

Recommendations for Regenerative Almond Systems



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In our recent paper, [Defining and validating regenerative farm systems using a composite of ranked agricultural practices](#), farms employing more regenerative practices had improved farm metrics like soil health, water infiltration, biodiversity, and profit ¹. Based on this, we distinguish regenerative farms as those that use 5 or more regenerative practices in their operation (Score of 5 or more in the survey at the end of the document).

Here, we outline six recommendations to assist you in transitioning your farm to a regenerative operation. Please note that the different practices work in concert to create a whole greater than the sum of the parts.

The following recommendations are laid out in accordance with the timeline of implementation, beginning in October and extending through July when you will start to prep the orchard floor for harvest.



1 Eliminate Tillage

- Eliminating tillage or greatly reducing tillage will reduce erosion and long-term compaction, while rebuilding soil structure and the soil microbial and invertebrate communities.



2 Spread Compost (Early October)

- Spread throughout the entire block (within and between rows). Spread before planting the cover crop in the Fall (this will help retain moisture and increase the chance of the cover crops getting established) ².
- It is recommended that 5 tons/acre of compost be spread in the Fall as a starting point (any subsequent applications through spring will also be useful) ³. 1 ton is equivalent to ~2.5 cubic yards ³.

» **5 tons of composted manure will contribute ²:**



Nitrogen
165-200 lbs/acre
*A slow-release form that is not readily leachable



Phosphate (Phosphorus)
125 lbs/acre
*Immediately available



Potash (Potassium)
250-290 lbs/acre
*Immediately available

- Consider applying 1-2 tons/acre of compost when doing the last mow of the cover crop, so that the microbes in the compost can speed the decomposition of the cover crop residue.

Useful Links:

- [How to add compost to your farm guide](#) ³
- [Summary of the benefits of compost to your operation](#) ⁴

3 Implement Ground Cover

- Consider allowing resident vegetation to grow.
- A number of resident vegetation species** (species typically considered weeds) provide many benefits to the orchard ². Consider leaving some rows unplanted with cover crops to encourage greater diversity in your farm ².
 - Further, **if irrigating your cover crop is not an option, simply allowing the resident vegetation can provide a host of benefits**, from erosion control to habitat for beneficials.



» **Examples of the benefits of resident vegetation** ²

- » **Common knotweed:** An important source of nectar for at least 29 parasitic and predatory insects that control almond pests ².
- » **Chickweed:** Flowers from December through March and is an important early-season nectar source for various parasitic wasps ².
- » **Aster family weeds, such as sowthistle, mayweed, and pineapple weed:** Harbors lady beetles ².
- » **Pea family weeds, burr medic, clovers, and vetches:** Fix nitrogen, while the extrafloral resources attract lacewings, wasps, and predatory ants ².
- » **Grasses:** Grass pollen supports the predatory mite *Euseius tularensis* which attacks spider mites and scale crawlers ².
- » **Spotted Spurge:** During the summer it is a source of nectar for parasitic wasps ².



Planting a Cover Crop

- Plant a cover crop mix in the fall after spreading your compost. ****It is best to initiate irrigation and not wait for the rains!**
 - » Apply a light irrigation after planting (~2 acre -inches) .
 - » To ensure the flowers bloom before the almonds the mixes need to be sown and germinated before November 1. Therefore, plant and irrigate in early October. ****If you do not have access to irrigation you will need to wait until the first significant rain is forecast and plant the cover crop before the rain event.**
 - Table 11 of [BIOS for Almonds guide](#) suggests a dryland mix for the middles of almond orchards on drip irrigation systems ².
- Ideally you will want to plant your seed with a no-till drill for the best establishment.
 - » Project Apis m recommends a Schmeiser implement. This no till compact drill is designed to "tackle stubborn non-cultivation ground" ⁵.
- **Maximize the diversity of your cover crop**
 - » **The more species in your cover mix, the better!** Use at least **7** different species, with at least 15 being ideal. This will help to cover your bases if a few of the selections do not work out, while providing larger swath of benefits.

Example Mix Recommendations

Combine the [Project Apis m.](#) (more information listed under additional resources at the end of this section) Wildflower Mix with their Clover Mix and Soil Builder Mix. For every ten rows plant the following cover crop mixes. Feel free to adjust this example. Also, you can check out their website and talk to Billy Synk about different variations.

		
Soil Builder Mix	Clover Mix	Wildflower Mix
60-75 lbs/acre drilling 6 rows	10 lbs/acre drilling 3 rows	10 lbs/acre drilling 1 row

This combination will provide an early source of pollen for pollinators, a late source of nectar/habitat for beneficials, prevent soil erosion, suppress weeds, and fix nitrogen. Further the CA natives in the wildflower mix are well adapted to CA's unique climate.

Managing the cover crop

- **Middles Management** to ensure mixture of seeded and resident vegetation. This, "leads to differing heights, stages of maturity, and plant species composition in adjoining sections of the orchard understory . These differences could be important to maintaining habitat for beneficial insect and dictating their movement into the trees ²."
 - » Sowing different cover crops in different middles
 - » Mowing middles at different times
 - » Combination of the above 2
- Manage cover crop so that it is **flowering during the bloom** to help support the bee's pollinating the orchard.
 - » Bees require a diverse diet and if they only have a single pollen source (i.e almond blossoms) they will develop nutritional deficiencies, reducing their fitness. Research shows that cover crops flowering during the bloom do not compete with the almond blooms for pollinator activity ^{13,6}.
 - » Further [recent research](#) suggest that cover crops do not affect ambient air temperatures in the orchard's canopy, suggesting they do not increase the risk of frost damage ^{14,6}.
- If possible, **graze the cover crop** in February and again in April.
 - » Ask the grazer to remove ~40% of the vegetation to stimulate cover crop growth.
- May-July start mowing alternate strips of cover crops to a height of at least 10 inches ².
 - » This will leave remnant strips of habitat for beneficials, allowing the regrowth of plants and reseedling. The mulch will provide some weed suppression and food for earthworms and other key decomposers, while reducing evapotranspiration.
 - » Some mowers will allow you to blow the residue into the tree rows, maximizing the mulch in the tree rows.

- Warm season resident vegetation will come up through the cool season cover crop, providing resources for beneficials and erosion control benefits ².
 - » The staggered strip mowing as promoted by “Middles Management” will allow for the gradual emergence of warm-season resident vegetation through the cool season stubble ².
- In July begin closely mowing orchard floor vegetation to ensure the floor is ready for harvest ².
- If you are putting in a new orchard, some of the farmers in the study report success with installing micro spray sprinklers. Some farmers are also installing micro spray and buried drip to get the benefits of both. These can be used to help establish a cover crop in the fall, while helping maintain the winter cover crop if the winter/spring is dry.
 - » The effect of cover crops on increased irrigation usage appears to be minimal-nonexistent, since bare soil consumes water via increased surface temperatures, evaporation, and runoff ^{15,6}.



4 Graze the Orchard with Livestock in the Spring

- Integrating grazers like sheep or chickens will speed up the nutrient cycling associated with the cover crop, help keep those nutrients on the farm, and reduce the need for inputs. Grazers can also provide effective biomass control - reducing the number of mow passes. It may even be a source of revenue, if you own the flock.
- Since you will most likely be grazing the sheep February-April you want to ask the shepherds to remove ~40% of the vegetative to stimulate growth and provide habitat for the beneficials.
 - » If possible, graze in mid-February and again in April.
 - » If you are harvesting off the orchard ground the grazers need to be off the orchard 120 days before harvest.



Useful Links:

- [List of Contract Grazers](#) ⁹
- [Summary of the benefits of integrated crop livestock systems](#) ¹⁰
- [Grazing Cover Crops: A How-To-Guide](#) ¹¹



5 Eliminate the Use of Synthetic Pesticides

- **Emphasizing ground cover reduces the need for costly herbicides.**
- The use of pesticides such as herbicides, insecticides, and fungicides disrupt beneficial invertebrate communities ¹².
 - » Also, many shepherds will not graze their sheep in areas treated with herbicides.
- Insecticides, herbicides, and fungicides all work together to negatively impact pollinators.
- Pesticides negatively affect human health and reduce soil health and productivity.

Seed Resources

- **Project Apis m.'s Seeds for Bees Program.** Apply for free cover crop seed to try out the practice in your orchard. See their guidelines and enrollment information [here](#).
 - » Billy Synk Director of Pollination Programs Office: (916)216-2227 billy@projectapism.org
 - » Try and get your seed order in before August 1st!
- Seed companies
 - » [Kamprath Seed](#) (wholesale): 800-466-9959
 - » Ag Seeds (retail): (530) 666-3361
 - » TS&L (retail): (530) 666-1239
 - » [Green Cover Seed](#) (wholesale and retail): (402) 469-6784
 - They also have a [cover crop mix calculator](#) that is useful
 - » [Great Valley Seed](#): (209)737-4454, Doug@Bfarm.com
 - Native seeds specifically suited for the Central Valley.
 - Seeds and drilling services.

Planting & Equip

- Planting and equipment resources
 - » Miller Cover Crop Planting, Modesto, CA. (209) 526-2111 (equipment and planting)
 - » Joe Muller and Sons Farming, Woodland, CA. (530) 662-0105 (equipment only)
 - » Paul Strojan, Farmington, CA. (209) 573-1656, strojanp@velociter.net
 - » Kellogg's Ag Service, Paradise, CA. (530) 624-3045, www.kelloggsagservice.com
 - California Ag Solutions, Madera, CA. <https://www.calagsolutions.com/>
 - * Silas Rossow. 209-617-7701, silas@calagsolutions.com
 - * Equipment, planting, and advising

Cover Cropping

- Going over one or all these guides will be helpful in determining the mixes you want, what you want to accomplish, and the various pros/cons of different mixes.
 - » **The Almond Board** has a [Cover Cropping Guide](#) that was just published ^{6!}
 - » **The CAFF BIOS for Almonds guide** has tables outlining ideal cover crop mixes for the middles, the tree rows, micro sprinkler irrigation systems, and buried drip systems. It also outlines, ideal planting times, mowing schedules, etc. to optimize ground cover management in your orchard ².
 - » **CAFF has a shorter cover cropping decision guide** for perennial crops ⁷.
 - » [Summary of the benefits of cover crops to your operation](#)
- Check out the [NRCS EQIP program](#) to learn more about cost-share opportunities for implementing conservation practices like cover crops, hedgerows, drip irrigation, and compost application.
- Check with your local RCD office for equipment rental services. ⁸



- **Alternatives to herbicides**

- » Mowing, grazers, and potentially burning biomass within the tree rows.

- **Alternatives to synthetic insecticides**

- » Having a highly diverse cover crop, combined with “Middles Management” will help promote a diverse community of invertebrates that should do most of the work keeping insect pests in check.
- » Winter sanitation
 - Also having cover crops will increase the biological activity on the orchard floor, breaking down the mummy nuts that NOW larvae reside in ².
- » A functioning system will not need pest management inputs. But for the transition period, there are some organically minded management options that should interfere less with the transition.
 - You can consider releasing predatory wasps: *Trichogramma* (align release with first flight of Peach Twig Borer) and *Goniozus* (If high levels of NOW in mummies) in mid-April through July if there is significant concern for Peach twig borer and NOW ².
 - OMRI approved Bioinsecticides such as Grandevo and the hormone disruptor CIDETRAK + NOW MESO
 - Utilize brassicas as a cover crop if you are having issues with nematodes.

- **Alternatives to synthetic and copper-based fungicides**

- » OMRI approved sulfur sprays and bio fungicides like BT and compost teas.

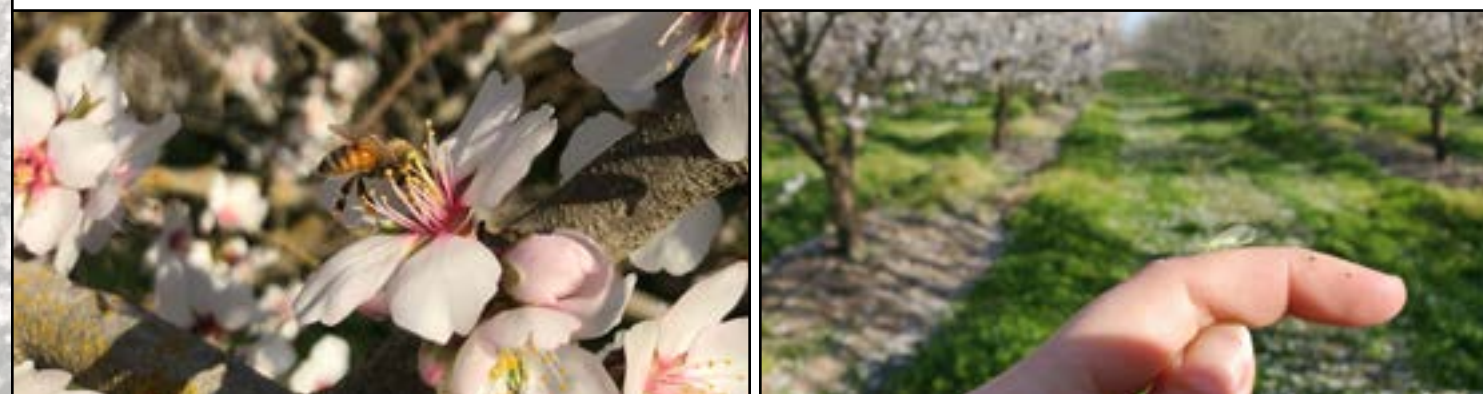
- **Alternatives to synthetic fertilizers**

- » **Dried Poultry Litter (DPL).** Several regenerative producers that we are working with report the DPL is a key component in ensuring their trees meet their N needs.
 - 4 tons/acre /year
 - * Broken in to two separate 2 ton/acre applications.
- » Foliar and fertigation applications of fungal dominated compost tea.
- » Can also consider foliar and fertigation applications of other OMRI approved nutrients
- » Farmers have reported foliar sprays playing an important role in their transitions from conventional to regenerative management systems, reporting that it speeds up the beneficial biology that has been absent under conventional management.



6 **Plant Hedgerows/Native Vegetation Along the Edges**

- A long-term goal is to plant native shrubs and trees along the edges of blocks.
- Several of the key beneficial insects in almonds prefer shrubs and trees to cover crop. Therefore, establishing hedgerows of these plant species along the borders of your orchard can provide critical pest management services ².
- **Resource Contact:** [Great Valley Seed](http://GreatValleySeed.com), (209)737-4454, Doug@Bfarm.com
 - » Native seeds and transplants specifically suited for the Central Valley.
 - » Seeds, transplants and drilling services.
 - » Contract growing.



- Over the coming years work to establish plantings of plants such as (More information in Table 16 of [BIOS for Almonds guide](#))²
 - » Blue elderberry
 - » Coyote brush
 - » Quail Bush
 - » California coffeeberry
 - » California lilac
 - » California wild buckwheat
 - » Holly-leaved cherry
 - » Mule fat
 - » Toyon
 - » Native willows (Good for near waterways)
 - » Yarrows
 - » Narrowleaf Milkweed
 - » St. Catherine’s Lace



Orchard Regenerative Score Presurvey

Please answer the following questions specifically for the study field during the previous year	-YES- <i>color in circle</i>	-NO- <i>color in circle</i>
1) Were any synthetic fertilizers applied?	<input type="radio"/> Value = 0	<input type="radio"/> Value = 1
2) Were any herbicides (granular or sprayed) applied?	<input type="radio"/> Value = 0	<input type="radio"/> Value = 1
3) Were any synthetic or metal fungicides (spray or other) applied?	<input type="radio"/> Value = 0	<input type="radio"/> Value = 1
4) Were any synthetic insecticides (spray or other) applied?	<input type="radio"/> Value = 0	<input type="radio"/> Value = 1
5) Was there any mechanical tillage of the soil besides planting activity?	<input type="radio"/> Value = 0	<input type="radio"/> Value = 1
6) Were cover crops or perennial vegetation grown on this orchard within one year prior to the study?	<input type="radio"/> Value = 1	<input type="radio"/> Value = 0
7) Are there any strips of perennial vegetation on orchard borders or throughout (unmanaged road ditches not included)?	<input type="radio"/> Value = 1	<input type="radio"/> Value = 0
8) Were any natural amendments applied (ex: compost, biologics, compost tea, etc.)? If other, list here: _____	<input type="radio"/> Value = 1	<input type="radio"/> Value = 0
9) Was the field grazed by livestock ? Livestock type: _____	<input type="radio"/> Value = 1	<input type="radio"/> Value = 0

MATRIX SCORE

(Sum of values adjacent to colored circles in both YES and NO columns above)

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