

# SOIL MANAGEMENT IN NON-IRRIGATED ORCHARDS

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# Soil Management in Non-Irrigated Orchards

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Cultivation or flailing, weed control, and cover cropping can aid in maintaining a productive orchard. Good soil management can assure maximum availability of moisture and essential mineral nutrients, maintain a soil structure that permits the ready penetration and movement of rain and irrigation water, and prevent undue losses from erosion and leaching.

## Non-Tillage Soil Management

Non-tillage weed control using a flail mower between the tree rows and herbicides in the row is a new practice which offers the following advantages over cultivation: (1) it eliminates the need for extensive ground preparation for mechanical harvest of nuts; (2) it eliminates all damage to tree roots due to cultivation; (3) it greatly reduces soil erosion; (4) tree roots can grow in the fertile top 6 inches of soil; (5) cost of operation is reduced; (6) sometimes water penetration is improved; and (7) non-tillage can also protect against loss of top soil in a flood.

It does require purchase of special equipment, a flail mower, and smooth-tread high-flotation tires on all vehicles used in the orchard when the soil is wet. Another disadvantage is that it is difficult to travel steep slopes on a wet cover crop with smooth tractor tires. In an unusually rainy summer, more frequent mowing will be required, thereby increasing costs. Suppression of cover crop or weed growth very early in the season is absolutely essential to success of non-tillage weed control using a flail mower.

Commonly subterranean clover or annual blue grass, plants which normally die early in the season, are used as cover crops. Competition from more vigorous perennial plants is a problem, especially where much sunlight reaches the orchard floor. If the cover is allowed to remain too tall too late in the season it will use moisture which is needed for tree growth. Mowing will usually begin in March or early April. Usually the cover should be clipped to within  $\frac{1}{4}$  inch of the ground by late May. Very soon after the rains stop the cover must die. Such close mowing can only be achieved if the orchard is dragged and floated the season before flail culture is begun in order to remove all hillocks and depressions. Sometimes it will be necessary to drag or scrape the flailed surface to fill small ruts prior to nut harvest. Rapid re-growth of perennial weeds before harvest is a serious problem if it occurs.

Although flailing has been practiced primarily in non-irrigated nut orchards, flail culture is also suited to cherry and prune orchards. If prunes which are firmer than is usually desired for drying are shaken onto the hard flailed surface, they may split. Although volunteer

weed growth is often all that is required to prevent erosion, a cover crop of subterranean clover is quite compatible with non-tillage using a flail mower. Cover crops with more vigorous growth habits are less easily handled in this system. Mole and gopher mounds are particularly troublesome in flail-mowed orchards.

## Cultivation

Except under the flail-mowing system, cultivation is necessary in the early spring to kill the cover crop and winter weed growth in order to avoid unnecessary competition for moisture and plant nutrients. This dead and decaying plant material provides continuing protection from erosion by slowing runoff. It also helps the soil take in moisture from rainfall or irrigation. Additional cultivation may be necessary during the season to control weeds. In some orchards it may be necessary to smooth over irrigation rills or other roughness before harvest, and sometimes it is necessary to prepare a seedbed before seeding the cover crop.

Cultivation does not conserve moisture by preventing evaporation from the soil surface. An extra cultivation on a weed-free soil may result in unnecessary moisture losses since most of the usable moisture is lost from the soil to the depth that it is stirred. It is obvious that the operation of an implement that will kill weeds will also kill tree roots. Deep cultivation, especially if repeated, can keep the trees from using moisture and plant food to the depth of cultivation. Small cracks that form on the surface of a weed-free soil do not indicate a need for cultivation. Heavy cultivation can create a surface layer of light dust, which may hamper establishment of a cover crop.

Excessive cultivation, regardless of moisture content, destroys the natural soil structure. The resulting fine material runs together, severely limiting the movement of water and air, and impedes root growth. Moisture losses from runoff increase with slow water penetration and extra runoff increases erosion. Cultivation of soils that are on the wet side is especially damaging to structure, leading to formation of near-indestructible clods and development of "plow pans" or clay pans that limit moisture movement and root growth.

Here are some common-sense guides for orchard cultivation: (1) cultivate to kill the cover crop as early as possible in the spring to stop unnecessary competition for moisture; (2) cultivate no deeper nor more often than necessary to kill the cover crop and weed growth; (3) use implements that mix the vegetative materials with the surface soil; (4) equip discs or other implements with some means of depth control to avoid over-deep penetration; and (5) never cultivate when the soil is wet and sticky.

## Herbicides

Recommendations for use of herbicides in orchards are changed each year because of changes in federal registrations. Herbicides must be registered for use on a specific tree fruit or nut crop at a specified rate and timing. Since registrations may also be rescinded, follow published recommendations for the current year only.

Usually one of the pre-emergence herbicides with a long-term residual action, such as Princep (Simazine), Diuron (Karmex), or dichlobenil (Casoron), is used as the principle chemical in a weed control program for orchards. Contact herbicides are used to kill those weeds not controlled by the principle herbicide. By alternating chemicals every few years the orchardist can avoid or reduce the problem of herbicide-tolerant weed species.

Precise application is important since an overdose could injure the tree. Use a herbicide sprayer specifically designed for the purpose and carefully calibrated. Never put herbicide in equipment used to spray trees. Avoid spraying herbicide on the tree leaves. Avoid spraying the trunks of trees in the first two seasons and minimize spraying the trunks as much as possible after that. Do not let livestock graze treated cover. Read and follow label instructions closely.

## Mulches

Mulches, particularly sawdust, can be effectively used to control weeds. Mulches likewise permit the tree roots to utilize the moisture and plant food in all of the surface soil since the roots are not excluded by cultivation. A sawdust mulch around the trunk of a newly planted tree is especially helpful in preventing competition from weeds. Completely mulched orchards need not be cover-cropped. The temperature at the surface of a sawdust mulch sometimes becomes high enough to injure very young filbert trees. It is essential to protect young filbert trunks with white latex paint at the ground line. Since a mulched surface absorbs less heat during the daytime than bare ground, radiation frosts would occur more frequently in a mulched orchard.

The cost of applying the mulch heavily enough to control weeds—a minimum of 3 or 4 inches thick—is practically prohibitive. However, it is often practical to use mulches to control weeds around trees or in tree rows.

Mulches have some additional drawbacks. They provide cover for mice which may girdle the trees at the ground level. Gopher control is difficult where mulches are used. Mulches composed of loose material such as shavings may be a fire hazard. With mulches it is always necessary to apply extra nitrogen fertilizer to make up for the nitrogen tied by the soil organisms that live in part on the organic mulch.

## Cover Crops

Annual winter cover crops are a necessary part of orchard-soil management in Oregon orchards under cultivation. Cover crops prevent erosion and reduce the loss of soluble nutrients by leaching. The growing cover crop slows runoff and aids the penetration of rainfall and irrigation water.

Cover crops reduce the amount of damaging soil compaction resulting from the operation of spray or other equipment in the orchard during the late fall, winter, or early spring.

Usually the cover crop growth will be adequate if it is seeded early enough to permit germination with the first fall rains. Annual cover crops adapted to western Oregon north of Josephine County include:

1. Willamette vetch, 40 to 50 pounds per acre with Abruzzi rye, winter barley, or winter oats at the rate of 60 pounds per acre.

2. Austrian peas, 75 to 90 pounds per acre.

3. Crimson clover, 20 pounds per acre. Crimson clover should be seeded in late July or August.

4. Subterranean clover (seeds itself once established).

Annual cover crops suitable for eastern Oregon and southern Oregon include:

1. Rosen rye, 30 pounds + 70 pounds hairy vetch.

2. Winter wheat + Austrian winter peas.

There are a number of other annual cereals and annual legumes that make a highly satisfactory growth.

A light application of nitrogen fertilizer applied at seeding time will often aid in growing an effective cover crop in advance of the heavy winter rains. Nitrogen application should not exceed 30 pounds of actual nitrogen (N) per acre to avoid the possibility of increasing the susceptibility of the trees to winter damage.

Some orchards are so situated that a winter growth of annual weeds or other volunteer plants makes an effective winter cover. If the stand is adequate to prevent erosion during the winter, these volunteer cover crops will be as effective as a seeded cover crop.

## Drainage in Orchards

Trees make little or no growth and often die if planted in wet, poorly drained soils. One of the first symptoms of "wet feet" in an orchard is yellowing and stunting of new growth similar to that caused by boron, zinc, or potassium deficiency. Often a sub-surface layer of heavy non-porous soil restricts drainage. Sometimes tiling is helpful. If the layer is not too thick, sub-soiling may temporarily improve drainage. Subsoiling, as with any tillage, should be avoided when the soil is wet. Frequently, the effect is too temporary to be worthwhile because the subsoil quickly reverts to its original condition. With sweet cherry, mazzard roots are better than mahaleb on poorly drained soils while with prune, plum roots are better than peach. In the final analysis, it is best not to plant an orchard on poorly-drained soil.



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