Developing Effective Plant Nutrition Programs for North Coast Vineyards

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OFAC & North Coast CAPCA
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UC CE | University of California
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Basic strategies for organic winegrowing soil fertility

- Increased soil organic matter to improve CEC
- Improve soil structure and rooting area
- Improve water holding capacity, infiltration
- Create and maintain adequate fertility for production so as not to be a limiting factor
- Increase biotic activity of both macro and micro organisms

North Coast Soil Issues

Problems	Solutions
• Low pH	• Apply gypsum or lime
• Low calcium	• “
• High magnesium	• “
• Low potassium	• Potassium sulfate
• High clay, poor soil structure	• Initial ripping, cover crops, reduced tillage
• Phosphorus deficiency (when pH> 8, <5	• Rock phosphorus, compost high in P, bone meal

Soil Sampling is Critical

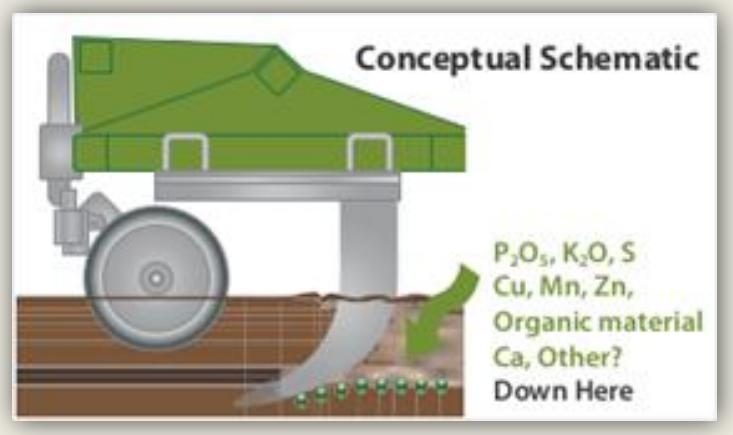
- Determine nutrient and soil chemical status
- Sample multiple spots, composite samples
- Examine soil profiles
- Minimum one pit/ 5 acres
- If obvious soil differences in spots, sample those, too

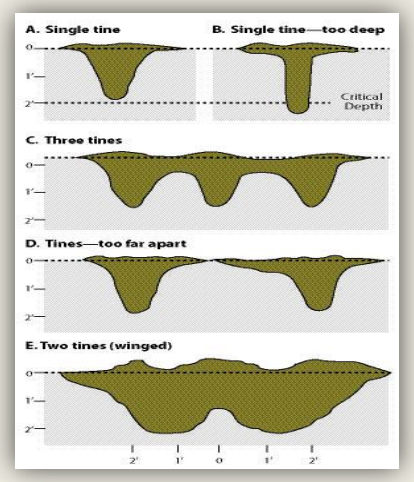
Don’t Forget the Vines!

- Visual assessment
- Petiole sample, tissue analysis

Deep Tillage is Important Initially

- Rip to rooting depth
- Don’t destroy soil structure
- Apply amendments and nutrients that are difficult to leach before ripping





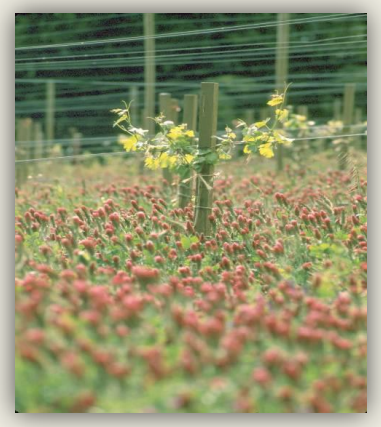
*Dr. Al Cass images

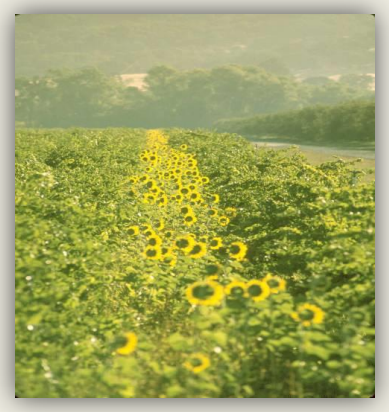
The Importance of Organic Matter

- Source of nutrients, recycling, energy efficiency, sequestering carbon

Documented Benefits of Increased SOM

- Limited research in vineyards
- Improved soil quality under biodynamic and organic growing
- Reduced number of root pathogens
- Vineyard root health, tolerance of phylloxera





Soil Structure and Organic Matter

Vineyard Organic Matter Per Year, Tons Per Acre

Item	Conventionally Farmed	Organic, BD Farmed
Prunings	900 lbs.	900 lbs.
Leaves	1200	1200
Weeds/Cover Crops	1000	1000-10,500
Compost	0	2000-4000
Total, tons/acre	**1.5 tons**	**1.5-8.5 tons**

On Farm Composting

Aerobic Composting—Typical Changes

Decreases:	*Increases:*
Mass	Density
Particle size	Mineral concentrations
Porosity	pH
Total C & N	Humus
Mineral N	Chemical stability
C:N Ratio	Organic bound nitrogen, other nutrients
Ammonia	Disease suppression
Pathogens and Weeds	

Typical Analysis of "Fresh" Green Waste and Manure

Nutrient	Green Waste	Manure
N	1-5%	1-5%
P	0.1-5%	0.5-6%
K	0.5-1.5%	0.5-4%
Salts	1-2%	1-8%
C:N	20-40/1	15-20/1
Phytotoxins	Often	Not usually
Weed Seed	Often	Often
Pathogens	Plant, often	Human, potentially

Nitrogen in Compost

- Available N = mineral N in the root zone
- Mature composts: typically 1-3 %
- About 20- 60 lbs N per ton
- Apply unincorporated broadcast to cover crops in fall
- When mixed in the soil, N release is usually temperature dependent. Some is released right away, some takes time

Other Minerals in Compost

- 0.5-1% P (10-20 lbs/ ton)
- 0.5-3% K (10-60 lbs/ ton)
- Numerous micronutrients
- Held in organic matrix, which may be more exchangeable than clay micelles

Compost Applications: Beneath Vines or Across the Vineyard Floor

Immediate Effect of Cover Crops

- Plant tissue is the primary source of OM
- Soil life is stimulated from root exudates
- Cover crops serve as food sources for vertebrates, invertebrates and microbes
- Soil respiration rates and microbe numbers increase

Grass and Legume Mixes

- Very complimentary
- Important to have N to build SOM
- Much of biomass is respired into the atmosphere as cover crops decompose

Carbon: Nitrogen Ratios in Organic Materials and Decomposition Rates

- C:N ratios<20:1, materials decompose rapidly
- C:N ratios>24:1, materials decompose slowly
- Microbes composed of 8 parts C for 1 part 1
- One third of the C is assimilated, the rest is respired
- One gram of N is used for 24 grams C metabolized by microbes

Cover Crop Decomposition Rates

- If left on the surface, OM will oxidize
- Need soil moisture, warmth when incorporating
- Finer pieces decompose quicker (more surface area
- More SOM accumulates in finer textured soil
- Organic matter may have easier exchange rates for P and K (less likely to bind to other soil colloids)

Crop Maturity, Decomposition Rates

- More mature the cover, the greater the C:N ratio
- Mature covers should be left on the soil surface for mulches
- For N, shred and incorporate at bloom time

What Can You Expect from Cover Crops in Terms of Nitrogen?

Cover Crop Type	Lbs N per Planted Acre
Vetches	50--200
Medics (bur clover)	50-100
Sub clovers	185-250
Rose clover	50-100
White clover*	115-200
Strawberry clover *	100-300
Berseem clover	100-300

*expect gophers, too

Typical Average Nutrient Inputs, Pounds Per Acre

Inputs (source of minerals)	N	P	K	Ca
Composted pomace and manure, 2 T/A	49	8	62	59
Rainfall deposition (EPA estimates)	11	0	0	2
N from cover crops (half of rows, every other row), annual self reseeding legume	10	0	0	0
Soil tillage and mineralization from soil organic matter	10	1?	5	5
Total Input	80	9	67	66
Estimated Available For Current Season (Compost availability estimated at N=15%, K= 85%, Ca=85%)	38	6	57	56

Source: W. Brinton, A. York, and G. McGourty, 2008

Mineral Removal in an Organic Vineyard, Pounds per Acre

Outputs (based on 3 ton wine grape yield)	N	P	K	Ca	Mg
Wine grapes	8	4.3	21	12	1.6
Trunk, stems and leaves	15	1	1.8	11	3
Leaching and mineralization	15	0	5		?
Estimated Total Mineral Removal	38	5.3	28	33	4.6

Concentrated Organic Fertilizers

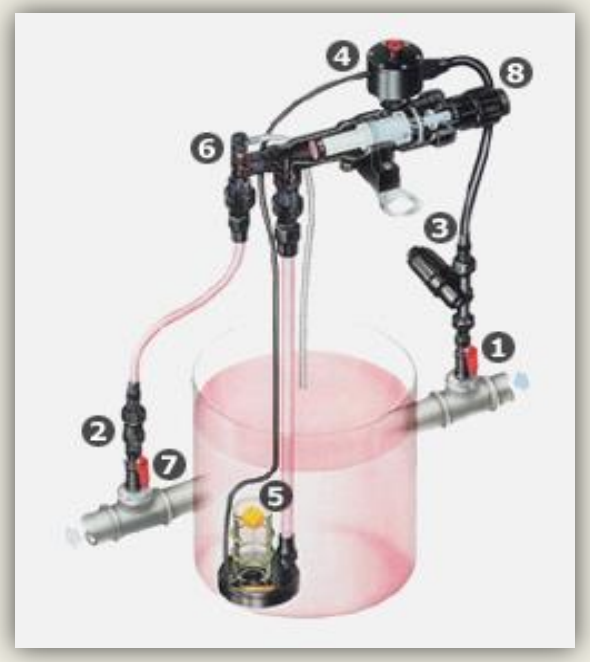
- Most based on processed proteins
- Fish proteins expensive, work quickly
- Spray dried animal protein
- Feather meal: used by pet food industry, easy to source
- Expensive per unit of N



Organic Fertigation

Requires The Right Material

- Spray dried animal protein
- Suspended fertilizers
- Must be able to pass through a 200 mesh filter
- May require agitation to keep material suspended
- Best used often in small amounts
- Concerns about microbial contamination of food crops



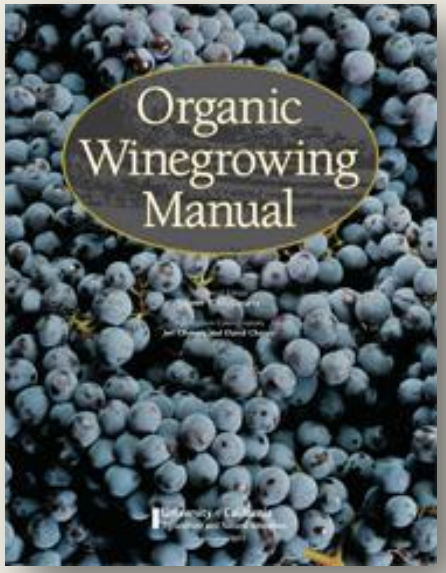
Organic Foliar Sprays

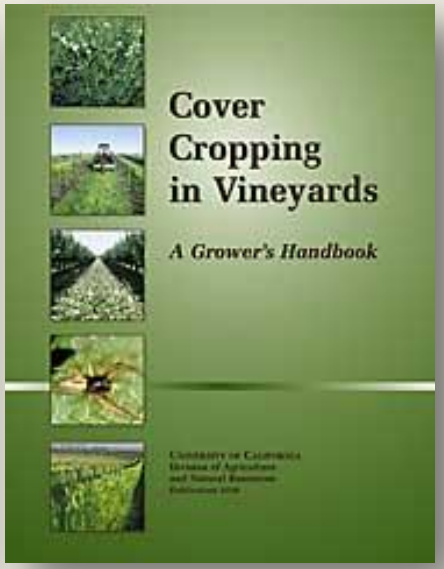
- Lots of products
- Expensive
- May be helpful at bloom time
- Calcium, Boron, Potassium most important

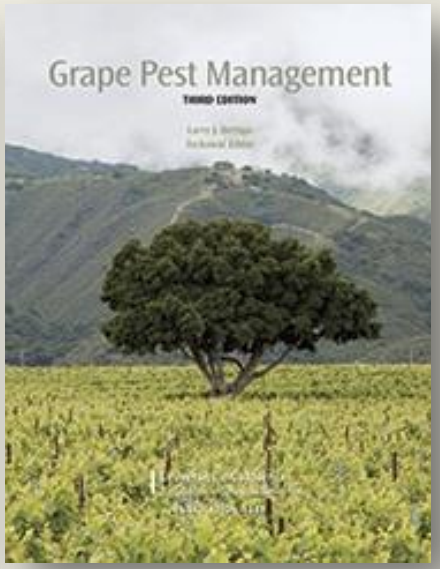
Compost Tea

- Mixed research results
- Probably not worth the expense and effort
- There are true believers!
- Concerns about microbial contamination of food products, wine?

Helpful Resources







- Available: UC ANR Press: http://anrcatalog.ucdavis.edu/

Thanks for Your Attention!