbial pathogens.

Phytophthora palmivora - kills milkweed vine (pest in Florida).

De-Vine - (Abbott Chemical Co.) mixture of spores and mycelia in vermiculite. **Specific** to vine, can be sprayed into citrus canopy.

- worked so well, sales declined after release!

Puccinia (rust fungus) species - P. canaliculata works on yellow nutsedge (Cyperus esculentus); significantly reduces tuber growth, and works in conjunction with herbicides.

C. Chemical - most common method, in conjunction with mowing sod middles.

1. Classes of herbicides:

A. Soil-applied

a. Pre-emergence

1. Fumigants (biocides) - Vapam, MeBr.

2. Soil residual materials - kill germinating seeds after absorption and translocation. Weed seedlings or seed must grow through an herbicide-laden layer of soil (surface layer).

e.g., Krovar, Princep, Solicam

b. Post-emergence + soil residual - have "top burn" and soil residual activity; used shortly after emergence.

e.g., Krovar (diuron), Hyvar (bromacil), Karmex (diuron & bromacil).

Selectivity is based on rooting depth; trees = deep, weeds = shallow.

B. Foliar applied.

a. Contact - desiccation of foliage, general disruption (Paraquat).

b. Systemic - absorbed and translocated throughout plant, disrupts metabolism (Roundup).

2. Factors affecting herbicide efficacy:

a. Water. Some chemicals require irrigation or rain to carry into soil and activate. If excess rain/irrigation, chemicals are leached, effectiveness reduced, ± groundwater pollution.

b. Temperature. Generally, higher temperatures promote quicker control; especially with systemic chemicals.

c. Sunlight. Some soil-applied chemicals are photodegradable; must incorporate into soil.

d. Soil type.

Coarse (sand) - less adsorption, lower rates necessary for control; potential for leaching is high.

Fine (Clay) - high adsorption, higher rates needed; less leaching.

e. Weed size. Younger weeds usually easier to kill. With tall, dense weeds, spray coverage and rate may have to be increased for control.

f. Surfactants. Improve efficacy by increasing spray coverage, and/or emulsifying chemical in water better.

3. Herbicide application:

A. Methods.

1. Trunk-to-trunk - Complete coverage, bare soil; better for arid climates where erosion not a problem and ET is.

2. Strip treatment - tree rows bare to drip line, ± 1 ft. Row middles mowed 3-6 times/yr, tree rows treated with herbicide . 2-3 times/yr.

3. Chemical mowing - ¼% or less roundup (usually), sprayed or "wicked" onto vegetation; **stunts growth, does not kill**.

B. Herbicide sprayers - components.

1. Spray boom - frame (slotted channel) upon which nozzles are mounted, often pivots at tractor. Boom shielded with cover sometimes, which protects and reduces drift.

2. Tank - Normally 100 gallons

Stainless steel - best; heavy and expensive.
Fiberglass - adequate; light and inexpensive.

3. Filters - at filler hole (10-20 mesh) and in-line after pump.

4. Agitation - paddles inside tank (PTO) for mechanical agitation and/or by-pass agitation - some solution is pumped back into tank.

5. Pump - ***Low*** pressure, since large droplets and low application rates/acre desired (20-40 psi).
Characteristics:

1. Positive displacement - pistons or rollers for accurate output.
2. Minimum flow of 4 gallons per minute.
3. Corrosion resistant.

6. Nozzles [see DuPont bulletin]

- 0.2 to 0.6 GPM
- Wide angle, elliptical pattern; 50-100% overlap best.
- "Flat fan" - popular.

Numbered designation: 8002 - 1st 2 digits = angle of spray pattern
2nd 2 digits = GPM at 40 psi

Nozzle materials:

Material	**Life (hrs)**	**Estimated initial cost (dollars)**	**Cost per hr of use (cents)**	**Replacement interval in (acres)**
Brass	100	1.22	9.8	250-500
Aluminum	80	1.22	12.2	200-400
Nylon	400	1.87	3.8	1000-2000
Stainless Steel	500	3.59	5.8	1260-2520
Hardened stainless steel	1500	4.26	2.2	2750-7500

C. Calibration.

1. Volume - 50-100 gallons water per **treated** acre for most herbicides and weeds.

2. Pressure - 20-40 psi; depends on nozzle, lower psi for low output.

3. Tractor speed - 2-4 mph.

Field calibration - for checking output on previously designed rig.

Fill tank with water, run tractor over test area of known size, note volume of water

required to refill tank afterwards.

$$GPA = \frac{\{43560\ (ft^2/acre)\} \times \{\#\ gallons\ to\ refill\}}{Test\ area\ (ft^2)}$$

Example: 5 gallons required to refill tank after spraying a 500 ft long by 10 ft wide area.

$$\frac{43560 \times 5}{5000} = 43.6\ GPA$$

Initial calibration - to determine size of nozzle tip when GPA known.

$$GPM = \frac{GPA \times mph \times W}{5940}$$

GPM = gallons/min
mph = tractor speed
W = nozzle spacing (inches)
5940= conversion factor