Understanding Tissue Testing

Advanced Viticulture Shortcourse June 5, 2018

College Station, TX



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Tissue Testing

- Helpful in determining a fertilizer program
- Measurement of the assimilation and utilization of mineral nutrients in a vine
- Measurement allows insight into plant's ability to absorb nutrients from the soil

Values are Time sensitive, depending on vine phenology

Assessing Vineyard Nutrition

Soil

Initial Test: Identifies soil chemistry and nutrient uptake problems Susequent Tests: Monitors pH and nutrient status

Tissue

Helpful in putting together a fertilizer program

Water

Identifies water quality benefits or limitations in delivering nutrients

Petiole versus Leaf???

Christensen, Monitoring and Interpreting Vine Mineral Status for Wine Grapes

Petioles

Leaves

- Less surface contamination
- More representive sample (from a greater number of vines)
- Standard method in most growing regions
- Researchers are more fluent with petiole data, values are more defined
- Easy to handle

- Nitrogen values are more stable (petioles tend to overestimate N need)
- Nitrogen more representative in leaves

Timing of the Tissue Collection

Bloom

- 50% Capfall
- Good indicator for:
 Nitrogen (N)
 Phosphorus (P)
 Potassium (K)
 Magnesium (Mg)
 Zinc (Zn)
 Boron (B)

Veraison

- Or as long as the canopy is healthy and functional
- Good indicator for:
 Nitrogen (N)
 Potassium (K)
 Magnesium (Mg)
 Iron (Fe)

To Fully Benefit from Tissue Testing...

Consistent timing of sample bloom or veraison

Consistent sample tissue leaf or petiole

Good understanding of limitations and influence of soil & water on nutrient uptake

Tissue Testing



Image source: Sampling Guide for Nutrient Assessment of Irrigated Vineyards in the Inland Pacific Northwest http://cru.cahe.wsu.edu/CEPublications/PNW622/PNW622.pdf

Tissue Testing

When	Where	How
Bloom (50%)	Petioles opposite basal clusters	80 – 100 petioles, no more than 4 petioles /
Veraison (50%)	First fully mature leaves of untrimmed shoots	vine, taken from both sides of canopy



- ✤ Be consistent in collection time
- Take separate samples for variety/rootstock/block differences
- Clean with phosphate-free detergent and rinse in distilled water
- Dry in paper bags before shipping to lab
- Do not store or ship in sealed plastic bags

Target Petiole Nutrient Values

Kamas, Growing Grapes in Texas, 2014

Nutrient	Bloom Petiole Sample Target	Veraison Petiole Sample Target
N	1.2 - 2.5	1.2 - 2.5
Р	0.15 - 0.4	0.15 - 0.4
К	1.5 - 3.0	1.5 - 3.0
Mg	0.5 - 0.75	0.5 - 0.75
Ca	1.2 - 3.0	1.2 - 3.0
Na	< 0.1	< 0.1
В	25 - 100	25 - 100
Zn	30 - 100	30 - 100
Mn	25 - 1000	25 - 1000
Fe	30 - 100	30 - 100
Cu	6 - 25	6 - 25

College Station TX 77845 Burleson County

Sample received on: 4/17/2012 Printed on: 4/26/2012

Laboratory Number		99434		
Customer ID		V-12		
Туре		Grapes		
		(Wine)		
Collection method for range		petoles opposite basal flower cluster		
Nitrogen	%	1.10		
survey range or average		1.7 - 3		
Phosphorus	%	0.67		
survey range or average		0.15 - 0.5		
Potassium	~	1.07		
	76	15.2		
ourrey range of average				
Calcium	%	1.30		
survey range or average		1-3		
Magnesium	%	0.20		
survey range or average		0.3 - 1.5		
C a dlama		44044		
Soaium	ppm	11041		
Zinc	ppm	56		
survey range or average		25 - 100		
Iron	DDD	29		
survey range or average	PP····	40 - 300		
Copper	ppm	12		
survey range or average		0 - 00		
Mangenese	ppm	286		
survey range or average		30 - 150		
Sulfur	000	1865		
survey range or average	ppin	1005		
Boron	ppm	65		
survey range or average		30 - 100		
Nitrate-N	ppm			

Results reported on a 100% dry matter basis

For more information visit: http://colligation.tom/.adv. the inhoration/ website

Sample Date 6/28/2017

Subfield

		Very Low	Low	Optimum	High	Excessive	
Total N	0.72						N-Pact 1.5 gl/A or Awaken 2 qts/A
Total P	0.07						Quick Ultra + Awaken 3 qts/A or Black Label Zn 1.5
Total K	1.17						LoKomotive 2 to 4 qts/A
Macronutri	ents	Very Low	Low	Optimum	High	Excessive	
Ca	2.97						Optimum level
Mg	0.45						Fullback 1 to 3 pts/A
Na	0.12						Questionable
S	0.09						ReNForce K 1 gl/A or CATS 1 gl/A
Micronutri	ents	Very Low	Low	Optimum	High	Excessive	
Zn-ppm	61.00						Optimum level
Mn-ppm	108.00						Optimum level
Fe-ppm	64.00						Optimum level
Cu-ppm	35.00						Monitor Level
B-ppm	27.00						Borosol 1 qt/A or BoMnZn 5-10 oz/A
Petioles	s	Very Low	Low	Optimum	High	Excessive	

Very Low or Problem	Comments:
Low	
Optimum	
High	
Very High	

Analytical data provided by Waypoint Analytical Inc.. Recommendations provided in this report are proprietary in nature whereby nutrient thresholds used as a reference may or may not match Waypoint Analytical Inc. ranges for this particular crop and growth stage.

Sample Date 5/7/2018

Subfield

		Very Low	Low	Optimum	High	Excessive	
Total N	1.15						N-Pact 1.5 gl/A or Awaken 2 qts/A
Total P	0.30						Quick Ultra + Awaken 2 qts/A or Black Label Zn 1 g
Total K	1.98						Optimum level
Macronutri	ents	Very Low	Low	Optimum	High	Excessive	
Ca	2.22						Optimum level
Mg	0.21						Fullback 3 to 6 pts/ A
Na	0.09						Questionable
S	0.15						ReNForce K 1 gl/A or CATS 1 gl/A
Micronutrie	ents	Very Low	Low	Optimum	High	Excessive	
Zn-ppm	55.00						Optimum level
Mn-ppm	78.00						Optimum level
Fe-ppm	18.00						Pro Iro 5 2-3 qts
Cu-ppm	12.00						Optimum level
B-ppm	41.00						Optimum level
Petioles	5	Very Low	Low	Optimum	High	Excessive	

Very Low or Problem	Comments:
Low	App Note: Large section
Optimum	
High	
Very High	

Analytical data provided by Waypoint Analytical Inc.. Recommendations provided in this report are proprietary in nature whereby nutrient thresholds used as a reference may or may not match Waypoint Analytical Inc. ranges for this particular crop and growth stage.



	GUARANTEED ANALYSIS
Total Nitrogen (N)	6.00%
6.00% Ammoniacal Nitrogen	
Sulfur (S)	
3.0% Combined Sulfur (S)	
Iron (Fe)	5.00%
5.0% Chelated Iron (Fe)	

Derived from: Anhydrous Ammonia and Ferrous Sulfate. Chelated with Citric Acid and EDTA (Ethylenediaminetetraacetic acid).

KEEP OUT OF REACH OF CHILDREN CAUTION

Density: 10.60 lbs/Gallon @ 68° F. Net Contents: 2.5 Gallons (9.46 liters) Net Weight: 26.50 lbs. (12.02 kg)

GUARANTEED BY: LOVELAND PRODUCTS, INC.[®] + P.O. BOX 1286, GREELEY, COLORADO 80632-128



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Application Guide



GUARANTEED ANALYSIS

Soluble Calcium (Ca)	6%
Combined Sulfur (S)	10%

Plant Nutrient Sources:

Soluble Calcium: Calcium Thiosulfate, Sulfur: Calcium Thiosulfate

Density:

Lbs. per Gallon @ 60°F	10.43
Gallons per Ton	191.75



A Nitrogen and Potassium Fertilizer Solution Containing Sulfur for Application to Agronomic Crops

GUARANTEED ANALYSIS	94
3.33% Urea Nitrogen	10
Soluble Potash (K ₂ 0)	96 92
13% Combined Sulfur (S)	
Derived from: urea, urea triazone and potassium thiosulfate.	
*1 67% cloudy available nitrogen from uses triazone solution	
1.07 % slowny available hill ogen nom brea-triazone solution.	
Chlorine, not more than	%
KEEP OUT OF REACH OF CHILDREN	
CAUTION	
	F1548
0 21077 78268 2	
Density: 11.70 lbs/Gallon @ 68°F	R
Net Contents: 2.5 Gallons (9.46 liters)	Loveland
Net Weight: 29.25 lbs. (13.27 kg)	PRODUCTS
GUARANTEED BY:	
LUVELAND PRODUCTS, INC.** P.O. BOX 1286, GREELET, COLORADO 80632-1285	



GUARANTEED ANALYSIS

Magnesium (Mg)

.....6.00%

Derived from: Magnesium Acetate.

KEEP OUT OF REACH OF CHILDREN CAUTION

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GENERAL INFORMATION

Fullback® 6% Magnesium is generally compatible with most pesticides and fertilizer solutions. Add to water before adding pesticides. Test for compatibility by means of a jar test prior to large scale tank mixing. Fullback 6% Magnesium is intended for use as a plant nutrient supplement for the correction of magnesium deficiencies. Fullback 6% Magnesium is intended for use on all agricultural, horticultural and ornamental crops that require and respond to magnesium nutritional supplements. Fullback 6% Magnesium is to be applied directly to the soil as a spray or through drip or injection systems, or foliar application through conventional, low-volume, or aerial sprayers. Fullback 6% Magnesium is compatible with a wide range of fertilizer materials, pesticides, herbicides and fungicides. Fullback 6% Magnesium may be formulated into NPK fertilizers as a source of magnesium. This product should be stored in a cool, dry area out of direct sunlight. NOTE: When used as directed this product does not supply all nutrients required by plants and is to supplement a soil fertility program based on soil tests.

FOR COMMERCIAL OR PROFESSIONAL USE ONLY



Density: 10.16 lbs/Gallon @ 68°F Net Contents: 21/2 Gallons (9.46 liters) Net Weight: 25.4 lbs. (11.52 kg)



fulback_L0711

Guaranteed By: LOVELAND PRODUCTS, INC.® + P.O. BOX 1286, Greeley, COLORADO 80632-1286

ANAKEN 16-0-2

MULTI-PURPOSE FERTILIZER ADDITIVE FOR USE ON MANY CROPS

GUARANTEED ANALYSIS

Total Nitrogen (N) 5.7% Ammoniacal Nitrogen	
3.4% Nitrate Nitrogen	
6.9% Urea Nitrogen	
Soluble Potash (K.O)	
Boron (B)	0.02%
Copper (Cu)	0.15%
0.15% Chelated Copper (Cu)	
Iron (Fe)	0.15%
0.15% Chelated Iron (Fe)	
Manganese (Mn)	0.15%
0.15% Chelated Manganese (Mn)	
Molybdenum (Mo)	0.0006%
Zinc (Zn)	
0.15% Chelated Zinc (Zn)	

Derived From: Urea Ammonium Nitrate, Anhydrous Ammonia, Potassium Nitrate, Sodium Borate, Copper Citrate, Iron Citrate, Manganese Citrate, Sodium Molybdate, Zinc Oxide, Zinc Citrate.

KEEP OUT OF REACH OF CHILDREN CAUTION

See Inside For Additional Precautionary Statements.



Density: 10.20 lbs/Gallon @ 68° F. Liquid Measure: 21/2 Gallons (9.46 liters) Net Weight: 25.50 lbs. (11.6 kg) Loveland

F1548

AWAKEN_A1612rev

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N-Pact.

26-0-0

GUARANTEED ANALYSIS

Total Nitrogen (N)..... 17.40% Urea Nitrogen 8.60% Other Water Soluble Nitrogen*

Derived From: Urea and Urea-Triazone Solution

*8.60% Slowly Available Nitrogen from Urea-Triazone Solution.

KEEP OUT OF REACH OF CHILDREN

F1548



Density: 10.09 lbs/Gallon @ 68° F Net Contents: 21/2 Gallons (9.46 liters) Net Weight: 25.23 lbs.





26.00%



DENSITY: 11.64 LBS/GALLON @ 68° F. LIQUID MEASURE: 2.5 GALLONS (9.46 LITERS) NET WEIGHT: 29.1 LBS. (13.19 KG)

s or clothing. GUARANTEED BY: LOVELAND PRODUCTS, INC.® P.O. BOX 1286 GREELEY, CO 80632-1286

NING

Harmful if swallowed. Avoid contact with skin, eyes or clothing.

QuickUltraAwaken_10414

Black Label[®] Zn 6-20-0 0.77 Zn

GUARANTEED A	GUARANTEED ANALYSIS	
Total Nitrogen (N)		
5.00% Ammoniacal Nitrogen		
0.30% Nitrate Nitrogen		
0.70% Urea Nitrogen		
Available Phosphate (P.O.)		
Zinc (Zn)		
0.77% Water Soluble Zinc (Zn)	111	

Derived From: Anhydrous Ammonia, Urea-Ammonium Nitrate Solution, Phosphoric Acid and Zinc Sulfate

ALSO CONTAINS NON-PLANT FOOD INGREDIENT: SOIL AMENDING INGREDIENTS:

7.1% Humic Acids derived from Leonardite ore. 92.9% Other Ingredients

KEEP OUT OF REACH OF CHILDREN CAUTION

21077 88889

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FOR COMMERCIAL OR PROFESSIONAL USE ONLY

Density: 11.00 lbs/Gallon @ 68° F Net Contents: 21/2 Gallons (9.46 liters) Net Weight: 27.50 lbs.

BlacklabelZn_C3112

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