

Supplementary support material

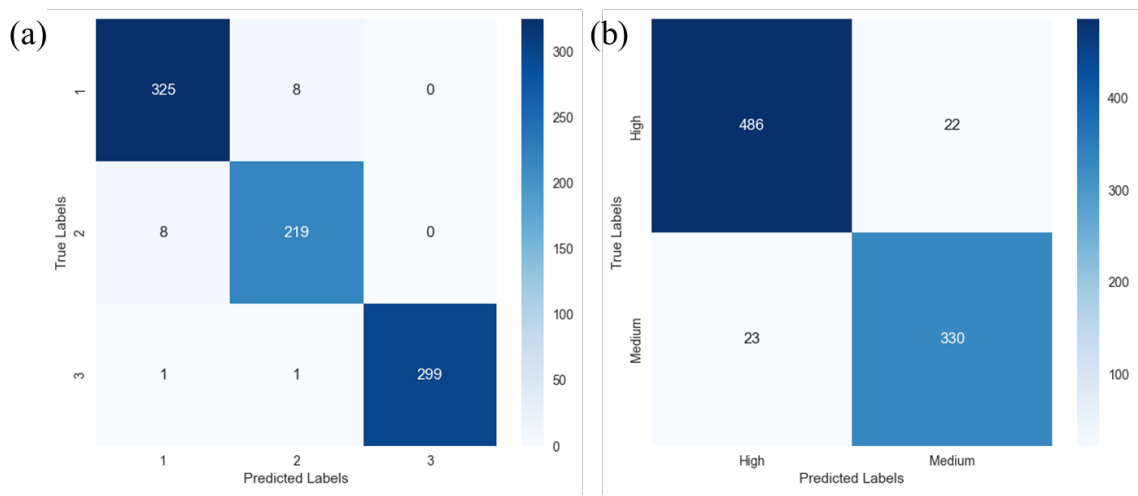


Figure S1. Confusion matrices for soil cluster classification models (a), and soil aptitude (b) with respect to potato crop.

1 **Table S1.** Main environmental attributes of potato production zones in Colombia by department.

Department	<i>n</i>	Elevation (masl)*	Cumulative precipitation range (mm/year)**	Average Temperature range (°C)**	Solar radiation range (MJ m ⁻²) **	Wind speed (m s ⁻¹) **
Antioquia	122	2010-2547	2216-2725	13,8-18,1	15,42-17,90	0,87-1,05
Boyacá	684	2292-3448	839-2322	7,4-15,9	15,17-17,90	0,87-1,67
Cauca	122	2922-3399	1295-1791	8,4-11,1	13,18-15,95	1.38-2.27
Cundinamarca	548	2212-3526	867-2071	7,7-15,2	14,11-17,03	0,90-1,68
Nariño	605	2561-3511	1016-1899	8,3-13,3	12,88-14,75	1,77-2,70
Norte de Santander	34	2278-3326	1014-1597	8,4-14,4	15,87-16,54	0,93-1,38
Santander	88	2502-3734	894-1189	5,3-13,3	15,85-17,25	0,90-1,30

2 * Data calculated from a DEM (10 m)

3 ** WorldClim

4 **Table S2.** Aptitude scale of the soil variables analyzed in this study

Variable	High aptitude value	Medium aptitude value	Low aptitude value
Total Nitrogen (%)	>0.5	>=0.25 & <=0.5	<0.25
Available Phosphorus (mg/kg)	>60	>=40 & <=60	<40
Exchangeable Potassium (meq/100g)	>0.6	>=0.3 & <=0.6	<0.3
Exchangeable Calcium (meq/100g)	>6	>=3 & <=6	<3
Exchangeable Magnesium (meq/100g)	>1.8	>=1.2 & <=1.8	<1.2
Boron (ppm)	>1	>=0.5 & <=1	<0.5
Copper (ppm)	>4	>=2 & <=4	<2
Available sulfur (mg/kg)	>15	>=10 & <=15	>10
Zinc (ppm)	>6	>=3 & <=6	<3
pH	>5.4 & <=6.6	>6.6 y <=7.3	>7.3 & <=7.8
CEC (meq/100g)	>20	>=10 & <=20	<10
Organic carbon (%)	>2.6	>=1.3 & <=2.6	<1.3
Base Saturation (%)	>60	>=35 & <=60	<10
Aluminium saturation (%)	<60	>=60 & <=90	>90
Sodium saturation (%)	<10	>=10 & <=15	<35
Textural class	Clay, sandy clay, silty clay, clay loam, sandy clay loam, silty clay loam	Sandy loam, silt, loam, silt loam	Sand, loamy sand
Aptitude	>66.6	<=66.6 & >=33.3	<33.3

6 **Table S3.** Univariate analysis of soil chemical properties per soil clusters generated for the study
7 area.

Cluster	1				2				3			
Variable	Mean ± SD	CV	Min	Max	Mean ± SD	CV	Min	Max	Mean ± SD	CV	Min	Max
Sand (%)	25.22 ± 11.67	46.27	2	56	57.36 ± 12.75	22.23	5.7	88.64	33.68 ± 14.56	43.23	2	72
Silt (%)	59.42 ± 14.86	25.01	2	96	24.08 ± 6.44	26.74	0.06	61.6	47.62 ± 17.92	37.63	4	96
Clay (%)	15.36 ± 7.97	51.89	2	62	18.56 ± 10.98	59.16	0.33	57.69	18.69 ± 8.88	47.51	2	56.51
pH	4.86 ± 0.28	5.76	4.05	5.51	5.12 ± 0.53	10.35	3.72	7.24	5.41 ± 0.52	9.61	4.04	7.54
CICE (meq/100g)	6.13 ± 1.83	29.85	1.8	12.8	10.06 ± 5.79	57.55	0.54	43.32	7.95 ± 3.74	47.04	0.98	27.94
Organic Matter (%)	15.5 ± 6.66	42.97	3.15	37.6	8.72 ± 5.67	65.02	0.52	31.62	10.67 ± 5.99	56.14	0.6	33.6
Organic Carbon (%)	9.01 ± 3.87	42.95	1.83	21.86	5.07 ± 3.3	65.09	0.3	18.38	6.2 ± 3.49	56.29	0.35	19.53
Total Nitrogen (%)	0.75 ± 0.32	42.67	0.15	1.82	0.44 ± 0.28	63.64	0.03	1.58	0.52 ± 0.29	55.77	0.03	1.62
Available P (ppm)	83.12 ± 73.98	89.0	3.16	476	71.78 ± 80.3	111.87	0.01	477.95	99.09 ± 103.1	104.05	1.12	498
Exchangeable K (meq/100g)	0.64 ± 0.39	60.94	0.07	2.72	1.26 ± 0.94	74.6	0	8.94	0.94 ± 0.62	65.96	0.06	4.91
Exchangeable Ca (meq/100g)	2.17 ± 1.04	47.93	0.12	6.21	6.05 ± 5.25	86.78	0	39.25	5.37 ± 3.05	56.8	0.55	24.29
Exchangeable Mg (meq/100g)	0.43 ± 0.25	58.14	0.05	2.44	0.98 ± 0.89	90.82	0	5.12	1.05 ± 0.71	67.62	0.09	5.32
Available S (ppm)	17.6 ± 10.83	61.53	3.03	74.6	8.51 ± 6.4	75.21	5	73.7	17.19 ± 11.62	67.6	0.93	94.2

Available B (ppm)	0.6 ± 0.26	43.33	0.08	1.58	0.37 ± 0.26	70.27	0.14	2.07	0.69 ± 0.31	44.93	0.1	3.29
Zn (ppm)	5.5 ± 3.34	60.73	0.66	29.4	4.75 ± 4.19	88.21	0.36	36.3	9.14 ± 6.57	71.88	0.43	43.42
Mn (ppm)	26.33 ± 15.76	59.86	1.55	142	26.75 ± 20.66	77.23	1.47	165.51	38.89 ± 22.54	57.96	2.78	188
Fe (ppm)	103.92 ± 95.14	91.55	7.67	488	23.31 ± 38.36	164.56	0.36	429.38	108.65 ± 107.32	98.78	0.71	498
Cu (ppm)	1.98 ± 1.17	59.09	0.46	14.4	0.32 ± 0.74	231.25	0	10.5	2.84 ± 2.02	71.13	0	17.6
Exchangeable Na (meq/100g)	0.09 ± 0.04	44.44	0	0.31	0.29 ± 0.34	117.24	0	2.38	0.12 ± 0.07	58.33	0	1.32
Exchangeable Al (meq/100g)	2.79 ± 1.22	43.73	0.61	7.35	1.48 ± 1.76	118.92	0	9.34	0.47 ± 0.53	112.77	0	2.96
Base Saturation (%)	37.82 ± 9.06	23.96	20	81.1	23.73 ± 17.86	75.26	0.96	98.86	35.18 ± 11.29	32.09	15.1	98.39
K Saturation (%)	10.34 ± 5.15	49.81	1.64	30.5	3.47 ± 2.82	81.27	0	21.53	12.03 ± 5.8	48.21	1.26	38.7
Ca Saturation (%)	35.24 ± 12.09	34.31	5.1	65	16.71 ± 14.59	87.31	0	80.68	65.49 ± 11.03	16.84	26.95	93.1
Mg Saturation (%)	6.96 ± 3.28	47.13	1.14	21.2	2.74 ± 2.68	97.81	0	17.67	12.81 ± 5.1	39.81	1.61	32.5
Na Saturation (%)	1.68 ± 0.83	49.4	0.27	6.18	0.82 ± 1.02	124.39	0	5.84	1.65 ± 0.87	52.73	0.07	6.99
Al Saturation (%)	45.8 ± 15.14	33.06	14.8	87.8	3.89 ± 4.85	124.68	0	32.56	7.51 ± 8.43	112.25	0	41.9
Ca+Mg/K Ratio (meq/100g)	5.29 ± 4.04	76.37	0.9	41.8	7.98 ± 8.2	102.76	0	54.87	9.08 ± 7.23	79.63	1.33	69.1
Ca/Mg Ratio (meq/100g)	5.95 ± 3.19	53.61	1.27	27	7.72 ± 7.14	92.49	0	99.3	6.27 ± 3.83	61.08	1.74	45.5
Ca/K Ratio (meq/100g)	4.45 ± 3.58	80.45	0.66	39.6	6.98 ± 7.38	105.73	0	48.12	7.73 ± 6.56	84.86	0.88	60.6

Mg/K Ratio (meq/100g)	0.84 ± 0.64	76.19	0.12	5.45	1.0 ± 1.06	106.0	0	7.7	1.35 ± 0.96	71.11	0.25	8.58
ESP (%)	1.68 ± 0.84	50.0	0	6.18	0.82 ± 1.02	124.39	0	5.84	1.65 ± 0.88	53.33	0	6.99

9 **Table S4.** Metrics of the evaluated models.

Source	Metric				
	Accuracy (AC)	Precision (PR)	Recall (RE)	F1 Score (F1)	MCC
Cluster	0.979094	0.979171	0.979094	0.979127	0.96827
Aptitude	0.947735	0.947715	0.947735	0.947724	0.891925

11 **Table S5.** Analysis of the spatial distribution of the clusters of the estimated areas in each
12 department

Department	Prediction	Number of polygons	Average area (ha)	Total area (ha)
Antioquia	1	199	541,9	107830,4
	2	1	542,7	542,7
	3	12	542,2	6506,1
Boyacá	1	602	533,9	321417,1
	2	200	533,2	106645,4
	3	171	534,4	91379,7
Cauca	1	219	568	124386,6
	2	49	568	27829,9
	3	71	567,9	40323
Cundinamarca	1	321	543,3	174401
	2	94	542,6	51007
	3	196	543,5	106517,5
Nariño	1	805	580,8	467541,6
	2	133	581,3	77313
	3	181	581,6	105262,3
Norte de Santander	1	250	521,9	130483,2
	2	73	522,6	38148,8
	3	61	522,1	31847,9
Santander	1	73	524,1	38260,9
	2	50	523,8	26190,1
	3	23	524,1	12054,2