

## Supplemental Data for:

Ledderhof D, Reynolds AG, Brown R, Jollineau M and Kotsaki E. 2017.

Spatial variability in Ontario Pinot noir vineyards: Use of geomatics and implications for precision viticulture.

Am J Enol Vitic 68:151-168. doi: 10.5344/ajev.2016.16062.

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**Supplemental Table 1** Summary statistics of harvest components, grape composition, and vineyard soil variables for the Red Paw 1 Pinot noir vineyard, St. Davids, ON, in 2008 and 2009.

Variable <sup>a</sup>	Year	Median	Max	Min	CV (%)	Spread <sup>b</sup>
Yield (kg/vine)	2008	2.80	5.48	0.75	38.5	169.4
	2009	2.52	4.67	0.57	37.2	162.7
Cluster weight (g)	2008	107.2	177.9	63.3	17.8	107.0
	2009	100.9	139.4	64.6	15.7	74.2
Berry weight (g)	2008	1.69	1.98	1.22	9.1	45.3
	2009	1.53	1.81	1.10	9.2	46.3
Soluble solids (Brix)	2008	21.4	24.2	15.8	7.5	39.3
	2009	22.9	25.6	17.7	6.9	34.5
Berry pH	2008	3.58	3.73	3.44	1.6	7.9
	2009	3.54	3.64	3.40	1.6	6.9
TA (g/L)	2008	9.1	10.7	6.5	8.0	46.0
	2009	9.8	12.8	8.2	8.4	47.0
Vine size (kg)	2008	0.41	0.88	0.06	39.4	200.8
	2009	---	---	---	---	---
Crop load	2008	7.72	58.35	1.33	84.2	739.0
	2009	---	---	---	---	---
Total anthocyanins (mg/L)	2008	257.0	371.4	186.9	17.9	71.8
	2009	346.4	475.5	191.4	16.1	82.0
Total phenols (mg/L)	2008	1743	2609	880.0	17.2	99.2
	2009	2387	3048	1779	11.5	53.2
Color	2008	9.43	13.91	7.09	17.0	72.3
	2009	9.98	13.04	5.83	14.5	72.2
Hue	2008	0.63	0.74	0.51	6.5	37.1
	2009	0.56	0.63	0.51	4.9	21.9
Mean soil moisture (%)	2008	12.7	20.7	10.1	14.1	83.7
	2009	10.3	14.8	7.1	15.5	75.1
Mean leaf $\psi$ (MPa)	2008	-0.79	-0.73	-0.86	5.6	17.7
	2009	-0.82	-0.71	-0.95	8.5	28.9
Clay (%)	2008	37.0	45.0	33.0	8.9	32.4
Sand (%)	2008	6.5	12.0	1.0	49.0	169.2
Silt (%)	2008	56.5	63.0	49.0	6.6	24.8
OM (%)	2008	2.4	5.2	1.4	36.8	158.3
CEC (mEq/100 g)	2008	16.1	27.9	13.8	21.8	87.6
Soil pH	2008	5.6	7.2	5.0	10.9	39.6

<sup>a</sup>TA, titratable acidity; OM, organic matter; CEC, cation exchange capacity; CV, coefficient of variation.

<sup>b</sup>Spread is defined as the range (max-min) divided by the median, expressed as a percent (Bramley 2005).

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**Supplemental Table 2** Summary statistics of harvest components, grape composition, and vineyard soil variables for the Red Paw 2 Pinot noir vineyard, St. Davids, ON, in 2008 and 2009.

Variable <sup>a</sup>	Year	Median	Max	Min	CV (%)	Spread <sup>b</sup>
Yield (kg/vine)	2008	2.61	5.38	0.48	43.1	188.0
	2009	2.32	3.90	0.35	33.8	153.1
Cluster weight (g)	2008	94.9	127.7	62.0	16.6	69.1
	2009	106.6	141.4	58.2	15.3	78.1
Berry weight (g)	2008	1.65	2.03	1.15	12.0	53.5
	2009	1.67	2.00	1.25	8.0	45.0
Soluble solids (Brix)	2008	21.8	24.3	17.7	7.3	30.3
	2009	23.9	25.7	20.6	4.4	21.3
Berry pH	2008	3.62	3.78	3.48	1.8	8.2
	2009	3.65	3.81	3.46	2.0	9.6
TA (g/L)	2008	7.9	9.3	7.0	5.8	29.1
	2009	8.1	9.4	7.1	5.8	27.7
Vine size (kg)	2008	0.29	0.71	0.06	45.1	221.3
	2009	---	---	---	---	---
Crop load	2008	8.42	49.66	1.66	76.9	570.3
	2009	---	---	---	---	---
Total anthocyanins (mg/L)	2008	288.1	416.4	170.2	19.2	85.5
	2009	383.9	465.2	279.8	10.4	48.3
Total phenols (mg/L)	2008	1582	2516	798.1	17.5	108.6
	2009	2014	2948	1433	17.8	75.2
Color	2008	10.45	14.78	6.63	17.3	78.0
	2009	7.86	10.44	5.64	12.2	61.1
Hue	2008	0.64	0.96	0.51	11.1	69.3
	2009	0.68	0.76	0.61	4.0	21.3
Mean soil moisture (%)	2008	12.6	17.6	9.8	12.2	61.4
	2009	10.6	13.2	8.5	10.1	44.1
Mean leaf $\psi$ (MPa)	2008	-0.81	-0.76	-0.88	3.6	15.4
	2009	-0.77	-0.65	-0.85	7.5	26.3
Clay (%)	2008	38.0	51.0	30.0	16.8	55.3
Sand (%)	2008	6.0	24.0	1.0	80.8	383.3
Silt (%)	2008	54.0	67.0	44.0	9.4	42.6
OM (%)	2008	3.7	5.4	2.7	20.9	73.0
CEC (mEq/100 g)	2008	17.6	28.6	15.6	20.3	73.9
Soil pH	2008	6.4	7.4	5.8	7.7	25.0

<sup>a</sup>TA, titratable acidity; OM, organic matter; CEC, cation exchange capacity; CV, coefficient of variation.

<sup>b</sup>Spread is defined as the range (max-min) divided by the median, expressed as a percent (Bramley 2005).

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**Supplemental Table 3** Summary statistics of harvest components, grape composition, and vineyard soil variables for the Black Paw Pinot noir vineyard, St. Davids, ON, in 2008 and 2009.

<b>Variable<sup>a</sup></b>	<b>Year</b>	<b>Median</b>	<b>Max</b>	<b>Min</b>	<b>CV (%)</b>	<b>Spread<sup>b</sup></b>
Yield (kg/vine)	2008	1.09	3.88	0.12	65.0	344.5
	2009	2.51	5.08	1.00	29.2	163.0
Cluster weight (g)	2008	72.5	107.1	43.8	22.5	87.3
	2009	103.5	170.6	40.6	21.8	125.6
Berry weight (g)	2008	1.50	1.89	1.04	12.0	56.4
	2009	1.39	1.69	1.03	9.1	46.8
Soluble solids (Brix)	2008	22.6	27.5	17.9	6.8	42.5
	2009	22.9	25.1	17.2	7.8	34.6
Berry pH	2008	3.60	3.70	3.46	1.5	6.8
	2009	3.58	3.74	3.45	1.8	8.1
TA (g/L)	2008	8.6	12.3	7.4	10.2	56.5
	2009	7.8	9.2	0.6	14.3	110.3
Vine size (kg)	2008	0.29	0.82	0.06	57.2	261.5
	2009	---	---	---	---	---
Crop load	2008	3.37	17.2	0.77	78.2	487.3
	2009	---	---	---	---	---
Total anthocyanins (mg/L)	2008	358.9	613.3	234.5	17.6	105.5
	2009	296.3	416.7	194.5	13.9	75.0
Total phenols (mg/L)	2008	2091	3039	1595	12.5	69.1
	2009	2002	2556	1450	11.2	55.2
Color	2008	14.46	28.90	9.58	19.9	133.7
	2009	8.03	11.46	5.21	15.3	77.9
Hue	2008	0.57	0.86	0.37	12.6	84.7
	2009	0.58	0.66	0.45	6.1	36.1
Mean soil moisture (%)	2008	29.2	39.3	19.7	17.6	66.9
	2009	25.4	33.1	17.4	15.7	61.8
Mean leaf $\psi$ (MPa)	2008	-0.87	-0.78	-0.94	6.3	18.5
	2009	-0.87	-0.80	-0.93	4.9	14.7
Clay (%)	2008	64.0	68.0	61.0	3.6	10.9
Sand (%)	2008	4.0	6.0	1.0	61.5	125.0
Silt (%)	2008	33.0	36.0	30.0	5.1	18.2
OM (%)	2008	5.1	6.5	3.2	18.4	64.7
CEC (mEq/100 g)	2008	38.8	46.2	34.3	11.6	30.7
Soil pH	2008	7.4	7.5	7.2	1.4	4.1

<sup>a</sup>TA, titratable acidity; OM, organic matter; CEC, cation exchange capacity; CV, coefficient of variation.

<sup>b</sup>Spread is defined as the range (max-min) divided by the median, expressed as a percent (Bramley 2005).

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**Supplemental Table 4** Summary statistics of harvest components, grape composition, and vineyard soil variables for the Lowrey Pinot noir vineyard, St. Davids, ON, in 2008 and 2009.

<b>Variable<sup>a</sup></b>	<b>Year</b>	<b>Median</b>	<b>Max</b>	<b>Min</b>	<b>CV (%)</b>	<b>Spread<sup>b</sup></b>
Yield (kg/vine)	2008	2.60	5.33	0.25	43.9	195.0
	2009	2.72	6.50	0.62	39.8	216.2
Cluster weight (g)	2008	110.3	210.4	45.8	24.1	149.2
	2009	99.8	144.4	62.2	17.0	82.3
Berry weight (g)	2008	1.46	1.72	1.13	8.4	40.8
	2009	1.73	2.14	1.41	8.4	42.3
Soluble solids (Brix)	2008	20.4	22.3	17.4	5.4	24.0
	2009	22.2	23.6	19.4	3.7	18.9
Berry pH	2008	3.47	3.61	3.34	1.5	7.6
	2009	3.55	3.70	3.41	1.7	8.2
TA (g/L)	2008	8.3	9.6	7.1	6.1	30.3
	2009	8.3	11.0	7.5	7.5	41.5
Vine size (kg)	2008	0.60	1.48	0.20	39.0	214.3
	2009	0.68	1.56	0.06	39.4	220.8
Crop load	2008	4.59	11.44	0.59	45.0	236.3
	2009	3.65	12.87	0.84	51.5	329.5
Total anthocyanins (mg/L)	2008	224.1	373.8	150.7	18.6	99.6
	2009	283.8	386.7	173.3	12.1	75.2
Total phenols (mg/L)	2008	1835	3156	1213	16.1	105.9
	2009	2242	2754	1785	9.1	43.2
Color	2008	9.23	14.24	6.85	16.5	80.1
	2009	6.48	8.73	4.70	13.4	62.2
Hue	2008	0.65	0.77	0.53	9.0	37.0
	2009	0.62	0.71	0.57	3.9	22.7
Mean soil moisture (%)	2008	22.5	31.1	15.9	14.9	67.5
	2009	23.3	32.2	14.8	16.3	74.8
Mean leaf $\psi$ (MPa)	2008	-0.72	-0.60	-0.83	9.6	32.0
	2009	-0.78	-0.59	-0.95	12.0	46.9
Clay (%)	2008	40.0	48.0	30.0	13.2	45.0
Sand (%)	2008	11.0	29.0	4.0	50.6	227.3
Silt (%)	2008	48.0	52.0	41.0	7.0	22.9
OM (%)	2008	2.9	4.5	2.0	21.1	86.2
CEC (mEq/100 g)	2008	24.5	37.9	19.9	17.5	73.5
Soil pH	2008	6.7	7.4	6.3	3.8	16.4

<sup>a</sup>TA, titratable acidity; OM, organic matter; CEC, cation exchange capacity; CV, coefficient of variation.

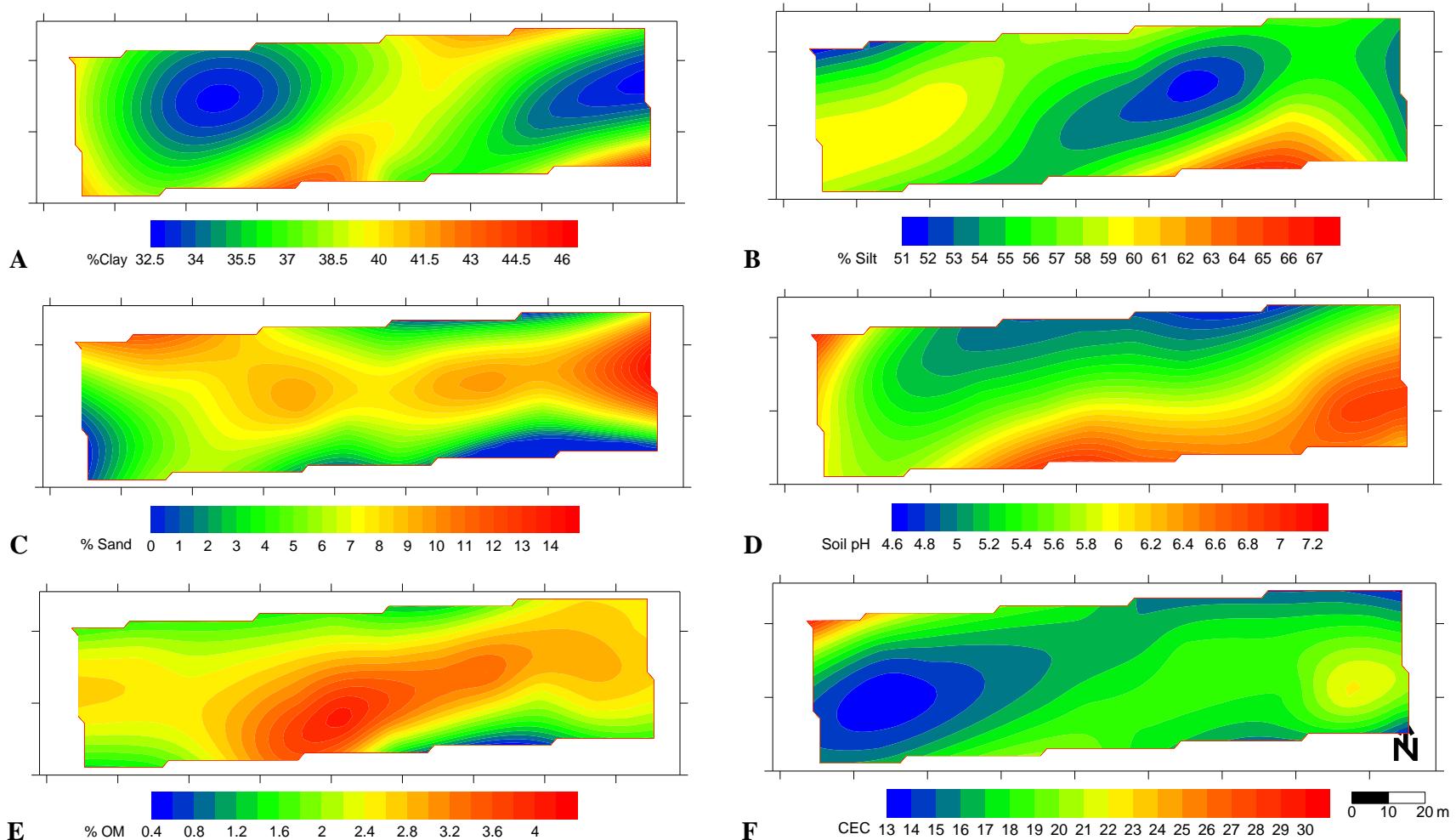
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**Supplemental Figure 1** Soil variables in the Red Paw 1 Pinot noir vineyard, St. Davids, ON, in 2008.

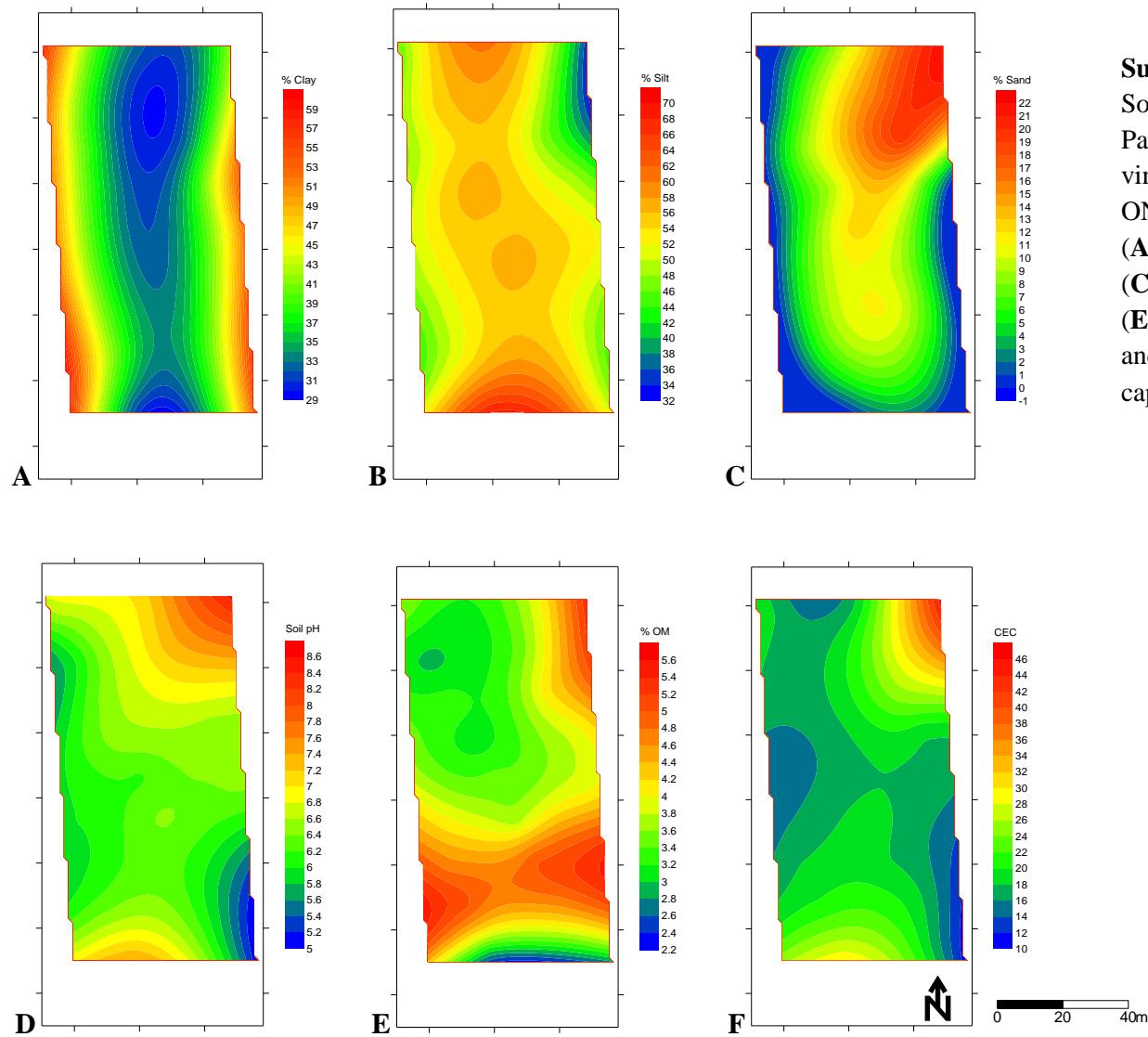
(A) % Clay; (B) % silt; (C) % sand; (D) soil pH; (E) % organic matter; and (F) cation exchange capacity.

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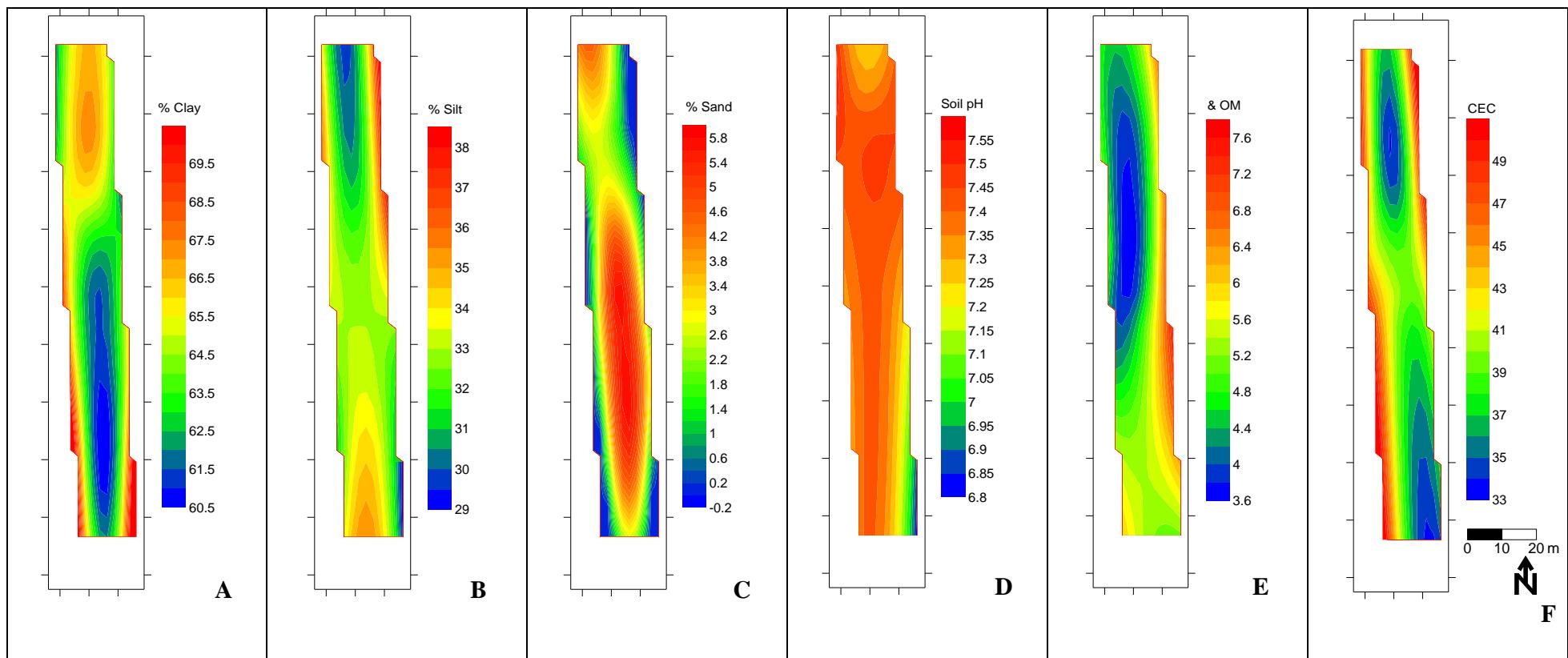
**Supplemental Figure 2**  
Soil variables in the Red Paw 2 Pinot noir vineyard, St. Davids, ON, in 2008.  
(A) % Clay; (B) % silt;  
(C) % sand; (D) soil pH;  
(E) % organic matter;  
and (F) cation exchange capacity.

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**Supplemental Figure 3** Soil variables in the Black Paw Pinot noir vineyard, St. Davids, ON, in 2008.

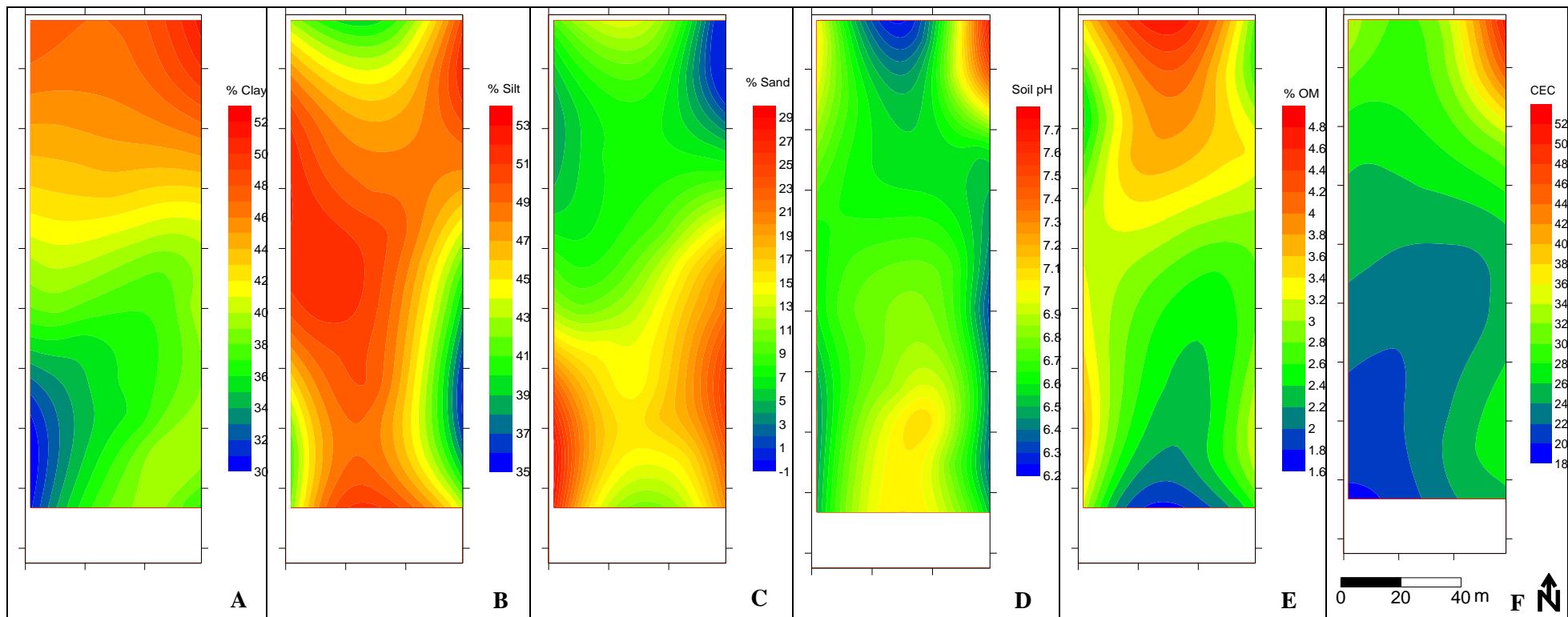
(A) % Clay; (B) % silt; (C) % sand; (D) soil pH; (E) % organic matter; and (F) cation exchange capacity.

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**Supplemental Figure 4:** Soil variables in the Lowrey Pinot noir vineyard, St. Davids, ON, in 2008.

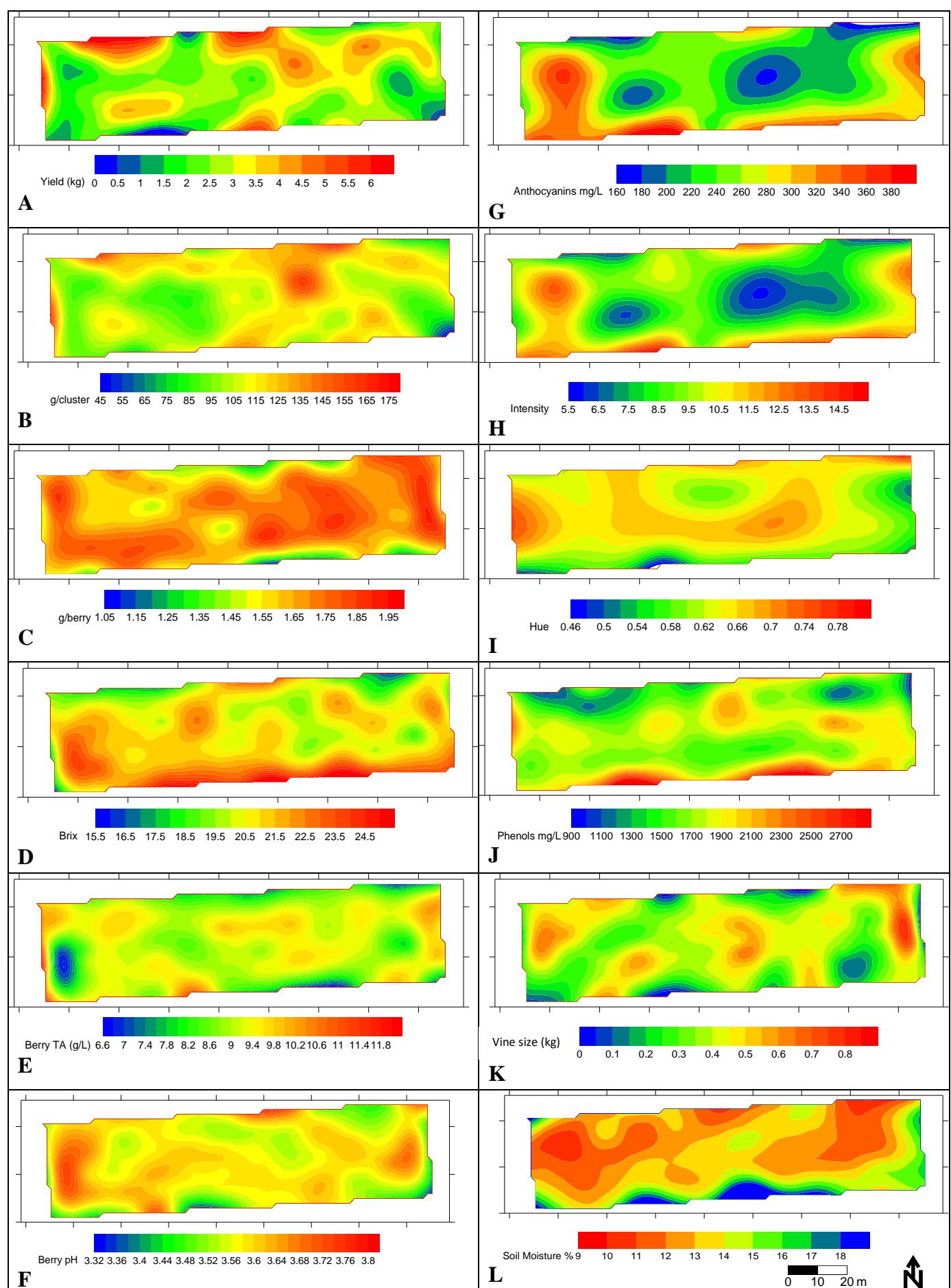
(A) % Clay; (B) % silt; (C) % sand; (D) soil pH; (E) % organic matter; and (F) cation exchange capacity.

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**Supplemental Figure 5** Yield components, grape composition, soil moisture, and vine size variables in the Red Paw 1 Pinot noir vineyard, St. Davids, ON, in 2008.

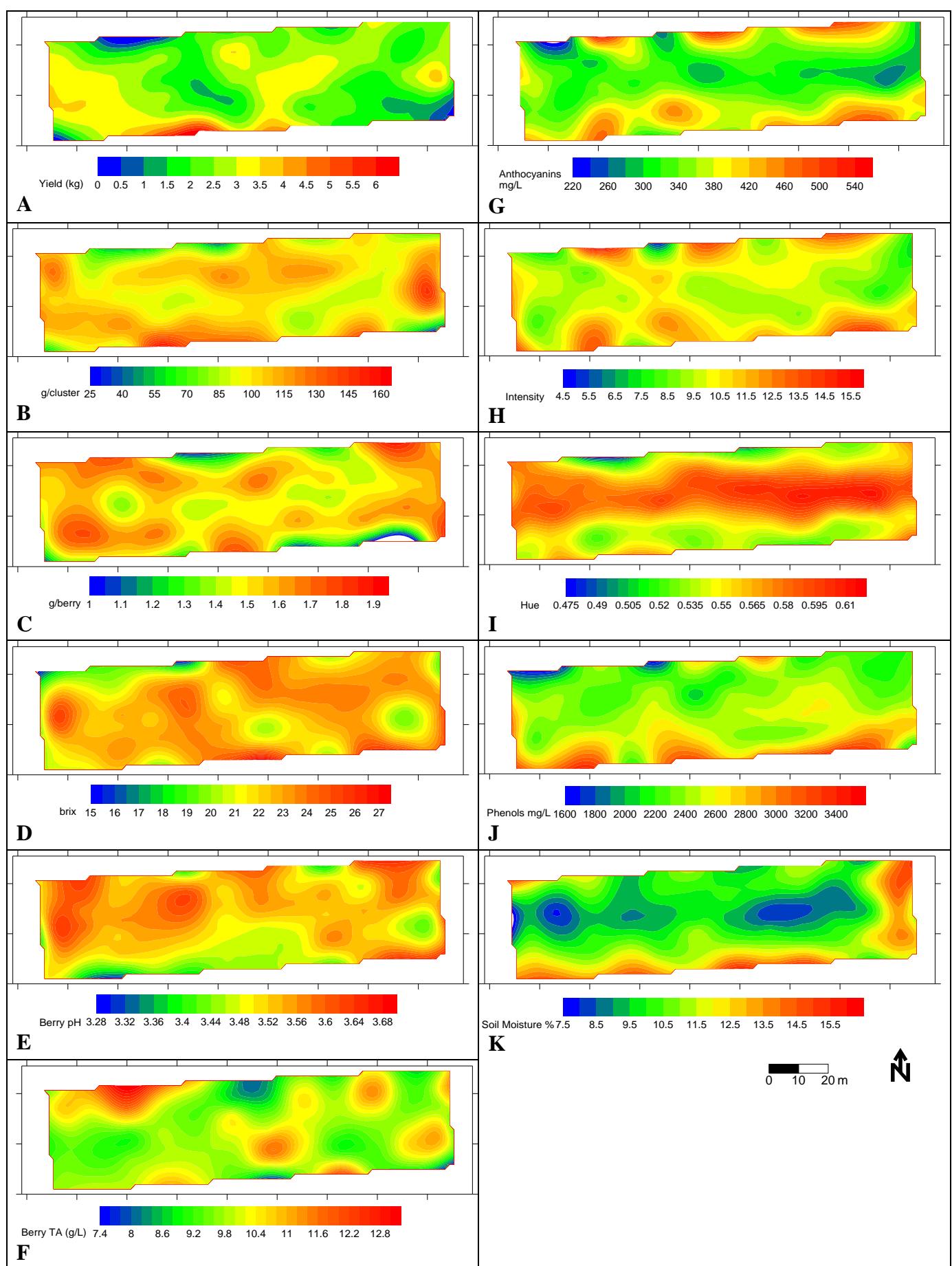
(A) Yield per vine (kg); (B) cluster weight (g); (C) berry weight (g); (D) berry Brix; (E) berry TA (g/L); (F) berry pH; (G) total anthocyanins (mg/L); (H) color intensity (A420+A520); (I) hue (A420/A520); (J) total phenols (mg/L); (K) vine size (kg); and (L) mean soil moisture (%).

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**Supplemental Figure 6** Yield components, grape composition, and soil moisture variables in the Red Paw 1 Pinot noir vineyard, St. Davids, ON, in 2009.

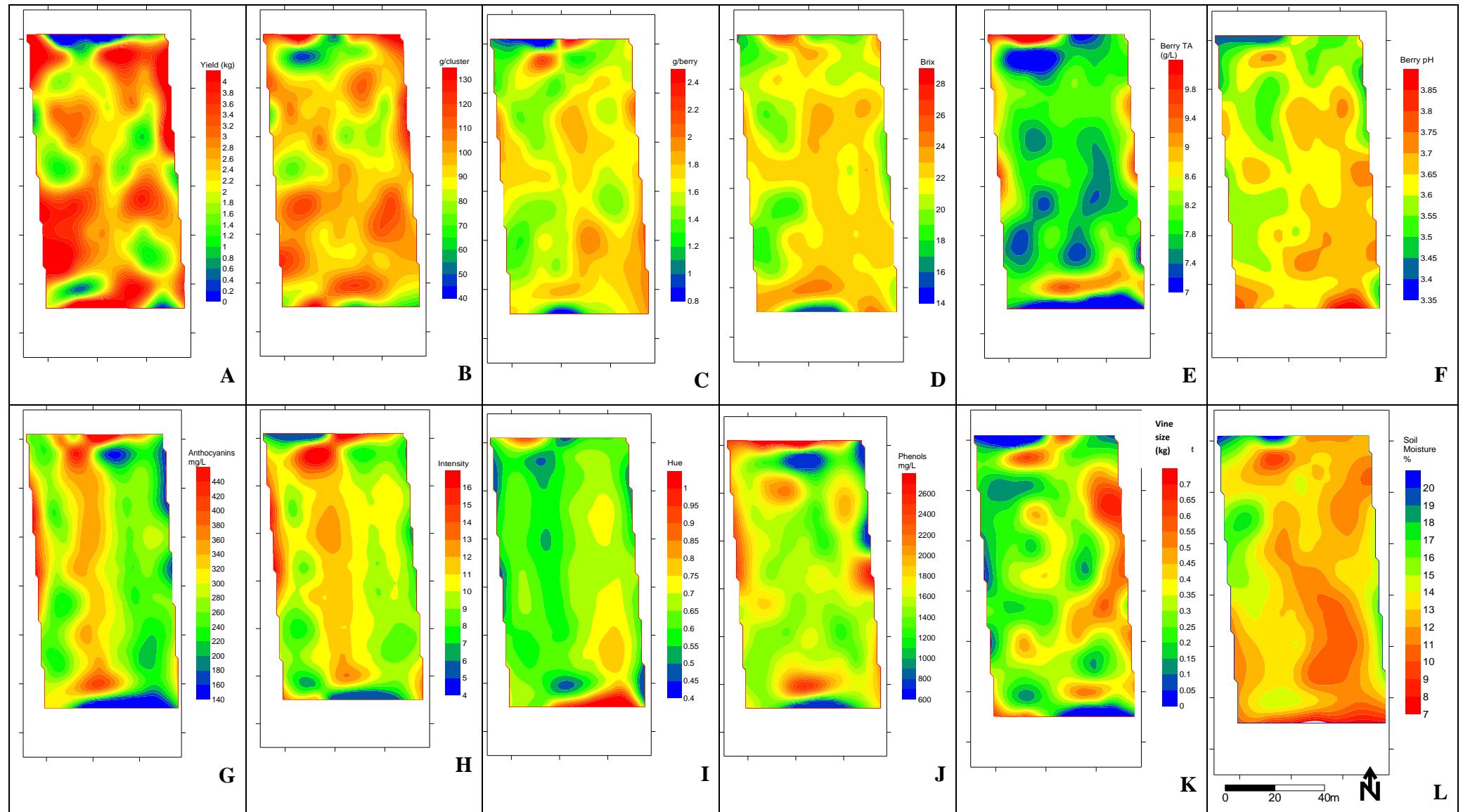
(A) Yield per vine (kg); (B) cluster weight (g); (C) berry weight (g); (D) berry Brix; (E) berry TA (g/L); (F) berry pH; (G) total anthocyanins (mg/L); (H) color intensity (A420+A520); (I) hue (A420/A520); (J) total phenols (mg/L); and (K) mean soil moisture (%).

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**Supplemental Figure 7**

Yield components, grape composition, soil moisture and vine size variables in the Red Paw 2 Pinot noir vineyard, St. Davids, ON, in 2008.

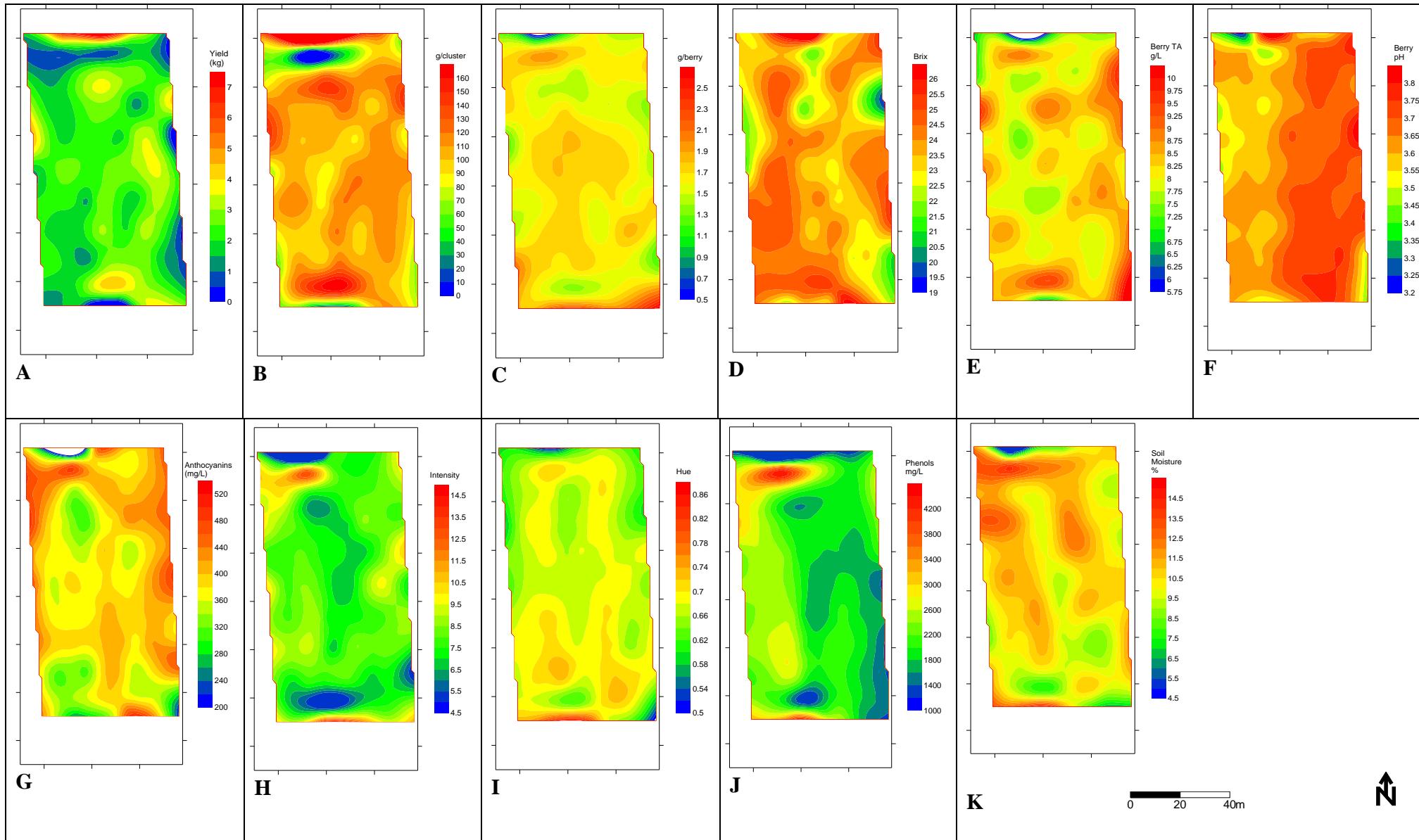
- (A) Yield per vine (kg);
- (B) cluster weight (g);
- (C) berry weight (g);
- (D) berry Brix;
- (E) berry TA (g/L);
- (F) berry pH;
- (G) total anthocyanins (mg/L);
- (H) color intensity (A420+A520);
- (I) hue (A420/A520);
- (J) total phenols (mg/L);
- (K) vine size (kg); and
- (L) mean soil moisture (%).

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**Supplemental Figure 8**

Yield components, grape composition, and soil moisture variables in the Red Paw 2 Pinot noir vineyard, St. Davids, ON, in 2009.

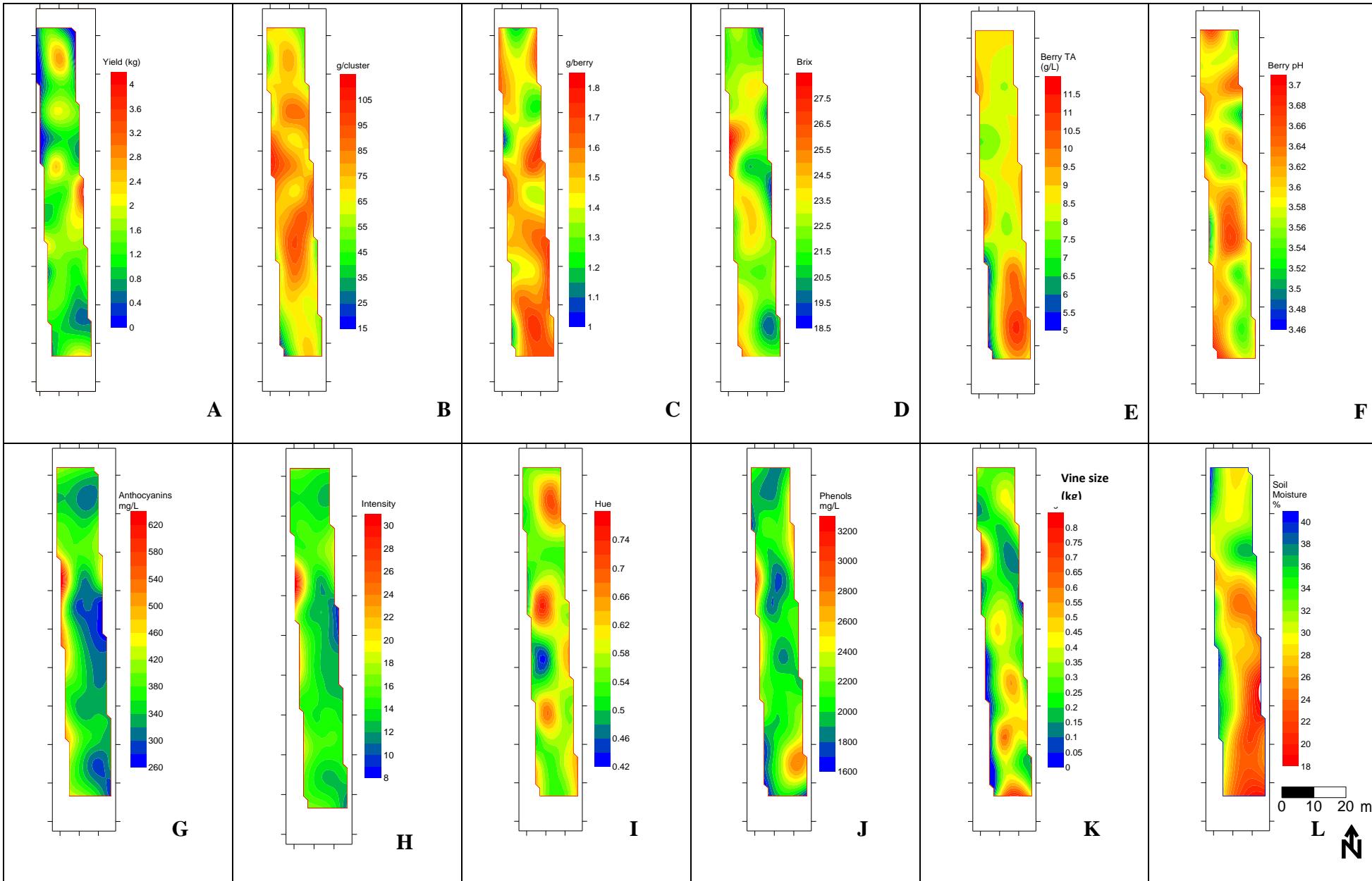
- (A) Yield per vine (kg);
- (B) cluster weight (g);
- (C) berry weight (g);
- (D) berry Brix;
- (E) berry TA (g/L);
- (F) berry pH;
- (G) total anthocyanins (mg/L);
- (H) color intensity (A420+A520);
- (I) hue (A420/A520);
- (J) total phenols (mg/L); and
- (K) mean soil moisture (%).

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**Supplemental Figure 9**

Yield components, grape composition, vine size, and soil moisture variables in the Black Paw Pinot noir vineyard, St. Davids, ON, in 2008.

(A) Yield per vine (kg);

(B) cluster weight (g);

(C) berry weight (g);

(D) berry Brix;

(E) berry TA (g/L);

(F) berry pH;

(G) total anthocyanins (mg/L);

(H) color intensity (A420+A520);

(I) hue (A420/A520);

(J) total phenols (mg/L);

(K) vine size (kg); and

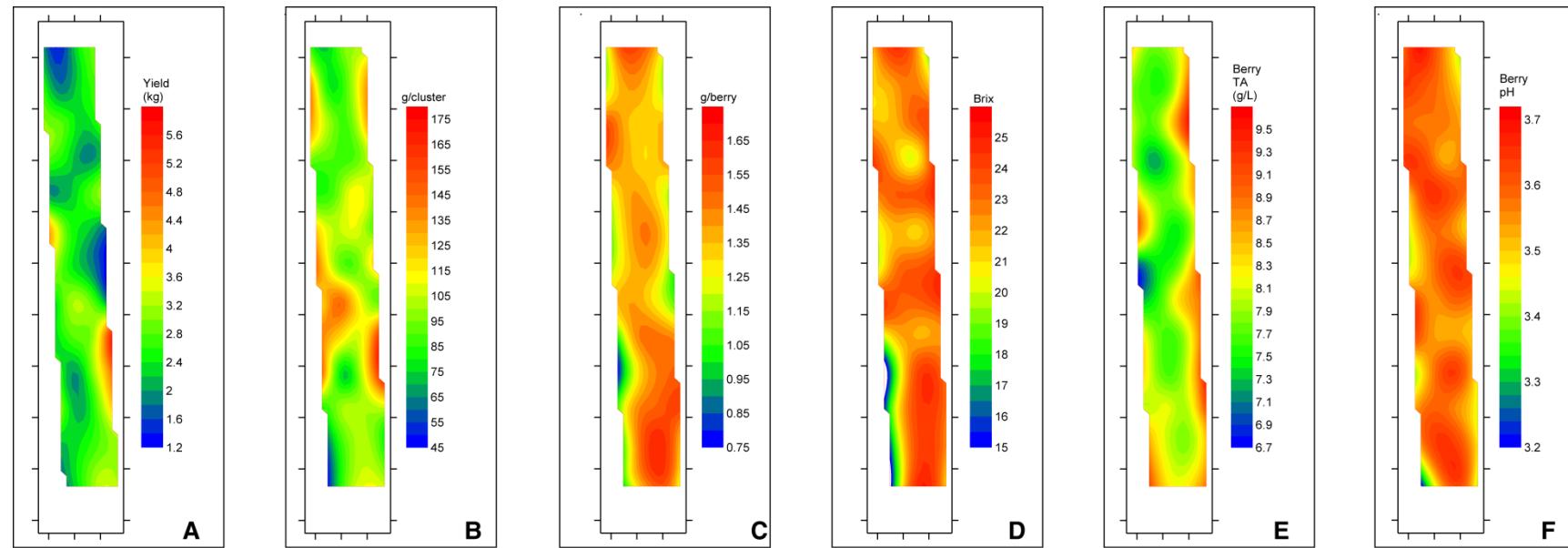
(L) mean soil moisture (%).

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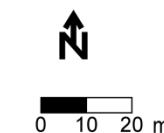
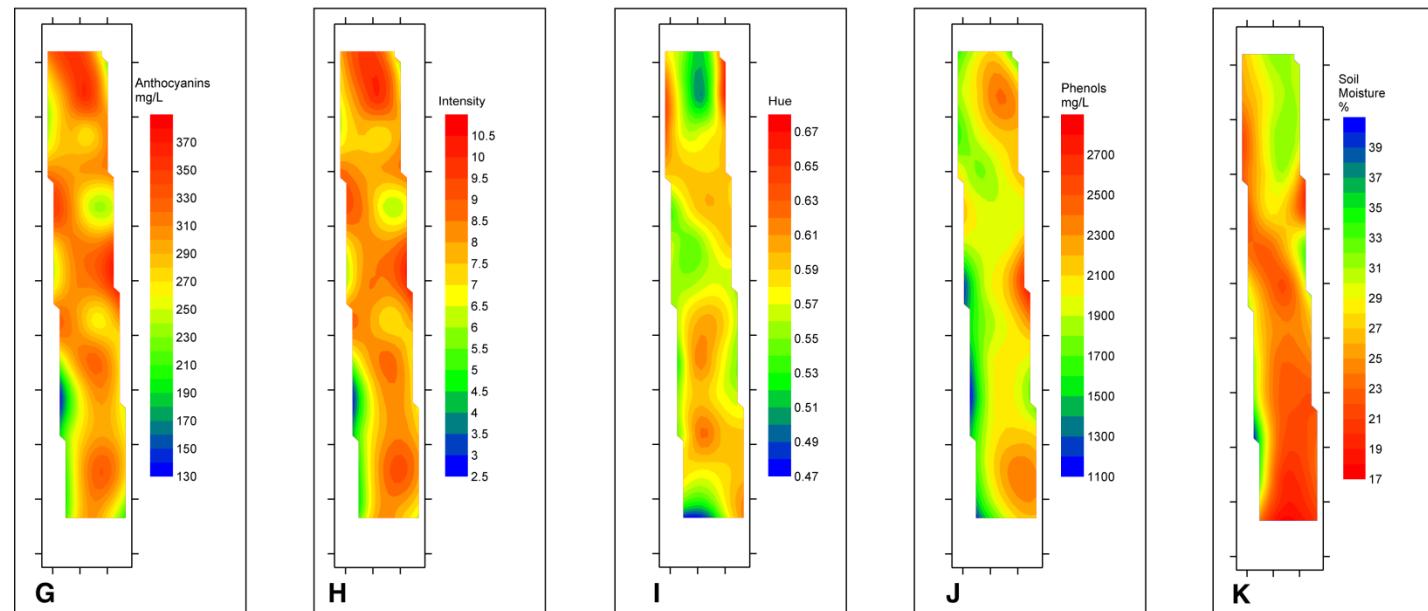
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**Supplemental Figure 10**

Yield components, grape composition, and soil moisture variables in the Black Paw Pinot noir vineyard, St. Davids, ON, in 2009.

- (A) Yield per vine (kg);
- (B) cluster weight (g);
- (C) berry weight (g);
- (D) berry Brix;
- (E) berry TA (g/L);
- (F) berry pH;
- (G) total anthocyanins (mg/L);
- (H) color intensity ( $A_{420}+A_{520}$ );
- (I) hue ( $A_{420}/A_{520}$ );
- (J) total phenols (mg/L); and
- (K) mean soil moisture (%).

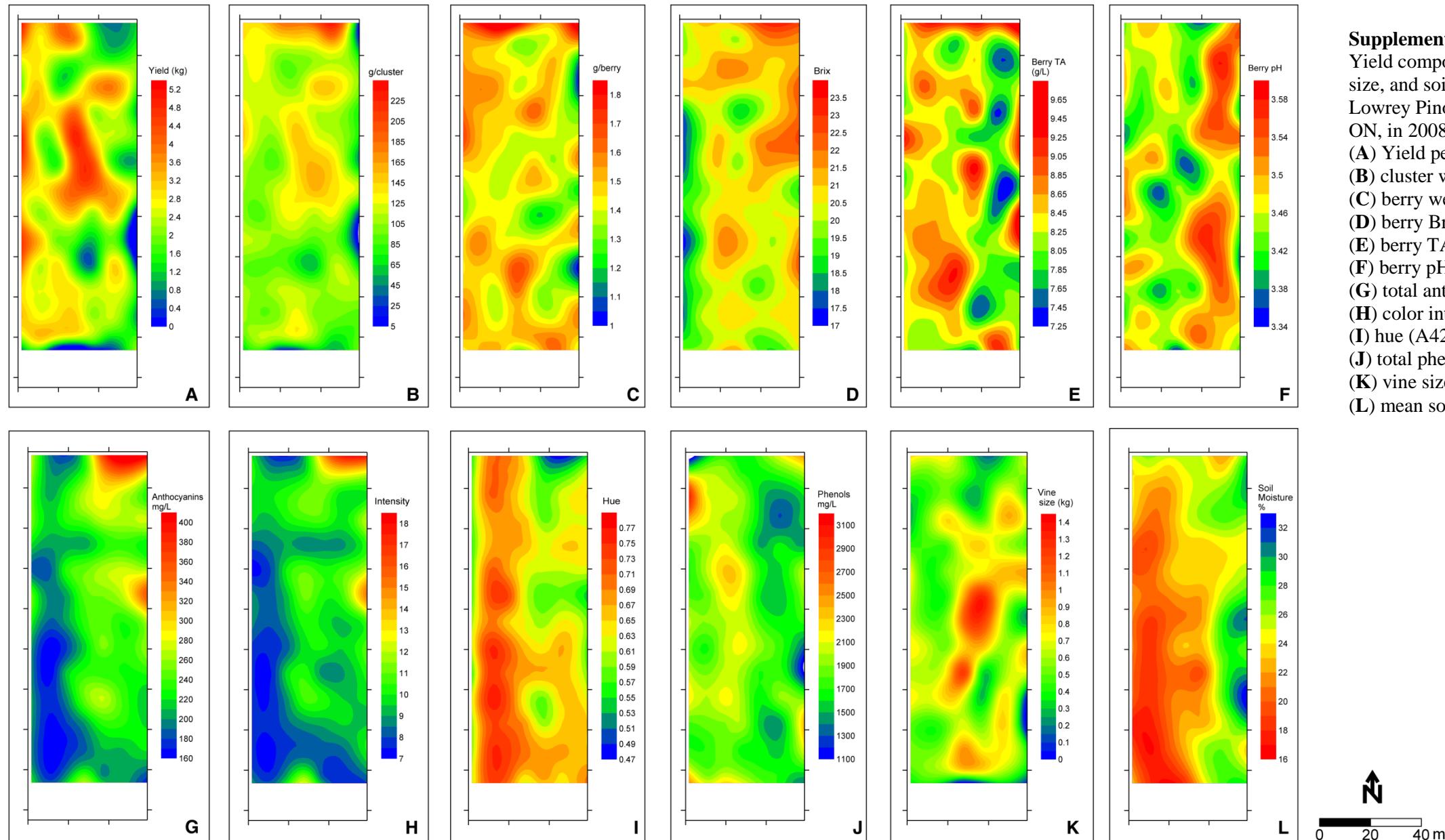


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Am J Enol Vitic 68:151-168. doi: 10.5344/ajev.2016.16062.



**Supplemental Figure 11**

Yield components, grape composition, vine size, and soil moisture variables in the Lowrey Pinot noir vineyard, St. Davids, ON, in 2008.

(A) Yield per vine (kg);

(B) cluster weight (g);

(C) berry weight (g);

(D) berry Brix;

(E) berry TA (g/L);

(F) berry pH;

(G) total anthocyanins (mg/L);

(H) color intensity (A420+A520);

(I) hue (A420/A520);

(J) total phenols (mg/L);

(K) vine size (kg); and

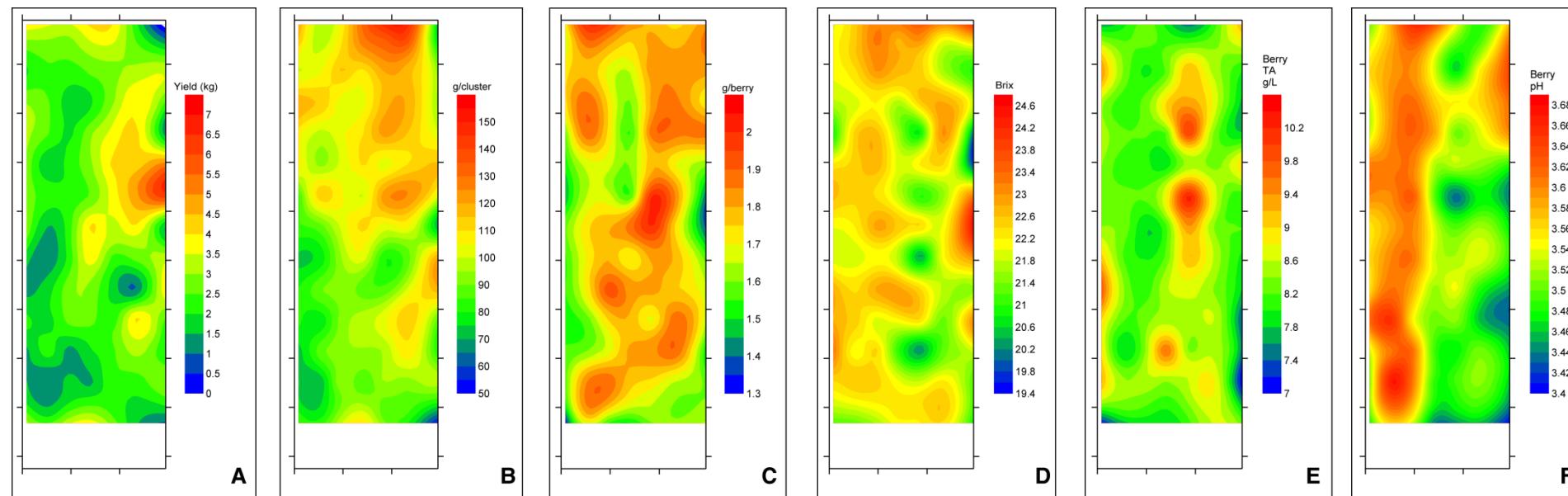
(L) mean soil moisture (%).

## Supplemental Data for:

Ledderhof D, Reynolds AG, Brown R, Jollineau M and Kotsaki E. 2017.

Spatial variability in Ontario Pinot noir vineyards: Use of geomatics and implications for precision viticulture.

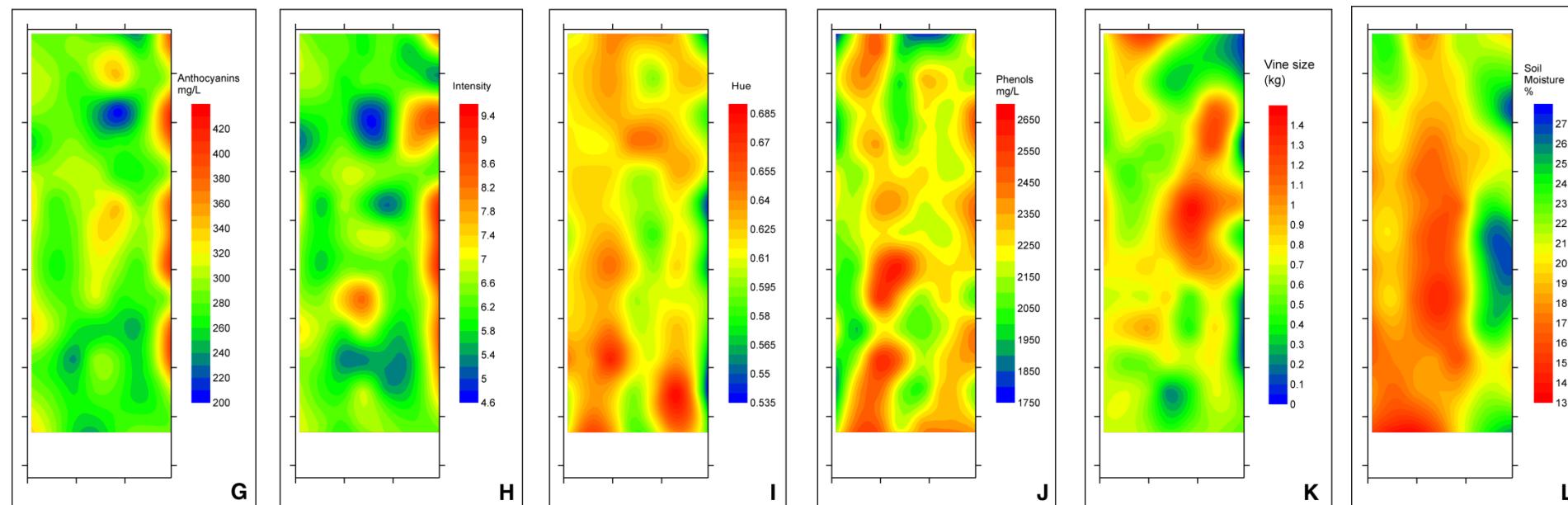
Am J Enol Vitic 68:151-168. doi: 10.5344/ajev.2016.16062.



**Supplemental Figure 12**

Yield components, grape composition, vine size, and soil moisture variables in the Lowrey Pinot noir vineyard, St. Davids, ON, in 2009.

- (A) Yield per vine (kg);
- (B) cluster weight (g);
- (C) berry weight (g);
- (D) berry Brix;
- (E) berry TA (g/L);
- (F) berry pH;
- (G) total anthocyanins (mg/L);
- (H) color intensity ( $A_{420}+A_{520}$ );
- (I) hue ( $A_{420}/A_{520}$ );
- (J) total phenols (mg/L);
- (K) vine size (kg);
- (L) mean soil moisture (%).



0 20 40 m