

Developing a Nutrition Management Plan for Your Field or Vineyard

Sustainable Ag Expo
November 15, 2010

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Budgeting is a Fundamental Component in Crop Management:

- Applied resources such as nutrients can and should be managed through budgeting
 - To optimize resource use efficiency
 - To minimize resource loss to the environment
 - To conserve resources
- Management plans and good record keeping provide organization and the ability to learn from past experience

Nutrition budgeting fundamentals - nutrient supply:

- Plants get most of their nutrients from the soil solution
- The availability of mineral nutrients in the soil solution over time is affected by physical, chemical, and biological soil factors
- Efficient long-term budgeting optimizes use of mineral nutrient resources present in the soil
- Our ability to monitor mineral nutrient supply is limited to snap shot lab analysis results

Nutrition budgeting fundamentals - nutrient acquisition:

- Plants take in most of their nutrients through roots
- Anything limits root growth and function will limit nutrient uptake
- Mineral uptake capabilities vary over the course of a growing season
- Mineral nutrient uptake involves both passive and active processes to varying degrees
- For perennial crops: rootstock influences

Nutrition budgeting fundamentals - nutrient demand:

- Plant growth and development drives mineral demand
- Plant growth and development depends on growing conditions - heat, sunlight, water, etc
- It also depends on crop phenology
- Usually, the harvested crop represents the greatest nutrient loss from a field
- Therefore, it is often proportionate to the requirement for applied mineral nutrients

What are the basic elements of a nutrition management plan?

- Management goals for the field or block
- Estimate plant nutrient demand
- Appraisal of mineral nutrient supply
- Nutrient applications required to achieve goals
- Nutrient economy monitoring guidelines
- Constructing a nutrient management budget and plan for the field or block

Developing a Nutrition Management plan: Start with Goals

What are your management goals?

- What is your target yield?
- What are your crop growth and quality requirements?
- Do you have a financial budget for nutrients?
- Do you need to root zone issues regarding supply?
- Are there root growth and activity concerns?

Estimating Nutrient Demand for Management Unit - Field or Block

- Biomass per acre is proportionate to the plant population density
- Crop phenology: seasonal growth drives seasonal demand
- Replacement of nutrients removed with the harvested crop

Appraising The Mineral Nutrient Supply

- **Soil Analysis**
 - Potentially available nutrients: those commonly reported = extracted nutrients
 - Readily available nutrients: soluble nutrients
- **Contributions from soil amendments/cover crops**
- **Contributions from irrigation water**
- **For perennial crops, contributions of stored nutrient reserves in woody tissues**

Nutrient Applications Required to Achieve Goals

- Assuming sound management with minimum nutrient loss to the environment:
- Total nutrient requirement = nutrients in harvested crop - available nutrients
- Schedule applications to meet demand for growth and development (e.g. size & quality)

Nutrient Economy Monitoring Guidelines

- **Supply monitoring**
 - Soil analysis
 - Irrigation water analysis
 - Soil amendment analysis
 - Fertilizer analysis
- **Demand monitoring**
 - Visual observations of plant condition
 - Plant tissue analysis

Creating a nutrition management plan/budget – putting it altogether

- The plan might have the following components
 - Stated goals and keys to success
 - Historical records of yields and inputs
 - Nutrient sources considered
 - Estimated application schedule and method for nutrient inputs = the nutrient budget
 - Financial budget
 - Monitoring locations and guidelines
 - Timetable for plan review

On-Site Mineral Resource Consideration

Consider making optimum use of on-site mineral nutrient resources

- Agricultural soils contain substantial quantities of mineral nutrients, but most are unavailable to plants
- Steps for optimizing the availability of on-site nutrient sources
 - Add mineral amendments as needed to neutralize pH
 - Regularly add organic amendments

Small increases in OM make large & varied contributions

- Promote nutrient release from minerals
- Serve as a source of mineral nutrients
- Enhance the root environment
- Conserve topsoil & its fertility
- Buffer the supply of mineral nutrients
- Impart resistance to large chemical changes
- Suppress root damaging organisms
- Increase uniformity in the mineral nutrient supply

Example Mineral Nutrient Budget for Wine Grapes

Mineral Nutrient Management Plan

Example - Primary Goals, Wine Grapes

- Location = the Sierra Foothills
- Target yield = 3.5 tons/acre
- Optimize wine grape quality
 - Balanced growth
 - Fruit exposure to intermittent &/or dappled sunlight
 - Timely fruit ripening
- Maximize use of on-site nutrient resources using a cover crop as a source organic matter

Mineral Nutrient Management Plan

Example - Secondary Goals

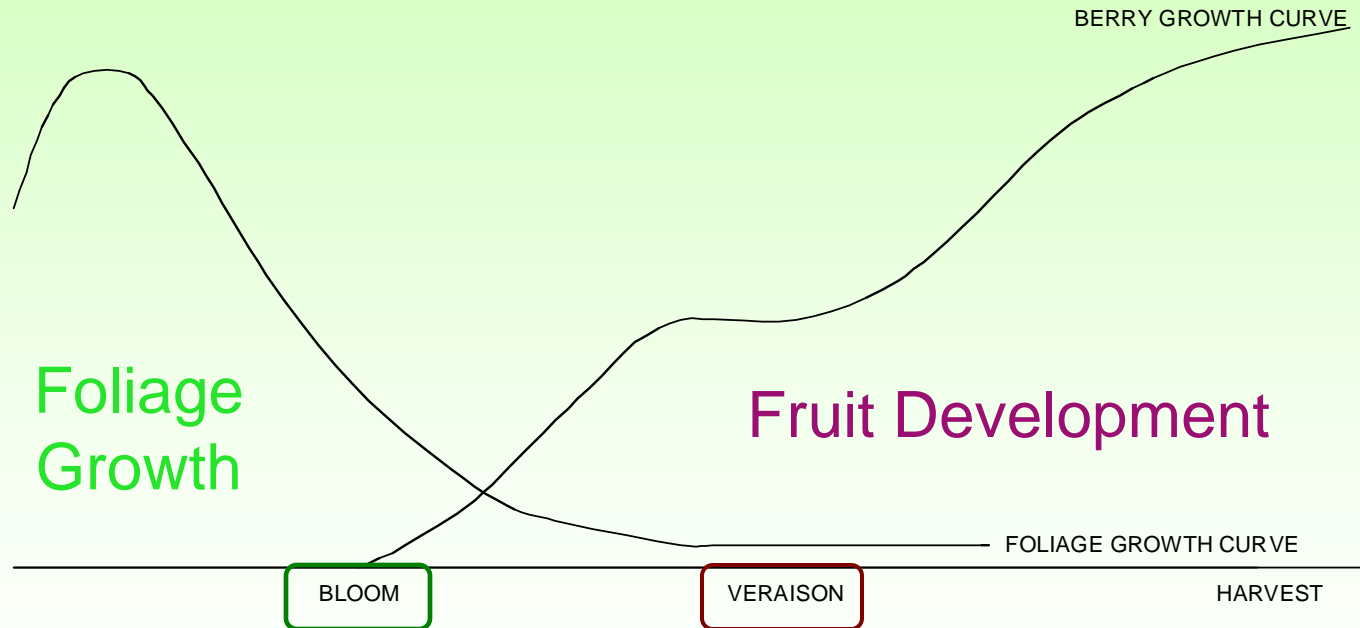
- Optimize soil conditions for root growth and function, including nutrient uptake
- Promote a supply of mineral nutrients in the soil solution that is balanced with internal vine demand
- Ensure vines are well nourished during all developmental stages

Fruit Nutrient Content at Harvest

Nutrient	Average (lb/ton)	High (lb/ton)	Low (lb/ton)
N	2.92	4.12	1.80
P	0.56	0.78	0.44
K	4.94	7.38	3.18
Ca	1.00	1.86	0.34
Mg	0.20	0.32	0.10

Source: Mullins, et. al. (1992)

Seasonal Mineral Nutrient Demand



Designing an In-Season Fertilization Budget

- Start with nitrogen (N)
 - N is a growth accelerator
 - Improper N application will have adverse effects of on soils & crops
- Use N-P-K formulations to balance P & K, if possible
- Use calcium nitrate with N-P-K to regulate soil pH
- Apply supplemental calcium & magnesium as needed
- Beware of quantities of applied sulfate & chloride

Example Fertigation Plan for Wine Grapes in the Sierra Foothills

Fertigation Period	Fertilizer Formulation	Fertilizer/Acre	N	P	S	K	Ca	Mg
		gal	lb/ac	lb/ac	lb/ac	lb/ac	lb/ac	lb/ac
Shoot	3-12-14-4(S)	4	1.3	2.3	1.8	5.1	0.0	0.0
Emergence	CN 9	0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Subtotal</i>		4	1.3	2.3	1.8	5.1	0.0	0.0
Post bloom	3-12-14-4(S)	5	1.7	2.9	2.3	6.4	0.0	0.1
	CN 9	2	2.2	0.0	0.0	0.0	2.7	0.0
<i>Subtotal</i>		7	3.8	2.9	2.3	6.4	2.7	0.1
Post Harvest	3-12-14-4(S)	7	2.3	4.1	3.2	9.0	0.0	0.1
	CN 9	2	2.2	0.0	0.0	0.0	2.7	0.0
<i>Subtotal</i>		9	4.5	4.1	3.2	9.0	2.7	0.1
SEASONAL TOTAL		20	9.6	9.3	7.2	20.6	5.4	0.2



Thank You