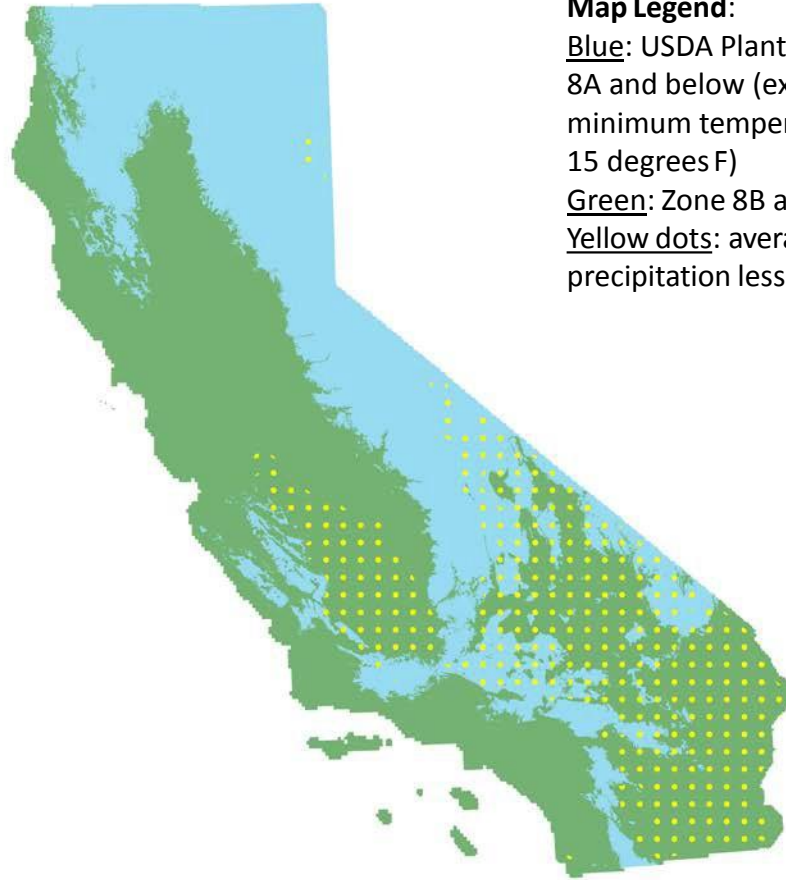


Cover Crop Chart: Common Cover Crops for California



Map Legend:

Blue: USDA Plant Hardiness Zone 8A and below (expected annual minimum temperature less than 15 degrees F)

Green: Zone 8B and above.

Yellow dots: average annual precipitation less than 10 inches

California Cover Crop Chart*

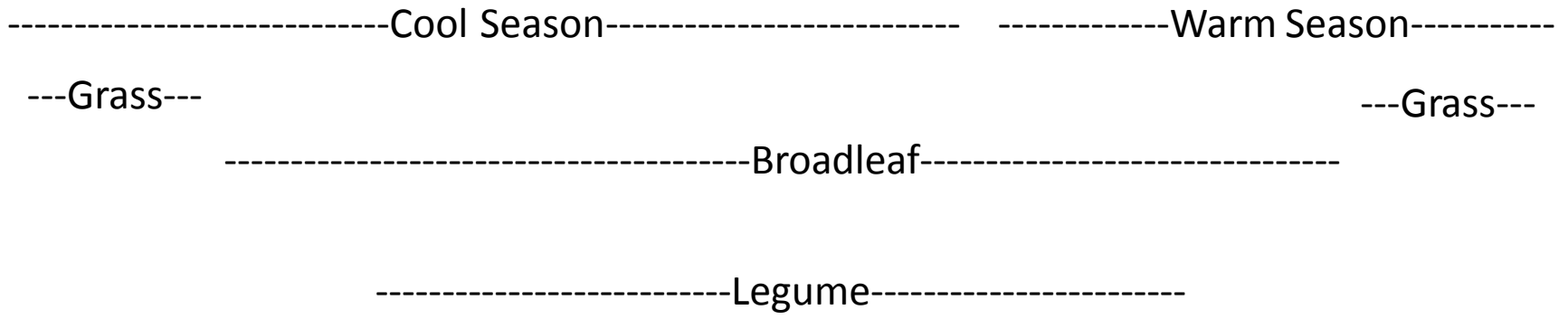
The California Cover Crop Chart is designed to give NRCS planners a relatively easy-to-access resource that provides an overview of commonly used California cover crop species. It is not intended to be a replacement for, or duplication of eVegGuide, but is offered as a planning aid that compliments the details in eVegGuide. The Cover Crop Chart includes information that is not included in eVegGuide, may be helpful to the planner such as growth form, relative drought and salinity tolerance, establishment and management concerns and considerations, the primary and associated benefits, external sources for additional species information, and pest concerns. The Cover Crop Chart can be used as a “first step” in the cover crop planning process to help identify species that can meet the goals of the grower, and work within the constraints of the system.

Not all species and varieties that can be useful as cover crops in California are included in the chart, but only those that are most commonly used across the state. Also, not all species included in the chart can be grown equally well in all parts of the state. The two primary constraints on growth are temperature and moisture. The figure on page 1 provides the approximate locations where cold temperature (‘blue’) or lack of moisture (‘yellow dots’) are particularly severe and will likely limit growth of some species. Planting dates may need to be modified in colder areas, and supplemental irrigation may be required in drier areas.

Another consideration when selecting cover crops is potential for invasiveness, and whether the species may serve as a crop pest host. The information in the Cover Crop Chart should not be used prescriptively to replace planner discretion. Each farm and field are unique and should be planned accordingly. NRCS California has determined that eVegGuide is the authoritative source of information when planning and implementing any vegetative conservation practice in the state, and the planner should defer to it if there is a discrepancy with the Cover Crop Chart.

*The concept and format for the California Cover Crop Chart is taken directly from the cover crop chart created by Mark Liebig, Holly Johnson and others at USDA-ARS in Mandan, ND (<http://www.ars.usda.gov/Services/docs.htm?docid=20323>).

Cover Crop Chart



								Corn
	Brassicas	Fava bean						Japanese millet
	Flax	Field pea	Balansa clover	Red clover	Common vetch	Chickpea	Amaranth	Proso millet
	Phacelia	Lentil	Berseem clover	Rose clover	Hairy vetch	Cowpea	Buckwheat	Sorghum
	Radish	Lupine	Crimson clover	Sweetclover	Purple vetch	Soybean	Safflower	Sudangrass
	White mustard	Medic/burr clover	Persian clover	Subterranean clover	Woollypod vetch	Sunnhemp	Sunflower	Teff

Annual Grass

'Blando' soft brome (*Bromus hordeaceus* L. ssp. *hordeaceus*)

- Cool season annual grass naturalized in California
- Height: 8 – 24 inches tall
- Good drought tolerance
- Typically planted: Early fall
- Seeding depth: 0.5 inch
- Seeding rate: 5 – 10 lb/acre
- Maturity: Medium to early maturing
- Termination Strategies: Must be prior to seed set or plants may regenerate next fall
 - Mowing at mid- to late- bloom (multiple mows will be required)
 - Grazing
 - Tillage
 - Applying herbicide in late spring
- Purpose: Erosion control, increase organics, capture nutrients, reduce soil compaction.



'Blando' soft brome, Lockeford PMC.

Pest Alert:

- Weediness: Cal IPC rating limited invasive. Will reseed.

['Blando' brome Release Brochure](#)

[UC SARAP Cover Crop database](#)

Annual Grass

'Cucamonga' California brome (*Bromus carinatus* Hook. & Arn.)

- Cool season native grass
- Height: 1 – 3 feet tall
- Excellent drought tolerance
- Typically planted: Early to mid-fall
- Seeding depth: 0.5 – 1 inch
- Seeding rate: 10 – 20 lb/acre
- Maturation: Early
- Termination Strategies: Must be prior to seed set or plants may regenerate next fall.
 - Mowing at mid- to late-bloom (multiple mows will be required)
 - Grazing
 - Tillage
 - Applying herbicide in late spring
- Purpose: Erosion control, increase organics, capture nutrients, reduce soil compaction.



'Cucamonga' California brome, Lockeford PMC.

Note: California brome is generally perennial.

['Cucamonga' California Brome Release Brochure](#)

[UC SARAP Cover Crop database](#)

Pest Alert:

- Weediness: If allowed to mature and drop seed, will reseed and may be weedy.

Annual Grass

Annual ryegrass (*Festuca perennis* (L.) Columbus & Sm.,
Lolium perenne ssp muliflorum)

- Cool season grass
- Height: 3 -4 feet tall
- Does well on heavy, waterlogged soils, but will survive drought
- Typically planted: Early to mid-fall
- Seeding depth: 0.5 - 1 inch
- Seeding rate: 4.4 – 8.8 lb/acre
- Biomass: 4,700-8,500 lb/acre
- N content depends on cultivar
- Maturation: May-June
- Termination strategies:
 - Mowing at mid- to late- bloom (multiple mows will be required)
 - Grazing
 - Tillage
 - Applying herbicide in late spring
- Purpose: Erosion control, suppress weeds, increase organics, capture nutrients, reduce soil compaction.



Common annual ryegrass, Lockeford PMC.

Pest Alert:

- Weediness: Cal-IPC rating moderately invasive, very difficult to eradicate once established, resistant to common herbicides. May compete excessively with grape vines and orchards, necessitating intense mowing regimes.

[UC SARAP Cover Crop database](http://covercrops.cals.cornell.edu)
<http://covercrops.cals.cornell.edu>

Annual Grass

Annual (rattail) Fescue (*Vulpia myuros* L.)

- Cool season grass
- Height: 10 to 20 inches tall
- Excellent drought tolerance, but can tolerate flooding.
- Typical planting: October 1 – November 15
- Seeding depth: 0.5 – 1 inch
- Seeding rate: 6 -10 lb/acre
- Maturity: March – June (4 to 5 month elapsed time from seeding and flowering)
- Termination strategies:
 - Mow before maturation (multiple mows will be required)
 - Tillage
 - Herbicides (resistant to glyphosate and other herbicides)
- Purpose: Erosion control, suppress weeds, increase organics, capture nutrients, reduce soil compaction maintains dry cover over the summer.
- 'Zorro' is a commonly used variety in California, especially for Conservation cover in vineyards, as it reseeds and regrows reliably with fall rains.



Annual fescue (Zorro), Lockeford PMC.

Pest Alert:

- Weediness: Cal IPC rating moderately invasive, very difficult to eradicate once established, and resistant to common herbicides.

http://plants.usda.gov/plantguide/pdf/pg_vumy.pdf

['Zorro' Annual Fescue Release Brochure](#)

[UC SARAP Cover Crop database](#)

Barley (*Hordeum vulgare* L.)

- Cool season grass
- Height: 2 – 4 feet tall
- Good drought tolerance
- Good salinity tolerance
- Benefits from arbuscular mycorrhizal associations
- Typically planted: Early fall
- Seeding depth: 0.75 – 2 inches
- Seeding rate: 60 – 90 lb/acre)
- Biomass: 6,800 – 12,900 lb/acre
- Maturity date:
 - Early maturing varieties: UC 937, Belford, Hayes, Gwen, Veredant
 - Late maturing varieties: Endeavor (95Ab2299), Thorobred, Valor
- Termination Strategies:
 - Mowing at mid- to late- bloom, will continue to set heads until soil moisture is exhausted
 - Incorporation by tillage
 - Herbicide in late spring
- Purpose: Erosion control, suppress weeds, increase organics, capture nutrients, reduce soil compaction.



Barley (UC 937) 150 days after planting, Lockeford PMC.

Pest Alert:

- Insects: Harbors oat aphid (*Rhopalosiphum padi*).
- Nematodes: Host for *Meloidogyne javonica*, minor host *M. arenaria*.
- Weeds: Will volunteer.

[UC-SAREP cover crop database barley](https://plants.usda.gov/plantguide/pdf/ccpg_horde)

https://plants.usda.gov/plantguide/pdf/ccpg_horde.pdf

Cereal rye (*Secale cereale* L.)

- Cool season grass
- Height: 3 – 6 feet tall
- May be allelopathic to small-seeded species
- Will form arbuscular mycorrhizal associations
- Moderate drought tolerance (cultivar dependent)
- Fair salinity tolerance
- Typically planted: Mid-fall
- Seeding depth: 1 inch
- Seeding rate: 60 – 90 lb/acre
- Biomass: 4,000 – 10,000 lb/acre
- Maturity date: Early, varies with cultivar
- Termination strategies:
 - Mow or roll at soft dough stage
 - Grazing
 - Tillage
 - Herbicides
- Purpose: Erosion control, suppress weeds, increase organics, capture nutrients, reduce soil compaction.



Cereal rye (Merced) 120 days after planting, Lockeford PMC.

Pest Alert:

- Insects: Harbors bird cherry - oat aphid (*Rhopalosiphum padi*).
- Nematodes: Host for *Meloidogyne javonica*, minor host *M. arenaria*.
- Weeds: May become weedy if sets seed.
- Allelopathic: May inhibit following crops.

[Plant Guide for Cereal Rye \(*Secale cereale* L.\)](#)

[UC SARAP Cover Crop database](#)

Oat (*Avena sativa* L.)

- Cool season grass
- Height: 2 – 5 feet tall
- Allelopathic: Can slow the germination of lettuce, cress, timothy, rice, wheat, and peas
- Fair drought tolerance
- Fair salinity tolerance
- Will form arbuscular mycorrhizal associations
- Typically planted: Mid-fall to early winter
- Seeding depth: 1 – 2 inches
- Seeding rate: 60 – 90 lb/acre
- Biomass: 8,000 – 12,000 lb/acre
- Maturity date: Late, depending on cultivar
- Termination Strategies:
 - Mow
 - Roller crimper at dough stage (no-till systems)
 - Grazing
 - Tillage
 - Herbicide
- Purpose: Erosion control, suppress weeds, increase organics, capture nutrients.



Oats (Cayuse) 120 days after planting, Lockeford PMC.

- Pest Alert:
- Insects: Harbors bird cherry - oat aphid (*Rhopalosiphum padi*), and English grain aphid (*Sitobian avance*).
- Weeds: Regrowth if sets seed.

[UC SARAP Cover Crop database](http://covercrops.cals.cornell.edu)
<http://covercrops.cals.cornell.edu>

Triticale (*x Triticosecale* Wittm.)

- Cool Season, wheat rye hybrid
 - Height: 3-5 feet tall
 - Good Drought tolerant
 - Good salinity tolerance
 - Deep root system, arbuscular mycorrhizal associations
 - Typically planted: Mid-fall Seeding depth: 0.5 – 2 inches
 - Seeding rate: 80 lb/acre
 - Maturity: Variable with cultivar
 - Termination strategies: Mowing (safest to kill 3 weeks before planting your cash crop)
 - Mow prior to maturity
 - Grazing
 - Tillage
 - Herbicide
 - Purpose: Erosion control, suppress weeds, increase organics, capture nutrients, reduce soil compaction.
 - Well adapted to CA Central Valley
- http://www.advancecovercrops.com/portfolio_item/triticale/
- <http://covercrops.cals.cornell.edu>



Triticale (Juan) 120 days after planting, Lockeford PMC.

Pest Alert:

- Weediness: Will regrow if sets seed.
- Nitrogen tie-up can occur if vegetable crops are planted too soon after incorporation.

Wheat (*Triticum aestivum* L.)

- Cool season grass
- Height: 3-4 tall
- Fair drought tolerance
- Fair to good salinity tolerance
- Benefits from arbuscular mycorrhizal associations
- Typically planted: Fall to early winter
- Seeding depth: 0.5 – 1.5 inches
- Seeding rate: 50 – 100 lb/acre
- Biomass: 4,500 - 12,500 lb/acre
- Maturity: Late
- Termination strategies: (safest to kill 3 weeks before planting your cash crop)
 - Mow
 - Roller crimper at soft-dough stage or later
 - Herbicide
 - Tillage
- Purpose: Erosion control, suppress weeds, increase organics, capture nutrients, reduce soil compaction.



Wheat (Yamhill) 120 days after planting, Lockeford PMC.

Pest Alert:

- **Weediness:** Will regrow if sets seed.
- **Nitrogen tie-up** can occur if vegetable crops are planted too soon after incorporation.

Canola (*Brassica napus* L.)

Rape seed, Oilseed Rape

- Cool season broadleaf, non-legume
- Annual (Spring-type) or Biennial (Winter-type)
- Height: 1 – 3 feet tall
- Fair drought tolerance
- Good salinity tolerance
- Deep tap root
- Does not form arbuscular mycorrhizal associations
- Typically planted: Mid-fall
- Seeding depth: 0.25 – 1 inch
- Seeding rate: 6 – 12 lb/acre
- Biomass: 6,000 lb/acre
- C:N ratio: leaf 12 – 16, stem 21 – 37, root 24 – 43
- Maturity date: Early
- Termination strategies:
 - Mowing before full flower
 - Incorporation by tillage before full flower
 - Herbicide
- Purpose: Increase organics, capture nutrients, reduce soil compaction, suppress weeds.
- Flowers attract pollinators, early bloom



Canola at Lockeford PMC.

Pest Alert:

- Insects: May host pests including Lygus and Bagrada bugs. Can attract flea beetles.
- Weediness. Potential exists if sets seed.
- Disease: Potential host for *Sclerotinia sclerotiorum*.
- Do not use brassicas in rotation with one another.

[UC SARAP Cover Crop database](http://covercrops.cals.cornell.edu)

<http://covercrops.cals.cornell.edu>

Brown Mustard (*Brassica juncea* (L.) Czern.)

- Cool season broadleaf, non-legume
- Height: 3 to 6 feet tall
- Allelopathic: may suppress wheat and some weed species
- Potential nematode and soil-borne disease suppression
- Good drought tolerance
- Poor salinity tolerance
- Strong taproot (1 – 3 ft.)
- Does not form arbuscular mycorrhizal associations
- Typically planted: Mid-fall to early winter
- Seeding depth: 0.25 – 0.5 inches
- Seeding rate: 9 – 18 lb/acre
- Biomass: 8,500 – 12,000 lb/acre
- N content of 3.5% and a C:N ratio: 10 – 30
- Maturity: Intermediate
- Termination strategies:
 - Mow before full flower
 - Incorporation by tillage before full flower
 - Herbicide
- Purpose: Increase organics, capture nutrients, reduce soil compaction, suppress weeds.
- Flowers attract honeybees, and hoverflies



Brown mustard (Nemfix) 135 days after planting, Lockeford PMC.

Pest Alert:

- Insects: Can attract flea beetles and diamond-back moths. Apple skinworm (*Argyrotaenia citrana*) may also overwinter on mustard.
- Disease: Potential host for *Sclerotinia sclerotiorum*.
- Weediness. Mustards will volunteer if set seed.
- Do not use brassicas in rotation with one another.¹⁴

Black Mustard (*Brassica nigra* (L.) Koch.)

Oriental Mustard

- Cool season broadleaf, non-legume
- Height: 3 to 6 feet tall
- Allelopathic: may suppress wheat and some weed species
- Produce glucosinolates, may suppress soil-borne pathogens and plant parasitic nematodes.
- Good drought tolerance
- Strong taproot (1 – 3 ft.)
- Does not form arbuscular mycorrhizal associations
- Typically planted: Mid-fall to early winter
- Seeding depth: 0.25 – 0.5 inches
- Seeding rate: 9 – 18 lb/acre
- Maturity: Intermediate
- Termination strategies:
 - Mow before fullflower
 - Incorporation by tillage before full flower
 - Herbicide
- Purpose: Increase organics, capture nutrients, reduce soil compaction, suppress weeds.
- Flowers attract honeybees, and hoverflies



Oriental mustard, Lockeford PMC.

Pest Alert:

- Insects: : May host pests including Lygus and Bagrada bugs. Can attract flea beetles and diamond-back moths. Apple skinworm (*Argyrotaenia citrana*) may also overwinter on mustard.
- Disease: Potential host for *Sclerotinia sclerotiorum*.
- Weediness. Mustards frequently volunteer if set seed.
- Do not use brassicas in rotation with one another.

[UC SARAP Cover Crop database](http://covercrops.cals.cornell.edu)
<http://covercrops.cals.cornell.edu>

Field Mustard (*Brassica rapa* L. var. *rapa*)

Common mustard, wild mustard, wild turnip, forage turnip, bird's rape, rape mustard

Horticultural cultivars include: forage turnip, rapini, turnip

- Cool season broadleaf, non-legume
- Height: 1 – 5 feet tall
- Potential nematode and soil-borne disease suppression
- Drought tolerance depends on cultivar
- Salinity tolerance depends on cultivar
- Large tap root
- Typically planted: Mid-fall
- Seeding depth: 0.25 – 0.5 inches
- Seeding rate: 6 – 12 lb./acre
- Maturity: Varies with cultivar
- Termination options:
 - Mowing before full flower
 - Incorporation by tillage before full flower
 - Herbicides
- Purpose: Increase organics, capture nutrients, reduce soil compaction, suppress weeds.
- Flowers attract pollinators



Common mustard, Lockeford PMC.

Pest Aert:

- Insects: : May host pests including Lygus and Bagrada bugs. Can attract flea beetles and diamond-back moths. Not recommended for apple orchards as allow overwintering of orange tortrix/apple skin worm (*Argyrotaena citrana*).
- Disease: Potential host for *Sclerotinia sclerotiorum*.
- Weediness: Mustards frequently volunteer if set seed.
- Do not use brassicas in rotation with one another.

[Plant Guide for Field Mustard \(*Brassica rapa* ssp. *rapa*\)](#)

[UC SARAP Cover Crop database](#)

White mustard (*Sinapis alba* L.)

- Cool season broadleaf, non-legume
- Height: 3 to 6 feet tall
- Allelopathic: may suppress wheat and some weed species
- Potential for nematode and disease suppression
- Excellent drought tolerance
- Poor salinity tolerance
- Strong taproot (1 – 3 ft.)
- Does not form arbuscular mycorrhizal associations
- Typically planted: Mid-fall to early winter
- Seeding depth: 0.25 – 0.5 inches
- Seeding rate: 10 lb/acre
- Biomass: 8,500 – 12,000 lb/acre
- Maturity: Intermediate
- Termination strategies:
 - Mow before fullflower
 - Incorporation by tillage before full flower
 - Herbicide
- Purpose: Increase organics, capture nutrients, reduce soil compaction, suppress weeds.
- Flowers attract honeybees, and hoverflies



White Mustard (Bracco), Lockeford PMC.

Pest Alert:

- Insects: May host pests including Lygus and Bagrada bugs. Can attract flea beetles and diamond-back moths
- Disease: Potential host for *Sclerotinia sclerotiorum*.
- Weediness. Mustards frequently volunteer if set seed.
- Do not use brassicas in rotation with one another.

[UC SARAP Cover Crop database](http://covercrops.cals.cornell.edu)
<http://covercrops.cals.cornell.edu>

Radish (*Raphanus sativus* L.)

Forage radish, tillage radish, daikon, oilseed radish, Japanese radish

- Cool season broadleaf, non-legume
- Height: 2 – 3 feet tall
- Poor drought tolerance and salinity tolerance
- Major types: Oilseed (var. *oleiformis*)
 - Forage (var. *niger*)
 - Oilseed (var. *oleiformis*)
- Large tap root up to 6 feet deep
- Does not form arbuscular mycorrhizal associations
- Good Nitrogen scavenging and weed control; N released rapidly
- Typically planted: Mid-fall
- Seeding depth: 0.25 – 0.5 inches
- Seeding Rate: 10 - 20 lb/acre (lower seeding rates important for reducing compaction)
- Biomass: above ground 8,000 lb/acre
- Termination strategies:
 - Mow before full flower
 - Incorporation by tillage before full flower
 - Herbicide
- Purpose: Nitrogen scavenger, increase organics, capture nutrients, reduce soil compaction, suppress weeds.
- Flowers attract pollinators, excellent pollinator plant.



Mature radish plant showing large tap root, Lockeford PMC.

Pest Alert:

- Insects: May host pests including Lygus and Bagrada bugs. Can attract flea beetles.
- Weediness: May volunteer at some locations if sets seed.
- Do not use in rotations with Brassica vegetable crops.

[Plant Guide for Oilseed Radish \(*Raphanus sativus*\)](http://covercrops.cals.cornell.edu)

<http://covercrops.cals.cornell.edu>

Flax (*Linum usitatissimum* L.)

- Cool season broadleaf, non-legume
- Height: 1 – 3 feet tall
- Fair drought tolerance
- Fair salinity tolerance
- Benefits from arbuscular mycorrhizal associations
- Typically planted: Mid-fall to early winter
- Seeding depth: 0.5 – 1.5 inches
- Seeding rate: 10 – 20 lb/acre
- Typical Life cycle of flax:
 - 45- to 60-day vegetative period
 - 15- to 25- day flowering period
 - 30- 40-day maturation period
- Termination strategies:
 - Mow
 - Tillage
 - Herbicide
- Purpose: Increase organics, nutrient cycling, increase biodiversity as part of a mix.
- Flowers attract pollinators and beneficial insects



Flax, Lockeford PMC.

Phacelia (*Phacelia tanacetifolia* Benth.)

- Cool season native, broadleaf, non-legume
- Height: 1 – 3 feet tall
- Fair drought tolerance
- Low salinity tolerance
- Will form arbuscular mycorrhizal associations
- Will outcompete weeds including *Malva* spp.
- Typically planted: Mid-fall to early winter in CA
- Seeding depth: 0.25 inches
- Seeding rate: 7 - 12 lb drilled; 11 - 18 lb broadcast
- Biomass: 3,300 – 6,000 lb/acre
- Maturity: Late
- Termination strategies:
 - Mow prior to flowering
 - Grazing
 - Tillage
 - Herbicide
- Purpose: Erosion reduction, increase organics, nutrient cycling, increase biodiversity, suppress weeds.
- Excellent pollinator for European and native bees.

[UC SARAP Cover Crop database](#)

[Lacy phacelia - *Phacelia tanacetifolia* Benth.](#)



Lacy Phacelia, Lockeford PMC.

Pest Alert:

- Insects: May host lygus bugs, as well as beneficial insects.
- Disease: Alternative host for *Rhizoctonia* and *Sclerotinia* spp, should not be intercropped with susceptible plants such as lettuce.

Fava bean (*Vicia faba* L.)

Broadbean, bell, tick, horse, or field bean

- Cool season, legume
- Upright growth form
- Height: 2 – 6 feet tall
- Low drought tolerance, requires rain or irrigation for establishment.
- Deep-rooted, noted for reducing compaction.
- Somewhat tolerant of poor drainage
- Typically planted: Mid-fall
- Seeding depth: 1 – 2 inches
- Seeding rate: 80 lb/acre
- Maturity: Late
- Termination strategies:
 - Mowing
 - Tillage
 - Herbicide
- Purpose: Increase organics, nitrogen fixation, suppress weeds, reduce soil compaction.
- Good pollinator plant, especially bumble bees. Attracts beneficial insects.



Bell bean, Lockeford PMC.

Pest Alert:

- Insects: Harbors bean aphid and attracts other aphid species.
- Disease: Frequently attacked by bacterial blast in CA
- Nematodes: May host *Meloidogyne spp.*

Field pea (*Pisum sativum* L.)

Austrian winter pea, or Field Pea

- Cool season, legume
- Height: 20 – 28 inches tall
- Good drought tolerance
- Poor salinity tolerance
- Forms arbuscular mycorrhizal associations
- Typically planted: Early fall to late fall
- Seeding depth: 1 -2 inches
- Seeding rate: 50 lb/acre
- Biomass: 6,000 – 8,500 lb/acre
- N fixation around 150 lb/acre
- Maturity: Late
- Termination strategies:
 - Mowing after full bloom
 - Grazing
 - Tillage
 - Herbicide
- Purpose: Nitrogen fixation, increase organics, suppress weeds, .
- Pollinator plant, flowers attract bees.



Field pea (Dundale), Lockeford PMC.

Pest Alert:

- Insects: Harbors pea aphid.
- Disease: Potential host for *Sclerotinia minor*.

[UC SARAP Cover Crop database](#)

[Plant Guide for Pea, \(*Pisum sativum*\)](#)

Lentil (*Lens culinaris* Medik.)

- Cool season, legume
- Excellent drought tolerance
- Poor salinity tolerance
- Forms arbuscular mycorrhizal associations
- Poor competitor with weeds.
- Typically planted: Mid-Fall
- Seeding depth: 0.5- 1.5 inches
- Seeding rate: 20 lb/acre
- Maturity: Intermediate
- Termination strategies:
 - Mow
 - Will dry out and die
- Purpose: Increase organics, nitrogen fixation.
- Self pollinated, but flowers may attract pollinators



Lentil (Viceroy), Lockeford PMC.

[UC SARAP Cover Crop database](#)

https://plants.usda.gov/plantguide/pdf/pg_lecu2.pdf

<http://www.ag.ndsu.edu/pubs/plantsci/rowcrops/a1636.pdf>

Lupine (*Lupinus spp.* L)

White lupine (*L. albus* L.); Yellow lupine (*L. luteus* L.); Blue lupine (*L. angustifolius* L.)
California natives: *L. bicolor*, *L. densiflorus*, *L. nanus* and *L. succulentus*

- Cool season annual legume
- Height: white lupin 47", yellow lupin 10 – 31", blue lupin 8 – 59"
- Good drought tolerance
- Prefer acid soils
- Deep taproot
- Does not form arbuscular mycorrhizal associations
- Typically planted: Early to late Fall
- Seeding depth: 0.25 – 0.5 for native species, 0.5 – 1 for non-natives
- Seeding rate: varies with species
- Maturity: Late
- Purpose: Increase organics, nitrogen fixation, suppress weeds, reduce soil compaction.
- Flowers attract bees and beneficial insects



Grain Lupine Lockeford PMC.

Pest Alert:

- Livestock: Some species contain toxins and should not be grazed.
- Nematodes: Some species susceptible to nematodes

[UC SARAP Cover Crop database](#)

Medic/Burr Clover (*Medicago sp.*)

Barrelclover (*Medicago truncatula* Gaertn.), Gama Medic (*Medicago rugosa* L.)

- Cool season, annual legume
- Height: 4 – 24 inches tall
- Good drought tolerance
- Fair salinity tolerance
- Forms arbuscular mycorrhizal associations
- Typically planted: Early to mid-fall
- Seeding depth: 0.25 inch
- Seeding rate: 10 lb/acre
- Biomass: 2,000 – 8000 lb/acre
- Maturity: Late
- Termination strategies:
 - Mowing at late bloomstage
 - Tillage
 - Herbicide
- Purpose: Increase organics, nitrogen fixation, suppress weeds, reduce soil compaction.
- Flowers attract pollinators



Barrel Medic (Sultan), Lockeford PMC.

Pest Alert:

- Insects: May host lygus bugs, twospotted spider mite and is attractive to Egyptian alfalfa weevil.
- Weediness. May become weedy if sets seed.

[UC SARAP Cover Crop database](#)

Sweetclover (*Melilotus officinalis* (L.) Lam.)

Sour Clover, Yellow sweetclover (*Melilotus indicus* L.)

- Cool season, legume
- Annual or biennial
- Height:
- Good drought tolerance (best of all clovers)
- Fair salinity tolerance
- Forms arbuscular mycorrhizal associations
- Typically planted: Early to mid-fall
- Seeding depth: 0.25 inch
- Seeding rate: 10 lb/acre
- Biomass: 2,000 – 8000 lb/acre
- Maturity: Late
- Termination strategies:
 - Mowing at late bloomstage
 - Tillage.
 - Herbicide
- Purpose: Increase organics, nitrogen fixation, capture nutrients, reduce soil compaction.
- Flowers attract pollinators and beneficial insects.



Sweetclover SARE – Agriculture Sustainability Institute at UC Davis, CA.

Pest Alert:

- Livestock: Plants contain coumarin, which is an anticoagulant when the plant becomes moldy.
- Nematodes: Some species susceptible to nematodes
- Weediness: May be weedy if sets seed.

[UC SARAP Cover Crop database](#)

Balansa Clover (*Trifolium michelianum* Savi)

- Cool season, legume
- Height: Up to 24 inches tall
- Good drought tolerance
- Fair salinity tolerance
- Forms arbuscular mycorrhizal associations
- Typically planted: Mid-fall
- Seeding depth: 0.5 – 1 inch
- Seeding rate: 2.2 – 4.4 lb/acre
- Biomass: up to 15,500 lb/acre
- Maturity: Early
- Termination strategies:
 - Tillage
 - Undercut, mowing will not kill
 - Herbicide
- Purpose: Erosion control, suppress weeds, increase organics, nitrogen fixation.
- Pollinator and insectary plant for beneficial insects



Balansa clover (Frontier), Lockeford PMC.

Pest Alert:

- Insects: Can harbor flower thrips.
- Weediness: Moderately hard seeded, limited reseeding.

[Balansa clover: cover crop for no-till systems](#)

Berseem Clover (*Trifolium alexandrinum* L.)

Egyptian clover

- Cool season, annual legume
- Height: Up to 24 inches tall
- Good drought tolerance
- Fair salinity tolerance
- Forms arbuscular mycorrhizal associations
- Typically planted: Mid-fall
- Seeding depth: 0.5 – 1 inch
- Seeding rate: 1 – 2 lb/acre
- Biomass: up to 15,500 lb/acre
- Maturity: Early
- Termination strategies:
 - Undercut, mowing will not kill
 - Herbicides
 - Multiple diskings
- Purpose: Nitrogen fixation, increase organics, suppress weeds.
- Flowers attract bees and beneficial insects.



Berseem clover, Lockeford PMC.

[UC SARAP Cover Crop database](#)

Crimson Clover (*Trifolium incarnatum* L.)

- Cool season, annual legume
- Height: 12 – 20 inches tall
- Typically planted: Mid-fall
- Seeding depth: 0.5 inches
- Seeding rate: 7-10 lb/acre
- Biomass: 4,500 – 5,000 lb/acre
- Nitrogen: 70 -150 lb/acre
- Maturity: Intermediate to late
- Termination strategies:
 - Mowing after early bud stage
 - Grazing
 - Tillage
 - Herbicide
- Purpose: Nitrogen fixation, increase organics, suppress weeds.
- Flowers attract pollinators and beneficial insects.



Crimson clover, Lockeford PMC.

Pest Alert:

- Insects: Can harbor flower thrips and can attract Western tarnished plant bug.
- Disease: May host *Sclerotinia*.
- Weediness: Least hard seeded of clover species, limited reseeding.

[Plant Guide for Crimson Clover](#)
[\(*Trifolium incarnatum*\)](#)
[UC SARAP Cover Crop database](#)

Persian Clover (*Trifolium resupinatum* L.)

Reverse clover

- Cool season, annual legume
- Height: 10 – 24 inches tall
- Low drought tolerance
- Grows best on alkaline soils above pH 6
- Typically planted: Mid-fall
- Seeding depth: 0.25 - 0.5 inches
- Seeding rate: 5 lb/acre
- Biomass: 3,500 lb/acre
- Nitrogen: 70 -150 lb/acre
- Maturity: Intermediate to late
- Termination strategies:
 - Mowing
 - Grazing
 - Tillage
 - Herbicide
- Purpose: Nitrogen fixation, increase organics, suppress weeds.
- Flowers attract pollinators and beneficial insects.



Persian clover (Lightning), Lockeford PMC.

Pest Alert:

- Weediness: May be weedy if sets seed.

Red Clover (*Trifolium pratense* L.)

- Cool season, biannual legume
- Biennial, short-lived perennial
- Height: 12 – 30 inches tall
- Forms arbuscular mycorrhizal associations
- Typically planted: Mid-fall
- Seeding depth: 0.5 inches
- Seeding rate: 4 lb/acre
- Maturity: Late bloomer
- Termination:
 - Grazing
 - Is not killed by mowing except after bloom
 - Tillage
 - Herbicide
- Purpose: Nitrogen fixation, increase organics, reduce soil compaction.
- Flowers attract pollinators and beneficial insects.



Red clover, Lockeford PMC.

https://plants.usda.gov/plantguide/pdf/pg_trpr2.pdf
<http://covercrops.cals.cornell.edu>

Rose Clover (*Trifolium hirtum* All.)

- Cool season, annual legume
- Height: 6 – 18 inches tall
- Good drought tolerance.
- Tolerant of infertile soils
- Typically planted: Mid-fall
- Seeding depth: 0.5 inches
- Seeding rate: 7 lb/acre
- Biomass: to 6,200 lb/acre
- Maturity: Intermediate
- Termination strategies:
 - Mowing
 - Tillage
 - Herbicide
- Purpose: Nitrogen fixation, increase organics, reduce soil compaction.
- Flowers attract pollinators and beneficial insects such as the minute pirate bug.



Rose clover, Lockeford PMC.

Pest Alert:

- Insects: May harbor lygus bug.
- Weediness: Hard seeded tends to be invasive, naturalized in some areas.

https://plants.usda.gov/plantguide/pdf/pg_trhi4.pdf

[UC SARAP Cover Crop database](#)

Subterranean Clover (*Trifolium subterranean* L.)

- Cool season, legume
- Height: 6 – 15 inches tall
- Tolerant to shade
- Tolerant to acid and infertile soils
- Typically planted: Fall
- Seeding depth: 0.25 inches
- Seeding rate: 25 lb/acre
- Biomass: to 5,000 - 9,600 lb/acre
- Maturity: Varies by cultivar
- Termination strategies:
 - Mowing after mid-bloom stage
 - Tillage
 - Herbicide
- Purpose: Nitrogen fixation, increase organics, reduce soil compaction, suppress weeds.
- Flowers attract pollinators and beneficial insects.



Subterranean clover (Antas), Lockeford PMC.

Pest Alert:

- Weediness: Hard seeded can reseed if seed matures

Common Vetch (*Vicia sativa* L.)

- Cool season, annual legume
- Height: 2 feet in monoculture and up to 6 feet if supported by large cereal grain
- Good drought tolerance
- Poor salinity tolerance
- Forms arbuscular mycorrhizal associations
- Typically planted: Mid-fall
- Seeding depth is 0.5 – 2 inches
- Seeding rate: 15 lb/acre
- Biomass: 8,000 – 9,000 lb/acre
- Maturity: Late
- Termination strategies:
 - Mowing close to the ground at full bloom.
 - Tillage
 - Herbicide
- Purpose: Nitrogen fixation, increase organics, reduce soil compaction, suppress weeds.
- Flowers attract pollinators, bees and beneficial insects.



Common vetch, 165 days after planting, Lockeford PMC.

Pest Alert:

- Insects: Can attract Western tarnished plant bug and twospotted spider mite.
- Nematodes: Can host reniform nematode
- Weediness: Least hard seeded of vetch cultivars.

Hairy Vetch (*Vicia villosa* L.)

- Cool season, annual legume
- Height: 12 – 20 inches tall
- Good drought tolerance, more drought resistance than other vetches
- Taproot that reaches depths of 1 -3 ft.
- Typically planted: Early to mid-fall
- Seeding depth: 0.5 – 1.5 inches
- Seeding Rate: 15 lb/acre
- Biomass: 4,300 – 7,000 lb/acre
- Maturity: Late
- Termination strategies:
 - No-till vegetable transplanting: rolling stalk chopper
 - No-till delayed kill: roller/crimper and an undercutter
 - Herbicides
 - Cutting vetch close to the ground at full bloom stage
- Purpose: Nitrogen fixation, increase organics, reduce soil compaction, suppress weeds.
- Flowers attract bees, other pollinators, and beneficial insects.



Hairy vetch, Lockeford PMC.

Pest Alert:

- Insects: Can attract Western tarnished plant bug and twospotted spider mite.
- Nematodes: Can host reniform nematode
- Weediness: 10-20% seed is hard seeded, can be weedy

[UC SARAP Cover Crop database](#)

https://plants.usda.gov/factsheet/pdf/fs_vivi.pdf

Purple Vetch (*Vicia benghalensis* L.)

- Cool season legume
- Height: 23 inches tall, but will climb
- Poor drought tolerance
- Typically planted: Mid-fall
- Seeding depth: 0.5 – 1.5 inches
- Seeding Rate: 15 lb/acre
- Biomass: 3,000 – 7,000 lb/acre
- Maturity: Late
- Termination Strategies:
 - Mowing close to the ground at full bloom.
 - Tillage
 - Herbicide
- Purpose: Nitrogen fixation, increase organics, reduce soil compaction, suppress weeds.
- Flowers attract pollinators.
- Harbors beneficial insects.



Purple vetch, Lockeford PMC.

Pest Alert:

- Insects: Can harbor twospotted spider mite.
- Weediness: May be weedy if sets seed.

[UC SARAP Cover Crop database](#)

Woollypod Vetch (*Vicia villosa* Roth. subsp. *varia*)

- Cool season broadleaf, annual legume
- Height: 18 -27 inches tall, but will climb
- Fair drought tolerance
- Typically planted: Early to mid-Fall, most growth in spring.
- Seeding rate: 25 lb/acre
- Seeding depth: 0.75 inches
- Biomass: 8,000 lb/acre
- 'Lana' vetch can contribute 100 -300 lb N/acre
- Maturity: Early
- Termination strategies:
 - Low cut at full bloom,
 - Tillage
 - Herbicide
- Purpose: Nitrogen fixation, increase organics, reduce soil compaction, suppress weeds and will overgrow and smother other plants.
- Flowers attract pollinators, especially attractive to European honey bees.



Woollypod vetch (Lana), Lockeford PMC.

Pest Alert:

- Insects: Can attract Western tarnished plant bug and twospotted spider mite.
- Disease: Potential host for *Sclerotinia minor*.
- Weediness: Most harded seeded vetch and will persist in California's Central Valley. Some populations tolerant to glyphosate.

[UC SARAP Cover Crop database](#)

https://plants.usda.gov/plantguide/pdf/pg_viviv8.pdf

['Lana' Woollypod Vetch Release Brochure](#)

Chickpea (*Cicer arietinum* L.)

Garbanzo Bean

- Warm season broadleaf, legume
- Height: 1 – 3 feet tall
- Good drought tolerance
- Poor salinity tolerance
- Forms a taproot
- Forms arbuscular mycorrhizal associations
- Typically grows best when daytime temp is 70-80 F
- Typically planted: November to February
- Seeding depth: 1.5 – 2 inches
- Seeding rate: 35 lb/acre
- Matures in 95 – 110 days
- Purpose: Nitrogen fixation, increase organics, reduce soil compaction.
- Flowers attract bees and beneficial insects.



Chickpea, planted as no-till cover crop at UC West Side Agricultural Research and Extension Center. Photo courtesy of Jeffrey Mitchell, University of California.

http://www.agmrc.org/media/cms/ec183_435DBB048F8C5.pdf

http://www.harvesttotable.com/2009/04/how_to_grow_chickpeas_garbanzo/

Cowpea (*Vigna unguiculata* L.)

- Warm season broadleaf, annual legume
- Height: 19 – 24 inches tall in a monoculture. Some climbing cultivars.
- Good drought tolerance
- Poor salinity tolerance
- Forms arbuscular mycorrhizal associations
- Typically planted: After last threat of frost
- Seeding depth: 0.5 – 1 inch
- Seeding rate: 45 lb/acre
- Biomass: 3,800 – 4,800 lb/acre
- Can fix up to 100 – 150 lb N/acre
- Maturity: Varies on variety. Early varieties mature in as little as 90 days and late varieties mature in 240 days
- Termination strategies:
 - Mowing at any point stops vegetative development
 - Herbicides
 - Shallow tillage may be required
- Purpose: Nitrogen fixation, increase organics, suppress weeds.
- Flowers attract pollinators



Cowpea (Red Ripper), at Lockeford PMC.

Pest Alert:

- Disease: Cowpea is subject to mildew in heavy shade.

[UC SARAP Cover Crop database](https://plants.usda.gov/plantguide/pdf/pg_viun.pdf)

https://plants.usda.gov/plantguide/pdf/pg_viun.pdf

Sunnhemp (*Crotalaria juncea* L.)

- Warm season broadleaf, annual legume
- Height: 4 – 8 feet tall
- Poor drought tolerance
- Performs best on well drained sandy soils down to pH 5, will tolerate moderate alkalinity
- Forms arbuscular mycorrhizal associations
- Typically planted: After last threat of frost. May be planted in late summer and fall and will winterkill with first frost.
- Seeding depth is 0.5 – 1 inch
- Seeding rate: 40 lb/acre
- Biomass: 12,500-14,000 lb/acre
- Can fix up to 100 – 150 lb N/acre
- Maturity: Flowering in August-September
- Termination strategies:
 - Mowing
 - Herbicides
 - Shallow tillage may be required
 - Will winterkill with frost
- Purpose: Nitrogen fixation, increase organics, suppress weeds, suppress root knot nematode.
- Flowers attract pollinators



Sunnhemp (Tropic Sun), Lockeford PMC.

Pest Alert:

- Insects: Flowers attract lygus bugs.
- Weediness: Seldom sets viable seed in California.

[UC SARAP Cover Crop database](https://plants.usda.gov/plantguide/pdf/pg_crju.pdf)

https://plants.usda.gov/plantguide/pdf/pg_crju.pdf

Buckwheat (*Fagopyrum esculentum* Moench)

- Warm season broadleaf, annual non-legume
- Height: 12 – 22 inches tall
- Fair drought tolerance
- Poor salinity tolerance
- Mobilizes phosphorus
- Deep taproot
- Does not form arbuscular mycorrhizal associations
- Typically planted: After last threat of frost
- Seeding depth: 0.5 inches
- Seeding rate: 50 lb/acre
- Biomass: 2,000 – 3,000 lb/acre
- Maturity: 14 days after flowering begins, or around 50 – 70 days after sowing
- Termination strategies:
 - Mow 7 – 10 days after flowering begins
 - Herbicides
 - Will winterkill with freezing temperatures
- Purpose: Increase organics, capture nutrients, suppress weeds.
- Flowers attract pollinators, good insectary plant.



Buckwheat, Lockeford PMC.

Pest Alert:

- Insects: Attractive to lygus bugs and aphids.

[UC SARAP Cover Crop database](https://plants.usda.gov/plantguide/pdf/pg_faes2.pdf)

https://plants.usda.gov/plantguide/pdf/pg_faes2.pdf

Safflower (*Carthamus tinctorius* L.)

- Warm season broadleaf, non-legume
- Height: 2-4 feet tall
- Fair drought tolerance
- Good salinity tolerance
- Strong taproot (8 – 10 ft.)
- Will form arbuscular mycorrhizal associations
- Typically planted: Early to late spring
- Seeding depth: 1 – 1.5 inches
- Seeding rate: 80 lb/acre
- Maturity: Typically matures four weeks after the end of flowering season
- Termination strategies:
 - Mow
 - Tillage
 - Herbicide
- Purpose: Increase organics, capture nutrients, suppress weeds, reduce soil compaction.
- Flowers attract pollinators



Safflower, Lockeford PMC.

Pest Alert:

- Insects: Host for lygus bug.

[https://www.hort.purdue.edu/newcrop/afcm/safflower.
Html](https://www.hort.purdue.edu/newcrop/afcm/safflower.Html)

[https://ipmdata.ipmcenters.org/documents/cropprofil
es/Safflower%20Crop%20Profile%203-1-
2016%20MB.pdf](https://ipmdata.ipmcenters.org/documents/cropprofiles/Safflower%20Crop%20Profile%203-1-2016%20MB.pdf)

Sunflower (*Helianthus annuus* L.)

- Warm season broadleaf, non-legume
- Height: upwards of 9 feet, depending on cultivar
- Fair drought tolerance (cultivar dependent)
- Fair salinity tolerance
- Strong taproot (can be 6.5 ft. deep)
- Will form arbuscular mycorrhizal associations
- Typically planted: After the last frost
- Seeding depth: 1 – 2.5 inches
- Seeding rate: 7 lb/acre (depends on cultivar)
- Maturity: Depends on cultivar
- Termination strategies:
 - Will winterkill
 - Mow
 - Tillage
 - Herbicide
- Purpose: Increase organics, capture nutrients, suppress weeds, reduce soil compaction.
- Flowers attract pollinators.



Sunflower (black), Lockeford PMC.

Pest Alert: See UC IPM Website for most recent info.

https://plants.usda.gov/plantguide/pdf/cs_hean3.pdf

<http://ipm.ucanr.edu/PMG/GARDEN/FLOWERS/sunflower.html>

Japanese Millet (*Echinochloa esculenta* (Braun.) Scholz)

- Warm season, annual grass
- Height: 2-4 feet tall
- Good drought tolerance
- Grows best in soils from pH 4.6 – 7.4
- Typically planted: After the last frost
- Seeding depth: 0.25 - 0.5 inch
- Seeding rate: 20 – 25 lb/acre
- Maturity: Reached in 45 days
- Termination strategies:
 - Will winterkill with first frost
 - Tillage
 - Undercut, mowing will not kill
 - Herbicide
- Purpose: Erosion control, increase organics, capture nutrients, suppress weeds, reduce soil compaction.
- May act as a smother crop, for weeds including yellow nut sedge
- Insectary plant for beneficial insects



Japanese millet, Lockeford PMC.

Pest Alert:

- Nematodes: May be a host for root knot nematode.
- Weediness: May become weedy especially in wetland situations.

https://plants.usda.gov/plantguide/pdf/pg_eces.pdf

[UC SARAP Cover Crop database](#)

Proso Millet (*Panicum miliaceum* L.)

- Warm season, annual grass
- Height: 1 - 3.5 feet tall
- Excellent drought tolerance
- Poor tolerance to high salinity
- Will form arbuscular mycorrhizal associations
- Typically planted: After the last frost
- Seeding depth: 0.5 - 0.75 inches
- Seeding rate: 35 lb/acre
- Maturity: 60-90 days after planting
- Termination strategies:
 - Will winterkill with first frost
 - Tillage
 - Undercut, mowing will not kill
 - Herbicide
- Purpose: Erosion control, increase organics, capture nutrients, suppress weeds, reduce soil compaction.
- Insectary plant for beneficial insects.



Proso millet, Lockeford PMC.

Pest Alert:

- Weediness: High potential to reseed and become weedy. Considered a noxious weed in Colorado and Oregon. Has developed some herbicide resistance.
- Seeds attract birds.

https://plants.usda.gov/plantguide/pdf/pg_pami2.pdf

Sorghum (*Sorghum bicolor* (L.) Moench)

ssp. bicolor

Grain Sorghum

- Warm season, grass
- Height: 3 – 12 feet tall
- Good drought tolerance
- Tolerates high soil pH and salinity
- Benefits from arbuscular mycorrhizal associations
- Typically planted: Soil temp reaches 60 – 65 F
- Seeding depth: 0.5 – 2 inches
- Seeding rate: 80 lb/acre
- Maturity: Around 90 – 120 days
- Termination strategies:
 - Will winterkill with first frost
 - Tillage
 - Undercut, mowing will not kill
 - Herbicide
- Purpose: Erosion control, increase organics, capture nutrients, suppress weeds, reduce soil compaction, provide surface residue.



Sorghum, Lockeford PMC.

Pest Alert:

- Nematodes: Can suppress root knot nematodes.
- Allelopathic residues may reduce growth of following crops.

Sudangrass (*Sorghum bicolor* L. Moench *ssp. drummondii*)

- Warm season, annual grass
- Height: 5 – 12 feet tall
- Good drought tolerance
- Tolerates high soil pH and salinity
- Benefits from arbuscular mycorrhizal associations
- Typically planted: After last threat of frost
- Seeding depth: 1 inch
- Seeding rate: 42 lb/acre
- Maturity: Around 65 days
- Termination strategies:
 - Will winterkill with first frost
 - Tillage
 - Mowing will not kill
 - Herbicide
- Purpose: Erosion control, increase organics, capture nutrients, suppress weeds, reduce soil compaction, provide surface residue.



Sudangrass (Piper), Lockeford PMC.

Pest Alert:

- Nematodes: Can suppress root knot nematodes.
- Allelopathic residues may reduce growth of following crops.

[UC SARAP Cover Crop database](#)

https://plants.usda.gov/plantguide/pdf/pg_sobi2.pdf

Teff (*Eragrostis tef* (Zuccagni) Trotter)

- Warm season, annual grass
- Height: 1 - 2 feet tall
- Good drought tolerance
- Benefits from arbuscular mycorrhizal associations
- Typically planted: After last threat of frost
- Seeding depth: 0.25 inch (requires fine firm seedbed)
- Seeding rate: 1 lb/acre
- Termination strategies:
 - Will winterkill with first frost
 - Tillage
 - Grazing
 - Herbicide
- Purpose: Erosion control, increase organics, capture nutrients, suppress weeds, reduce soil compaction.
- Note: Seedlings are relatively drought-tolerant after 3 weeks.



Teff (Excalibur), Lockeford PMC.

<http://eol.org/pages/1114367/overview>

<http://covercrops.cals.cornell.edu/Teff.php>

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