For good soil management in peach orchards—

- Cultivate the area surrounding young peach trees.
- In bearing orchards use winter cover crops; rye, ryevetch, oats, ryegrass, and wheat are most commonly used.
- Seed cover crop early in fall and fertilize to obtain vigorous growth.
- Do not allow cover crops to compete with trees in spring and summer.
- Disk cover crop and leave as much residue as possible for a mulch and for organic matter.
- Where erosion is a serious hazard and moisture is sufficient, maintain a permanent sod strip between rows; cultivate around the trees and mow the sod strips occasionally during summer.
- Restrict continuous cultivation; cultivate only across slope if necessary to conserve moisture.
- On steep slopes add straw mulch to prevent erosion; add nitrogen fertilizer as needed.
SOIL MANAGEMENT OF PEACH ORCHARDS IN EASTERN UNITED STATES

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As a guide to the development of better soil management practices, this bulletin reviews reports on the effects of different cultivation methods, use of cover crops, sod, and mulches, and erosion control on tree growth and yields of peaches in the East. Fertilizer practices are not given, as growers should follow the recommendations of State agricultural experiment stations for different localities.

SELECTION OF A SITE

Growers should consider carefully the elevation, topography, and slope of the land and the depth, moisture-holding capacity, drainage, and chemical and physical features of the soil in selecting a site for a peach orchard (13, 14).

Orchards planted on sites that have good elevation are not so frequently injured by low winter temperatures as those on low lands. However, severe cold winds may sometimes cause more damage to trees on very high or exposed sites than to trees on slightly lower and better protected sites. Usually it is not advisable to plan commercial peach orchards in locations where the temperatures frequently drop below -12° F. (26).

In most localities, a preferred site is one where the land is elevated and free of obstructions to air movement to such an extent that cold air drains from it to lower levels. Good air drainage protects the flowers and young developing fruits from late spring frosts. Gently sloping or level land may be satisfactory where the climate is mild or where natural protection from cold is afforded by a nearby body of water.

Soil texture and the subsoil often cause a marked and outstanding difference in yield (27). The extent and depth of the root systems of peach trees have an important effect upon the productiveness and life of the trees.

Peaches do well on a great variety of soils. Coarse sands and shales to fine-textured clay loams have been used for peach orchards. Soils that are deep and can hold and store lots of moisture are preferred. Peach trees require an available supply of water while de-
veloping and during their producing period. Trees growing on light sandy soils or shallow soils often have reduced yields during dry seasons if irrigation water is not applied.

Good water drainage, however, is essential. On poorly drained soils excess water or poor soil aeration will damage peach tree roots. Such trees are less productive. Moreover, winter damage may be very severe and may cause early death of the trees on such soils.

**SOIL MANAGEMENT**

Sloping sites with good air drainage need a system of land management that will maintain the soil structure and permit ready intake of rainfall (fig. 1). Trees planted on the contour conserve maximum moisture and help prevent erosion. Thus, on sloping sites where erosion is a problem, the maximum use of good management practices is essential. However, most orchards are planted on the square to allow greater convenience in spraying, cultivating, and other cultural operations.

For any site, growers should follow the best soil management practices recommended for their area—planting winter cover crops, maintaining a sod crop or strip, mulching, or permitting weed cover in the fall. Soil tests should determine liming and fertilization needs.

**YOUNG ORCHARDS**

To provide good growing conditions during the first 2 or 3 years, the young trees should have a well-cultivated strip along each side of

![Figure 1](image.png)

*Figure 1.*—Peach orchards require good soil management to prolong the life of the orchard.
the row or a circular area around each tree made by a tree hoe. A cultivated strip 4 to 6 feet wide prevents soil moisture competition by weeds or sod in the area occupied by the young tree roots. This area should be free of grass and weeds during spring and summer. After the first 2 or 3 years, a winter cover crop should be planted in the cultivated strip. The cover crop is disked roughly in the spring and the residue left on the surface during the summer months.

**BEARING ORCHARDS**

Peach fruits need an ample supply of water during their development period. Soils cannot store enough moisture for maximum production and need to be replenished by summer rains or irrigation.

During fruit development, cover crops must give maximum soil protection and maintain organic matter without competing with the trees. Even on the more level sites where clean cultivation is practiced to keep down weeds during the growing season, winter cover crops and sometimes sod mulches are recommended (fig. 2).

A permanent sod gives the best erosion control and is recommended for sites where erosion is a serious hazard or where moisture is adequate to support both the sod and the trees. However, as moisture is usually in short supply during the summer, nearly all peach orchards receive some cultivation in summer to decrease competition from sod and weeds.

In addition to erosion control, growers should also consider spring frost damage in orchard soil management. The soil itself provides an important heat reservoir that can, under some conditions, lessen the spring frost damage to peach blossoms. An insulating layer will reduce the heat transferred from the soil to the air at night. It will also decrease the intake of solar en-

![Figure 2.—Winter cover crops are recommended even for level sites.](image-url)
nergy during the day. Thus, cultivation that leaves the ground in a loose, fluffy condition, or any cover crop, sod, or mulch may tend to increase the frost hazard, particularly on level areas with poor air drainage.

Investigations by the Weather Bureau (30) show that minimum temperatures actually are lower on frosty nights in orchards with heavy cover crops. Temperatures for orchards with cover crops averaged 0.5° F. lower at a height of 5 feet above the ground and 1.3° lower at a height of 10 inches than in orchards with bare ground. Investigations in California (6) also show that a cover crop may lower air temperatures. Furthermore, the California studies indicate that cultivation operations can increase or decrease frost hazard. Orchards in which the ground remains fairly solid because oil sprays have replaced cultivation for weed control usually are 1° to 2° warmer than orchards that are cultivated regularly. Cultivation can decrease the frost hazard by removing surface vegetation, which may act as an insulating layer. Less protection against frost is obtained from soil freshly pulverized by cultivation than from firm, clean soil.

**Winter Cover Crops**

A winter cover crop for peach orchards is desirable when moisture is usually plentiful. The cover crop is trash-cultivated in spring at the time when moisture is needed by the peach trees for growth and fruit development.

The cover crop is usually seeded in late summer or fall. Late summer is preferable, unless the soil is very dry. Growers should plant the cover crop when rainfall is sufficient to insure seed germination and to prevent possible moisture competition by peach trees and weeds. The size of the peach crop may determine the time to plant the cover crop. If the peach crop is light, the cover may be sown earlier. The cover then competes with tree growth and hastens hardening off to reduce winter injury. In northern areas, cover crops also protect the tree roots during severely cold weather when no snow is present.

No one cover crop is best for all localities. The best winter cover is the one that makes the most growth during fall and early spring and covers the soil completely. Ryegrass, rye, millet, field brome, wheat, oats, barley, vetch, and crimson clover and certain combinations of these have been used. The cover crop usually needs additional fertilizer to promote early and adequate growth to prevent depletion of nutrients for the peach trees. Usually, a complete fertilizer is applied at time of seeding of cover crop.

In areas where the root-knot nematode causes injury to peaches and certain cultivated crops, orchardists should plant oats or other nematode-resistant cover crops.

The time the cover crop is disked in the spring is very important. The crop should be permitted to grow as late as possible and still permit vigorous tree growth and good fruit size. Also, vigorously growing cover in a wet spring will help remove excess soil moisture.
But as soon as the cover crop begins to compete seriously with the peach trees for water and nutrients it should be disked. Two or three diskings are needed during the summer to keep the weeds down.

The more cover-crop residue that is left on the soil surface the greater is the erosion-control benefit to be derived. Adequate mulch or vegetal cover provided by trashy cultivation with a disk protects the soil surface from the dispersing action of rain and aids in infiltration of water (fig. 3). If the disk blades are set nearly straight, they will cut down the crop but leave most of it on the surface. Trashy cultivation is adapted to both old and young orchards.

**Sod**

Few peach orchards are maintained in sod cover. Peach trees do not tolerate competition from grass near the trees reduce competition for water and nutrients by other vegetation. The sod strips should be mowed occasionally during the summer, and the clippings allowed to remain on the orchard floor.

**Mulches**

On steep slopes where erosion control is difficult, peach trees grow and produce good crops under a heavy straw mulch (12). Soil tests indicate that the available po-
Potassium is important in tree and bud hardiness and also in fruit color and quality. From 100 to 200 pounds of straw or similar material per tree is needed.

When mulch is low in nitrogen content extra nitrogen fertilizer should be added. For example, with straw mulch containing 0.5 percent nitrogen, the addition of 3 pounds of ammonium nitrate fertilizer per 100 pounds of mulch material will give a favorable nitrogen content so the mulch will not compete with the peach trees for nitrogen. When mulch material is high in nitrogen content, as with heavily fertilized grasses or legumes, nitrogen from the mulch will be released to the peach trees.

The cost of mulching materials appears to limit their use in most peach orchards (2). Mice damage and fire are hazards if mulches are used. In winter, the mulch should be pulled away several inches from the tree trunks to prevent rodent damage.

**Continuous Cultivation**

Continuous clean cultivation of orchards during the summer damages the soil structure to such an extent that soil erosion and water runoff even on slight slopes may be serious. Cultivation also materially reduces organic matter content and the infiltration rate of water.

Cultivation may conserve moisture during the growing season and is practiced in some areas. How-

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Figure 4.—This orchard is maintained in sod, with the area under the trees cultivated.
ever, growers should cultivate only across the slope and only frequently enough to keep down weeds during rapid fruit enlargement period (fig. 5).

**Summer Cover Crops**

Summer cover crops are not recommended in peach orchards unless erosion is serious (16). Summer crops compete with the trees for available moisture and nutrients. On some sites, such summer crops as soybeans, cowpeas, and crotalaria are grown in addition to a fall or winter cover crop. However, a trashy cover obtained by disking the winter cover crop or a mulch is preferred to a summer cover crop.

**MANAGEMENT RECOMMENDATIONS FOR CERTAIN STATES**

A review of literature on soil management of peach orchards provides additional recommendations for certain States in the humid area.

**DELAWARE**

Kenworthy and Gilligan (21) reported that cover crops initially depressed tree growth; however, this reduction was largely overcome during the second and third year. In another report on this study of peach orchard management (19), soils that were maintained with a cover crop showed a higher content of organic carbon after a few years than those soils that were clean-
cultivated. During the first 4 years of the experiment the trees under clean cultivation grew as well as the trees with cover crops. During the last 6 years the trees with cover crops made better growth than the clean-cultivated trees. The cover crops also tended to increase the potassium content of the soil. The cover crops did not significantly affect yields (18) in these experiments.

Of the several winter and double-cover crops tested, a winter cover crop of 70 pounds of rye and 30 pounds of vetch proved superior to clean cultivation. As a result of measurements and studies of tree growth, fruiting, and fruiting potential, the rye-vetch cover, sowed about September 1 and disked in mid-May, was the most economically sound of the cover crops tested.

GEORGIA

In a 7-year study in northern Georgia (25), winter cover crops with summer cultivation gave the best peach yields when compared with either continuous clean cultivation or with continuous cover. Different dates for turning the winter cover crop were also tested. Peach yields did not differ when the covers were turned on March 1, April 1, or May 1.

Results of the cover crop experiments at Experiment (personal communication from E. F. Savage, 1960) for young orchards up to 7 or 8 years old show that (1) clean cultivation produces the highest yields for a short period of years, but thereafter peach production declines; (2) summer crops decrease yields; (3) permanent sod drastically reduces tree size and yields in the early years of the orchard; (4) if it were not for the increased frost hazard, rye and crimson clover would be the best cover crops for middle Georgia.

Crimson clover has the distinct advantage of reseeding itself, but it provides cover for the corn earworm, which may damage peaches. Rye and crimson clover should be used only in nonbearing orchards, as the cover crop increases the chance of losing the peach crop during late spring frosts.

Cover crops susceptible to root-knot nematode greatly reduced the growth of peach trees and the production of fruit in the Coastal Plain of Georgia (28). Such nematode-resistant cover crops as oats for winter and Crotalaria spectabilis for summer give much better peach yields than susceptible cover crops or clean cultivation.

Clitocybe tabescens is a fungus disease detrimental to peach tree growth and peach yields in Georgia. It commonly occurs in residues from old peach trees and their roots and in oak trees and their root residues. Best sites for new orchards are fields that have been planted to cotton for a few years.

INDIANA

In Indiana, Burkholder and Baker (8) recommend the use of winter cover crops and sods to maintain the organic matter content of the soil at a high level. On some soils a complete fertilizer may
be necessary for optimum cover crop growth.

Cultivation is the prevailing practice in seasons when the trees are carrying full loads of fruit. The first cultivation begins soon after blossoming, and subsequent cultivations continue until shortly before harvest. A disk or culticutter is usually used for the first two cultivations. A harrow is often substituted for later cultivations, which should be shallow and only frequent enough to keep down heavy weed growth. Cultivations are discontinued by August 1, to allow the trees to mature before early December.

Peach orchards may be left in sod on sites that are too steep to cultivate. Mulching or cultivating a circle 6 feet in diameter under each tree can help yields and tree growth. Sod-and mulch-culture is better adapted to clay soil than to sandy loam or sandy soils. On clay soils, mulches have given very satisfactory results even when compared with cultivation and cover crop systems of management.

MARYLAND

Vierheller recommends winter cover crops with trashy cultivation during summer (29). Application of 300 to 500 pounds of 5-10-5 fertilizer per acre should be added when seeding the cover crop. Best seeding time is between August 20 and September 10.

At Beltsville, time of disking down a rye cover crop had little effect on yields of fruit (14). Later periods of disking were the most effective for erosion control, how-
other hand, an orchard on a lighter soil would require longer periods of cultivation to remove competition by cover crops for moisture.

Orchards are cultivated less frequently than in former years. Frequent and thorough cultivation causes too rapid loss of organic matter from the soil with a consequent reduction in its fertility and water-retaining capacity. Cultivation should be only frequent enough to keep down weed growth reasonably well until the cover crop is sown. Cultivation should be only across the slope to aid in preventing loss of soil by erosion.

**MISSOURI**

Winter cover crops and stubble mulch or trashy cultivation are recommended for Missouri peach orchards (27). Summer cultivation should be across the slope with grass or sod strips left in depression areas to facilitate water removal without erosion.

**NEW JERSEY**

Rye, wheat, and ryegrass are recommended for winter cover crops for New Jersey (2). Hairy vetch is sometimes used in a mixture with one of these crops. If there is a light peach crop the cover should be sown by the middle of August. If the peach crop is heavy, the cover crop should not be sown until the middle of September. On sandy soils in southern New Jersey, 200 to 300 pounds per acre of 7-7-7 fertilizer, or its equivalent, usually results in the establishment of a good cover crop.

Although the cost of mulching materials limits their use, the mulches do conserve moisture and give good erosion control.

**NEW YORK**

On most sloping soils of New York, seeding the orchard to rye late in fall and plowing it down early in spring markedly reduce nitrogen and organic matter loss (10). Cultivation conserves moisture during the growing season, but it also permits high rainfall runoff. Soil organic matter and ultimately soil structure is depleted, although cultivation greatly aids nitrification.

Fruit growers in New York are concerned about the frequency of cultivation and the length of the cultivation period (12). For proper soil management, the cultivation should remove enough weed and cover-crop growth during spring and early summer to permit vigorous tree growth and good fruit size and to maintain the orchard topsoil. The benefits derived from winter cover crops depend especially on the time of seeding and the time of turning the cover under. In bearing orchards, cover is sown during early August. If the soil is very dry, the seeding may be delayed until there is enough rainfall to insure seed germination. Edgerton (12) recommends that rye be plowed or disked under at 4 to 5 inches in height, which is contrary to what most workers in other States recommend. In some areas field brome (*Bromus arvensis*) has been substituted for rye as a winter cover crop (9).
OHIO

In Ohio most peach orchards are cultivated during the summer. Winter cover crops that give ample growth are recommended, so that more organic matter will be incorporated with the soil to offset the loss resulting from stirring the land (15). Hairy vetch, vetch and rye, or wheat all form a good winter cover.

Areas subject to erosion can be used for peach production if a sod cover is maintained (17). In a recent study, bluegrass sod cover was just as good as normal cultivation with a winter cover crop of rye and summer cover of soybeans, provided the nitrogen rate for the sod cover was doubled. This study at Wooster was conducted when the average rainfall for 7 years was 19.6 inches during the growing season.

Growers should mow the sod cover several times during the fruiting period and allow the clippings to remain.

PENNSYLVANIA

Alderfer and Shaulis (1) recommend that orchards be planted only on soils that are sufficiently deep to permit the growth of heavy winter cover crops and trashy cultivation of the crops during spring and summer (fig. 6).

In Pennsylvania (3) a permanent Ladino whiteclover sod can be established in the young orchard as soon as possible after setting the
trees, with cultivated strips used in tree rows. The Ladino is destroyed when trees reach bearing age.

The bearing peach orchard soil should be partially cultivated by the time of blooming. Trashy cultivation is maintained until about mid-August when a winter cover is sowed. Ryegrass is highly recommended. It is fertilized with 300 to 400 pounds of 3-12-6 at or before planting.
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