

CHAPTER 11: Targeted Grazing with Sheep and Goats in Orchard Settings

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10 KEY POINTS

- Orchard trees planted in traditional wide-spaced patterns are well suited to targeted grazing.
- Ground cover must be managed in orchards for orchard health and productivity.
- Excess ground cover competes with trees for water and nutrients.
- Sheep and goats have been used for centuries to graze orchard understory vegetation.
- Livestock must be monitored carefully to avoid overgrazing or browsing.
- The number of animals needed for targeted grazing fluctuates during the growing season.
- Orchard and vineyard grazing requires fencing, access to water, and a secure holding area.
- Livestock should be removed when the orchard is wet.
- Actively growing grass and weeds can have high forage value for livestock.
- Collaboration with other orchard and vineyard growers could facilitate targeted grazing.



VEGETATION MANAGEMENT OPPORTUNITIES

About 3 million acres of non-citrus tree fruit and nut orchards are grown in the United States,¹⁹ much with the potential to use sheep and goats to manage orchard floor vegetation. Deciduous, non-citrus trees are grown on 2 million acres, producing apples, apricots, avocados, cherries, dates, figs, grapes, guavas, kiwifruit, nectarines, olives, papayas, peaches, and pears. Another million acres produce nuts, including almonds, hazelnuts, macadamias, pecans, pistachios, and walnuts. Vineyard acreage is dramatically expanding in many regions, and small ruminants are being used to prune the lower grape vines as well as to manage the understory vegetation.

Most nut trees and some fruit trees, like cherry, are cultured in the traditional fashion where large, widely spaced trees provide greater opportunities for grazing. For example, in Georgia, Texas, Alabama, and New Mexico, livestock routinely graze mature commercial pecan orchards.^{13, 20} Mature nut trees are large and grown at wider spacing than fruit trees, opening substantial pasture for grazing and understory management.⁴

The arrangement and care of fruit trees in many production systems have changed across much of the United States in the past few decades. Commercial orchards increasingly grow dwarf and semi-dwarf trees (using size-controlling rootstock) and high-density plantings along trellised hedgerows about 10 feet high when mature. This trend toward semi-dwarf varieties of apples, pears, plums, and citrus facilitates harvesting and pruning but reduces the potential for targeted grazing in orchard management. The browsing animals may harm lower tree growth and can damage things like sprinklers or drip emitters in irrigated orchards.

Regardless of crop, most orchards comprise a network of systematically arranged trees with some type of ground cover, which is an important component of orchards. This orchard floor includes a vegetation-free strip in the tree rows with grass alleys between the rows. In the vegetation-free zone, roots can grow without competition from weeds or grass sod. Grass alleyways serve as a cover crop and provide a firm surface for machinery. The cover crop also conserves water, protects against erosion, increases infiltration, and maintains soil structure and organic matter.

Orchard ground cover is generally a combination of perennial, sod-forming grasses and occasionally a legume like white clover, subterranean clover, vetch, or birdsfoot trefoil. Depending on location, common grasses used in orchards include orchardgrass, perenni-

al ryegrass, bentgrass, red fescue, Kentucky bluegrass, and timothy. There are specifically designed orchard mixes that provide the ideal growth form, biology, and phenology. Forage production, however, has not been a criterion in their development.

The orchard floor actively grows during spring, summer, and fall because of regular irrigation and fertilization. In many regions it grows year round. To assure orchard health and maximize productivity, ground cover must be managed. Vigorously growing ground cover can quickly build up excessive biomass that competes with trees for water and nutrients, especially nitrogen. Fruit trees compete poorly with other plants. The bulk of tree roots form in the top 3 feet of soil, where competition for water and nutrients is greatest. Tall vegetation can harbor pathogens, insect pests, and harmful rodents (mice and voles) that may girdle young trees and expose vulnerable surface roots. Managing ground cover is the most effective method of controlling mouse activity.⁵

In addition to the grass cover crop, herbaceous weeds compete with trees for water and nutrients. Weed growth and water uptake are greatest during the summer, a time when careful water management is important to maintain fruit quality,¹⁸ making weed control an important component of orchard management. Abundant weeds disrupt water management and threaten fruit quality when it's hot. What's more, large weeds block sprinkler heads and disrupt water delivery.

Conventional management of orchard floor vegetation involves repeated mowing (seven times a season is typical) with specialized low-profile equipment and application of systemic and pre-emergent herbicides. Mowing keeps competitive grasses and weeds in check, ensures access to trees, and inhibits rodents and diseases. In many orchards, herbicides are regularly sprayed to control weeds and to maintain a vegetation-free zone at the base of the trees. However, growers have limited herbicide options and must apply them carefully to avoid damaging trees. Cultivation is generally avoided in orchards because it can degrade soil, damage roots, and cause erosion.

Small livestock like sheep and goats have grazed orchard understory vegetation for centuries.¹⁵ In warm regions of the world, year-round or season-long grazing provides meat, milk, and fiber in addition to fruits and nuts. Orchard grazing was a common practice in North America until the 1950s. In contemporary commercial orchards, the primary purpose of grazing is to manage understory vegetation, which keeps grass from building up and competing with trees, minimizes pest and disease outbreaks, and maintains uniform water distribution. Orchard grazing provides several advantages, including greater economic returns,¹⁸ more diversified farm operations,⁸ and extended timing of cash flows.¹⁷ Orchard grazing can reduce fuel and chemical inputs⁹ and may enhance erosion control, water quality, water use efficiency, soil fertility, and nutrient cycling.^{9, 10}

Orchard grazing is not widely practiced for several reasons, but primarily for concern over browsing and bark damage.⁹ Growers also cite lack of research and technical assistance and difficulty obtaining and managing suitable animals. Orchardists without experience working with livestock may see that as a barrier. Contamination from livestock waste is also a concern.⁶ Unpasteurized apple cider, often made from apples collected from the orchard floor, can be contaminated with *E. coli* and other pathogens from animal waste.¹⁶ Similarly, nuts collected from the orchard floor can also be contaminated from animal waste and pose public health risks.¹

Despite these issues, orchard grazing is becoming more common today than in recent decades and is practiced in nearly every state where fruits or nuts are commercially produced. The widest acceptance appears to be in organic orchards.

Criteria for Animal Selection

Selecting the type and class of animal to graze depends mainly on orchard structure and the reasons

for including livestock grazing in the orchard management system. A goal to diversify farm revenues by producing meat, milk, brood stock, or fiber will have different criteria for selecting animals than a goal to strictly manage vegetation.

Animal size is also important. Cattle, and even horses, have been used, but their weight and contact with fruit-bearing branches make them less desirable than smaller ruminants like sheep and goats. Sheep are preferred to goats in most fruit production systems because they do not climb into trees to browse and are more easily contained. However, goats are commonly used in certain situations, for example in mature nut orchards.^{12, 14}

Breed and age correlate with size but may also determine some behaviors. In Washington, Hardesty and Howell (1991) began their work with a mixed-breed flock of sheep. Then, to control for browsing experience, they replaced it with a flock of Suffolks with no browsing experience. In spite of aversion training, the sheep quickly took to browsing. Because Suffolks are relatively tall sheep and have a reputation as browsers, the researchers added some short, stocky Hampshires. These animals could not access as many branches, but they compensated with determination, even feeding occasionally with their front feet on stems. Lambs and yearlings cannot browse as high and may benefit from the shelter offered by the trees. Much work remains to determine the best breeds for orchard grazing.

Animal selection may depend on their availability. Lawrence and Hardesty (1992) found that cattle were used more commonly than sheep in Washington orchards because cattle were more readily available than sheep or goats. Today, small ruminants are offered in irregular sales at local livestock auctions and through direct contact with producers, and the number of flocks and herds intended solely for vegetation management is growing.

Grazing Strategies to Meet Ecological Objectives

Proper animal husbandry is crucial for successful orchard grazing. Livestock must be carefully monitored and managed to avoid overgrazing or browsing.⁹ The degree of browsing depends on type of orchard and animal, season, and how animals are managed. Many trees can tolerate some browsing without reduced fruit production or quality,⁹ but orchardists generally find any level of browsing unacceptable. Browsing can be limited by continuously rotating livestock through the orchard and by grazing only mature orchards or



Photo: Linda Hardesty, Washington State University

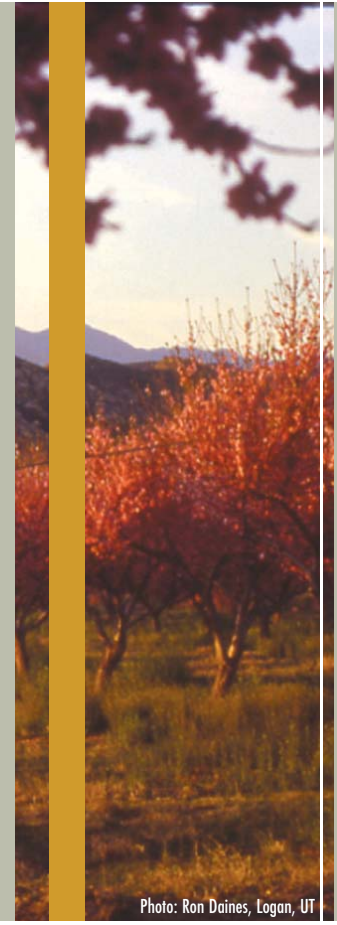


Photo: Ron Daines, Logan, UT

protecting trees in young orchards with temporary row fencing. Aversion training (when animals are dosed with a nausea-inducing compound after eating leaves or branches) can produce an aversion and reduce browsing on trees for about 10 days. (Lithium chloride has been used for research in aversive conditioning, but is not cleared for use in meat-producing animals.) For short periods, this may be enough if the herd or flock is small. Likewise, repellants have limited application against the high palatability of orchard browse.

Many fruit- and nut-producing regions have long growing seasons with the potential for season- or year-long grazing. In these situations, livestock can graze on a rotational basis and be removed from the orchard during spraying, pruning, irrigation, and harvest. An alternative is short-term, high-intensity grazing accomplished with a perimeter fence and a herder, often accompanied by a herding dog, moving higher numbers of animals quickly through the orchard.

Controlling the intensity of grazing is also important. Overgrazing ground vegetation can cause soil and feeder root problems. Growers need to develop a rotational grazing system to provide appropriate rest cycles, which will vary according to seasonal growing conditions and the orchard production calendar. Proper pasture rotation provides fresh feed for the livestock and allows rest for the grazed plants to recover. Without a controlled rotation grazing program, the livestock will

tend to feed only on the highly palatable forage and weeds within the larger area, leading to patchy grazing and a proliferation of ungrazed plants.

The production of understory biomass varies dramatically during the growing season. The number of animals needed to control vegetation in the spring and fall will be insufficient to achieve control during the peak growing period in the summer when plants are stimulated by irrigation, fertilization, and a humid canopy. Without flexibility in stocking rate, some mowing may still be needed during the peak growth period. A potential solution may be to select ground cover species that have low forage production, are reasonably palatable, and reach peak biomass at a time that fits the orchard management schedule. Some of these production traits might better balance year-long forage supplies, although no research was found in this area.

Orchard grazing requires a secure perimeter fence, access to water, and a non-orchard holding area.⁹ Electric fencing is effective to facilitate rotating animals among paddocks if it is properly installed and livestock have been trained to it. Animals may need training to familiarize them with humans and paddock rotation. Wire panels offer high containment security that may be useful in some settings. Some types of net or electric fence also offer protection from predators, particularly roaming domestic dogs.



Photo: Linda Hardesty, Washington State University

Livestock should be removed during irrigation or naturally wet periods when soil is saturated. They should also be removed during the prescribed reentry period for agricultural chemicals.⁹ In addition to fertilizers, pesticides, and herbicides, these chemicals include growth regulators, thinning agents, and oil sprays. Some tree species (e.g., apples) use considerably more fertilizers than others (cherries). Likewise some species take only weeks to bear (cherries) while others mature over several months (apples). These characteristics may affect chemical exposure and other management variables. Few chemicals used in orchards have been evaluated for grazing reentry, posing a particular concern for meat animals. Fruit intended for export may be more heavily treated with pesticides than fruit for local or domestic consumption. Organic orchard production does not preclude the use of chemicals, just synthetic chemicals. The impacts on animals of products used in organic orchards are likewise unknown. Many tree fruit leaves and seeds contain cyanide. Toxicity risk to grazing animals is probably low, but the question has not been examined in detail. Using animals not destined for consumption avoids most of these problems as long as synthetic or natural chemicals are not toxic to the animal themselves.

Animal Production Considerations

Orchard grazing must also fit into the animal owner's production cycle. Animals may be produced on rangeland, irrigated pasture, and crop aftermath, areas that may be distant from each other and perhaps from the orchard.

Actively growing grass and weeds in orchard ground cover can have considerable forage value. The residue of leaves and unharvested fruit that falls to the ground can also provide important nutrients late in the season. Grazing fruit orchards after the leaves fall reduces cover for rodents and clears the debris that harbors pests and pathogens. Leaves cut from fruit trees comprise nutritious and palatable forage that animals readily consume.⁹ One range sheep producer in Washington routinely prepares his ewes for breeding (i.e., "flushing") in pear orchards because of abundant high energy forage. Properly grazed, orchard understory will likely provide animal gains similar to those from irrigated pasture.

An extensive economic analysis of sheep grazing in a Washington cherry orchard determined that the most important considerations were the availability and age class of livestock, sheep handling, transportation, and market.² Alezi (1997) analyzed two alternative livestock management systems: 1) grower-owned livestock, either as a permanent flock or weaned lambs purchased in the spring, grazed through the season, and sold in the fall, and 2) contract grazing, where grazing rights are leased to a livestock owner/operator. In the first case, where the orchardist owned the sheep, the production of meat and wool was the primary goal of grazing. Depending on the availability of additional pasture or rangeland, the sheep were grazed in the orchard year-round, being removed only during critical periods of fruit production. Alezi (1997) found that raising sheep year-round required high lamb prices to yield more net revenue than traditional orchard management. Under the livestock lease scenario, vegetation management is the primary goal. Grazing takes place only during the growing season when the orchard floor vegetation is actively growing and requires regular maintenance. However, Alezi (1997) found that leasing orchard forage was less profitable than traditional orchard management.

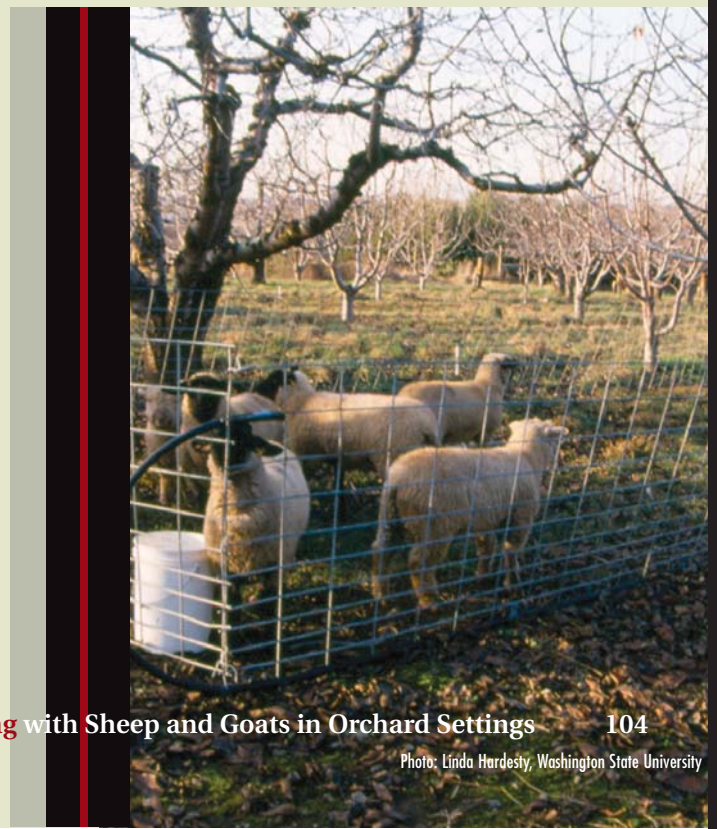
Labor availability and the cost of the manager's time are critical to profitability, necessitating efficient routines.^{2, 9} Each product and production system has one or more periods of peak labor demand. These periods should be evaluated when formulating orchard grazing plans and selecting animal species to minimize overlap.

EFFECTIVENESS AND INTEGRATED MANAGEMENT

Livestock grazing provides a useful and important alternative for managing orchard ground cover. Depending on the type, age, and production system of the orchard and the grower's willingness to participate, orchard grazing programs can be developed to fit the needs of the orchard.

Several studies have shown sheep and goats to be as effective as conventional practices in meeting growers' vegetation management objectives. Hardesty and Howell (1991) conducted a study of sheep grazing in a mature sweet cherry orchard in Washington. Traditional orchard understory management (mowing and herbicide use) was compared with a variety of orchard grazing strategies using sheep. Over the five years of the study, they determined that sheep (and probably other grazers) can be successfully grazed in a mature orchard, reducing the need to mow and spray in the orchard and providing an additional revenue source. Alezi's (1997) economic analysis of this same project showed that grazing can be an effective and economic way to manage orchard floor vegetation, depending on animal market conditions. Overall, sheep grazing yielded substantial income, generating net returns of about \$3,900 per acre. Orchard grazing also reduced labor, machinery, fuel, and herbicide costs for vegetation management.⁹

The trend toward integrated pest management, reduced chemical inputs, and enterprise diversity creates additional opportunities for integrating tree crop and livestock production. While the practice of livestock grazing in orchards can be effective, environmentally sound, and economically feasible, the extent to which it is adopted will depend on its acceptance by growers. Orchardists unfamiliar with handling and using livestock may resist any perceived risk to their highly capitalized orchard. Grower education is needed to increase the acceptance of orchard grazing. To modify a traditional orchard production system, the grower should have specific objectives identifying the intended role of livestock, acquire knowledge and understanding of livestock husbandry, understand basic grazing management principles,⁷ and create realistic time and financial budgets. The large number of variables in successful orchard grazing presents both challenges and opportunities. But it also requires experimentation to optimize its use for each operation. Collaborative efforts with other local producers may facilitate implementation of grazing into orchard management and produce other efficiencies.



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