



Soil Nutrient Demonstration 2018/19 Season Results

Background

- Leaching of nutrients represents environmental and economic cost to the farm
- Fertiliser regimes influence livestock intensity and therefore nutrient surpluses
- Conventional fertiliser regime in NZ is 'sufficiency' approach which meets soil nutrients below which crops respond to added fertiliser
- Different philosophies of soil management claim alternative fertiliser regimes may be able to improve nutrient retention and recycling
- In 2012 Methven farmers Jeremy Casey and Kim Solly decided to use their two dairy farms to compare the impact of conventional or Albrecht-Kinsey fertiliser regime on production and profit

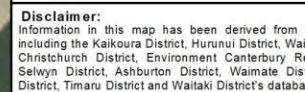
The Albrecht Kinsey (A-K) philosophy

- The A-K philosophy believe the correct soil chemistry and physics create an environment for optimal biology.
- “Feed the soil and let the soil feed the plants”
- Total soil cations should be 65-70% Ca, and 10-12% Mg (ie. calcium and magnesium should add up to 80% of the base saturation)
- The A-K regime is expected to give more consistent yield and quality, though not necessarily the greatest yield at one time
- Spin-off is healthier animals and people



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Conventional
Waiora

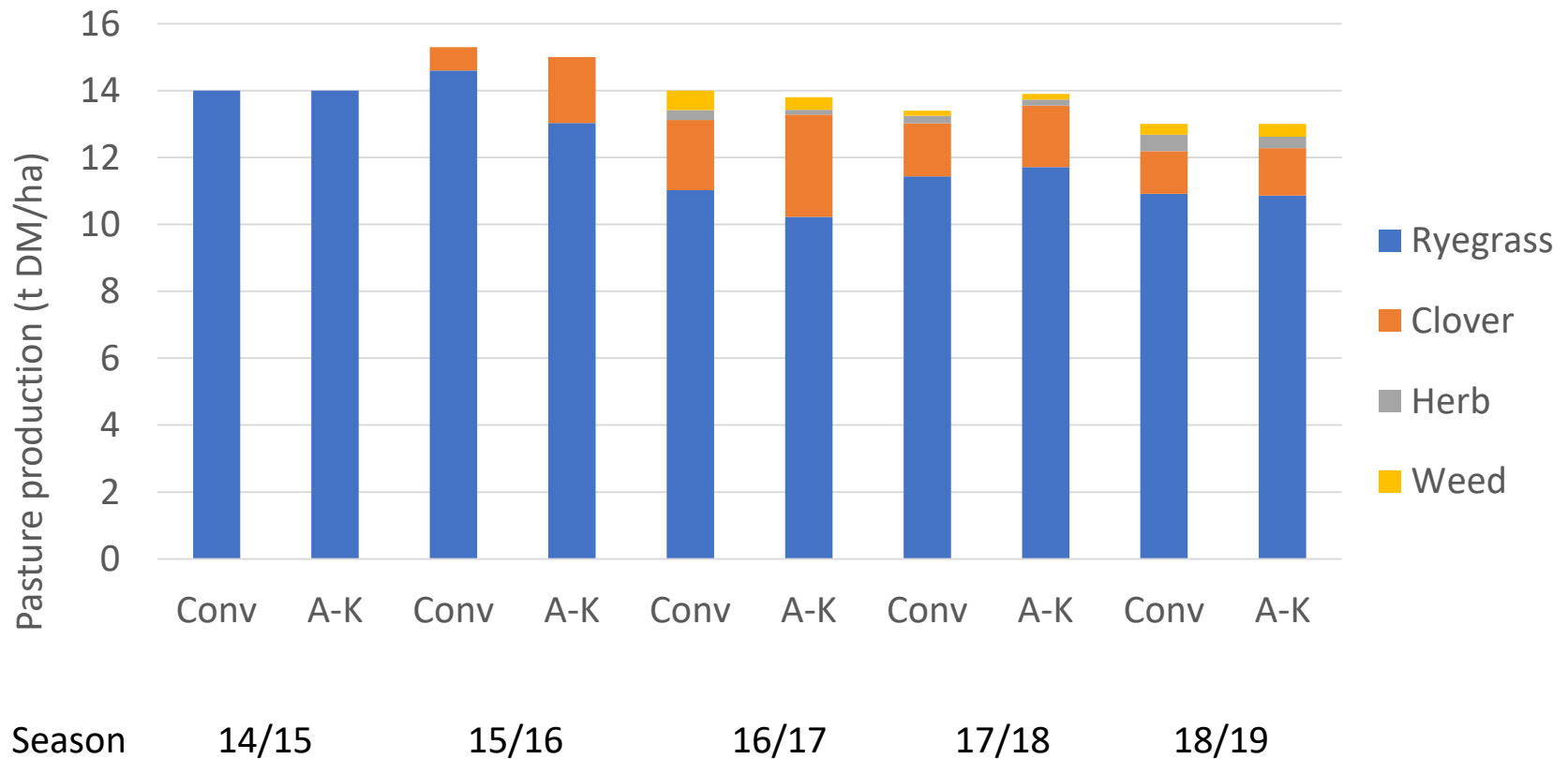
A-K
Whakapono



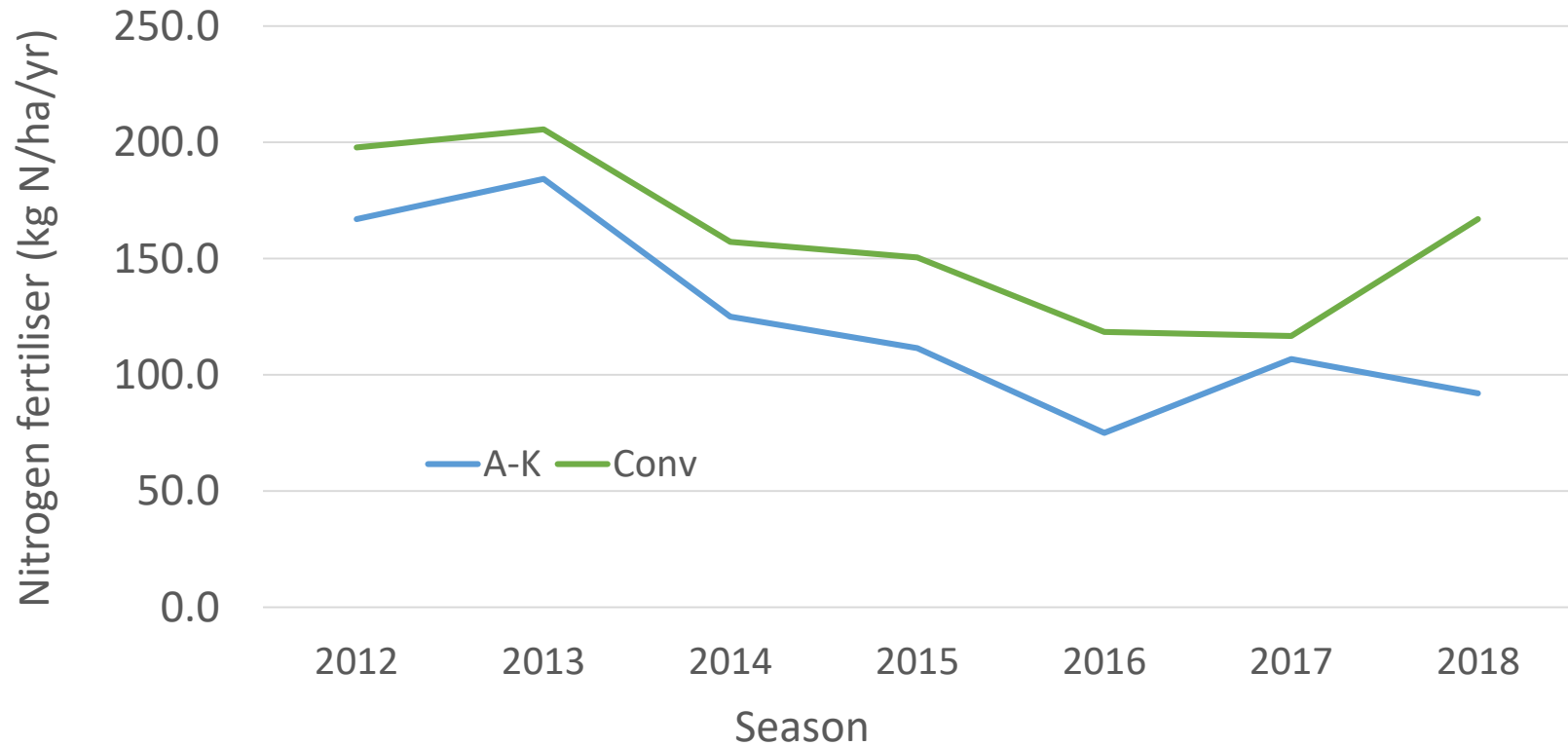
Backtrack Dairies – 2018-2019 Season

	Whakapono	Waiora
Effective Area	155	210
Stocking Rate	3.5	3.4
Peak Cows	542	724
Treatment	Albrecht-Kinsey (AK)	Conventional (Conv)
Total MS/ha	1595	1609
Total MS/cow* incl calf milk	456	467
Total N Applied (kg N/ha)	92	167
Total Supplements Made TDM	41	104
Total Supplements Fed (kg DM/cow)	740	667
Total Pasture Eaten t DM/ha	13.4	13.8

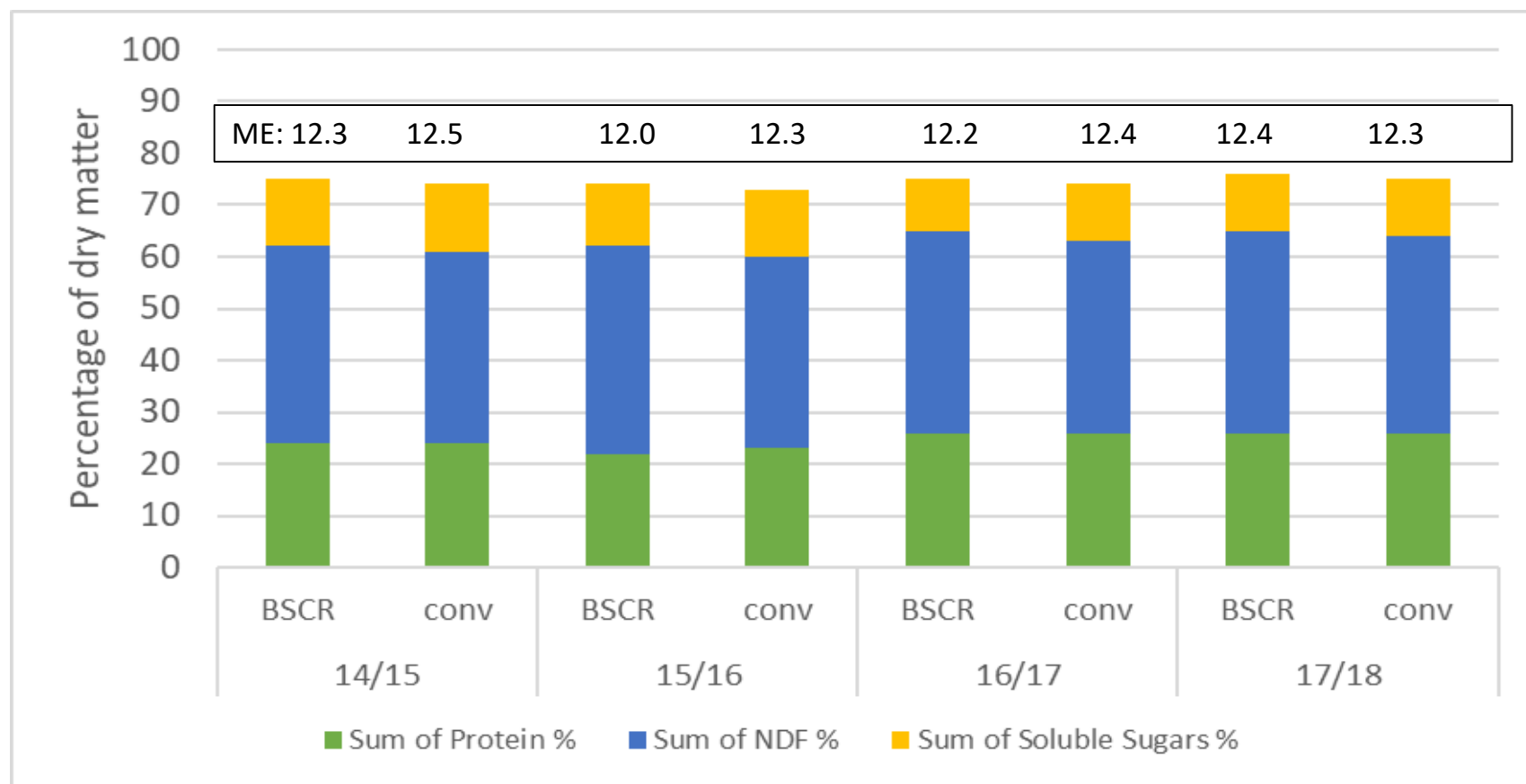
Both farms have similar pasture production, though lower N fertiliser on the A-K farm has resulted in more clover growth compared with Conventional



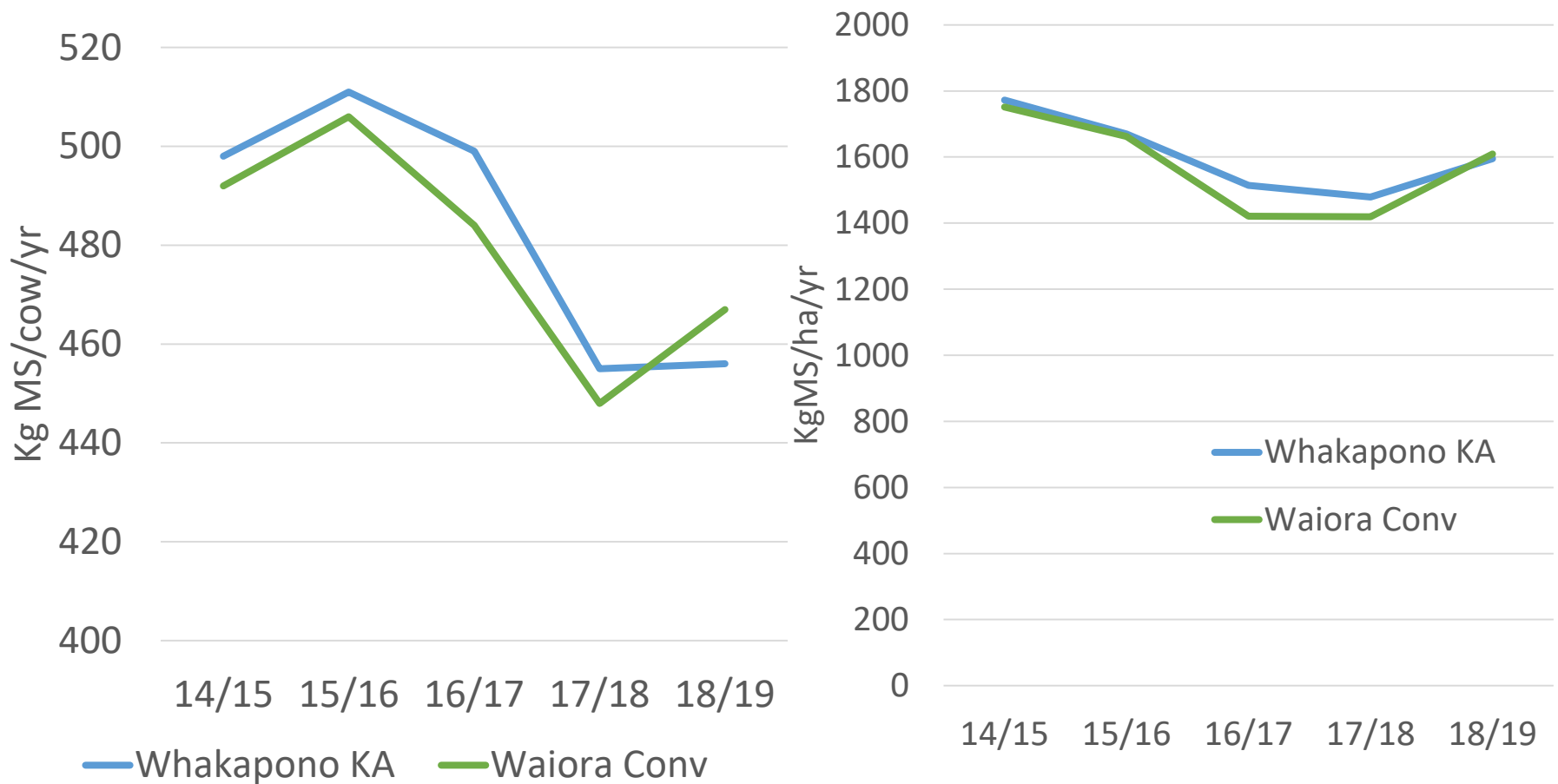
More N fertiliser has been applied to the conventional farm compared with the A-K farm.



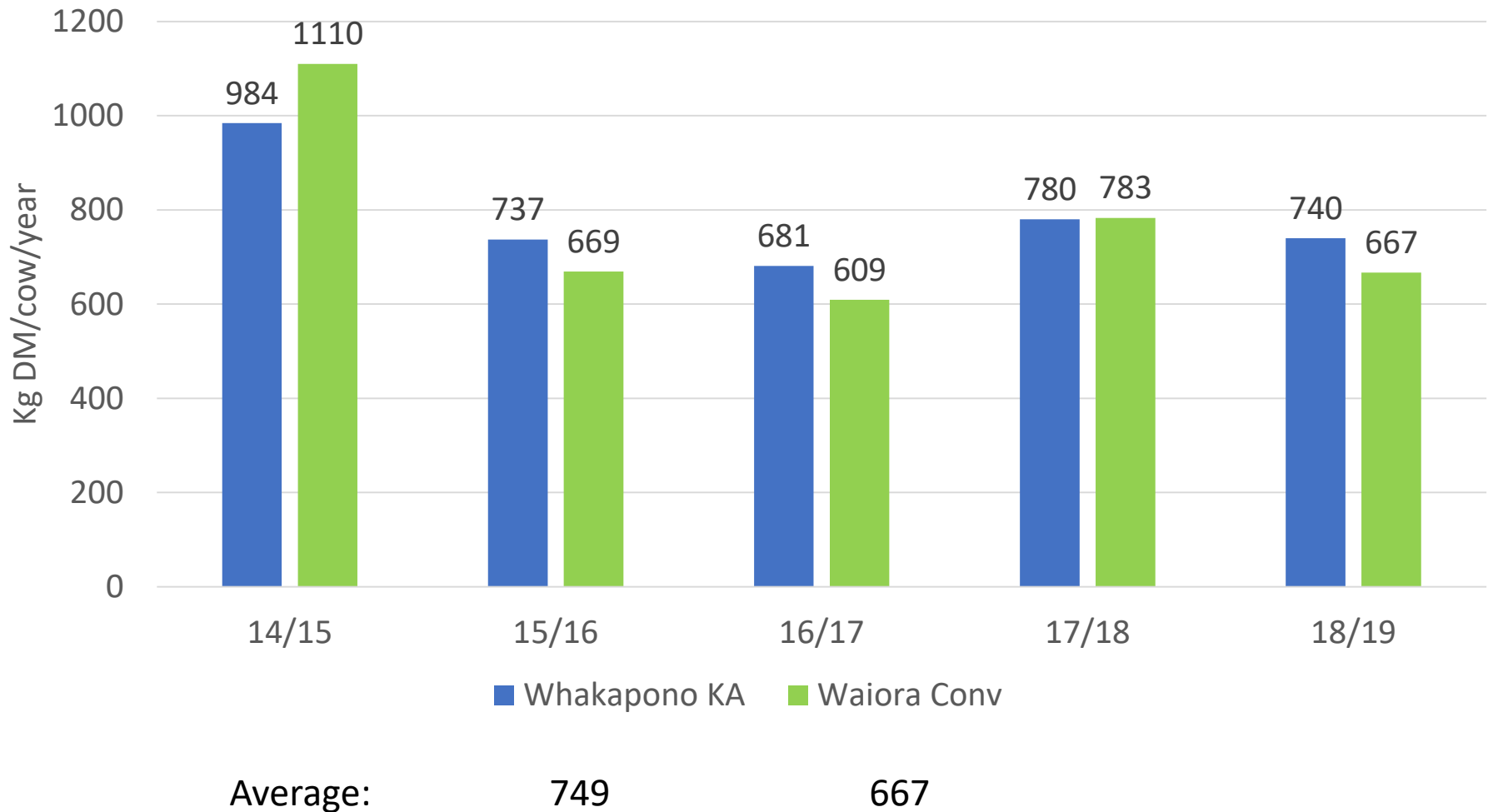
On average the pasture quality has been similar for both farms, likely due to similar decision rules and grazing management on both farms



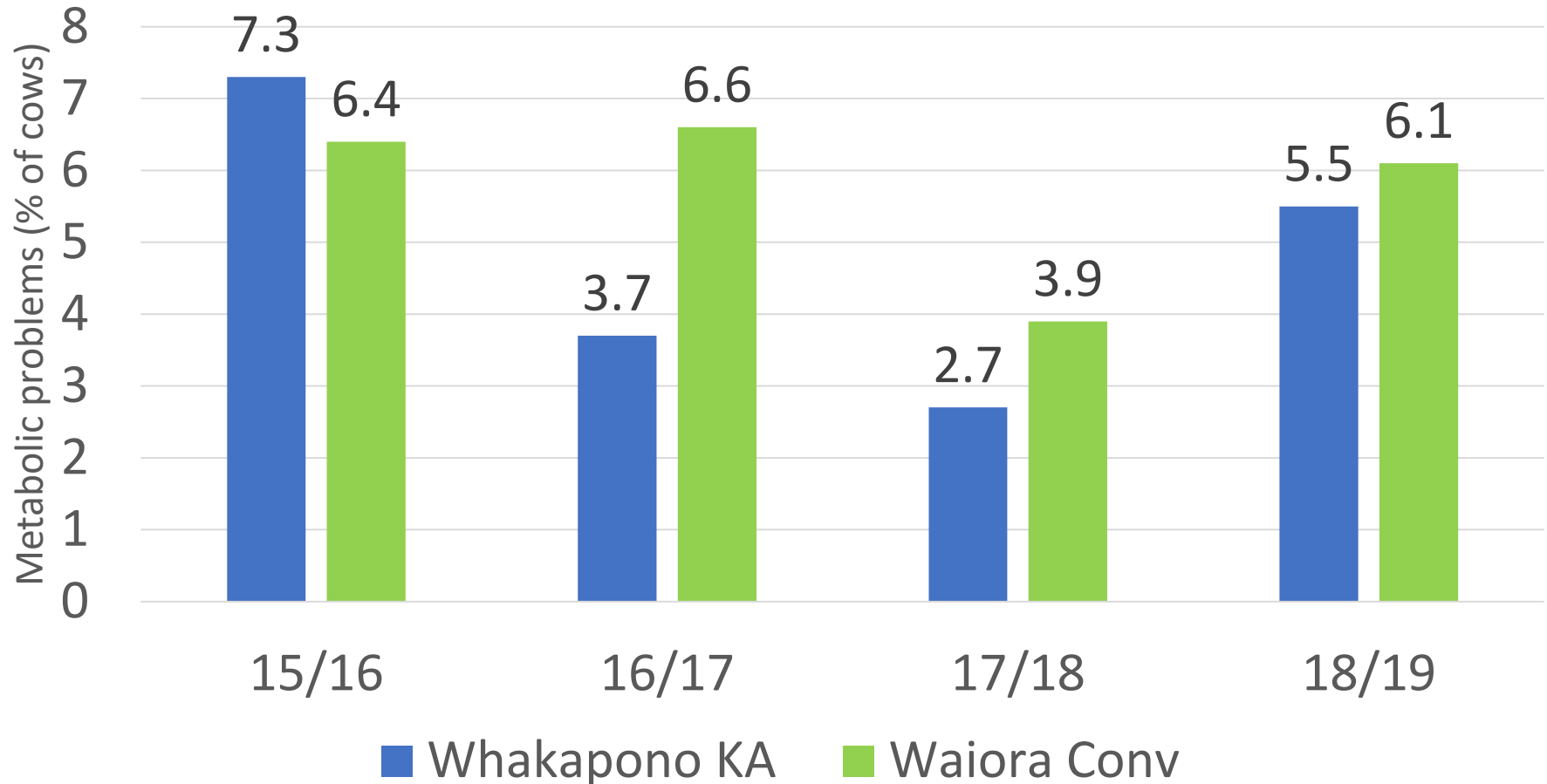
Milk yield has been similar for both farms, decline over time has been the result of decreasing reliance on supplements, N fertiliser and subsequent reduction in stocking rate



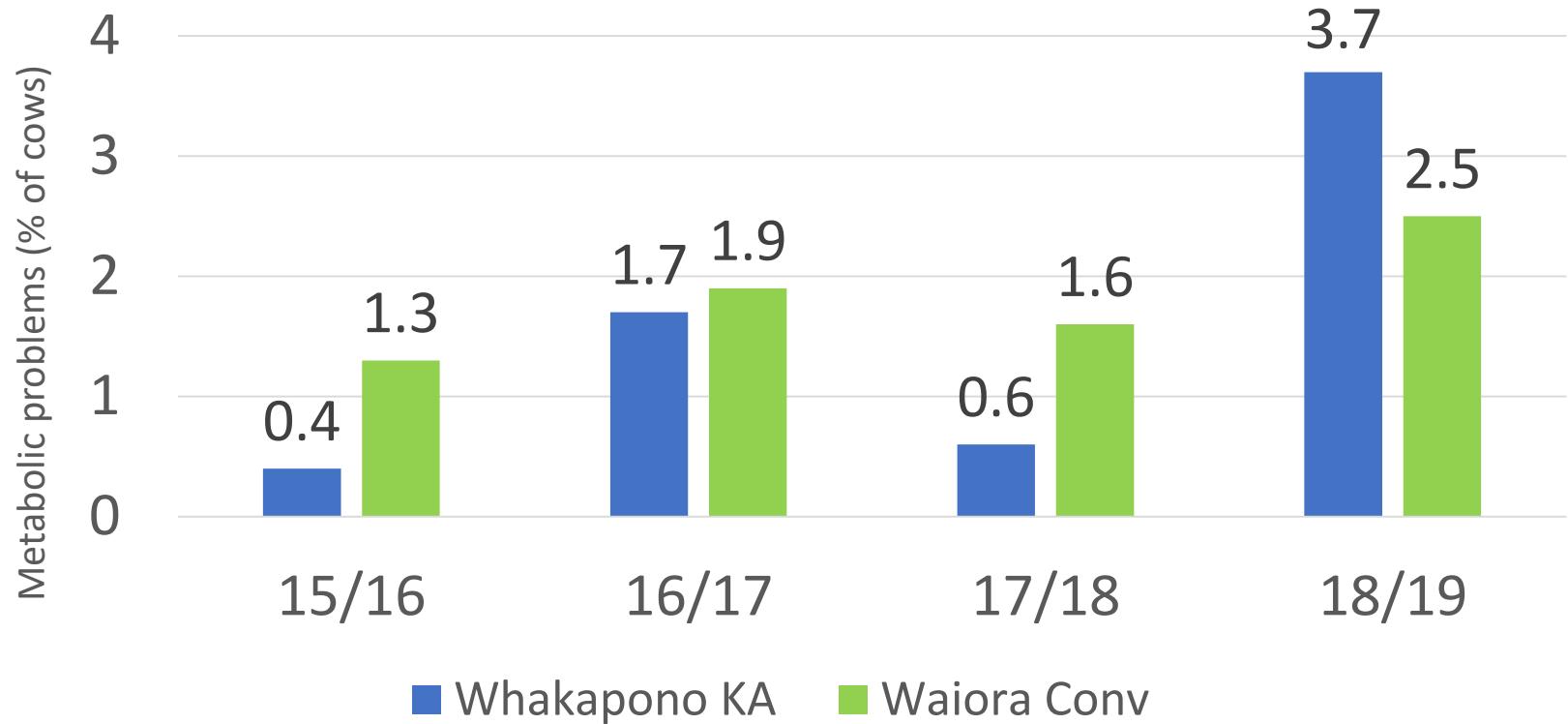
Supplement use has also been similar for both farms



Anecdotally, fewer problems with animal health
on the A-K farm at Calving



For the rest of the season the results are variable across both farms

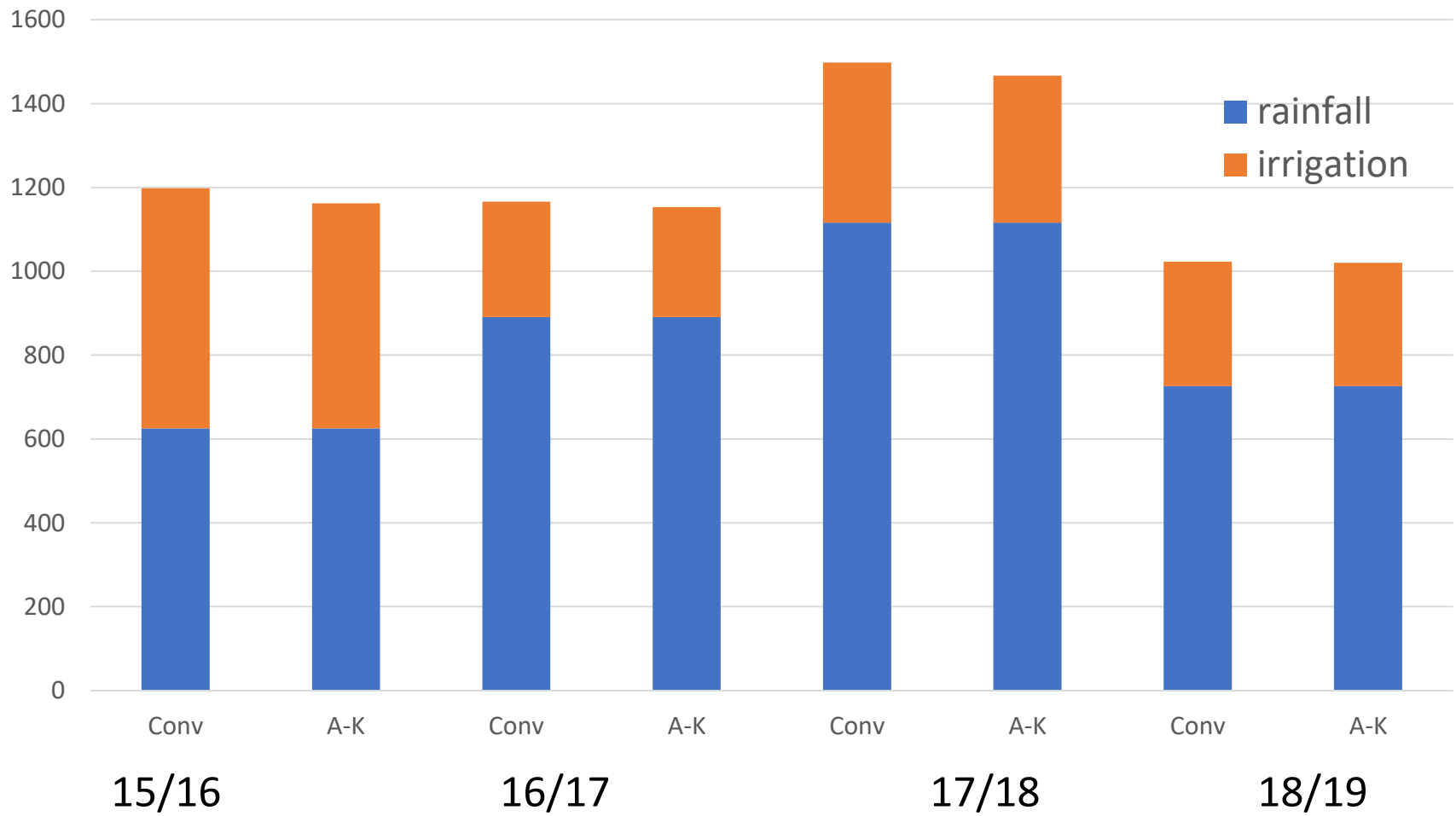


No statistical difference between the two farms for fertility parameters across the four years

A-K	14/15	15/16	16/17	17/18	18/19
3 week Submission Rate	92	91	91	85	91
Non Cyclers	8	9	9	15	9
MT Rate	8	14	15	11	9.5

Conventional	14/15	15/16	16/17	17/18	18/19
3 week Submission Rate	89	88	87	86	87
Non Cyclers	11	12	13	14	13
MT Rate	10	15	15	13	11.5

Water use has been similar on both farms



Over 6 years, more Mg, Ca and K (kg/ha) has been applied to the A-K but less N and P compared to the conventional

Season		N	K	P	Sul	Mg	Ca
2012/2013	Conv	198	39	49	58	35	60
	A-K	167	13	26	165	90	210
2013/2014	Conv	206	53	39	79	20	93
	A-K	184	142	51	245	14	129
2014/2015	Conv	157	59	39	60	21	96
	A-K	125	75	16	150	33	164
2015/2016	Conv	151	68	37	69	27	90
	A-K	111	45	28	96	123	328
2016/2017	Conv	118	48	48	57	0	48
	A-K	75	93	32	116	63	195
2017/2018	Conv	117	57	39	59	29	99
	A-K	107	61	33	197	5	80
2018/2019	Conv	167	37	65	82	15	28
	A-K	92	63	34	118	55	548

Little difference in soil quality of monitor paddocks based on standard indicators from 0-15cm sampling (July 2018)

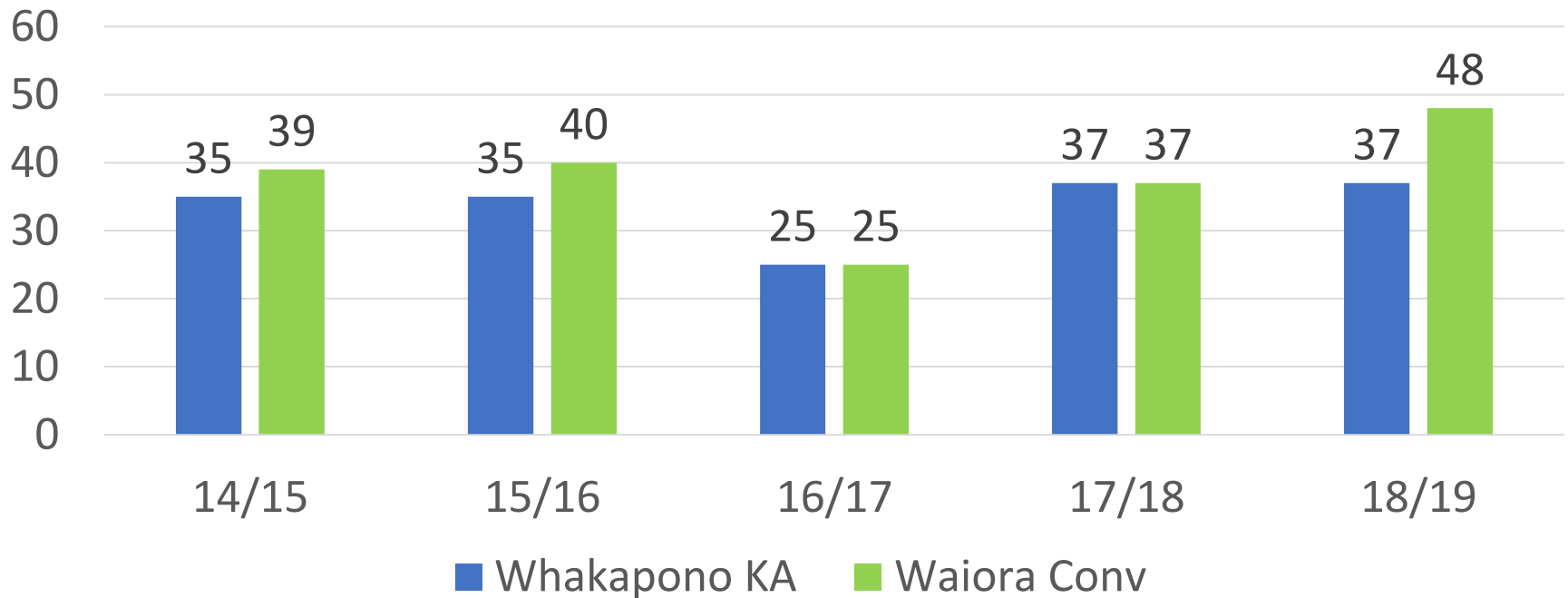
	Conventional	A-K
Organic matter (Carbon %)	2.98	3.08
pH	6.3	6.2
Nitrogen (N%)	0.29	0.29
Calcium	8.3	8.0
Magnesium	17.0	27.7
Potassium	6.3	5.7
Aggregate stability (mm, MWD)	2.41	2.28
CEC	14.0	14.7
Earthworms	755	1300
Total numbers (incl GG, CRW, porina)	884	1675

With the exception of Mg and P, soil chemistry is similar

Hills	A-K	Conv
PH	6.4	6.2
Olsen P	15	19
S	15	10
K	6	8
Ca	9.5	9
Mg	31	18
Na	1	2

Kinsey Albrecht	A-K	Conv
PH	6.4	6.4
Total Exchange Capacity	10.9	10.5
Calcium %	68.5	73.2
Magnesium %	13.6	8.4
Potassium %	3.2	2.9
Sodium %	0.8	1.0

With the exception of the 2018/19 season N Leaching estimates from OVERSEER have been similar



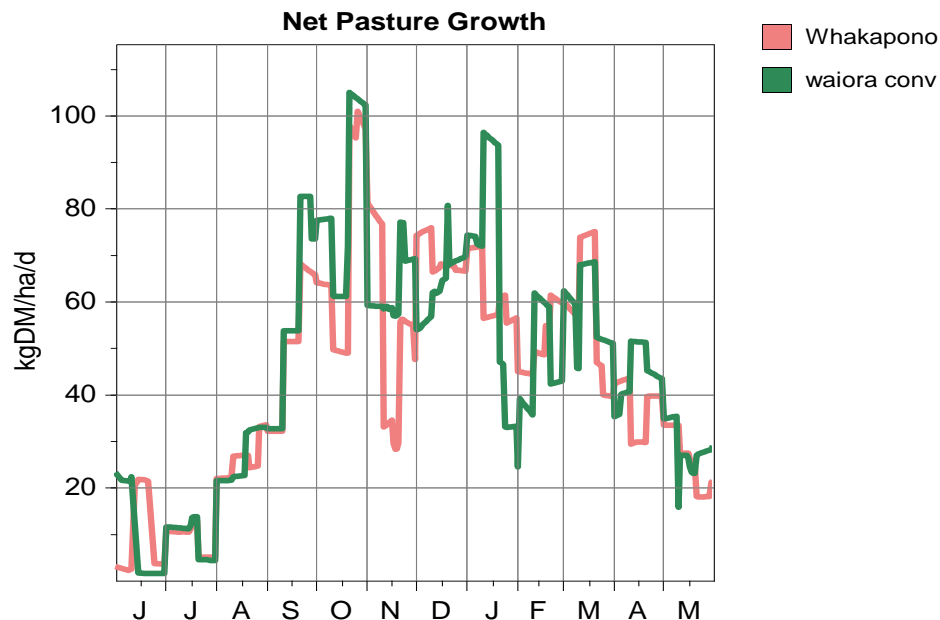
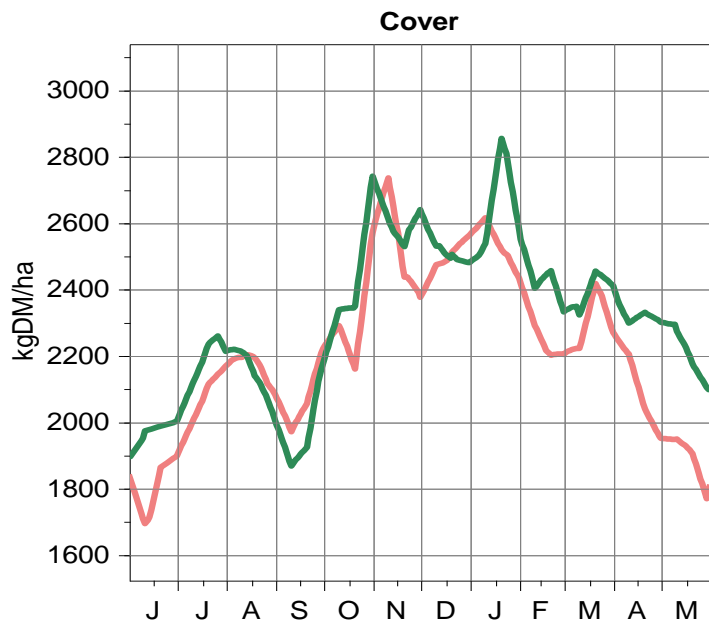
NB: considerably more N fertiliser applied to Conv, compared with A-K in 2018/19

Compare Physical Summary

Jun 18 - May 19

Category	Description	Whakapono Monitoring	waiora conv Monitoring	Difference	Units
Farm	Effective Area	155	210	55	ha
	Stocking Rate	3.5	3.4	0.0	cows/ha
	Potential Pasture Growth	17.3	16.7	-0.6	t DM/ha
	Nitrogen Use	92	163	71	kg N/ha
	Feed Conversion Efficiency (eaten)	11.0	10.8	-0.1	kg DM eaten/kg MS
Herd	Cow Numbers (1st July)	542	724	182	cows
	Peak Cows Milked	542	724	182	cows
	Days in Milk	276	277	1	days
	Avg. BCS at calving	5.0	4.8	-0.2	BCS
	Liveweight	1,601	1,580	-21	kg/ha
Production	Milk Solids total	247,174	337,852	90,678	kg
(to Factory)	Milk Solids per ha	1,595	1,609	14	kg/ha
	Milk Solids per cow	456	467	11	kg/cow
	Peak Milk Solids production	2.07	2.16	0.08	kg/cow/day
	Milk Solids as % of live weight	99.6	101.8	2.2	%
Feeding	Pasture Eaten per cow *	3.8	4.0	0.2	t DM/cow
	Supplements Eaten per cow *	0.6	0.6	-0.1	t DM/cow
	Off-farm Grazing Eaten per cow *	0.5	0.5	0.0	t DM/cow
	Total Feed Eaten per cow *	5.0	5.1	0.1	t DM/cow
Diagnostics	Pasture Eaten per ha	13.4	13.8	0.4	t DM/ha
	Supplements Eaten per ha	2.4	2.1	-0.2	t DM/ha
	Off-farm Grazing Eaten per ha	3.7	3.5	-0.2	t DM/ha
	Total Feed Eaten per ha	19.5	19.4	-0.1	t DM/ha
	Supplements and Grazing / Feed Eaten *	23.4	21.2	-2.3	%
	Bought Feed / Feed Eaten *	13.0	11.2	-1.8	%

(*) feed eaten by females > 20 months old / peak cows milked

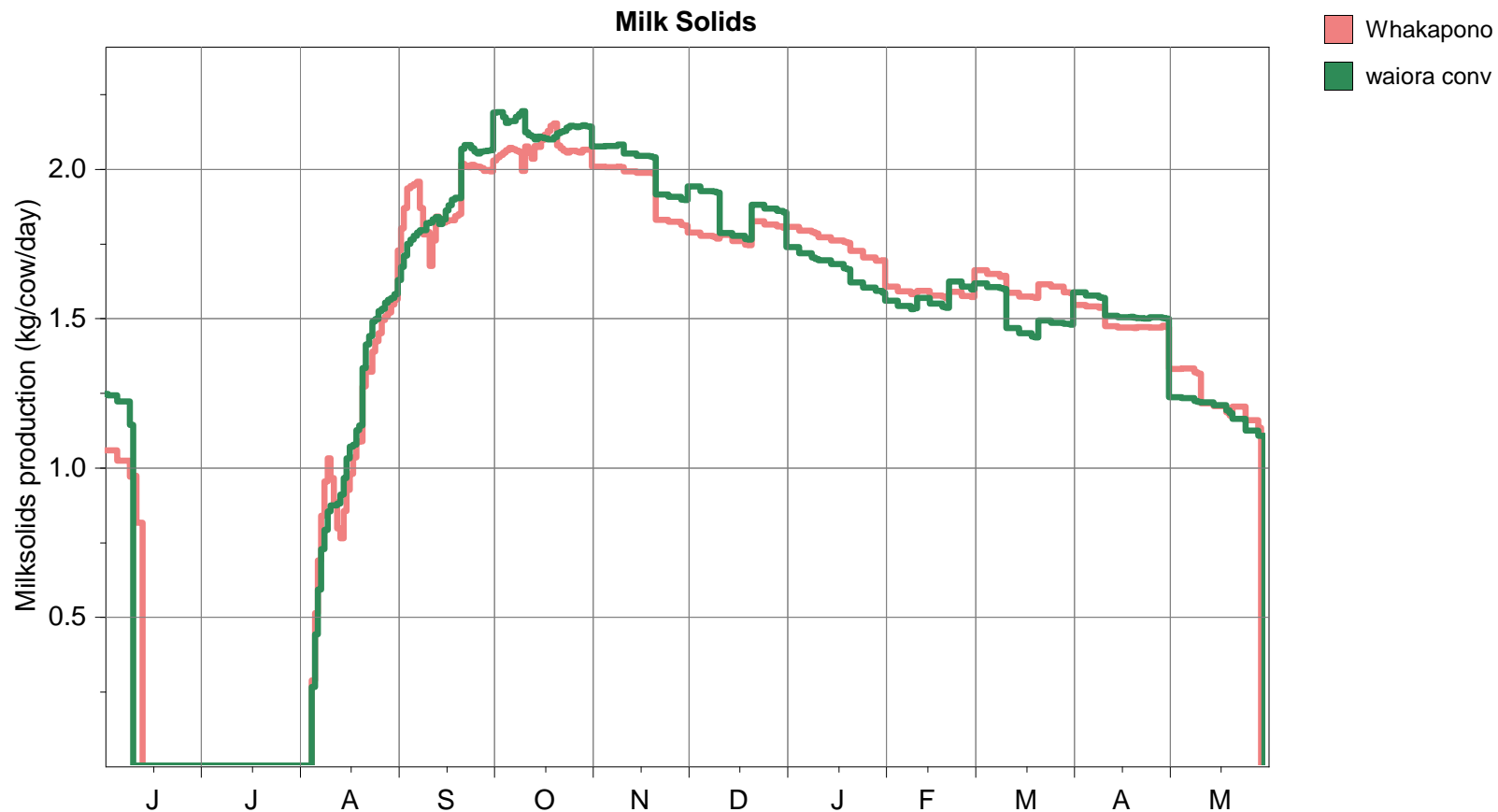


		Jun 18	Jul 18	Aug 18	Sep 18	Oct 18	Nov 18	Dec 18	Jan 19	Feb 19	Mar 19	Apr 19	May 19
Cover (kg DM/ha)	Whakapono	1,896	2,167	2,081	2,221	2,570	2,374	2,562	2,431	2,203	2,269	1,950	1,810
	waiora conv	2,000	2,212	2,002	2,176	2,740	2,639	2,479	2,578	2,331	2,410	2,300	2,100
Net Pasture Growth (kg DM/ha/d)	Whakapono	9.0	8.7	25.7	50.0	71.0	55.0	69.4	61.8	51.1	57.6	37.3	25.8
	waiora conv	8.1	9.1	26.3	55.2	81.0	62.8	62.7	67.0	46.4	58.8	44.5	28.6
Demand (kg DM/ha/d)	Whakapono	8.2		33.7	50.0	56.6	57.5	56.3	58.4	56.3	55.2	50.7	40.7
	waiora conv	6.7	3.0	33.9	51.6	60.3	59.8	60.2	56.5	55.9	51.6	51.1	43.3

KPIs		Milk Solids			BCS 31 May 19	Operating Profit	
		kg Total	kg/ha	kg/cow		\$ Total	\$/ha
	Whakapono	247,174	1,595	623		543,566	3,507
	waiora conv	337,852	1,609	625	4.59	750,764	3,575
	Difference	90,678	14	1		207,198	68

Compare Milk Solids

Jun 18 - May 19



Supplement Usage Summary for Whakapono

Jun 18 - May 19

Feed	tonnes DM offered													kg
	Jun 18	Jul 18	Aug 18	Sep 18	Oct 18	Nov 18	Dec 18	Jan 19	Feb 19	Mar 19	Apr 19	May 19	Total	/milker
F4 Hay/Straw bought	0												0	1
F1 Meal and Grains bought	3		2	11	13	10	7	7	7	8	12	13	92	170
F5 Palm Kernel			3	5	6	8	5	5	7	8	9	7	64	118
F2 Pasture Silage bought	9		44	15					15	29	25	66	203	375
F2 Pasture Silage			4	24	5						9		41	76
Total													401	740

Supplement Usage Summary for waiora conv

Jun 18 - May 19

Feed	tonnes DM offered													kg
	Jun 18	Jul 18	Aug 18	Sep 18	Oct 18	Nov 18	Dec 18	Jan 19	Feb 19	Mar 19	Apr 19	May 19	Total	/milker
F4 Hay/Straw bought	1												1	1
F1 Meal and Grains bought	5			13	18	9	7	7	12	13	20	20	123	170
F5 Palm Kernel				6	10	7	9	9	10	13	12	8	83	115
F2 Pasture Silage bought	13	9	36	9							28	78	173	239
F2 Pasture Silage			5	34	9				40		14		102	141
Total													483	667

Performance Indices 2018/19 Season		Whakapono KA	Waiora Conv
Area		155	210
Cows Peak Milk		542	724
Production per Ha		1575	1601
Deaths & Losses		3.0%	2.2%
Times Topped		45%	73%
Metabolic Cases		26	54
Empty Rate @ \$1,300 / replacement		9.5%	11.5%
Metabolic %		8%	7%
Milk Solids		247,174	337,852
Fertiliser Spreads		4	6
Mastitis Incidence		9%	14%
Lameness		14%	16%
SCC		91	122
Silage Made (TDM)		42	102
Supplement Use (kgDM/cow)		740	667

Whakapono KA					Waiora Conv				
Season	2015/16	2016/17	2017/18	2018/19	2015/16	2016/17	2017/18	2018/19	Units
Effective Area	155	155	155	155	210	210	210	210	ha
Stocking Rate	3.3	3.1	3.4	3.5	3.29	3.03	3.3	3.4	cows/ha
Nitrogen Use	117	84	107	92	160	124	132	163	kg N/ha
Peak Cows Milked	506	483	523	542	690	636	690	690	cows
Production									
Milk Solids total (To Fonterra)	254,672	231,745	236,584	236,584	340,295	297,258	303,958	303,958	kgMS
Milk Solids per ha	1,643	1,495	1,535	1,595	1,620	1,416	1,482	1,609	kg/ha
Milk Solids per cow	503	480	455	456	493	467	451	467	kg/cow
Feeding									
Pasture Eaten per cow	4166	4076	3793	3832	4048	4094	3865	4200	kgDM per Cow
Supplements Eaten per cow	764	715	777	740	683	581	738	667	kgDM/cow
Total Feed Eaten per cow	4930	4791	4570	4572	4731	4675	4603	4867	t DM/cow
Pasture Eaten per ha	13.6	12.7	12.8	13.4	13.3	12.4	12.7	13.8	t DM/ha
Feed Conv. Efficiency (on platform)	9.8	10.0	10.0	10.0	9.6	10.0	10.2	10.4	kgDM per KgMS
Silage Harvested per Ha	173	353	372	42		676	137	102	kgDM/Ha
Total Feed Utilised per Ha	13.8	13.1	13.2	13.4	13.3	13.1	12.8	13.9	TDM/HA
Empty Rate	14%	13%	11%	10%	15%	14%	13%	12%	Empty Rate

COMPARISON - AVERAGE 2015 TO 2019

Season	Whakapono KA	Waiora Conv	Units
Effective Area	155	210	ha
Stocking Rate	3.33	3.20	cows/ha
Nitrogen Use	100	139	kg N/ha
Peak Cows Milked	513.5	672	
Milk Solids total (To Fonterra)	239,896	313,837	kgMS
Milk Solids per ha	1567	1506	kg/ha
Milk Solids per cow	474	471	kg/cow
Pasture Eaten per cow	3967	4002	kgDM per Cow
Supplements Eaten per cow	749	667	kgDM/cow
Total Feed Eaten per cow	4716	4670	t DM/cow
Pasture Eaten per ha	13.1	12.8	t DM/ha
Feed Conv. Efficiency (on platform)	10.0	9.9	kgDM per KgMS
Silage Harvested per Ha	235	407	kgDM/Ha
Total Feed Utilised per Ha	13.4	13.1	TDM/HA
Empty Rate	11.9%	14.0%	Empty Rate

Gross Marginal Analysis:				Whakapono		waiora conv	
Milk Soilids Price				\$	6.00	\$	6.00
Milk Income				1,483,044		2,027,112	
less	Capital Livestock (Deaths) @		1600/hd	26,016		25,485	
Total Revenue				1,457,028		2,001,627	
						9,400	9,532
Expenses				Total	\$/Ha	Total	\$/Ha
	Conservation(@ \$150 / t)			6,300	41	15,300	73
	Purchased Feeds			129,551	836	139,213	663
	Additional Replacements		\$1,300/hd			18,824	90
	Fertiliser (excl spreading)			104,160	672	124,073	591
	Fert Spreading		\$9/Ha	5,580	36	11,340	54
	Topping	\$ 75.00	/Ha	5,231	34	11,498	55
	Animal Health& Breeding						
	Mastitis Treatment		\$ 100.00 /hd	4,700	30	10,100	48
	Lameness		\$ 30.00 /hd	2,280	4	7,762	11
	Downer Cow Treatment		\$ 104.75 /hd	2,724	18	5,657	27
	Dusting for Metabolics			0	0	2,460	12
Total Variable Expenses				260,526		346,226	
						1,681	1,649
Gross Margin per ha						7,719	7,883

Cost Of Nutrients		year 1	year 2	year 3	year 4	year 5	year 6	year 6	TOTAL	average
		2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19		last 4 yrs
Whakapono	KA	178,424	235,957	151,966	114,614	93,310	101,539	104,160	979,970	
Waiora	Conv	169,232	168,781	132,075	139,632	85,738	95,549	124,073	915,080	
Per Hectare										
Whakapono	KA	1,151	1,522	980	739	602	655	672	6,322	667
Waiora	Conv	806	804	629	665	408	455	591	4,358	530

Summary of answers to research questions

- **Does soil nutrient management improve soil health?** In spite of differences in fertiliser input, there is little impact on soil chemistry or plant growth
- **Can I grow more grass using an A-K fertiliser regime?** Dynamics between N fertiliser and clover growth have shown it is possible to grow the same amount of pasture with 20% less N fertiliser
- **Will soil fertiliser regime improve milk production?** Not enough data to support this, though increased clover could improve animal production
- **Will soil fertiliser regime improve animal health?** Anecdotal evidence for % of downer cows at calving and in-calf rates suggest animal health benefits with A-K
- **Will soil fertiliser regime reduce my environmental impact?** If N surplus is reduced then possibly. A lot of nutrients have been applied with little benefit to the system.
- **Will adopting an alternative fertiliser regime effect my profitability?** Potential to be expensive, large additions of Ca, Mg and S have increased costs with small off-set in animal health savings



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Soil nutrient management in dairy farming systems