



Vegetation management systems in almond orchards

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Orchard floor management systems used in California almonds vary from planting cover crops between the tree rows to management of the existing ground cover or weeds in the orchard to removal of the vegetation on the soil surface. Cover crops, sometimes called living mulches, have been used in orchards for many years. Many orchardists have successfully converted their weed management practices from repeated disking to maintenance of the vegetation through mowing.

The principal interest in cover crops has been for erosion control on sloping sites. Also, a variety of legumes have been evaluated with the idea that these nitrogen-fixing species might reduce the need for fertilizer applications. Compared with repeated disking, maintenance of orchard floor vegetation by mowing can be less costly, reduce insect and mite problems, cause less soil compaction, increase water penetration, and require less management time. Since the soil is not soft from disking, cover crops also may permit more timely pruning, pesticide spraying, placement of frost-protection heaters, and other operations.

The most common cover crop is "resident vegetation" (weeds) maintained between the tree rows, with an herbicide-treated

strip in the row. This cover is a mixture of winter annual weeds followed by summer annuals and perennials. Some perennial weeds, such as bermudagrass, nutsedge, and dallisgrass, can become more severe under nontillage, requiring nonselective post-emergence herbicide treatments.

Ideally, an orchard cover crop species would have several desirable characteristics. It would (1) be a winter annual plant, providing erosion control in the winter without remaining to use water in the summer; (2) have a low growth stature, allowing trash degradation before harvest, minimizing the chance of frost damage, and decreasing the need for mowing; (3) produce enough seed in the early spring to regenerate itself; (4) be easily controlled with cultivation or herbicides if necessary and (5) not be a host or reservoir for harmful insects, rodents, mites, nematodes, or plant pathogens.

Despite the long use of cover crops, little information has been available on their effects on other aspects of orchard management. A study was therefore established in two Central Valley almond orchards in 1983 and 1984 to compare various vegetation management systems. Included in the evaluation were effects of these systems on

weed and insect pests, orchard water use, and costs of cover crop establishment and maintenance. Other aspects evaluated but not reported here include tree growth and nutrient analysis of the leaves.

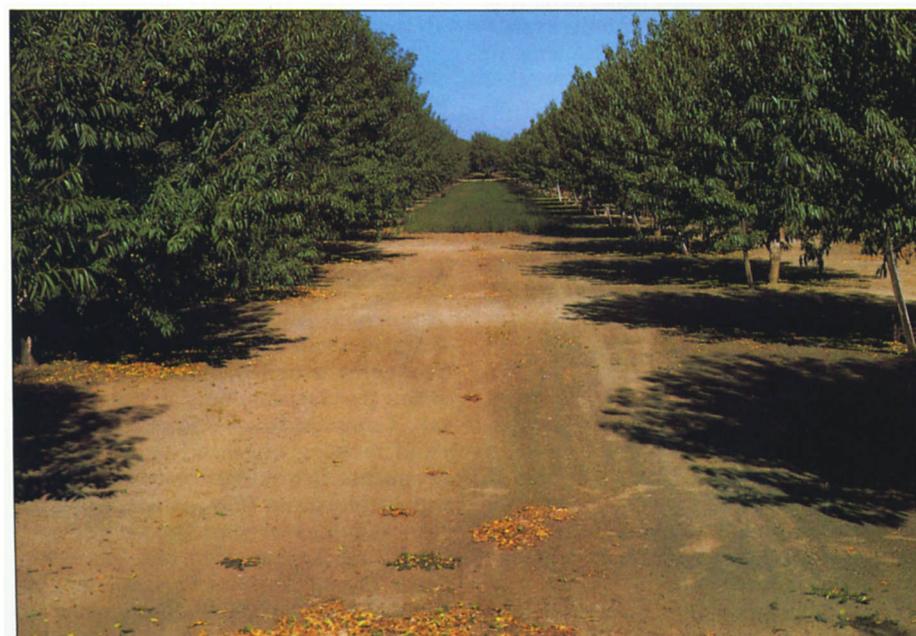
Orchard A, in Merced County, was a new planting of Nonpareil, Carmel, and Price cultivars on a sandy-loam soil ranging from 6 to 10 feet in depth. In 1983, four floor management systems were established: resident vegetation (weeds); winter annual Blando bromegrass (*Bromus mollis*); perennial Salina strawberry clover (*Trifolium fragiferum*); and complete residual chemical control of all vegetation. All plots received a 10-foot-wide strip treatment of herbicide down the tree rows. Plots consisted of four tree rows, each six trees long, replicated four times. The study was in a 4 treatment x 4 Latin square design. Data were taken in the center of each plot.

The bromegrass and strawberry clover were seeded into a prepared seedbed to establish the cover. The resident vegetation, bromegrass, and clover treatments were mechanically mowed as needed.

In the residual chemical control treatment, herbicides were applied to control all weed growth. In orchard A, oryzalin (Surflan) and oxyfluorfen (Goal) were used annually



Orchard floor management systems compared in the following series of four articles included resident vegetation, or weeds (facing page); strawberry clover and Blando bromegrass as planted cover crops (above, and insert of bromegrass, right); and complete residual chemical control of vegetation (foreground, below). A fifth treatment, chemical mowing of resident vegetation, was also tested in one of the two study orchards. The researchers used the same test plots to evaluate effects of the different systems on orchard floor plant composition, insect pests, water use, and orchard costs.



until the trees were 3 years old, and then simazine (Princep) was substituted for oxyfluorfen. Glyphosate (Roundup) was added as a post-emergence treatment to control existing weeds and was used again in the summer to control escaped weeds.

The same four treatments plus a fifth one—chemical mowing—were established in 1984 in orchard B, a 7-year-old Stanislaus County orchard of the same almond cultivars. In chemical mowing, low rates of glyphosate were used post-emergence to retard early growth of the resident vegetation. Glyphosate was used late in the summer to eliminate all the resident vegetation in the chemical-mow plots before harvest.

The complete residual chemical control treatment in orchard B consisted of oryzalin or napropamide (Devrinol) and simazine used as pre-emergence herbicides. Glyphosate was used in the winter and summer to control existing weeds.

Tree rows in this orchard also were treated with the 10-foot-wide herbicide strip application. This study was established as a 5 treatment x 4 replication randomized block design.

All treatments in both orchards were maintained annually through 1988, during which time the researchers participating in the various aspects of the study gathered data for their evaluations. Highlights of their findings are presented in the following articles.

The study results show advantages and disadvantages to each system. The choice of one or another would depend on which considerations are most important in a particular orchard: for example, increased water penetration with vegetation; decreased water consumption with Blando bromegrass, residual herbicide, or chemical-mowing; shifts to harder-to-control weeds with a Blando bromegrass cover or chemical-mowing; planting a perennial clover, which is hard to control; increased ant damage to nutmeats in orchards with vegetation cover; decreased navel orange-worm overwintering in areas with vegetation; or decreased maintenance costs with chemical-mowing.

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