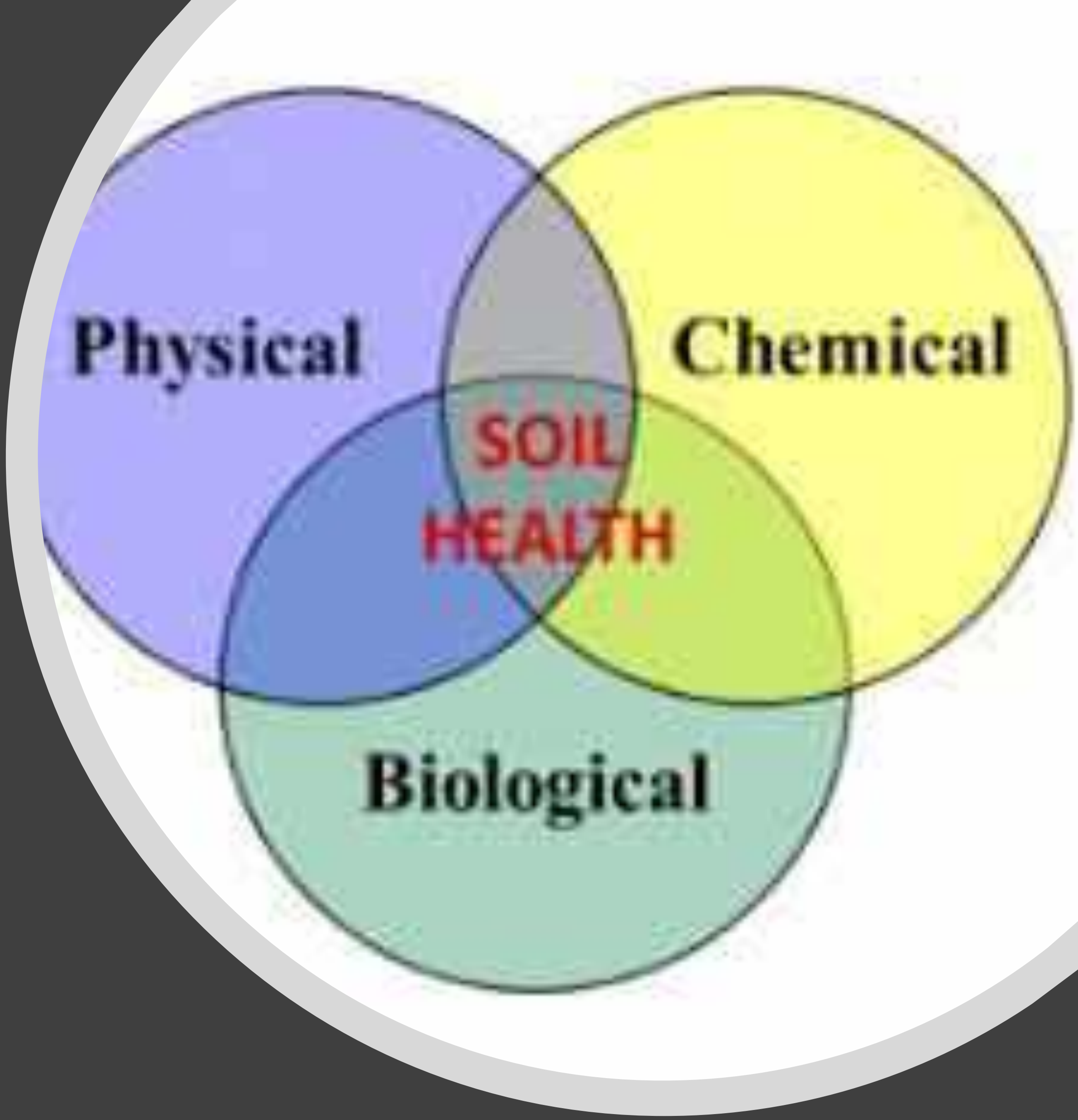
"Can a farm really work successfully with a closed organic system"

“What can we do to work towards a successful closed organic system”

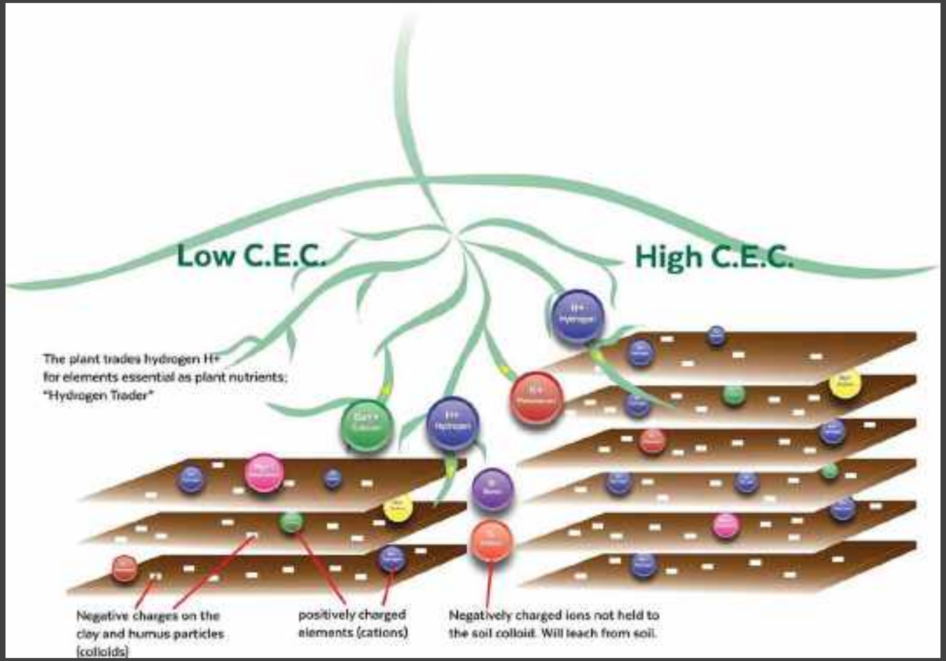
Need information

- Need to establish most limiting agronomic factor
- Soil Test
- Available Phosphorus
- Soil Balance - CEC
- Trace elements
- Soil Carbon levels
- Case study - HOW TO DO IT
- Building Soil structure with diverse cover crops
- Use of Compost & Biostimulants
- Soil Biology
- Utilise natural cycles



Get the most of Soil Tests

- The correct information to make the best decisions
- Albrecht Soil Balancing?
- Integral part of strategy.
- Which numbers to believe?
- LAB OFF
  - 5 sites
  - 5 Identical samples
  - 5 Labs



The Lab Off

pH 6.7	LAB RESULTS						BASE SATURATION				
STR02	LAB A	LAB B	LAB C	LAB D	LAB E		LAB A	LAB B	LAB C	LAB D	LAB E
	cmol/kg	cmol/kg	cmol/kg	cmol/kg	cmol/kg		%	%	%	%	%
Exc. Calcium (cmol/Kg)	8.1	7.12	7.56	8.70	6.9	**Ca**	87.4	85.36	78.4	76.18	63.5
Exc. Magnesium (cmol/Kg)	0.85	0.92	1.71	1.27	0.83	**Mg**	9.2	11.01	17.8	11.09	7.6
Exc. Potassium (cmol/Kg)	0.14	0.16	0.2	0.21	0.12	**K**	1.5	1.91	2.1	1.84	1.1
Exc. Sodium (cmol/Kg)	0.14	0.14	0.16	0.19	0.12	**Na**	1.5	1.72	1.7	1.64	1.1
Exch. Hydrogen	0.04	0.02	0	0.51	5.6	**H**	0.4	0	0	4.5	26.7

pH 6.6	LAB RESULTS						BASE SATURATION				
Cullen	**LAB A**	**LAB B**	**LAB C**	**LAB D**	**LAB E**		**LAB A**	**LAB B**	**LAB C**	**LAB D**	**LAB E**
	cmol/kg	cmol/kg	cmol/kg	cmol/kg	cmol/kg		%	%	%	%	%
Exc. Calcium (cmol/Kg)	6.33	5.08	5.3	6.23	**4.74**	**Ca**	77.8	74.65	74.1	66.25	50.9
Exc. Magnesium (cmol/Kg)	1.23	1.22	1.322	1.61	**1.06**	**Mg**	15.1	17.93	18.5	17.11	11.4
Exc. Potassium (cmol/Kg)	0.44	0.41	0.422	0.56	**0.34**	**K**	5.4	6.01	5.9	5.93	3.6
Exc. Sodium (cmol/Kg)	0.1	0.10	0.1	0.14	**0.08**	**Na**	1.2	1.4	1.4	1.46	0.9
Exch. Hydrogen	0.04	0.00	0	0.42	**5.8**	**H**	0.5	0	0	4.5	33.3

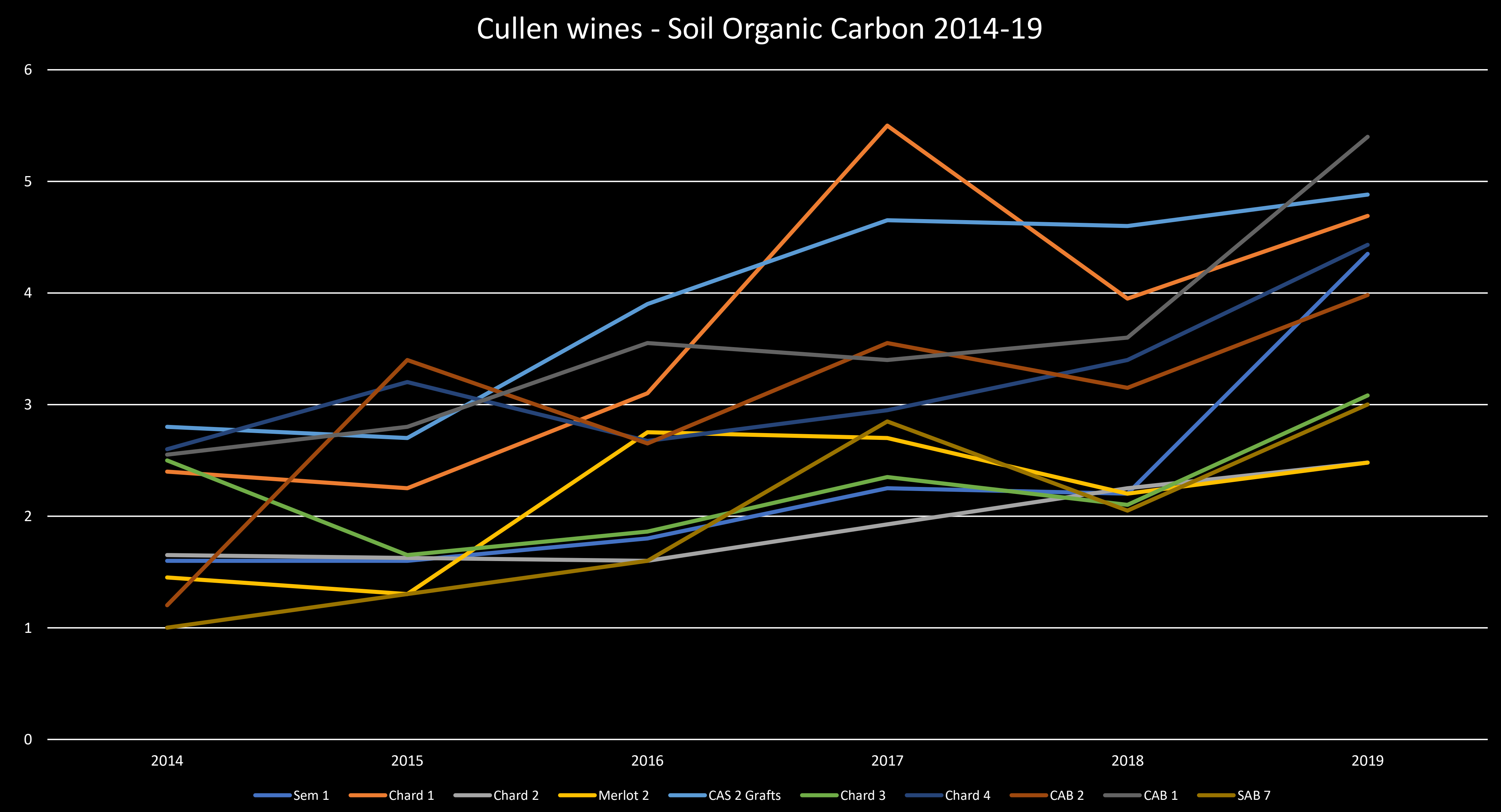
pH 6.01	LAB RESULTS						BASE SATURATION				
Borrisokane	**LAB A**	**LAB B**	**LAB C**	**LAB D**	**LAB E**		**LAB A**	**LAB B**	**LAB C**	**LAB D**	**LAB E**
	cmol/kg	cmol/kg	cmol/kg	cmol/kg	cmol/kg		%	%	%	%	%
Exc. Calcium (cmol/Kg)	4.31	3.24	3.47	4.62	3.3		79.2	76.18	74.2	57.62	40
Exc. Magnesium (cmol/Kg)	0.79	0.75	0.84	1.13	0.72		14.5	17.74	17.9	14.15	8.7
Exc. Potassium (cmol/Kg)	0.15	0.16	0.15	0.21	0.13		2.8	3.7	3.3	2.66	1.1
Exc. Sodium (cmol/Kg)	0.11	0.10	0.10	0.15	0.09		2.0	2.38	2.2	1.87	1.6
Exch. Hydrogen	0.08	0.09	0.09	1.44	6.7		1.5	2	2	18	48.5

pH 5.42	LAB RESULTS						BASE SATURATION				
Edwards C block	**LAB A**	**LAB B**	**LAB C**	**LAB D**	**LAB E**		**LAB A**	**LAB B**	**LAB C**	**LAB D**	**LAB E**
	cmol/kg	cmol/kg	cmol/kg	cmol/kg	cmol/kg		%	%	%	%	%
Exc. Calcium (cmol/Kg)	1.61	1.47	1.57	1.64	1.48		74.5	60.54	54.9	44.62	12.3
Exc. Magnesium (cmol/Kg)	0.15	0.17	0.18	0.25	0.16		6.9	7.03	6.4	6.81	1.3
Exc. Potassium (cmol/Kg)	0.08	0.10	0.07	0.10	0.08		3.7	3.93	2.5	2.69	0.8
Exc. Sodium (cmol/Kg)	0.09	0.09	0.10	0.11	0.09		4.2	3.86	3.4	2.96	0.7
Exch. Hydrogen	0.23	0.07	0.51	1.32	10.2		10.7	2.87	17.7	36	84.9

pH 6.96	LAB RESULTS						BASE SATURATION				
ILLAWARRA	LAB A	LAB B	LAB C	LAB D	LAB E		LAB A	LAB B	LAB C	LAB D	LAB E
	cmol/kg	cmol/kg	cmol/kg	cmol/kg	cmol/kg		%	%	%	%	%
Exc. Calcium (cmol/Kg)	11.5	10.27	7.96	9.2	**9.8**		78.1	75.9	74.8	69.14	60
Exc. Magnesium (cmol/Kg)	2.36	2.44	2.02	2.48	**2.27**		16.0	18.02	19	18.63	14
Exc. Potassium (cmol/Kg)	0.57	0.56	0.46	0.58	**0.49**		3.9	4.14	4.4	4.35	3
Exc. Sodium (cmol/Kg)	0.24	0.26	0.19	0.24	**0.22**		1.6	1.94	1.8	1.83	1
Exch. Hydrogen	0.06	0.02	0	0.2	**3.5**		0.4	0	0	1.5	22

Case Study – Cullen Wines

- 22 years Certified / 14 years BD
- Certified Carbon Neutral 2007
- Soil tests – 10 sites – 6 years
- Biodynamic Applications
- Lime & dolomite additions
- Custom mineral blends
- Compost production & applications
- Intensive cover crop program
- Biological Soil drenches & biostimulants



Cullen wines - Soil Organic Carbon 2014-19
6
5
4
3
2
1
0
2014
2015
2016
2017
2018
2019
Sem 1
Chard 1
Chard 2
Merlot 2
CAS 2 Grafts
Chard 3
Chard 4
CAB 2
CAB 1
SAB 7

Soil carbon sequestration calculations

Block sampled	Sem 1	Chard 1	Chard 2	Merlot 2	CAS 2 Gra	Chard 3	Chard 4	CAB 2	CAB 1
Area of sample block (Ha)	0.61	5.31	0.87	0.7	0.77	2.01	1.75	4.74	3.72
Total area of blocks sampled (Ha)	21.39								
Total area of vineyard under uniform management	31								
Depth being assessed (m) *	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Average bulk density (g/cm^3) **	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Average bulk density (kg/m^3)	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400
Weight of soil kg/ha	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000	3,500,000
Baseline soil C % (2014)	1.625	1.425	1.65	2.48	2.8	2.5	2.6	1.2	2.55
New soil C % (2019)	4.35	4.69	2.48	2.48	4.88	3.08	4.43	3.98	5.4
Change in soil C %	**2.725**	**3.265**	**0.83**	**0**	**2.08**	**0.58**	**1.83**	**2.78**	**2.85**
Time for change to occur (years)	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**
Change in soil C (%/year)	0.545	0.653	0.166	0.000	0.416	0.116	0.366	0.556	0.570
Change in soil C stocks (kg/ha/year)	19,075	22,855	5,810	0	14,560	4,060	12,810	19,460	19,950
Change in soil C stocks (t/ha/year)	19.08	22.86	5.81	0.00	14.56	4.06	12.81	19.46	19.95
Soil organic carbon gain (t)									
CO2e generated (t/ha/year)	70.01	83.88	21.32	0.00	53.44	14.90	47.01	71.42	73.22
CO2e generated in sample area (t/year)	42.70	445.39	18.55	0.00	41.15	29.95	82.27	338.52	272.37
TOTAL t CO2e/Ha gain 2014-19	350.03	419.39	106.61	0.00	267.18	74.50	235.06	357.09	366.08
TOTAL t CO2e gain in sample area (21.39Ha)	213.52	2,226.96	92.75	0.00	205.73	149.75	411.36	1,692.61	1,361.83
Total t CO2e gain across 21.39Ha sample area			6,588						
Average t CO2e gain per Ha in sample area from 2014-2019			308						
Total t CO2e sequestered across the 31Ha vineyard area from 2014-19			**9,548**	=	**2,602**	of soil organic carbon stored across 31Ha in			
Estimated tonnes of CO2e sequestered in 31Ha vineyard per year			**1,910**	=	**520**	of soil organic carbon stored across 31Ha pe			

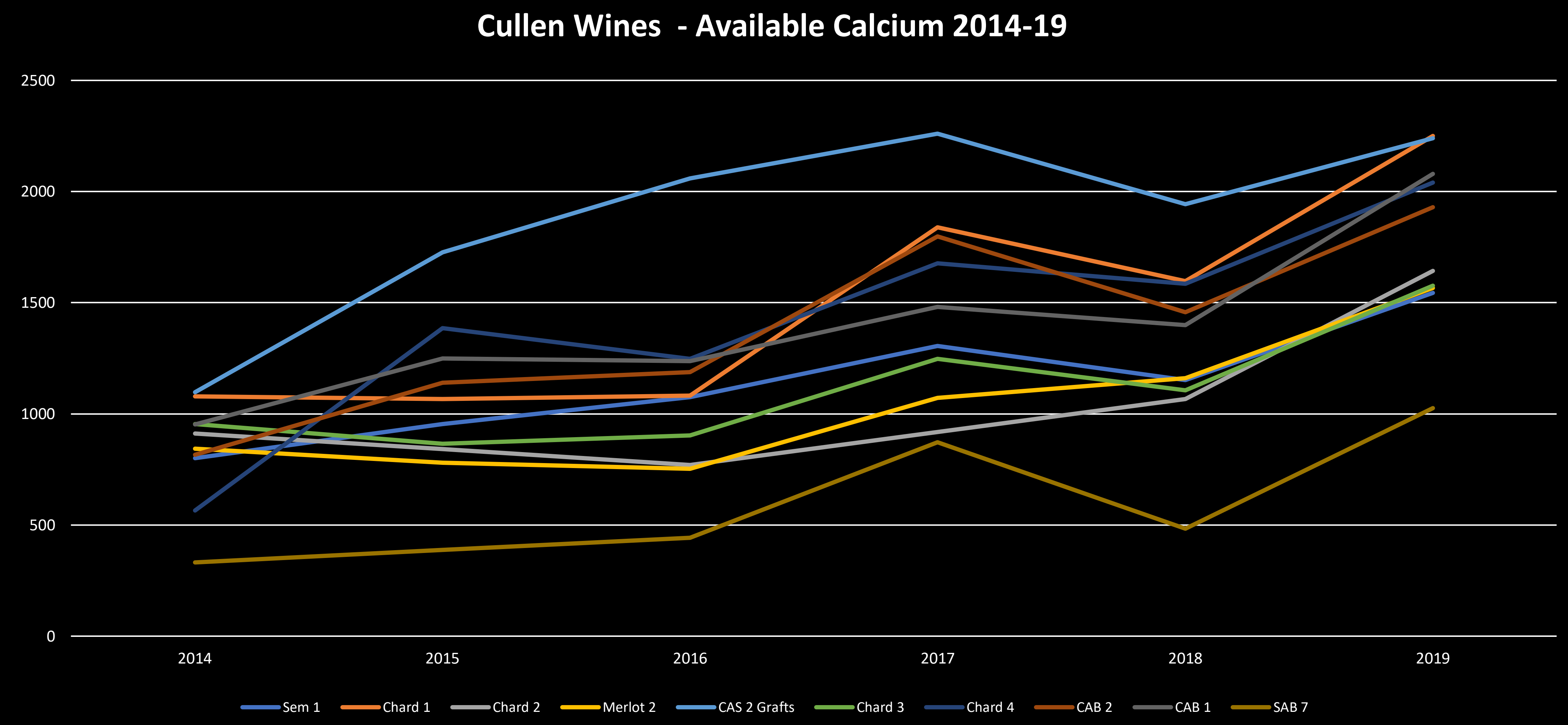
2602 tons C for 5 years
520 tons/yr
16.7 tons/Ha/yr
Or
9548 tons CO2
1910tons/yr
61 tons/Ha/yr

Sample analysis results for SOC

Cullen Wines vineyard

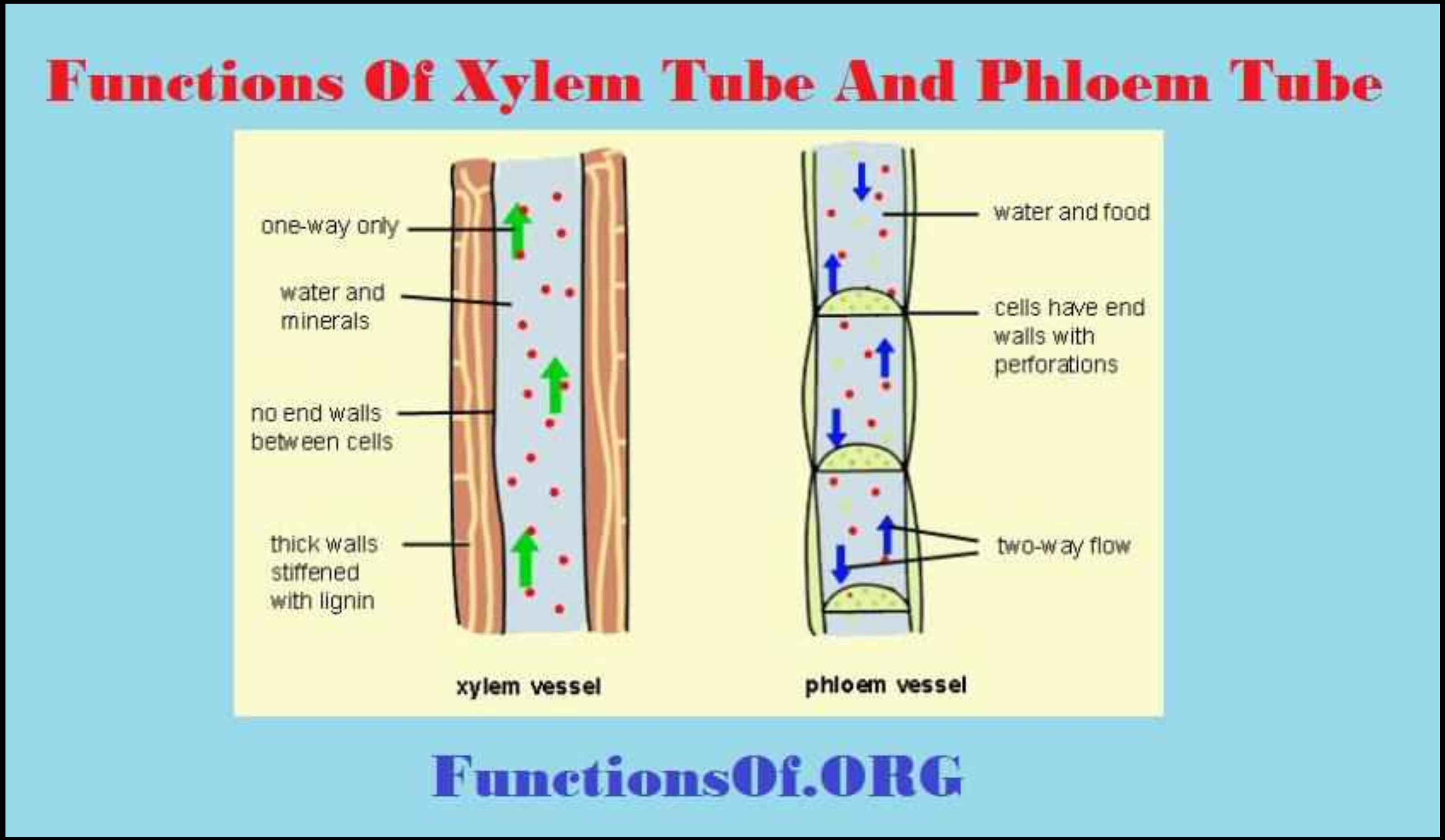
Year	2014	2015	2016	2017	2018	2019	Change
Sem 1 (%)	1.63	1.60	1.80	2.25	2.20	4.35	2.73
Chard 1 (%)	1.43	1.73	3.10	5.50	3.33	4.69	3.27
Chard 2 (%)	1.65	no data	1.60	no data	2.25	2.48	0.83
Merlot 2 (%)	2.48	1.30	2.75	2.70	2.20	2.48	0.00
CAS 2 Grafts (%)	2.80	2.70	3.90	4.65	4.60	4.88	2.08
Chard 3 (%)	2.50	1.65	1.64	2.35	no data	3.08	0.58
Chard 4 (%)	2.60	no data	no data	2.95	3.40	4.43	1.83
CAS 2 (%)	1.20	3.40	2.65	3.55	3.15	3.98	2.78
CAS 1 (%)	2.55	2.80	3.55	3.40	3.60	5.40	2.85
SAB 7 (%)	1.00	no data	1.60	2.85	no data	3.00	2.00

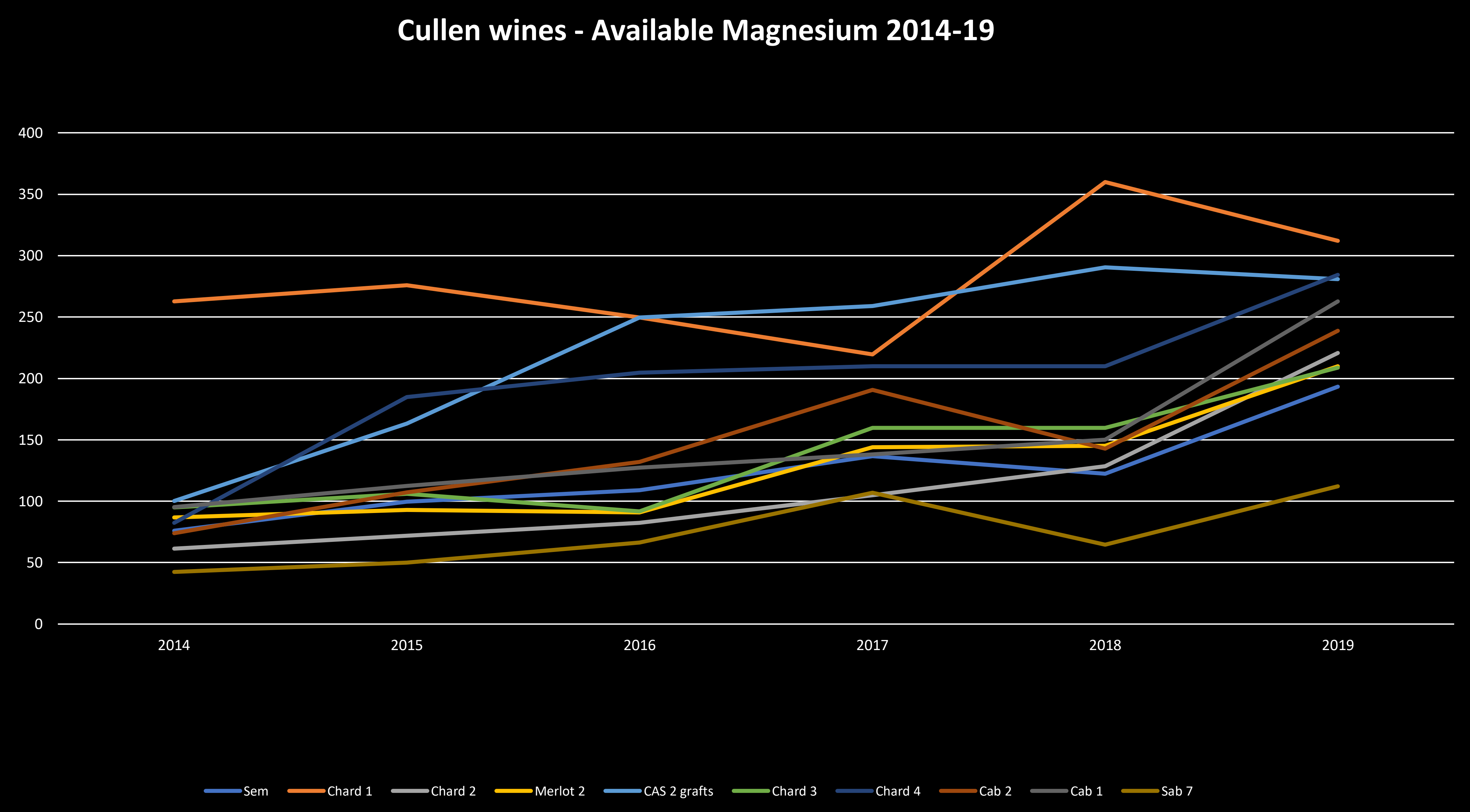
2% average increase
0.4% pa


Cullen Wines - Available Calcium 2014-19
2500
2000
1500
1000
500
0
2014
2015
2016
2017
2018
2019
Sem 1
Chard 1
Chard 2
Merlot 2
CAS 2 Grafts
Chard 3
Chard 4
CAB 2
CAB 1
SAB 7

Calcium

- Constant need for cell walls
- Only moves through xylem
- Phloem immobile
- Need continual supply from soil

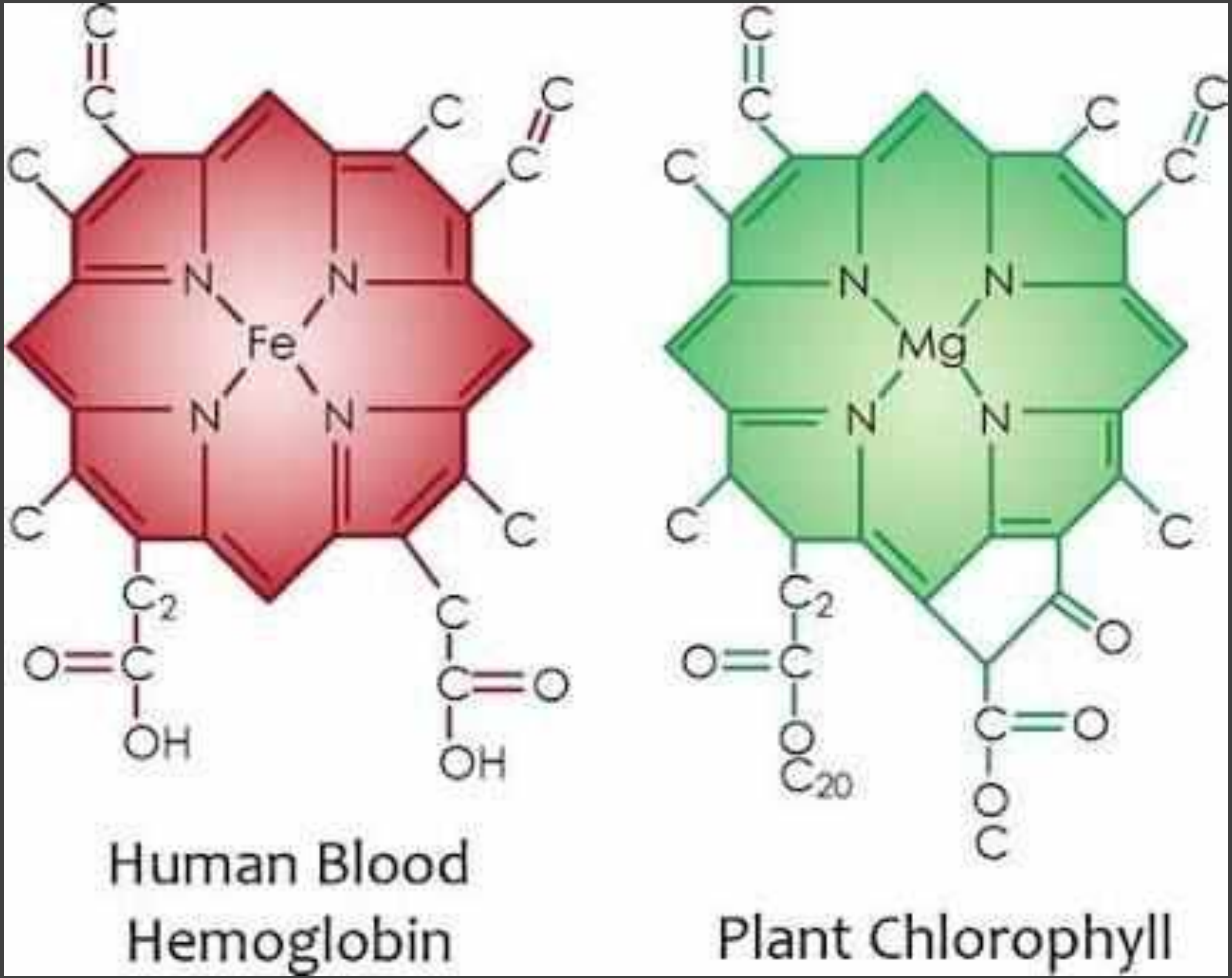


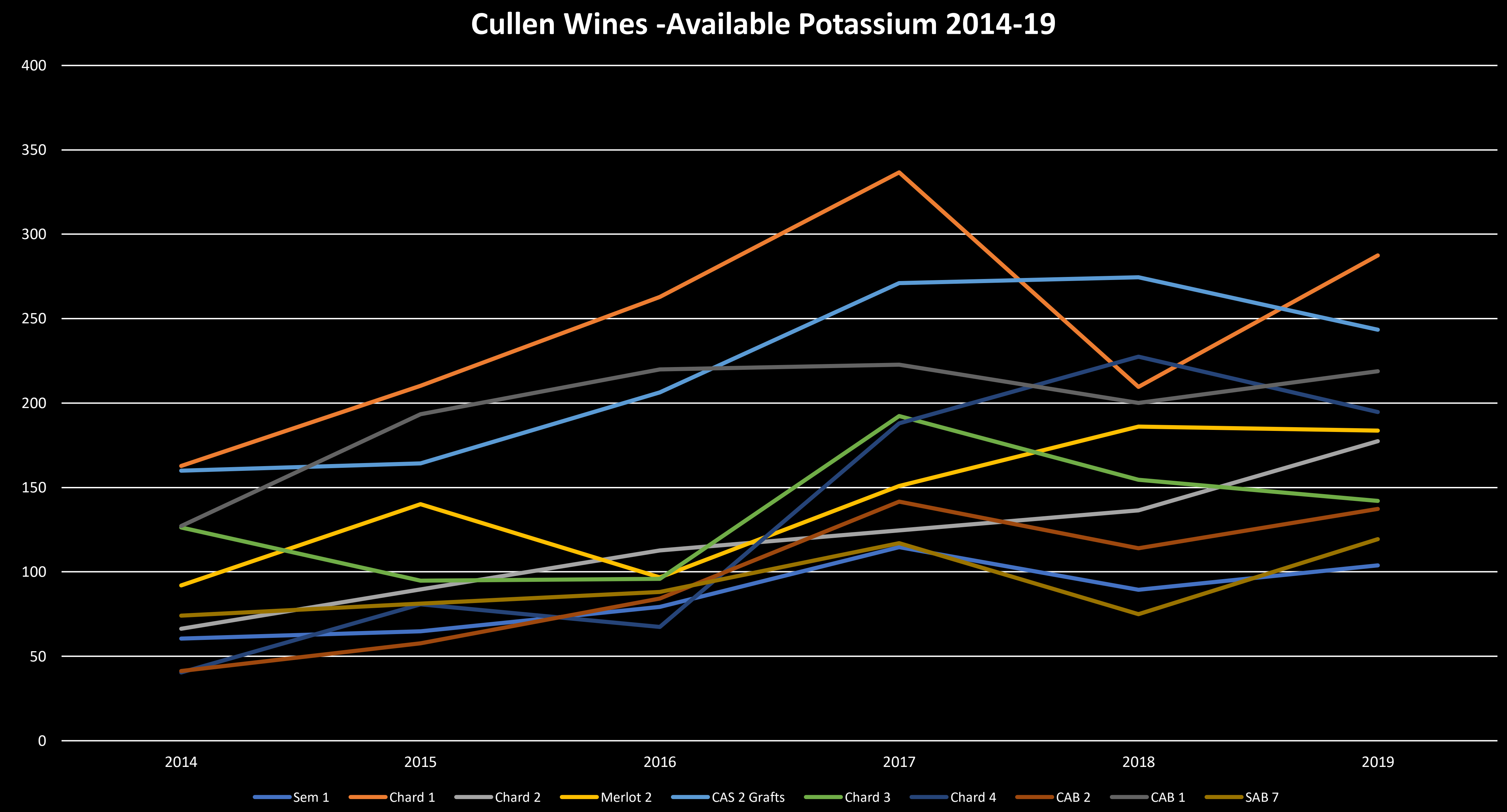


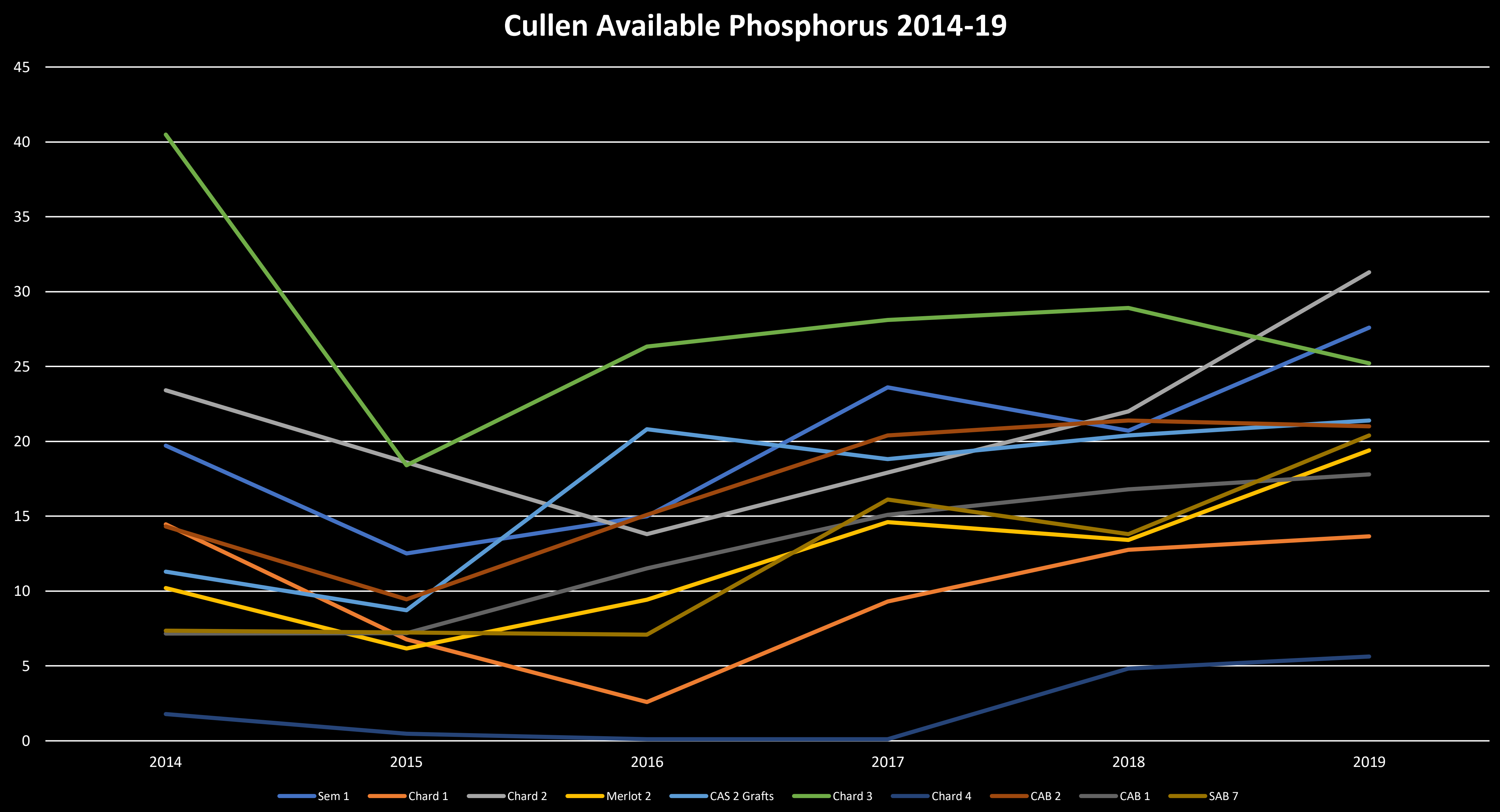
Cullen wines - Available Magnesium 2014-19
400
350
300
250
200
150
100
50
0
2014
2015
2016
2017
2018
2019
Sem
Chard 1
Chard 2
Merlot 2
CAS 2 grafts
Chard 3
Chard 4
Cab 2
Cab 1
Sab 7

Mg

- Can’t produce sugars without it
- Critical for photosynthetic efficiency



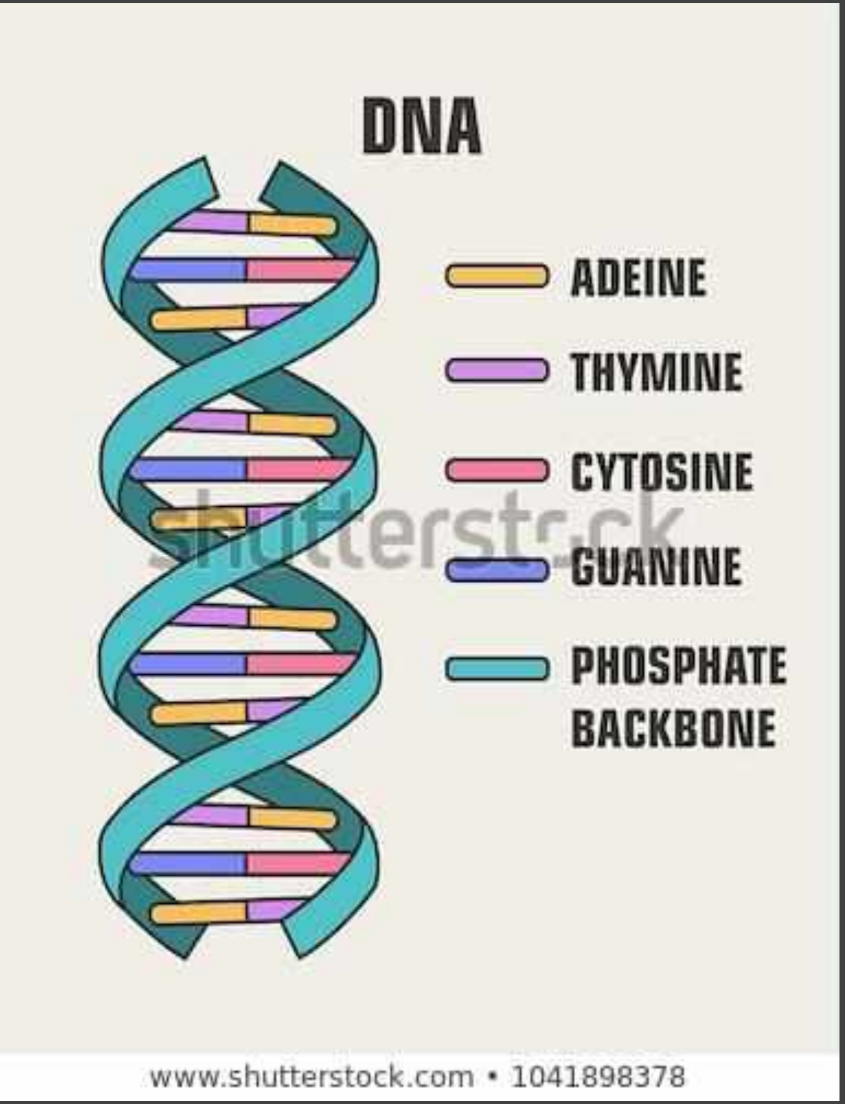

Cullen Wines -Available Potassium 2014-19
400
350
300
250
200
150
100
50
0
2014
2015
2016
2017
2018
2019
Sem 1
Chard 1
Chard 2
Merlot 2
CAS 2 Grafts
Chard 3
Chard 4
CAB 2
CAB 1
SAB 7

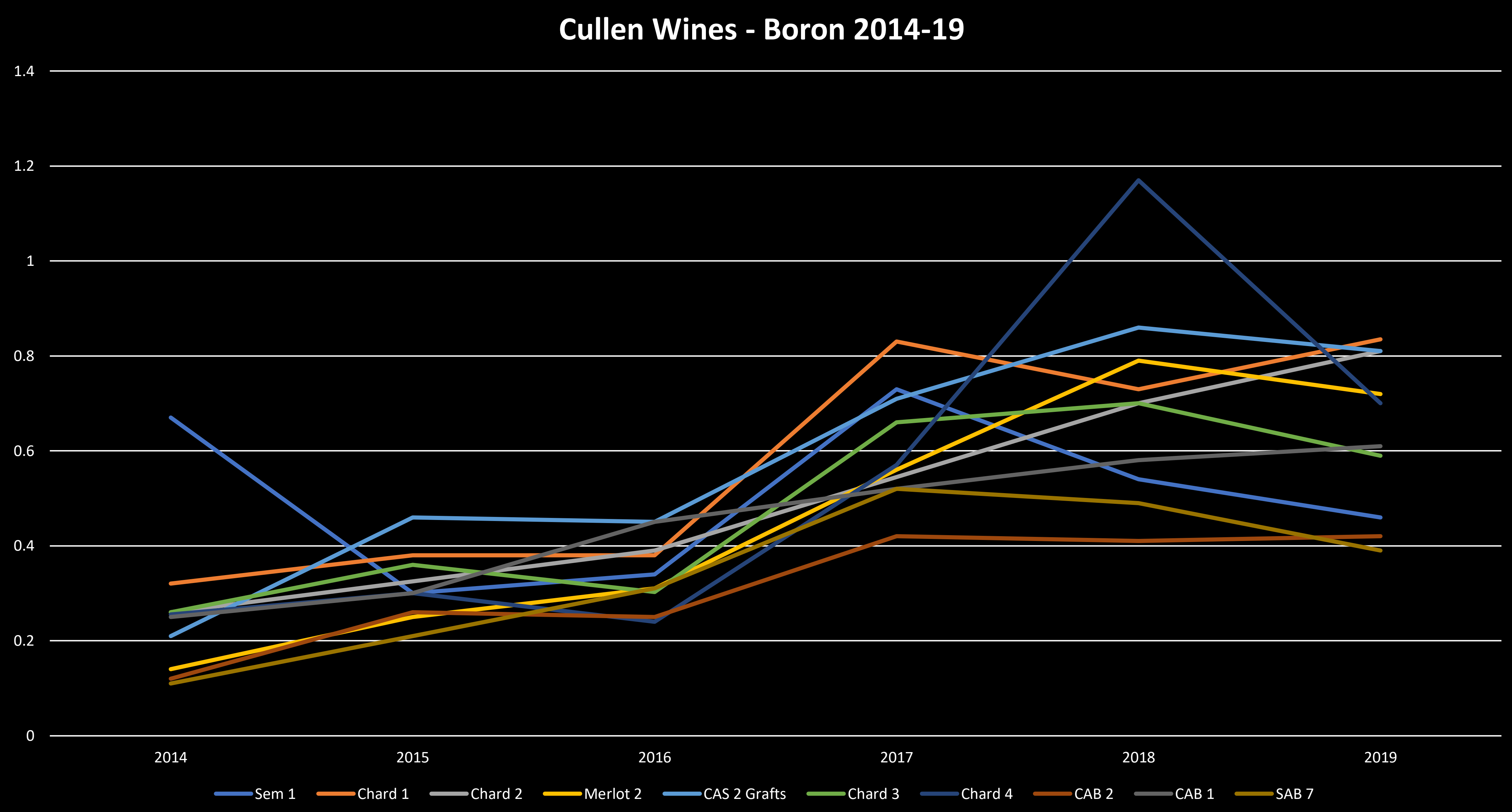


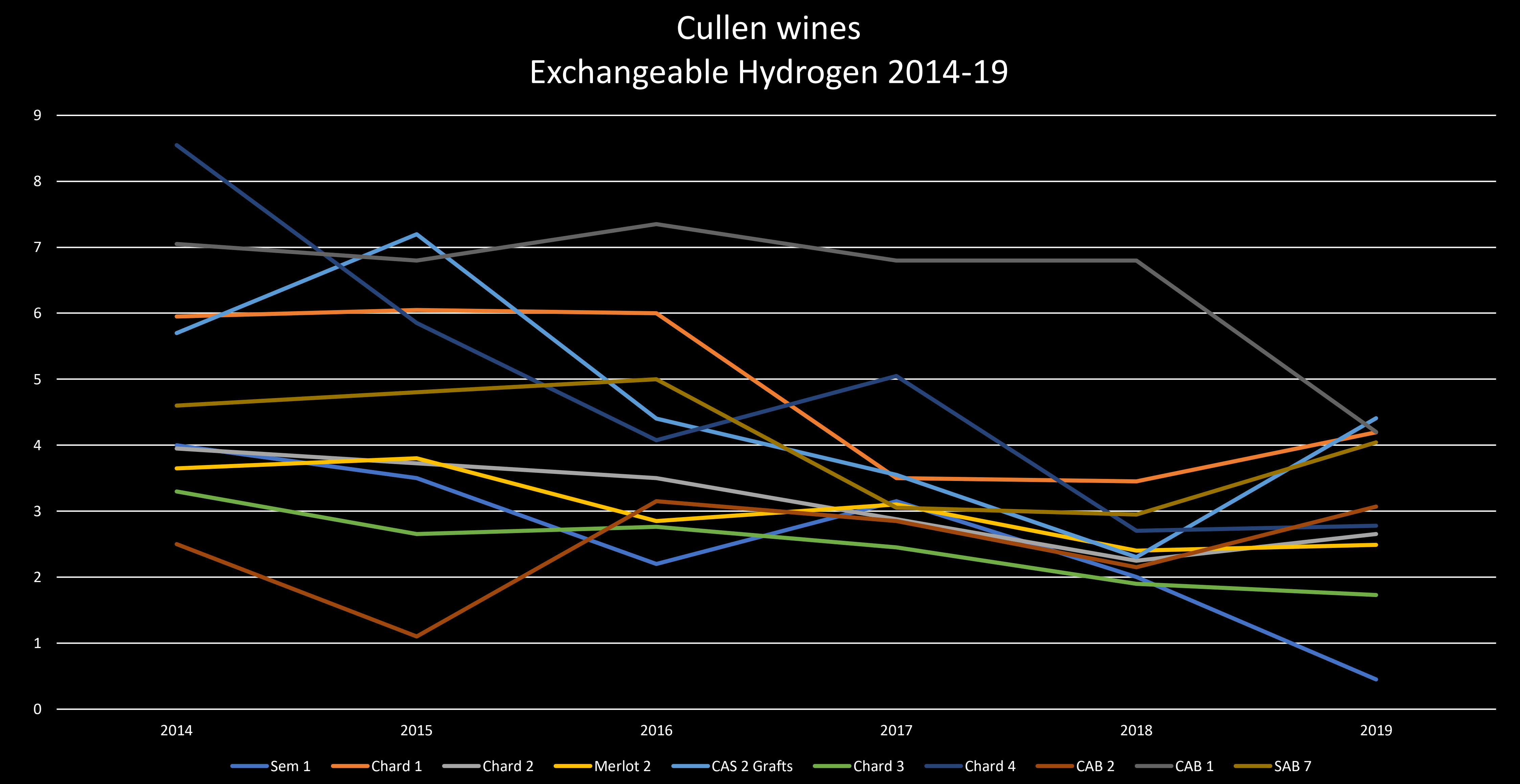
Cullen Available Phosphorus 2014-19
45
40
35
30
25
20
15
10
5
0
2014
2015
2016
2017
2018
2019
Sem 1
Chard 1
Chard 2
Merlot 2
CAS 2 Grafts
Chard 3
Chard 4
CAB 2
CAB 1
SAB 7

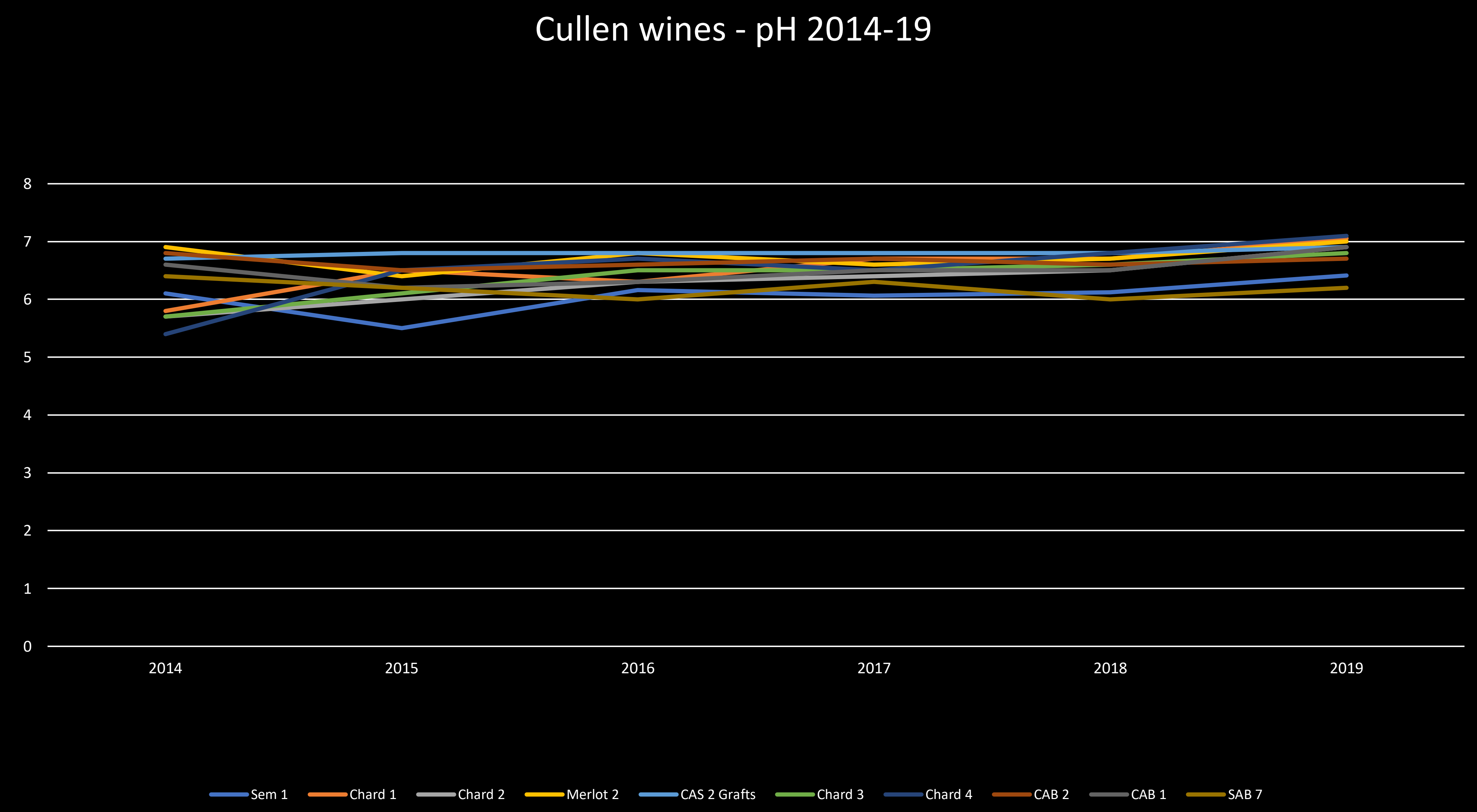
Phosphorus

- Seed germination, Photosynthesis.
- Protein formation, Fruit & flower formation.
- Almost all aspects of growth and metabolism.
- Backbone of DNA molecule.
- Every Cell of every plant, microbe & animal
- Best to use microbe friendly P such as guano




Cullen Wines - Boron 2014-19
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2014
2015
2016
2017
2018
2019
Sem 1
Chard 1
Chard 2
Merlot 2
CAS 2 Grafts
Chard 3
Chard 4
CAB 2
CAB 1
SAB 7


Cullen wines
Exchangeable Hydrogen 2014-19
9
8
7
6
5
4
3
2
1
0
2014
2015
2016
2017
2018
2019
Sem 1
Chard 1
Chard 2
Merlot 2
CAS 2 Grafts
Chard 3
Chard 4
CAB 2
CAB 1
SAB 7

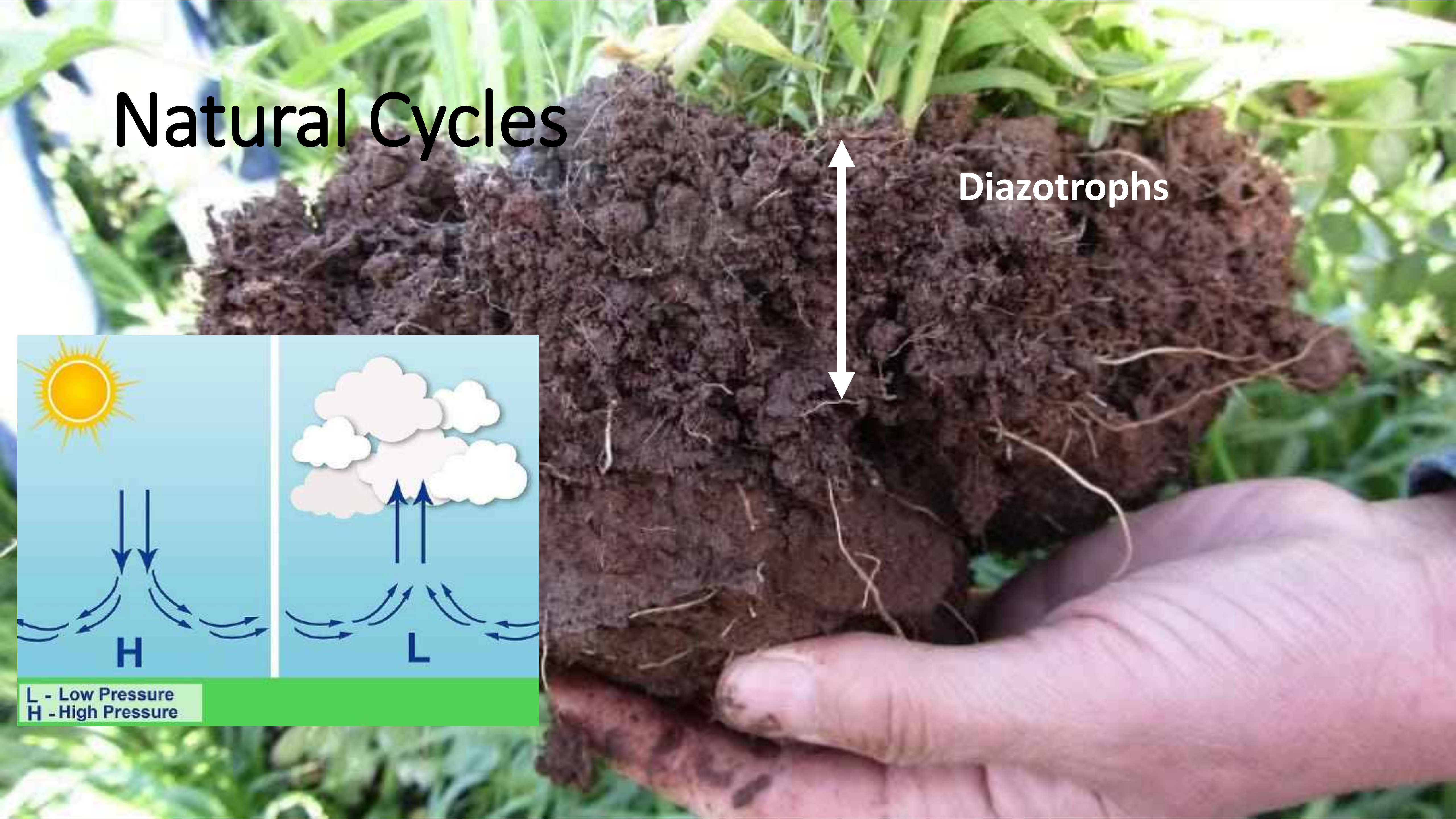

Cullen wines - pH 2014-19
8
7
6
5
4
3
2
1
0
2014
2015
2016
2017
2018
2019
Sem 1
Chard 1
Chard 2
Merlot 2
CAS 2 Grafts
Chard 3
Chard 4
CAB 2
CAB 1
SAB 7

Results

- Notable increases in yield and quality.
- Enhanced resilience. Notably this year.
    - increased water storage btw 350,000 – 700,000 L/Ha
- Reduced Garden Weevil pressure.
- Reduced need for fertiliser additions


Winter Crops
Peas
Cereal Rye
White Lupins
Arrowleaf, Crimson,
Persian, Balansia &
Gosse Clovers
Ryegrass
Tillage Radish
Wheat
Oats
Triticale
Barley
Vetch


Natural Cycles




Summer crops

Sunflowers
Cowpea
Lablab
Buckwheat
Millet


22


25

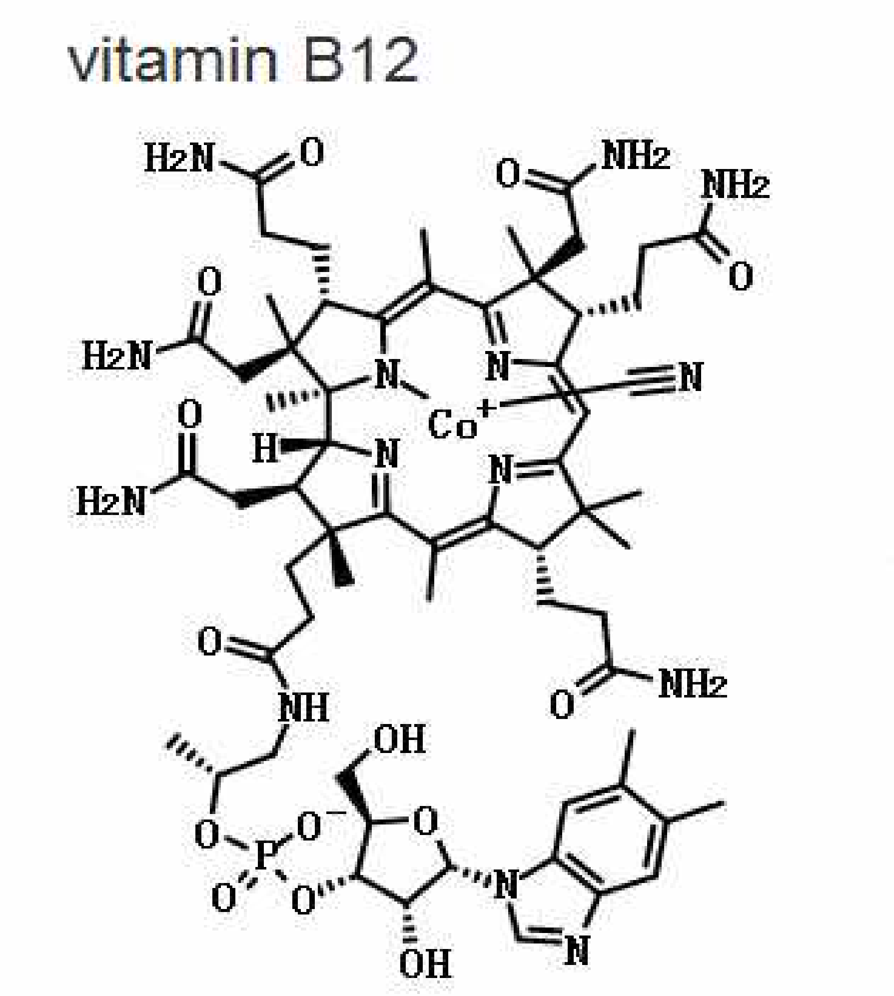

Cobalt
Bioessential B12

- Required by at least 80% all animal life
- Synthesized only by bacteria & archaea

AVAILABLE IRON[†]	Fe	ppm	107	> 30
AVAILABLE MANGANESE[†]	Mn	ppm	12	> 20
AVAILABLE COBALT	Co	ppm	3.12	0.7-0.8
AVAILABLE MOLYBDENUM	Mo	ppm	0.23	0.3-0.4

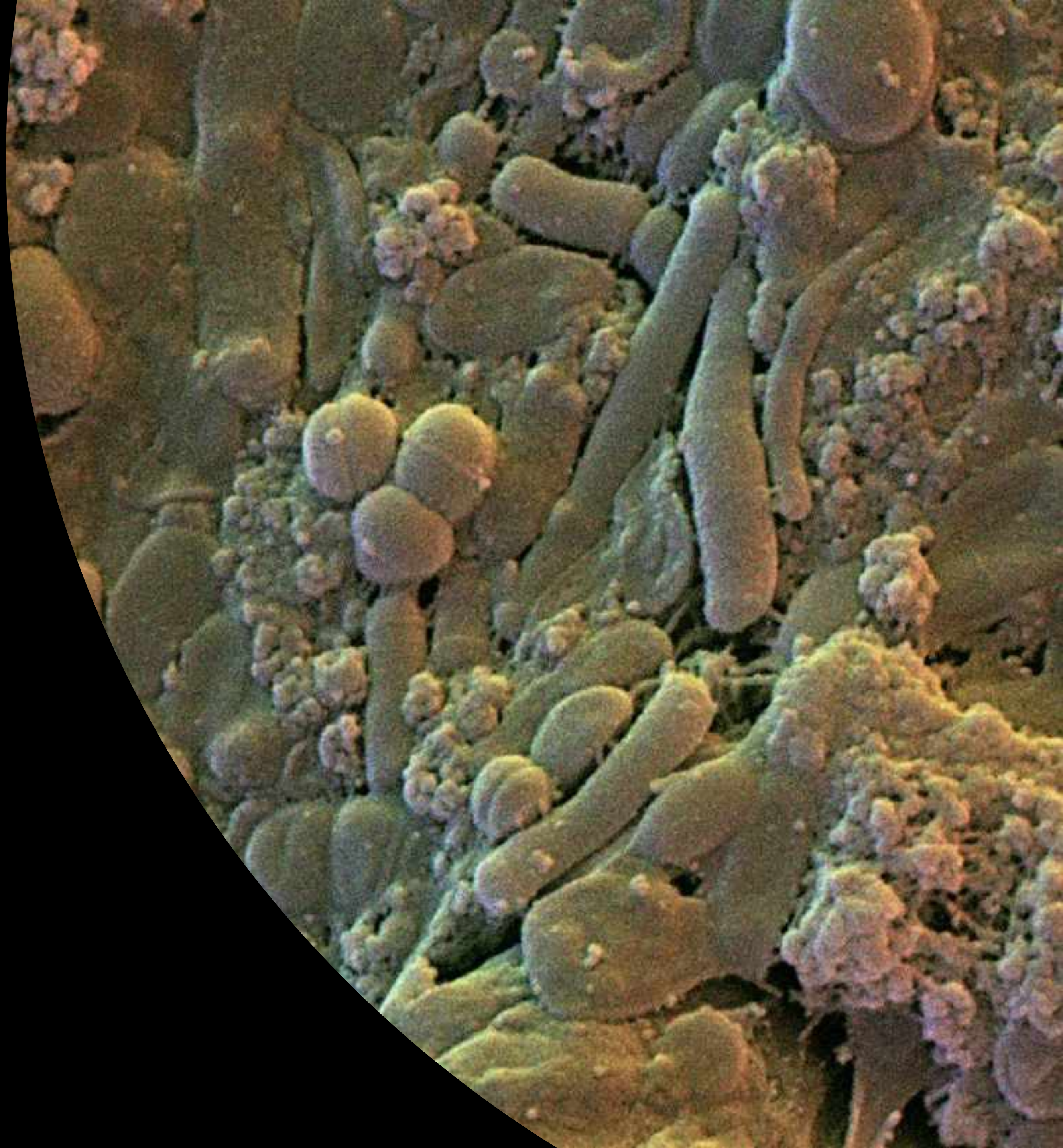
AVAILABLE IRON[†]	Fe	ppm	9	> 30
AVAILABLE MANGANESE[†]	Mn	ppm	3	> 20
AVAILABLE COBALT	Co	ppm	0.01	0.5-0.7
AVAILABLE MOLYBDENUM	Mo	ppm	0.15	0.1-0.2

Most concentrated natural source of Cobalt?



Biology Trumps

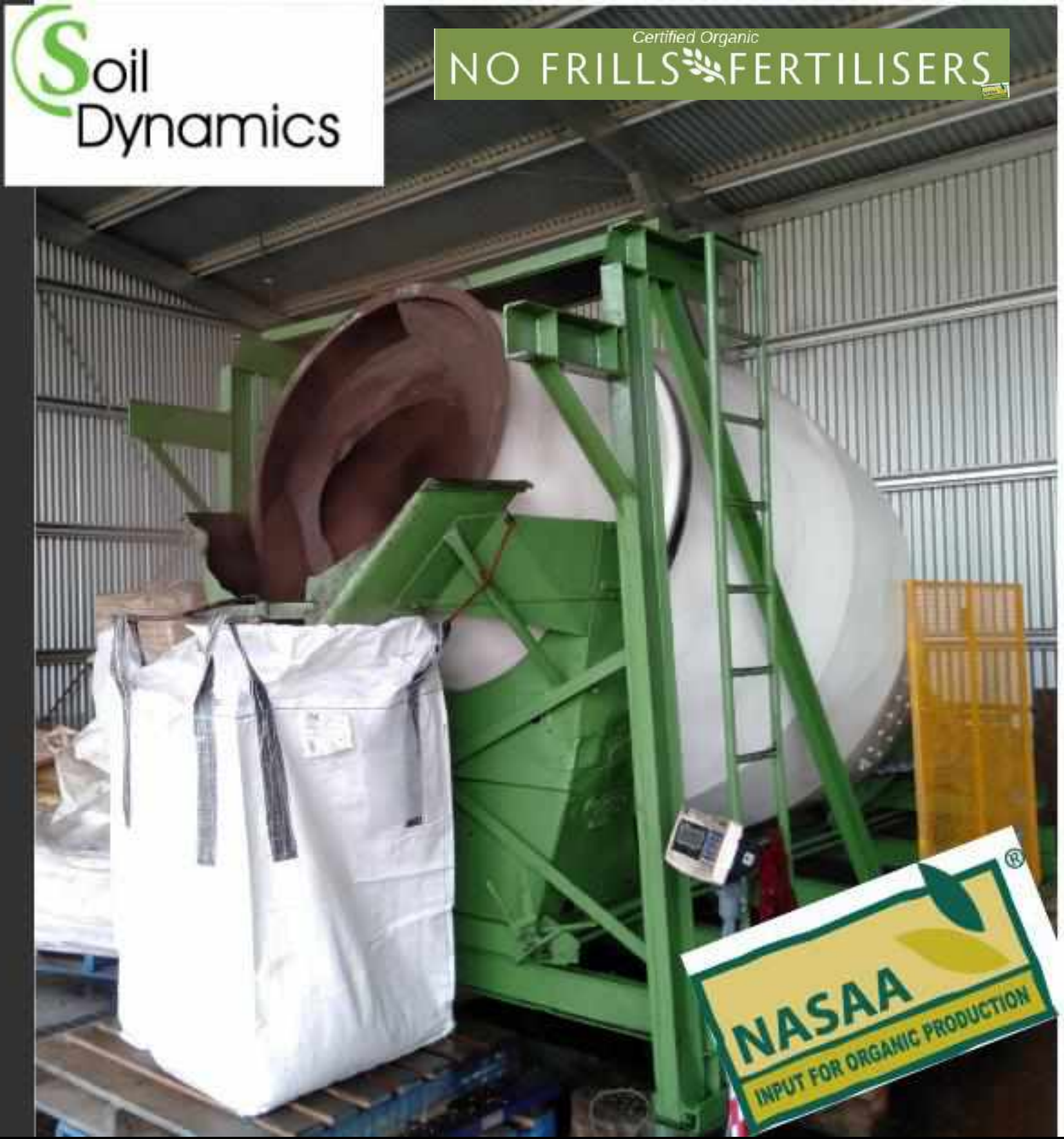
- Between 2 Billion & 1 trillion species of microbes.
- We currently have identified about 0.001%
- 1800 bacterial species in the air we breathe.
- NASA discovered 5100 species of bacteria in 1m ^{3} of Air - 33,000 feet high.
- 20 Billion oral bacteria at any one time.
- 100 Billion within 24hrs with no brushing.
- Who is in control?



Tailored Blends to suit your Soil & Crops

ORGANIC CUSTOM BLENDING FACILTIY

Introducing HydroN13
13.6% slow release organic nitrogen



Certified Organic
NO FRILLS FERTILISERS

Guano
Humates
Potassium Sulphate
Kieserite
All trace elements
Biological inoculants
Compost extracts
Full range of biostimulants – Hydrofish, Seaweed extract, Molasses


Demodex mite