Soil Investigations and Site Evaluation for Vineyard Suitability

Eide Farm 217 Acres
Liberty Road, Salem Hills
Salem, Oregon

May 22, 2017

By: Andy Gallagher, Red Hill Soils
Corvallis, Oregon

Andy Gallagher, Soil Scientist PO Box 2233 Corvallis, OR 97333
Red Hill Soils
541-745-7878 avg@redhillsoil.com

INTRODUCTION

This report provides more detailed site and soil information on the vineyard suitability of the Eide Farm 217 acres on Liberty Road in the South Salem Hills (Figure 1).

Detailed soil mapping in other vineyards of the Willamette Valley has demonstrated that soils are much more diverse than they are at the scale of the county soil survey. Soil diversity and soil quality within the vineyard can profoundly affect wine grape management and quality. Precision maps of relevant soil properties are needed to evaluate the potential of a site as a vineyard and later to support decision making in existing and new plantings and to meet the intensive management associated with wine grape production.

This soil mapping project was done to evaluate the soils and terrain on this farm for their suitability as future vineyards. Terrain was evaluated based on slope, aspect and elevation and soils were sampled from soil borings to evaluate existing soil mapping and to revise soil classification and soil maps based on these new findings. The new soil map provides precise soil sample locations using GPS and reports results and soil interpretations relevant to the suitability of the soils for vineyards.

Soil investigations included transects of the property to sample soil profiles in order to classify soils, record soil drainage characteristics, soil depth to bedrock, depth to gravel, surface thickness, soil texture of the surface and the subsoil and other relevant soil properties. The combination of terrain analysis and soil sampling provided information necessary to estimate acreage suitable to high quality vineyards. The soil map produced from this work can be used to give a more detailed and more accurate appraisal of the soils suited to viticulture on this property.

Figure 1. Location of Project Area (shaded green)

BACKGROUND AND METHODS

Previous Soil Mapping

The previous soil survey map from the NRCS showed predominantly moderately deep volcanic Nekia soils (NeB, NeC, NeD and NeE) and small areas of shallow Witzel soils mapped along the north property line and moderately well drained McAlpin soils on the terrace near the pond on the east side. (See NRCS soil map Figure 1A and Figure 1B). The first two letters of the map unit symbol is the soil type and the last capital letter is the slope class (A= nearly level, B =2 to 7%, C= 7 to 12%, D=12 to 20%, E=20 to 30% slopes.)

Figure 2. NRCS Soil map property.

Geology and Terrain

This site is in the South Salem Hills and has the geology of Columbia River Basalt. These are 15 to 17 million year old volcanic rocks. Columbia River Basalt caps some of the best winegrowing areas in Willamette Valley including Dundee Hills and Eola Hills. The elevation, slope gradient and slope aspect for this parcel are well suited to winegrapes. Elevation on the property from 350 to 695 feet m.sl. (Figure 3.) The hillslopes are strongly sloping to very steeply sloping. Slopes are broken up by benches where slopes are not as steep and there are gently sloping terraces on the lower lying part of the property.

The property has a north south trending ridge with two prominent knobs and slopes fall in all four directions from the summit ridge. Slopes that were extremely steep (>30%) as well as those north- facing slopes that are very steep (>20%) are considered to be unsuitable for vineyards (ST in revised soil map).

Figure 3. Topographic map of the property with soil boring locations (25 ft. contour interval).

Soil Mapping and Sampling

Twenty four soil borings were made on the property on the upland ridges, benches and side slopes that are suited to winegrowing. Soil samples are not evenly spaced and this sampling pattern is intended to capture soil variability on the main landscape components. Approximately 111 acres have both soils and terrain well suited to winegrowing. The sampling intensity is about one sample per 5 acres on average of suitable terrain. Borings were made with soil pits about 60 inches deep or to the contact with hard bedrock if shallower.

A brief profile description was made for each soil boring; recording thickness and morphology of soil horizons. Soils were classified according to USDA-Soil Taxonomy. Soil characteristics were compared to the current Official Series Descriptions (OSD's) from the USDA-NRCS. Slopes were classified using a digital elevation model for slope gradient and slope aspect. Soil colors were determined using a Munsell Color Chart. Available water holding capacity (AWHC) for each soil was estimated based on soil textures, structure, coarse fragments, depth to rock and available water retention data for these soil series. Effective rooting depth for each profile was assumed to be that of the deepest observed roots or the lowest depth of distinctive rhizosphere soil morphology.

Precision Sampling

There are several improvements in the revised high intensity (precision) soil information over the previous NRCS soil mapping. More variability was resolved in the precision map than in the previous soil map from NRCS, in which almost all soils were mapped as Nekia soils of varying slope classes. In addition to Nekia, I also classified volcanic soils of the Witzel, Ritner, Gelderman and Jory soil series. All of these soils are well drained and suited to vineyards. A small area of moderately well drained soils with clayey subsoil and soft weathered bedrock are classified as Dupee.

Sampling intensity is much higher in this current project compared to the original soil map and soil boring locations are preserved and embedded in the map. All soil boring locations were recorded with a GPS. Some of the very steep wooded areas and drainage ways were avoided in sampling since these are not well suited to vineyards.

RESULTS

Data from soil borings are presented in Table 2. Soil boring locations are shown on Figures 3 and 4. The soils of cover a wider range of depths, available water holding capacity and vigor potential than was previously shown on the NRCS soil map. All of the soils observed in this sampling are well drained and formed from Columbia River basalt, except for an example of soil formed from clayey alluvium over sedimentary rock. Depth to bedrock is highly variable and ranges from shallow to very deep.

These are the classic Red Hill Soils of the Willamette Valley. This soil association makes up many of the best vineyards in the Salem Hills, Dundee Hills, Eola Hills and Chehalem Mountain. The surface is typically silty clay loam and the subsoil is reddish brown clay. The shallow Witzel soils lack the red clay layer and are brownish black gravelly loam.

This parcel is 227 acres and there are an estimated 111 acres of suitable soils and terrain for planting winegrapes on this property.

This acreage estimate of suitable soils is based on terrain and soil borings, and there may be slightly more or slightly less suitable soil found where soils are mapped in more detail prior to development. Additionally not all the suitable acres will be planted in productive vineyard since there are unproductive acres for roads, lanes staging areas etc. in a typical vineyard and perhaps 10 to 15 percent of suitable ground would be used that way.

Areas excluded from suitable soil estimate are the extremely steep slopes (>30 percent gradient) and steep north aspect slopes (>20 percent gradient and north aspect) (St), narrow drainage ways (Dr) and low lying soils on the east edge of the property next to the reservoir. There is a disturbed soil area on the west side of the parcel where soils have been cut down in places and filled in places overall that amounts to about five

acres. Some of this five-acre area may be regraded and reclaimed but in its current state it is not suitable to planting.

Table 2. Summary soil boring data.

Boring	Soil Name	Surface Thickness (IN)	Depth to Bedrock Cr-Horizon, R-Horizon (IN)	Available Water Holding Capacity (IN)	Notes
1	Jory	16	>60	10	Lower backslope
2	Ritner/Witzel	20	20-R	3	Few roots below 25 in
3	Jory	20	>60	10	10% gravel at 36 to 60
4	Jory	28	>60	10	Very gravelly clay at 48
5	Nekia/Gelderman	15	36-Cr, 41-R	7	Paralithic contact at 36,
6	Gelderman	16	39-Cr	8	red clay fills in paralithic layer
7	Witzel	9	11-R	1	Fractured basalt at 11 in
8	Witzel	14	14-Cr, 30-R	2	Harder lithic layer at 30 inches
9	Ritner	9	24-R	3	Fractured basalt at 24 in
10	Nekia	20	36-R	7	Fractured basalt at 36 in
11	Jory	16	>50	10	
12	Saum	15	44-Cr	8	
13	Jory	16	>60	10	concave-linear
14	Witzel	8	10	1	Just above disturbed area
15	Jory	21	60	10	Soft basalt at 60 in
16	Nekia	18	24-Cr, 36-R	5	Cr with reddish clay, hard basalt at 36 in
17	Jory	27	>60	10	Footslope, thickened surface
18	Jory	16	>60	10	Footslope
19	Gelderman	18	36	7	Crumbly weathered basalt at 36 in
20	Dupee	19	34	7	Weathered siltstone and seasonal perched water table at 34 in
21	Gelderman	9	20	3	Paralithic material at 20 with gravel of vitrified glassy fragments
22	Jory	20	>60	10	
23	Nekia	19	29	5	
24	Nekia	15	26	5	

Precision Soil Map Legend

Vineyard soils formed from basalt

Jr Jory
Nk Nekia-Gelderman
Rt Ritner
Wt Witzel

Vineyard soils formed in sediments

Du Dupee

Non-vineyard soils

W Reservoir
ST Slopes >30 % and north aspect slope >20 percent gradient,
DA Disturbed area, cut and filled needs to be reclaimed

Precision Soil Map Units

Nk – Nekia and Gelderman Soils

Depth to Weathered Basalt Bedrock: 20 to 40 inches to soft bedrock
Depth to Hard Basalt Bedrock: >40 inches
Depth to Seasonally High Water Table: greater than 40 inches and typically greater than 60 inches.
AWHC: 4 to 8 inches
The Nekia series are well drained moderately deep to weathered basalt; they formed in colluvium and residuum from basalt. These soils while having less AWHC than the deeper soils, they are also suited to non-irrigated viticulture. These soils have reddish clay subsoil that is strongly weathered. They differ in the hardness of the basalt underlying. The Nekia has a lithic (hard basalt) contact and the Gelderman soils have a paralithic (strongly weathered basalt soft enough to dig with shovel), and Gelderman also have more water holding capacity typically. The Nekia soils make excellent winesoils with moderate vigor potential and provide growers the flexibility to grow under dry farming or irrigation management.

Jr – Jory Soils

Depth to Weathered Basalt Bedrock: Greater than 60 inches
Depth to Hard Basalt Bedrock: Greater than 60 inches
Depth to Seasonally High Water Table: greater than 60 inches and typically greater than 60 inches
AWHC: 9 to 10 inches
Previously there were no Jory soils mapped on this parcel, but there is significant acreage of very deep red soils here. The Jory series consists of very deep, well drained soils that formed in colluvium and residuum from basalt. Jory soils produce higher vine vigor than the shallower basaltic soils. These are the classic Red Hill Soils that make excellent winesoils. These soils because of their great depth and high water holding capacity can produce high vine vigor without irrigation. Devigorating rootstocks and

competition from cover crops can be used to help control vigor. The surface thickness is typically 12 to 20 inches and has high organic matter. Care should be taken in development to keep soils on slopes protected from winter rainfall. This map unit includes some deep well drained soils like Saum.

Rt —Ritner Soils
Depth to Weathered Basalt Bedrock: 20 to 40 inches to soft bedrock
Depth to Hard Basalt Bedrock: >40 inches
Depth to Seasonally High Water Table: greater than 40 inches and typically greater than 60 inches. AWHC: 4 to 7 inches
The Ritner series is similar to Nekia in that they are well drained moderately deep to weathered basalt; they formed in colluvium and residuum from basalt. Ritner is distinctive among the basalt derived soils in being very gravelly in the surface to extremely gravelly in the subsoil and therefore Ritner has less AWHC than Nekia and Ritner has more rapid internal drainage. On this site the Ritner soils are very cobbly and extremely stony. While having potential to produce excellent wines, grapevines grown on these soils may show stress at droughty times and while they can be grown without irrigation they are often irrigated for vineyards.

Wt-- Witzel Soils
Depth to Hard Basalt Bedrock: 12 to 20 inches to fractured basalt bedrock
Depth to Seasonally High Water Table: greater than 40 inches and typically greater than 60 inches. AWHC: 2 to 4 inches
The Witzel series is well to somewhat excessively drained and shallow to hard fractured basalt. The surface is gravelly and cobbly loam and clay loam. These soils have low AWHC and yield lower vine vigor. Winegrapes grown on these soils commonly show stress at droughty times and while they can be grown without irrigation they are often irrigated for vineyards. In some Witzel soils with proper rootstock selection grape roots grow deep into the fractured rock. These shallow low vigor potential soils are sought after by some growers and winemakers who have recognized their potential for making great wines when properly managed.

Dr -- Drainage way
These are swales is where concentrated winter flow can occur and these areas are not recommended for vineyard blocks. This unit includes short steep slopes along the drainage way.

ST-- Excessive slope (>30 percent) and North aspect very steep slope (>20 percent gradient) This 30 percent slope gradient is too steep and 20 percent on a north aspect is too cool for growing winegrapes in Willamette Valley. Because of poor sun angle fruit does not consistently ripen and is of poorer quality.

Table 2. Acreage of vineyard soil by soil map unit

Soil Map Unit	Soil Name	Acres
Du	Dupee	2
Jr	Jory	58
Nk	Nekia	40
Rt	Ritner	5
Wt	Witzel	6

Depth to Weathered Bedrock (Cr-horizon) and Depth to Hard Basalt Bedrock (R horizon)

There is a distinction made on the depth to soft weathered bedrock (Cr-horizon) and to hard basalt bedrock (R-horizon) (Tables 1A and 1B). Many soils have a contact with soft weathered rock and then below the rock is much harder. Basaltic soils in this region are classified on the depth to these layers. The Gelderman soil is moderately deep (20 to 40 in) to weathered paralithic basalt (Cr), Saum is deep (40 to 60 in) and Jory is very deep (>60 in) to bedrock. Nekia, Ritner and Parrett are moderately deep to a lithic or hard basalt layer, and Witzel soils are shallow to hard fractured basalt. Generally the softer bedrock will allow rooting and will offer some available water holding capacity. The harder rocks restrict roots and water holding capacity to soil filled fissures and cracks. The jointing of Columbia River basalt is in columns with fissures that are oriented vertically as well as horizontally, so roots and water can move into this space.

The Cr-horizon of Gelderman and Saum soils retains rock structure and appearance but the rocks are soft enough to be dug into with hand tools. Root presence in a Cr-horizon was determined by presence of roots in boring samples or by presence of soil morphology that is indicative of the roots, such as abundant illuvial clay films and organic coatings in the rock fissures. The soils with hard basalt are generally well fractured to allow roots to penetrate deeply. Depth to bedrock affects the total rooting volume of the soil and hence also affects the available water holding capacity.

Available Water Holding Capacity (AWHC)

The AWHC values reported are the AWHC in the upper five feet of soil and represents an estimate of the water that can be stored in the soil profile that is available for plant uptake, which is the amount of water held between field moisture capacity and the permanent wilting point (reported in inches of water). For very deep soils like Jory, where grapevine roots extend below sixty inches this AWHC value is an underestimate. The value reported is calculated from a model based on the sum of the weighted average AWHC for each soil horizon, using values reported in the literature and measured soil profile data at each numbered point.

The AWHC is a function of soil depth, texture, organic matter, bulk density, porosity, and soil osmotic potential. Root restricting layers decrease the depth of the soil profile and the AWHC.

Clay soils can hold more “total” water because they have greater pore space at a given bulk density, however because the average pore volume is smaller, clay soils hold a greater proportion water that is unavailable at low soil moisture tensions. Since the majority of grape roots are in the upper soil profile, it can be assumed that the AWHC values for the upper five feet provide a useful relative scale of the variability in water supply available to the vine for the classes used here.

In the NRCS vineyard soil study, conducted in 2001, which included pedons from around the Willamette Valley, the results of water retention measurements for whole soils showed on a volumetric water basis, AWHC values for Jory soils ranged from 0.08 to 0.15 (inches AWHC per inch depth). Organic matter content and silt content are positively correlated with AWHC.

Since the majority of grape roots are in the upper soil profile, it can be assumed that the AWHC values for the upper five feet provide a useful relative scale of the variability in water supply available to the vine for the classes used here.

The Witzel and Ritner soils have the least AWHC and the Jory has the most for soils mapped on this farm. This variability can be addressed with blocking and management practices including can be addressed by combinations of micro-irrigation, vine spacing, use of drought tolerant rootstocks, and managed competition from cover crops and weeds. Soils with higher AWHC can be managed under dry land conditions, and a rootstock selection may favor those that reduce vigor.

Managed competition involves selecting combinations of cover crop mixtures, mowing and tillage options that are suitable to the soil water and soil productivity balance. More vigorous grass cover crops can help reduce water available to vines in deep soils, and in droughty soils less competitive cover crops may be more appropriate and alternate row tillage can be used to further reduce competition. Mulching in the vine row will help conserve soil moisture and may be especially useful on all soils in the establishment year before vines have put down a deep root system.

Soil Drainage

The soils sampled on this property are overall well drained. There is one spot where the Dupee like soils are mapped where there is a seasonal water table at about 34 inches. This is a small area that is probably not worth artificially draining. Drainage lines can be installed here to lower the water table and The terrace on the east side near the reservoir was not sampled since it is low lying and the McAlpin soil mapped there by NRCS is moderately well drained. Vineyards should not be planted in the bottoms of drainage ways since short term concentrated flows of surface runoff can cause severe erosion. A couple soils had evidence of perched water tables at a depth

of >40 inches so they are still considered well drained. This determination made by soil morphology indicating fluctuating water table during the winter rainy season is not restrictive for winegrapes, and does not need artificial drainage.

Soil Quality and Soil Conservation

Soil quality involves managing the physical, chemical and biological components of the soil towards the goal of overall soil health. Healthy soil has an active and healthy biotic community; it has good tilth and nutrient balance. Tilth is defined as the physical condition of the soil relative to ease of tillage, its suitability as a seedbed and its impedance to seedling emergence and root penetration. Organic soil amendments and additions of calcium as either lime or gypsum can improve soil aggregation, tilth and nutrient status of the soil and can stimulate the biotic community.

In general soils here have good tilth. The exception is the area where soils are disturbed and have been scraped to subsoil in some cases and filled in others.

Since the deeper soils have more potential for vigor more aggressive use of cover crops can be used.

Historical records for the Willamette Valley have documented the potential for severe erosion on foothill soils where soils were left unprotected or with poorly established vegetation in the winters when large runoff events occurred. These severe erosion events can be triggered by intense rain falling on saturated or frozen soils, or by rain on snow events. Such conditions may only have a calculated return period of 10 or 20 years, but if a grower is caught with sloping bare ground at such an unfortunate time, a lifetime's worth of soil development can be lost in one year. Soil loss rates from 10 to 100 tons $acre^{-1}$ $year^{-1}$ have been recorded for such events in the Willamette Valley.

Therefore it is critical to protect these soils from erosion. Cover crops are typically used to control erosion. Various cover crop mixes are available to provide both cover and suitable level of competition with wine grapes.

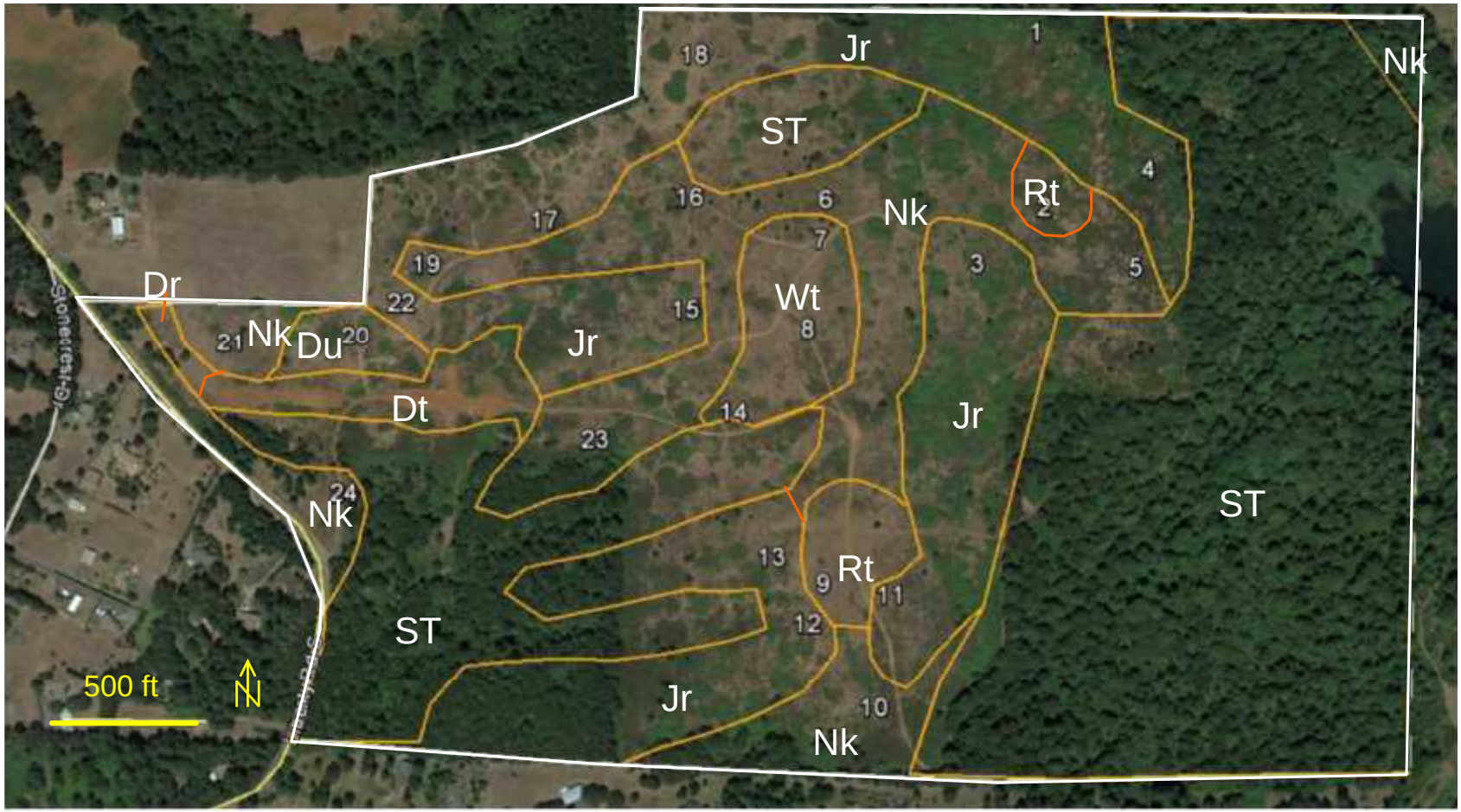
Soil Nutrient Analysis

Samples from two soil borings at two depths both surface and subsoil were collected and sent to the lab for chemical analysis and to get recommendations for soil amendments. These results are attached to the report. The soil nutrient profile for this site is fairly typical for volcanic Willamette Valley foothill soils. These soils have high organic matter levels, 7 percent and 4 percent in the surface and are very strongly to extremely acidic with low to very low phosphorus and calcium. They need lime and gypsum prior to planting. Two to four tons of lime are recommended and a ton of gypsum as well.

Table 3. Soil Boring Locations

Boring	Latitude N	Longitude W
1	44.817338	-123.040674
2	44.815713	-123.040487
3	44.815167	-123.041339
4	44.816100	-123.039137
5	44.815188	-123.039257
6	44.815712	-123.043362
7	44.815335	-123.043411
8	44.814502	-123.043536
9	44.812627	-123.043211
10	44.810977	-123.042489
11	44.812047	-123.042319
12	44.811750	-123.043411
13	44.812355	-123.043906
14	44.813685	-123.044476
15	44.814643	-123.045157
16	44.815685	-123.045162
17	44.815423	-123.047052
18	44.817008	-123.045161
19	44.814975	-123.048584
20	44.814278	-123.049472
21	44.814173	-123.051104
22	44.814608	-123.048891
23	44.813383	-123.046275
24	44.812805	-123.049552

Figure 4. Precision soil map and soil borings (1-24) locations



A & L WESTERN AGRICULTURAL LABORATORIES

10220 SW NIMBUS AVE Bldg K-9 I PORTLAND OREGON 97223 I (503) 968-9225 I FAX (503) 598-7702

REPORT NUMBER: 17-125-112

CLIENT NO: 4249

SEND TO: RED HILL SOILS
PO BOX 2233
CORVALLIS, OR 97339

SUBMITTED BY: ANDY GALLAGHER

GROWER: EIDE

DATE OF REPORT: 05/12/17

SOIL ANALYSIS REPORT

SAMPLE ID	LAB NUMBER	Organic Matter		Phosphorus		Potassium	Magnesium	Calcium	Sodium	pH		Hydrogen	Cation Exchange Capacity	PERCENT CATION SATURATION (COMPUTED)				
		* % Rating	** ENR lbs/A	P1 (Weak Bray) **** * ppm	$NaHCO_3$-P (OlsenMethod) **** * ppm	K ***** * ppm	Mg *** * ppm	Ca *** * ppm	Na *** * ppm	Soil pH	Buffer Index	H meq/100g	C.E.C. meq/100g	K %	Mg %	Ca %	H %	Na %
10A	59672	7.8VH	185	9L	6**	22	115	383	15	5.1	5.7	1.8	4.8	1.2	19.7	39.8	38.0	1.3
19A	59673	7.5VH	180	11L	10**	131H	87M	622L	8VL	5.4	5.7	1.7	5.9	5.7	12.3	52.9	28.5	0.6

** NaHCO3-P unreliable at this soil pH

SAMPLE NUMBER	Nitrogen NO_3-N ppm	Sulfur SO_4-S ppm	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Excess Lime Rating	Soluble Salts mmhos/cm	Chloride Cl ppm		PARTICLE SIZE ANALYSIS			
												SAND %	SILT %	CLAY %	SOIL TEXTURE
10A	11L	16M	0.6L	20H	21H	0.9M	0.2VL	L	0.1VL						
19A	3VL	10L	5.7H	11M	35VH	0.6L	0.2VL	L	0.1VL						

* CODE TO RATING: VERY LOW (VL), LOW (L), MEDIUM (M), HIGH (H), AND VERY HIGH (VH).
** ENR - ESTIMATED NITROGEN RELEASE
*** MULTIPLY THE RESULTS IN ppm BY 2 TO CONVERT TO LBS. PER ACRE OF THE ELEMENTAL FORM
**** MULTIPLY THE RESULTS IN ppm BY 4.6 TO CONVERT TO LBS. PER ACRE P_2O_5
***** MULTIPLY THE RESULTS IN ppm BY 2.4 TO CONVERT TO LBS. PER ACRE K_2O
MOST SOILS WEIGH TWO (2) MILLION POUNDS (DRY WEIGHT) FOR AN ACRE OF SOIL 6-2/3 INCHES DEEP

This report applies only to the sample(s) tested. Samples are retained a maximum of thirty days after testing.

Rogell Rogers, CCA, PCA
A & L WESTERN LABORATORIES, INC.

A & L WESTERN AGRICULTURAL LABORATORIES

10220 SW NIMBUS AVE Bldg K-9 I PORTLAND OREGON 97223 I (503) 968-9225 I FAX (503) 598-7702

REPORT NUMBER: 17-125-113

CLIENT NO: 4249

SEND TO: RED HILL SOILS
PO BOX 2233
CORVALLIS, OR 97339

SUBMITTED BY: ANDY GALLAGHER

GROWER: EIDE

DATE OF REPORT: 05/11/17

SOIL ANALYSIS REPORT

SAMPLE ID	LAB NUMBER	Organic Matter		Phosphorus		Potassium	Magnesium	Calcium	Sodium	pH		Hydrogen	Cation Exchange Capacity	PERCENT CATION SATURATION (COMPUTED)				
		* % Rating	** ENR lbs/A	P1 (Weak Bray) **** * ppm	$NaHCO_3$-P (OlsenMethod) **** * ppm	K ***** * ppm	Mg *** * ppm	Ca *** * ppm	Na *** * ppm	Soil pH	Buffer Index	H meq/100g	C.E.C. meq/100g	K %	Mg %	Ca %	H %	Na %
10B	59674	4.0H	109	2VL	5**	12VL	128M	687L	17L	5.7	6.5	1.2	5.8	0.5	18.1	59.1	21.0	1.2
19B	59675	4.7H	124	6VL	16**	28L	246VH	592L	17L	5.4	6.2	2.0	7.2	1.0	28.2	41.3	28.5	1.0

** NaHCO3-P unreliable at this soil pH

SAMPLE NUMBER	Nitrogen NO_3-N ppm	Sulfur SO_4-S ppm	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Excess Lime Rating	Soluble Salts mmhos/cm	Chloride Cl ppm		PARTICLE SIZE ANALYSIS			
												SAND %	SILT %	CLAY %	SOIL TEXTURE
10B	2VL	46VH	0.1VL	6M	4VL	0.3VL	0.1VL	L	0.1VL						
19B	1VL	55VH	0.1VL	2L	7L	0.2VL	0.1VL	L	0.1VL						

* CODE TO RATING: VERY LOW (VL), LOW (L), MEDIUM (M), HIGH (H), AND VERY HIGH (VH).
** ENR - ESTIMATED NITROGEN RELEASE
*** MULTIPLY THE RESULTS IN ppm BY 2 TO CONVERT TO LBS. PER ACRE OF THE ELEMENTAL FORM
**** MULTIPLY THE RESULTS IN ppm BY 4.6 TO CONVERT TO LBS. PER ACRE P_2O_5
***** MULTIPLY THE RESULTS IN ppm BY 2.4 TO CONVERT TO LBS. PER ACRE K_2O
MOST SOILS WEIGH TWO (2) MILLION POUNDS (DRY WEIGHT) FOR AN ACRE OF SOIL 6-2/3 INCHES DEEP

Rogell Rogers, CCA, PCA
A & L WESTERN LABORATORIES, INC.

A & L WESTERN AGRICULTURAL LABORATORIES

10220 SW NIMBUS AVE Bldg K-9 I PORTLAND OREGON 97223 I (503) 968-9225 I FAX (503) 598-7702

REPORT NUMBER: 17-125-112 **CLIENT:** 4249

SUBMITTED BY: ANDY GALLAGHER

SEND TO: RED HILL SOILS
PO BOX 2233
CORVALLIS, OR 97339

GROWER: EIDE

DATE OF REPORT: 05/12/17

SOIL FERTILITY GUIDELINES

RATE: lb/acre **PAGE:** 1

Sample ID	Lab Number	Crop	SOIL AMENDMENTS				Nitrogen N	Phosphate P_2O_5	Potash K_2O	Magnesium Mg	Sulfur SO_4-S	Zinc Zn	Manganese Mn	Iron Fe	Copper Cu	Boron B
			Dolomite	Lime	Gypsum	Elemental Sulfur										
10A	59672	WINEGRAPES		9999				180	300		10	10				2.0
19A	59673	WINEGRAPES	9999				10	160	90		10					2.0

COMMENTS

LIME REQUIREMENT: Liming may be necessary if buffer index is less than 6.9. Guidelines are based upon common agricultural lime (100-score) per six-inch depth to raise SOIL pH to about 6.5. You may want to split high lime requirements over more than one year if you are unable to adequately incorporate the material.

GRAPES: Minimize nitrogen applications prior to bloom, then apply through berry-set, and again immediately post-harvest. Later applications are not advised.

NITROGEN: Use local conditions and experience with variety to determine rates and timing. Allow for nitrate levels in your water source also (ppm NO3 X 0.61 = lb N/ac-ft water). Monitor tissue-N.

SULFATE-SULFUR: Low soil levels may cause yellowing and lack of vigor. Maintain above 15 to 20 ppm to guard against deficiencies. Although, sulfates may have leached below sampling depth.

NOTES:

Rogell Rogers, CCA, PCA
A & L WESTERN LABORATORIES, INC.