18

Vineyard Floor Management

DONNA J. HIRSCHFELT

Floor management is particularly important in San Joaquin Valley raisin vineyards since harvested fruit must sun-dry on the soil surface. Floor management practices must facilitate raisin drying operations. You have to eliminate weeds and plant residue from the row middle by late summer in order to terrace the vineyard for harvest.

In addition, your vineyard floor management strategies should

- control weeds, which otherwise reduce vine growth and grape yields by competing for water, nutrients, and sometimes light
- facilitate irrigation, fertilization, and pest management practices
- improve the physical, biological, and nutritional status of soils
- provide a suitable habitat for beneficial insects
- eliminate habitats that harbor or encourage vertebrate pests, insect, and diseases

The choice of management systems depends on soil type, weed pressure, irrigation method, equipment, frost hazard, expense, and other management factors such as the desire to grow the grapes organically or to avoid the use of synthetic chemicals.

Strip Nontillage

In strip nontillage, floor management for the vine row is managed differently than for the row middle. You use herbicides to control weeds in the vine row and use cultivation and mowing in the row middles. Strip nontillage offers flexibility for cover cropping and in cultivation practices for the row middles (Figure 18.1). Because fewer tillage operations are required, soil compaction is kept to a minimum. Strip nontillage is less disruptive to vine root systems than complete tillage.

Figure 18.1 Strip nontillage with barley winter cover crop in every other middle. *Photo: L. Peter Christensen.*

Growers cultivate row middles in furrow-irrigated vineyards because they need to form furrows. Cultivation may also be desirable in soils where surface sealing has caused water penetration problems. It is also used to prevent frost damage in the spring by incorporating vegetation into the soil, making furrows ready for water runs during frost, and achieving a bare, firm soil surface that will absorb radiant heat from the sun.

Cultivation also incorporates shredded prunings into the soil. This is done in alternate middles, or in every middle if vine growth is vigorous.

A permanent berm is established in flood- or furrow-irrigated raisin vineyards. Its purposes are to facilitate irrigation and to prevent water from leaching herbicides into the root zone. The berm is 6 to 12 inches (15 to 30 cm) high and 3 to 4 feet (0.3 to 1.2 m) wide, and it is treated with a combination of preemergent and contact herbicides. The berm is optional in drip-irrigated vineyards. Preemergent herbicides may break down and leach more rapidly under the emitter since the area is continuously wetted. Additional contact herbicide applications may be required in drip vineyards.

Complete Tillage

With complete tillage, growers use little or no herbicide. Weeds in the vine row are controlled with a French plow or spring-hoe weeder in late winter or early spring. The furrow in the vine row is often left open or filled with water for frost protection. Soil and weeds around the trunk and stake area usually are removed by hand with a shovel or a hoe. After budbreak and before shoot growth interferes (late April to early May), the soil is thrown back into the row to form a berm, covering the emerging summer annual weeds. Some mechanical cultivation may be needed to control summer weeds on the berm (Figure 18.2), especially if rainfall re-wets the new berm and stimulates seed germination.

The row middles are cultivated with standard disks and harrows as needed. This method requires a lot of equipment input, but it is the only alternative for organic vineyards or for growers who wish to avoid using herbicides.

Increased cultivation may have undesirable effects. Cultivation damages soil structure, especially if done while the soil is too wet. While cultivation may be necessary to form irrigation furrows, break up a sealed soil crust, and improve water penetration, eventually repeated cultivations reduce soil porosity and water infiltration.

Cultivation may also have an impact on pest management practices. An increase in dust may encourage spider mite problems in the vineyard. Cultivation may also bury grape cluster mummies, which can harbor bunch rot disease and omnivorous leafroller.

Complete Nontillage

In complete nontillage there is no soil cultivation, and weeds are controlled exclusively with herbicides. This system can be used in wine and table grapes, but is not suitable for raisin vineyards, except those intended for DOV (Figure 18.3).

Cover Crops

Cover crops are commonly grown in raisin vineyards. There are many reasons to grow cover crops. They can improve soil structure and tilth, reduce soil compaction, improve water penetration, and improve the soil environment for root growth. Cover crops may also play a role in vineyard pest management. Their contribution to soil fertility and vine nutrition is the best documented and most common reason cover crops are grown. However, there are costs and risks to growing cover crops, and it is important that growers evaluate these along with the benefits. Growers must ensure that their cover crop management practices will be compatible with quality raisin production.

Figure 18.2 Complete tillage by cultivation with spring teeth in row middles and spring blades in vine rows during summer. *Photo: L. Peter Christensen.*

Figure 18.3 Complete nontillage in an open-gable trellised DOV vineyard. *Photo: L. Peter Christensen.*

Three different types of cover crop systems are used in vineyards throughout California: winter annual, summer annual, and perennial. Obviously, perennial cover crops cannot be used in raisin vineyards where the raisins are sun-dried on the vineyard floor. The use of summer annual cover crops is also very limited since row middles must be free of trash and plant residue by the beginning of August. Only winter annual cover crops play a significant role in raisin vineyard management. Recommended cover crops and their seeding rates are listed in Table 18.1.

Green Manure Cover Crops

In raisin vineyards, winter annuals are most often grown as green manures, and are planted during the fall from September to early December. They consist of annual grasses, legumes, a few other broadleaf plants, and mixtures of these. The cover crops germinate within several weeks with adequate soil moisture and

Table 18.1 Annual cover crops for raisin vineyard floor management

Common name	Scientific name	Relative seedling vigor	Growth habit	Maximum height (*inches*)*	Time of flowering	Time of maturity	Potential nitrogen (*lb/acre*)†-	Suggested varieties	Inoculum type	Seeding rate (*lb per planted acre*)†	Soil type	Minimum rainfall (*inches*)
Legumes:												
Bell (fava) beans	*Vicia faba*	High	Erect	36–84	March–May	May–June	100–150	—	Type "Q"	100–150	Adapted to most soils	Not known
Bur medic	*Medicago polymorpha*	Moderate	Prostrate to erect	6–15	February–April	April–May	30–60	'Santiago' 'Circle Valley' 'Serena'	"Medicago"	15–20	Adapted to most soils	Not known
Cahaba white vetch	*Vicia sativa* × *V. cordata*	Moderate	Trailing to ascending	18–24	April–May	May–June	100–200	—	Type "C"	40–80	Sandy loam to clay loam	14"
Common vetch	*V. sativa*	Moderate	Trailing to ascending	18–24	April–May	May–June	100–200	—	Type "C"	40–80	—	Not known
Crimson clover	*Trifolium incarnatum*	Moderate	Erect	12–20	April–May	May–June	30–60	'Dixie' 'Flame'	Type "R"	15–25	Sandy to loam	14"
'Lana' Woolly-pod vetch	*V. villosa* spp. *dasycarpa*	High	Trailing	18–24	March–May	April–June	100–200	'Lana'	Type "C"	40–60	Fine, sandy loam to clay	14"
Purple vetch	*V. benghalensis*	High	Trailing	18–24	April–May	May–June	100–200	—	Type "C"	40–60	Fine, sandy loam to clay	14"
Rose clover	*T. hirtum*	Moderate	Erect	8–15	March–April	May–June	30–60	'Hykon' 'Kondidin'	Type "WR"	15–20	Sandy to loam	10"
Nonlegumes:												
Annual ryegrass	*Lolium multiflorum*	High	Erect	36–48	April–May	June–August	0	'Common' 'Gulf'	—	20–35	Loams to clays	12"
Barley	*Hordeum vulgare*	High	Erect	24–26	April–May	May–June	0	'UC 476'	—	80–100	Adapted to most soils	Not known
'Blando' brome (soft chess)	*Bromus horeaceus* spp. *molliformis*	High	Erect	12–30	March–April	April–May	0	'Blando' brome	—	10–15	Adapted to most soils	12"
'Merced' rye (cereal rye)	*Secale cereale* cv. 'Merced'	High	Erect	36–72	February–April	April–May	0	'Merced'	—	60–120	Adapted to most soils	Not known
'Zorro' fescue (foxtail fescue)	*Vulpia myuros* var. *hirsuta*	High	Erect	12–24	March–April	April	0	'Zorro'	—	8–12	Adaped to most soils	10"

*To convert to centimeters, multiply values by 2.54.
†To convert to kilograms per hectare, multiply values by 1.12.

proper temperatures. Substantial growth (biomass production) does not begin until daylength and temperatures increase in February or March.

A variety of plants can be grown as green manure cover crops. Legumes include vetches, peas, beans, clovers, and medics (Figure 18.4). Legumes contribute nitrogen to the soil with the aid of symbiotic bacteria on their roots. A legume plant produces a tap root that does not penetrate well into compacted soil layers, so they are less useful for loosening soils and improving water penetration than cereals, which have numerous, small, fibrous roots.

The most common legumes used in raisin vineyards are the vetches ('Lana' woollypod vetch, purple vetch, Cahaba white vetch), the medics (especially bur clover species), and bell beans. Clovers such as crimson and rose clover are also used, especially in mixes.

Cereals include barley, oats, and rye. Other grasses include 'Blando' brome, fescues, and ryegrass. Grasses do not fix nitrogen but may be useful as a trap crop to take up soil nitrogen and release it more slowly upon decomposition in the soil. This gradual release of nitrogen may be particularly advantageous in sandy, easily leached soils found in many raisin vineyards. Grasses almost always require supplemental nitrogen fertilizer for adequate growth. Grasses have numerous fine roots that are more likely to grow into compacted layers.

It is common to use a combination of plants in a cover crop. You can purchase a commercial blend, but it is often less expensive to combine seed types yourself. A blend of legumes and grasses offers the benefit of both tap and fibrous root systems and supplies the vines with moderate nitrogen. Additionally, cereal stems may provide support for fine-stemmed legumes.

The value of a cover crop largely depends on growth and dry matter produced. Seedbed preparation and planting are critical. The time of planting is one of the most important factors in plant establishment and growth. The optimal planting period for most cover crops is from September 15 to November 1. After November 1, a cereal such as 'Merced' rye would be the best choice because it grows better in cooler temperatures. Plant it by November 15 to get reasonable growth by the following spring.

Figure 18.4 'Lana' woollypod vetch in bloom and ready for incorporation as a green manure cover crop. *Photo: L. Peter Christensen.*

For each specific crop, ask the seed supplier about seedbed cultivation, moisture, and fertilizer requirements. Grasses will almost always require additional nitrogen fertilizer. Legumes should not be fertilized with nitrogen, but may benefit from gypsum or phosphorus. If you plant legumes and they have not previously been grown in the vineyard, you may need to add an inoculant of nitrogen-fixing *Rhizobium* bacteria. You can add this to the seed mixture or you may be able to purchase coated seed.

Cover crops are usually incorporated into soil while green and succulent. The cover crop adds organic matter and nitrogen to the soil. The time of incorporation influences the carbon-to-nitrogen (C:N) ratio and the amount of nitrogen available for vine uptake. Cereals and grasses have a favorable C:N ratio up to the flowering stage and will decompose rapidly.

A legume green manure cover crop can provide all of the nitrogen required by most raisin vineyards. Legumes are known to fix from 50 to 200 pounds of nitrogen per acre (56 to 224 kg/ha). Research in a San Joaquin Valley raisin vineyard has shown that 'Lana' woollypod vetch significantly increases soil nitrate-nitrogen levels within 5 to 6 weeks of incorporation and will raise the vine nitrogen status by bloom time. The response was similar to applying 50 pounds (56 kg) of inorganic nitrogen fertilizer. 'Lana' vetch strips planted in every row middle contributed approximately 75 pounds of nitrogen per acre (84 kg N/ha). The nitrogen contribution could be reduced by planting alternate row middles, combining legumes and cereals in the cover crop mixture, or reducing the width of the cover crop band. One practical approach is to plant the cover crop in alternating rows with cultivated rows where prunings can be shredded and disked.

Legume cover crops should be used with caution in excessively vigorous vineyards. The supplemental nitrogen may contribute to excess-vigor problems and may decrease vine fruitfulness and raisin quality.

Reseeding Annuals

Alternative management is used with reseeding winter annuals. The cover crop must be allowed to mature in spring in order to set seed (Figure 18.5). Often the cover crop is mowed in early spring for frost protection and then allowed to resume growth and go to seed. After the seed matures, the cover crop is disked and incor-

porated or mowed and left on the soil surface (Figure 18.6). Legume cover crops left to reseed will contribute less nitrogen than those incorporated as green manures, but research indicates that with adequate regrowth and biomass accumulation reseeding legumes may provide enough supplemental nitrogen to meet the needs of an average raisin vineyard. A significant amount of nitrogen is lost to volatilization in legume mulches that are left on the surface rather than incorporated.

Successful reseeding is less common in raisin vineyards due to deep tillage. Some replanting may be required. The exception is DOV vineyards, which do not require tillage for terrace preparation for raisin drying (Figure 18.7). Bur clover, 'Lana' woollypod vetch, and 'Blando' brome are particularly hardy reseeding covers.

Figure 18.5 The early bloom and maturity of bur medic make it an ideal self-reseeding cover crop for raisin vineyards. *Photo: L. Peter Christensen.*

Figure 18.6 This mature bur medic has produced a high seed population for self-reseeding in late fall after raisin pickup. *Photo: L. Peter Christensen.*

REFERENCES

Ingels, C., R. Bugg, G. McGourty, and P. Christensen, tech. eds. 1998. Cover cropping in vineyards: A grower's handbook. Oakland: University of California Division of Agriculture and Natural Resources publication 3338.

Miller, P. R., W. L. Graves, W. A. Williams, and B. A. Madson. 1989. Covercrops for California agriculture. Oakland: University of California Division of Agriculture and Natural Resources publication 21471.

Figure 18.7 Grass cover being maintained through summer in a DOV vineyard. *Photo: L. Peter Christensen.*