Sacramento Valley Field Crops Newsletter

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In This Issue

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Organic Amendment Management

Sarah Light, UCCE Farm Advisor, Sutter-Yuba and Colusa Counties

By definition, anything that was or is alive is considered organic matter because it contains carbon-based compounds. This article covers some of the considerations around using organic amendments, often used in both conventional and organic production.

Organic amendments help build soil microbial communities because they are a food source for microorganisms. Soil microbes are critical for nutrient cycling and building soil structure because soil aggregates are held together by organic compounds produced by microbes, by fungal hyphae, and by plant roots. The most common types of soil organic amendments for production agriculture are manure, compost, and crop residue (including cover crops).

Why we care about carbon (and C:N):

Soil carbon is important in all farming systems because of the role it plays in building and maintaining soil microbial communities. In addition, soil microbes are responsible for many parts of the N cycle, like converting ammonium to nitrate, the form of nitrogen most commonly taken up by plants. Even if there is sufficient total N in the soil, microbial processes will be slowed by reduced activity due to low soil carbon, cold soil temperatures, or inadequate soil moisture.

Turkey manure for use as a soil amendment and organic fertilizer

The amount of carbon to nitrogen (C:N) affects microbial breakdown of organic amendments, and thus potential nitrogen (N) release. Like us, microbes have dietary needs that have to be met. The ideal diet for microbes has a C:N ratio between approximately 20:1 and 25:1. Nitrogen is present in the soil

Save the Date!

Healthy Soils and Field Crop Grower Meeting

February 19, 2020

UCCE Office, Yuba City

Agenda and more details to come!

and in soil water. When microbes consume material with a higher C:N ratio than their ideal diet, they will "mine" N from the soil profile for their own use, making it unavailable (sometimes called "tied up") for crop uptake. It is not permanently lost from the system as with N leaching or volatilization. Rather, it is unavailable in the short term until the microbes die. When microbes are consuming material with a lower C:N ratio than their ideal diet, they are releasing the N that is in excess of their dietary needs that is immediately available for crop uptake.

Considerations for Material Selection:

Material Costs: With organic amendments that are high enough in N to be used as an N source, cost per unit N is more relevant than cost per unit weight. However, this may not be the only consideration. How much the material costs to transport and spread can eat into your bottom line quickly. Watch for percent moisture because this affects nutrient calculations in a load of compost and it's expensive to move water.

Calculate the true cost of organic amendments when deciding what material to use, including percent moisture. This includes product versus management costs to estimate how much a pound of N actually costs with each product for the growing season. In the short term, the goal may be to meet the demand of your current crop. In the long term, the goal is to build soil structure and fertility.

Material Efficiency: Fresh manures can contain a large proportion of ammonium-N and can lose a substantial amount of N to the atmosphere if they are not tilled in the same day they are applied. The C:N ratio of the material affects both the amount of N that will released for plant uptake, and the time in which the N will become plant available. Materials with a lower C:N ratio are broken down more rapidly. Thus, organic materials need to be applied in larger quantities and earlier in the season to meet crop N demand, especially in the first year of application. In contrast, synthetic N fertilizers provide the opportunity to apply N in-season, or through fertigation or sidedressing, for peak uptake. Watch manures, as they can also be a source of weed seeds.

Potential Risks:

When applying manure or manure-based compost to meet crop N needs, there may be over application of other nutrients. This is because:

- These materials contain micro and macro nutrients other than N.
- They are lower in percent N (and other essential nutrients) than synthetic fertilizer and require higher application rates to achieve crop nutrient needs.
- Organic N needs to be mineralized in order to be plant available and not all the N will become available for the current crop.

For example:

If you are planting corn and plan to apply composted chicken manure to meet crop N demand, you can expect approximately 35% of the N to be mineralized in year one (Resource #2 below) and available for plant uptake. While nutrient concentrations can vary due to bedding material and maturity of the compost, typical chicken manure compost (sometimes referred to as broiler chicken litter) has a nutrient content of 44 lb N, 26 lb phosphorus (P), and 33 lb potassium (K) per ton (Resource #3 below).

Based on CDFA fertilization guidelines, recommended total N application rates for corn are generally 200-275 lb N/A. Let's assume our goal is 225 lb N/A for the calculation below. Given that only 35% of the N will be mineralized in year one, you will have to apply a higher amount of compost to ensure enough is available for your crop in that year.

225 lb N required ÷ 0.35 = 643 lb N/A needed to apply to meet corn demand.

Given the amount of N in each ton of compost, you will need to apply:
643 ÷ 44 = 14.5 tons/A of compost (29,000 lbs of material).

How much phosphorous will be in that compost application?
14.5 tons x 26 lb. P/ton = 377 lbs. of P/A (this is 867 lb P_2O_5)

According to CDFA fertilization guidelines, P should be applied based on crop removal and 60-80 lb of P_2O_5 are removed when corn grains are harvested from the field and 60-100 lbs with silage corn.

This means, that you are applying 8-14 times more P in one year than your crop needs! Consider the nutrient loading that will occur if these elevated manure levels are applied year after year to meet the crop N demand.

It can be challenging to balance nutrients with organic materials and when possible consider other sources of amendments with different levels of NPK. While there is no inherent risk in having too much P to your crop, P contaminates waterways when soil moves off the field through erosion and is one of the main drivers of eutrophication. In addition, some organic amendments can be high in salts and can lead to salt build up in time. Efficient application of organic amendments is important. In conventional systems organic amendments can be supplemented with synthetic N fertilizer to optimize N application without excessive application of other nutrients. In addition, synthetic N can be applied to meet crop N need during peak uptake, when N from organic amendments may be released too slowly to meet crop demand. In certified organic systems, consider incorporating legume cover crops into your rotation to ensure adequate soil N levels while reducing the risk of overloading other nutrients.

If organic amendments are added consistently year after year, the soil structure is improved, which reduces the risk of soil erosion. In addition, N cycles can become tighter. The 65% of N that wasn't mineralized in year one may become available in future years although this is hard to account for in N budgeting. Organic amendments can build microbial activity, soil structure, and soil health. However, they should not be managed to meet annual crop N demand as is done with synthetic N fertilizer.

Resources:

Two new, and very useful, resources by UCCE Specialist Daniel Geisseler and UCCE Farm Advisor Margaret Lloyd:

#1 A worksheet to help calculate and manage N from organic sources:
https://ucanr.edu/blogs/capitolcorridorsmallorganicfarm/blogfiles/57917.pdf

#2 Release rates from organic amendments:
http://geisseler.ucdavis.edu/Project_Organic_Tomato_Flier.pdf

#3 A very comprehensive publication called Fertilizing with Manure and Other Organic Amendments from the Pacific Northwest: https://pubs.extension.wsu.edu/fertilizing-with-manure

Although this is not specific to California, most of the information is relevant to our region. This publication covers a wide range of concerns from food safety concerns to effective application strategies.

CDFA Corn Fertilization Guidelines: https://apps1.cdfa.ca.gov/FertilizerResearch/docs/Corn.html

Using Compost

Sarah Light, UCCE Farm Advisor, Sutter-Yuba and Colusa Counties

Compost can be a great soil amendment but what is it? By definition, compost is any product that results from the decomposition of organic material. Since the material that goes into compost can vary widely from food and yard waste to wood chips to animal manure, the fertility and benefit to agronomic productivity is also quite variable. Not all compost is the same and the expected performance of a compost on a farm is related to the starting material and properties of the finished product.

While all composts will have the benefit of adding organic matter and increasing soil carbon, the benefits of which are outlined in the article above, not all will be suitable to meet the nutrient needs of a crop. Manure-based composts are higher in fertility than green waste (i.e. yard trimmings) and it would be very difficult to meet crop nutrient needs with green waste compost. For example, while a typical chicken manure compost has a nutrient content of 44 lb nitrogen, 26 lb phosphorus, and 33 lb potassium per ton, a typical yard debris compost only has 18 lb nitrogen, 3 lb phosphorous, and 8 lb potassium per ton (Reference #3 above).

Loading and spreading compost.

There are advantages and disadvantages to using compost over fresh materials. The volume of composted versus fresh material generally decreases by 30-60% and compost is easier to spread. Compost has a lower risk of containing weed seeds or pathogens and is less likely to degrade water quality. Since compost has already been decomposed, it contains more stable carbon and less carbon is lost to microbial decomposition. This means that less nitrogen will be tied up for a high C:N ratio of composted material than when applying the fresh form of the same material. However, this means that compost can also be very slow to release nutrients. Compost can improve the physical, biological, and chemical properties of a soil including reducing erosion, increasing water holding capacity, and moderating soil temperature. For these reasons, compost can be an excellent soil builder and can lead to improved soil function, but it is important to evaluate the properties of the compost before application and know what you are using it for.

This is a good time to start thinking about compost. There are cost incentive programs for compost application through the CDFA Healthy Soils Program. If you are thinking of applying compost these programs can be a great opportunity to do so. In addition, beginning in 2022 cities and counties in California will be required to provide an organic material recycling collection service. This means that the supply of yard and food waste compost is likely to increase. In addition to the on-farm benefits of compost applications, the big-picture benefits of compost are diversion of organic materials from the waste stream and reduced methane emissions from landfills. Contact Emily Lovell at the UCCE office in Yolo County for more information on CDFA's Healthy Soils project, 530-666-8143, ejlovell@ucanr.edu.

COOL BEANS!

Rachael Long, UCCE Farm Advisor, Yolo-Solano-Sacramento

I've received several interesting calls on dry edible bean production issues recently, for California production, which I'd like to share.

1) Can I save my dry bean seed for planting? The short answer is "Maybe". Dry beans are largely self-pollinated, so there won't be much genetic drift (and the possibility of impurities) when growing seed saved from your bean production fields. However, saving seed for replanting is risky for a number of the following reasons.

Disease Risk? One of the most common and serious diseases of dry beans is bean common mosaic virus (BCMV), an aphid transmitted and seed borne disease that weakens plants, resulting in yield losses. Most dry bean varieties grown in California have the "I gene" conferring resistance to BCMV (see the **UC IPM guidelines** for a list), but not all. Some heirloom types may not have virus resistance, but see an update on new varieties below. I've seen large-

scale fields of dry beans heavily infested with BCMV that came from infected saved seed, resulting in no yields. One cannot tell the difference between infected versus clean BCMV seed, as the disease is internal to the seed coat.

Do you have quality seed? A second issue in saving seed is seed quality (e.g. germination problems), which can depend on how the beans were handled from harvest to cleaning to storage. Dry beans are highly sensitive to injury, especially in western states production where hot, dry summers cause excessive drying and brittle seeds. This makes them susceptible to cracking, splitting, and internal damage, especially during harvest, which in turn affects seed vigor and germination. Dry beans must be handled with 'kid gloves' at all times, including harvesting in the morning with higher bean seed moisture and slow moving harvesters (e.g. CB Hays Bean Harvester) to protect the seed. In addition, specialized bean seed processors must use care during seed cleaning and conditioning, such as having rubber bumpers at positions where moving seeds contact hard surfaces in equipment or storage containers, to ensure high quality seed. Never drop sacks of dry beans destined for planting as this can cause internal damage, leading to poor seed vigor.

Overcoming Seed Problems: If you save your dry bean seed for planting, you might have to seed more heavily to overcome any germination issues associated with any low quality, low vigor seed. Once plants are up and growing, there shouldn't be any persistent carryover of low quality seed on plant health and yield. That is, poor quality seed won't produce an adult plant that produces fewer pods; penalties would be limited to early crop establishment (e.g. damaged seed just won't germinate or grow well beyond the seedling stage). If there are skips in the field, in general, beans are hardy and generally will fill in the spaces and once they are growing well.

Penny-Wise, Pound Foolish? The reality is that it may be best to invest in certified seed of high quality to ensure a good crop. A lot of effort goes into breeding high quality planting seed (especially hybrids) with a rigorous seed certification process. This includes seed that is free of pests, weeds, and diseases and true to the variety being planted. Germination tests are done by companies to ensure good, uniform seed emergence after planting. Investing in certified seed is worth its weight in gold and always a good choice.

2) Why are some beans hard to cook? A farmer recently shared that his black turtle beans were rejected from market because the beans didn't cook up well. *What could cause poor cooking issues?* More than likely this was due to the crop being too dry when harvested (as indicated by major physical damage to the bean seed during harvesting) or changes in the starches making them resistant to water imbibition. Excessively dry crops can result in hard seeds (e.g., too dry to imbibe water), which would create a problem for cooking. Cooking generally breaks hard seed coats and softens seeds eventually, but this could delay the imbibition or extend the cooking time. This would be easy to check by putting some seeds in wet paper towels overnight and seeing how many are swollen versus still hard and dry. If that is the reason for the rejection, the farmer could put the seeds in higher humidity and raise their moisture content slowly via vapor phase until there are no more hard seeds, and this might fix the problem.

3) Soil borne diseases can be related to soil compaction- "Help, I need air!" A field call to a dry bean field this fall with low pod set brings to mind the need for a reminder to pay attention to soil compaction issues, especially in wet years. There's a tendency to push to get fields planted on time, especially with a need to make contracts. Although this seems like a high priority, the reality is that one might be further behind by planting too early, before soils have a chance to adequately dry out. Working wet soils compacts them, leading to low water infiltration, poor soil aeration, weaker plants, and higher disease pressure. Healthy plants are better able to withstand soil borne diseases.

This particular bean field had significant problems with **Fusarium root rot** and **southern blight** diseases that are most problematic when plants are stressed. Based on discussions, we think that the bean field was worked too soon after the 2019 Memorial Day rains (3-inches fell that weekend). This likely resulted in soil compaction issues that weakened plants, making them more susceptible to diseases. This disease problem, combined with high temperatures during bloom, along with lygus bug and mite pressure, were the likely causes for lower pod set in the field.

Once soils compact, it's hard to bring them back. Pay attention to land preparation (chiseling/disking) to ensure there are no hardpans in the field prior to planting. For soil compaction issues in the seedling stage, it's known that "A cultivation is just as good as an irrigation" for aerating soils. Increasing soil organic matter with compost or cover crops will also help with soil structure, aeration, and drainage. See an article from our Summer 2018 newsletter for more information on strategies to avoid and manage soil compaction (click the following link): **Agronomy Notes**

4) Garbanzo seed splits from rain damage (Rachael Long and Sarah Light). The late May rains (3-inches over Memorial Day weekend) caused some crop damage to garbanzo beans in the Sacramento Valley. Seeds that were physiologically mature absorbed water through the pods and started to germinate (swelled and split, see photo below, top row germinating, bottom row healthy). Cool, wet conditions did not last long enough to actually see full germination (e.g. no root development). About 17% of the crop was affected at cleanout at harvest.

Garbanzo germination in seed pods is rare here in California due to our hot, dry summers when garbanzos are harvested. It takes a long, extended period of cool, wet weather for germination in the seed pods to happen. We collected pods in the affected field and soaked them in wet paper towels at room temperature for 2-days. No seed splitting was observed in seeds in pods after 24-hours; it took nearly 48 hours of continual wetting to see the seed splitting symptoms (early phase in the germination process).

Splitting affects canning quality, as there can be no seed cracks or splitting, for meeting canning quality grade. Seed conditioning (cleaning and sorting out poor seed) can be done to improve seed quality in affected fields.

Overall, garbanzo yields in California were down about 10%-15% due to high rainfall and wet conditions in 2018-19. In general, for garbanzo production, the Five Points area averages 30-32 sacks/ac (cwt/ac), Stockton area 23-25 sacks/acre, and Sacramento Valley area, 17 sacks/ac.

Photo: Garbanzo beans in the initial germination phase (top row) from excessive rainfall in May 2019; bottom row healthy.

New heirloom-type common dry beans available for farm trials with bean common mosaic virus (BCMV) resistance

Heirloom type common dry beans are valued for specialty markets for their lively colors and unique flavors for a variety of bean dishes (Photo 1). Travis Parker, UC Davis PhD student, has been working on breeding varieties of heirloom beans that carry the "I gene", conferring resistance to bean common mosaic virus (BCMV), a serious disease of beans that's vectored by aphids and seed transmitted (in the planting seed). See photo 2 below for BCMV symptoms.

Yields of these new varieties are superior to similar types of beans that are susceptible to BCMV (Table 1). The new varieties were compared with similar parent heirlooms in trials in Yolo, Monterey, and San Diego counties. If you're interested in obtaining seed for small scale trials, please contact **Rachael Long** (rflong@ucanr.edu or 530-666-8143). The varieties should be released for larger scale plantings by CCIA (California Crop Improvement Association) in the next few years.

Watch for Boron Toxicity. For Yolo County, watch the boron content of soils and water; heirloom beans are common beans and sensitive to boron at 0.5-0.75 ppm. Boron plant damage symptoms include leaf burn (see photo 3, taken in Yolo County in 2019), resulting in stand losses, yield decline, and poor quality seed.

Photo 1. New heirloom dry bean varieties, with bean common mosaic virus (BCMV) disease resistance.

Photo 2. Tiger's Eye heirloom bean infected with bean common mosaic virus, BCMV (left) versus a new BCMV resistant Tiger's Eye bean variety (right)

Photo 3. Dry bean seedlings affected by boron (left) versus healthy plants (right). Common beans are sensitive to boron at 0.5-0.75 ppm; lima beans at 0.75-1.0 ppm, garbanzos at <1-2 ppm, and blackeyes at 2.5 ppm.

Table 1. Heirloom common dry bean varieties with bean common mosaic virus (BCMV) resistance available from UC Davis for on-farm demonstration trials with yield improvement compared to virus susceptible types. Contact Rachael Long for seed (530-666-8143).

Heirloom varieties with BCMV resistance	Heirloom parent	Growth Habit	Yield improvement
Southwest Gold	Zuni Gold	Medium-compact	+296%
Anasazi	Anasazi	Somewhat viney	+131%
Rio Zape	Rio Zape	Viney	+68%
Tiger's Eye	Tiger's Eye	Medium-compact	+39%
Sunrise	Zuni Gold	Somewhat viney	+68%
Good Daughter Stallard	Good Mother Stallard	Viney	+81%
Southwest Red	Anasazi	Medium-compact	+424%

ALFALFA HAY

Chlorpyrifos (Lorsban) ban in 2020.

The end is near for chlorpyrifos (Lorsban) use in California crops. This results from an agreement between the CA Department of Pesticide Regulation (CA-DPR) and pesticide manufacturers to withdraw their products beginning in February of 2020, for all forms of chlorpyrifos, including mixtures (e.g. Cobalt). This is a major issue for alfalfa, since it is one of the most popular wide-spectrum insecticides for management of key alfalfa pests, including weevils and aphids (**UC IPM for alfalfa hay**).

Photo: Alfalfa weevil larva, a key pest in California alfalfa fields in the spring months (January-May), reduces yields and quality from feeding on the foliage.

What are the Alternatives? Unfortunately, there are few alternative practices for weevil control. There are no effective resistant plant varieties, biocontrol is limited, and cultural practices have significant trade-offs with yield and forage quality. The only current effective management practice to control this key pest is the use of insecticides. Examples include pyrethroids like Warrior, as well as Steward, Malathion (no residual), and Entrust (spinosad used for organic production for suppression of weevils with 70% control). However, these insecticides have their own limitations. Weevil resistance to pyrethroids is beginning to be a problem throughout the western states, including select areas in California such as the Intermountain and Low Desert production areas. Steward is a stomach poison and works best under warmer temperatures when weevils are actively feeding. Some growers tank mix Malathion with Steward for quick aphid and weevil control, but watch the Malathion as it will move offsite in water and has caused surface water quality problems (impairments) in the Sacramento Valley.

Critical Need for Alternatives. UCCE is continuing to screen insecticides in the field for weevil control. In the meantime, following UC IPM guidelines for managing pests, including selecting locally adapted varieties with high levels of pest and disease resistance, are important steps for managing pests and reducing reliance on pesticide use in alfalfa fields.

UPCOMING MEETING

Farming in the New Normal

A workshop for growers on agriculture and climate

Exploring how your operation can adapt and thrive in a new climate reality

Topics Include:

- Coping with extreme weather
- Soil health and climate adaptation
- Optimizing irrigation water use
- Grazing system strategies for drought
- Pest control in a changing climate

JANUARY 7, 2020
8:00 am - 4:30 pm

Ulatis Community Center
1000 Ulatis Dr.
Vacaville 95687

Register at https://www.brownpapertickets.com/event/4429010

Early Bird Pricing: $30 General Tickets (after Dec. 7th) : $40
Lunch included in price of admission

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