BOOKHAM GRAZING

DEMONSTRATION RESULTS

Conducted at Bruce Hazell's, 'Kia-Ora', Bookham

Beginning June 1993

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Take home messages from the 25 years

- You should know your target soil phosphorus level. This depends on your soil type; use your soil PBI to determine your targets. The range of 22 to 32 (Colwell test) covers most of this region. Going above this target is a waste of money. Get yourself a copy of 'Five Easy Steps' fertilizer decision making guide from the MLA web site. http://www.mla.com.au/Extension-and-training/Tools-and-calculators/Phosphorus-tool

- Think of your property as groups of similar paddocks (based on soil, slope and aspect). This will influence your fertilizer rates. The country that has the longest growing season should be fertilised to the soil P target. Country with a lower pasture productivity potential would have a lower target.

- Run the correct stock numbers to utilise the pasture. Country with a 6.5 month growing season in an average year, at its target soil P level can run 14 dse/ha. The same country not fertilised has a capacity of 5.5 dse/ha. The closer you get to your maximum stocking rate for your country the more you need to have a strategy planned to handle the dry periods.

- Maintenance fertilizer rates of 70 to 80 kg/ha of super has maintained the desired soil P levels for the last 10 years.

- Productive pastures (native or introduced) fertilised to their target soil P level, running productive stock (above average genetics) is a very profitable enterprise at current fertilizer prices.

- Producers who maintained their soil fertility during the dry years (2003 to 2008) are in a stronger financial position now than the producers who let it decline.

- The impact of using superphosphate on soil pH was an issue of concern to local producers at the start of the work. The graph showing the 19 years of measured data indicates that the application of superphosphate has not changed the pH when compared to the no supered paddock.

- Yearly soil testing increases your confidence in fine tuning your fertilizer program. The trend line is more important than the yearly value.

- January - February rains lead to lower winter pasture growth and pasture quality issues due to the amount of frosted overburden. It can effectively reduce your grazing area in early winter by 15 to 35%. You need to work hard in autumn to get rid of the over burden in key winter paddocks. March rains do not have the same negative effects.

- Soil carbon should we chase it? No, improving pasture production by targeted fertilizer will result in increasing soil C levels as a side benefit.

- Foot abscess is a major issue in this environment and needs to be managed. The key warning sign is a ewe flock with an average fat score of 3 or better at joining. This will correspond with summer rain and potentially a good autumn. In early pregnancy the ewes need to be restricted to a herbage mass of no more than 750 kg DM/ha (green).

We don’t not want ewes to be more than fat score 3.5, twins ewes are the group that is most at risk.

- What conception rates should we target? The year of highest conception rates in the ewes (2010 and 170%) lead to the year with the lowest weaning percentage due to the high number of twins, increased ewe deaths due to foot abscess and 2 weeks of poor weather at lambing. It is my view that a target of 150% potential lambs is the best target. Going higher than that place too much pressure on the system and is a high risk strategy that does not lead to improved profits. In dry summers only feed the ewes that would be below fat score 2.5 at joining. If the season is favourable try and get the mob to fat score 3.

- The use of walk over weighing (WOW) has been a valuable tool in decision making related to ewe reproduction. You only need 4 to 5 days data each month from a mob to assess their performance. This means that a WOW unit could do 6 mobs a month, giving you solid data for decisions without the need to bring ewes to the yards. This is a plus in winter. For this system to work you need to have areas already fenced off in paddocks either around water for summer or around sheep camps in winter so it only requires the gear to be moved and set up. A 1 to 1.5 hour job every 5 days.

- This demonstration site has been continuously grazed for 25 years and produced a profitable and sustainable system. The common perception is that continuous grazing systems are a disaster; this is not the case if the stocking rate matches the capacity of the pasture, as shown by this site.

Bookham Grazing Demonstration

Background

This demonstration began after a request from the local wool producers to look at the question “Does it pay to put super out for fine wool production”?

This demonstration started in December 1993. A 12 hectare paddock was split, to form 2 paddocks. One side was to receive no super and the other to be supered each year. The following treatments have occurred to the supered side:

Year	Month	Fertilizer Application
1993	June	250 kg/ha **Mo** single superphosphate
1994-1997	Feb	125 kg/ha single superphosphate applied each year
1998	Feb	125 kg/ha **Mo** single superphosphate
1999-2000	Feb	62.5 kg/ha single superphosphate applied each year
2001	Feb	125 kg/ha **Mo** single superphosphate
2002-2003	Mar	90 kg/ha single superphosphate
2004-2006	Feb	90 kg/ha single superphosphate
2007	-	**No fertilizer applied**
2008	Feb	85 kg/ha single superphosphate
2009	Feb	70 kg/ha single superphosphate
2010	Feb	70 kg/ha single superphosphate + 90kg/ha accidentally spread by the contractor – total 160 kg/ha applied.
2011	Feb	**No fertilizer applied**
2012	Feb	70 kg/ha single superphosphate
2013	Mar	66 kg/ha single superphosphate
2014-2015	-	**No fertilizer applied**
2016	Mar	88 kg/ha (2/3 **Mo** single super,1/3 single super, due to supply issues)
2017	-	**No fertilizer applied**

Note: Mo – refers to Molybdenum

History

The total fertilizer applied to the supered side since 1993 is 2114 kg/ha or an average of **84.6 kg/ha/year**. Since the target soil P of 25 units has been achieved the average yearly application has been **64 kg/ha/year** over 19 years including the 5 years where nothing was spread.

Prior to the paddocks being used for the trial they had not received super since approximately 1975. The pastures are mainly microleana and danthonia, annual grasses with legume. The paddock consists of very good native pastures on a granite soil with pH 4.2 to B horizon consisting of heavy clay at 50 cm.

Stocking rate on the no super side has been set at a farm average for this country. Stocking rate on the supered side is set to try and maintain a similar live weight on wethers

on both sides. If body weight is kept the same then wool characteristics will be similar. Wethers have been run, set stocked.

Stocking rate on the supered side has increased from 11 wethers/ha to 15.1 wethers/ha over the life of the trial. A decision was made to lower the stocking rate in December 2002 to 13.1/ha due to paddock feed on offer and the forecasts for early 2003. The no supered side has remained around 6.3 wethers/ha.

The stocking rate was increased again in December 2003. Deaths during the year resulted in a lower full year stocking rate.

Supplementary feeding has occurred in 1998, 2003, 2004 and 2005 in both paddocks. In 2006 only the supered paddock were fed. A small amount of feeding was done in autumn 2015 and 2016.

Pasture cockchafers caused severe damage to the supered side in the winter of 2003. The impact of this pasture damage resulted in increased supplementary feeding of a similar magnitude to the drought feeding in the autumn of 2003 ($70/ha). In 2004 spraying occurred at the first sign of grub activity.

It was decided in November 2006 to stop the wether grazing and run a merino breeding ewe enterprise. This had been a request from producers for a number of years. The paddocks were stocked with ewes after joining in autumn 2007. The stocking rates were set so that the paddocks would build up to a suitable pasture mass for lambing in August. The super paddock was stocked at 6 ewes/ha and the no super paddock was stocked at just over 1 ewe/ha. The no super paddock had to be destocked in October because of the problems caused to the stock by the heavy infestations of crowsfoot. This weed has always been in this paddock but the wethers grazing at approximately 6 wethers/ha kept it under control. Because it would be an ongoing problem the decision was made to stop running ewes in the no super paddock and this paddock is now rotationally grazed by the owner.

No data was collected off the ewes in the super paddock in November 2007 because they had only run on the paddock for 7 months.

The stocking rate for 2009 was 6.84 ewes/ha. Lambing started 1st August and the lambs were weaned off the paddock in late November. The ewes are continuously grazed in the paddock to obtain a reliable animal data. The shearing date has changed from late November to mid May. In 2009 the ewes were shorn with 6 months wool and cut 2.8kg/hd. In 2014 to present, 9 ewes /ha are being run with the progeny weaned at 14 weeks and taken off the paddock. Lambing now occurs in late July.

Soil Carbon work

Studies on soil carbon, measured to a depth of 30 cm (international standard) has shown that the supered side has increased total soil carbon by 12 tonne/ha over the no supered paddock in the first 13 years of the demonstration. As we increase the soil nutrient level soil carbon also increases. For every unit of soil carbon present there is varying levels of other soil nutrients such as nitrogen, phosphorous and sulphur associated with it – you

cannot build soil carbon as a single entity, it is part of the soil organic matter which has a complex structure. One tonne of humus contains approximately 600kg of carbon, 60kg of nitrogen, 12 kg of phosphorus and 9 kg of sulphur. These nutrients are continually cycled in the soil between the unavailable pool and the available pool at varying rates. Most of the carbon from the humus returns to the atmosphere as CO2 as a result of breakdown by microbial activity.

The cycling of P has also been studied on the site. A fixed amount of P is taken up by plants in producing a tonne of feed. So we can work out that the super paddock uses about 30 kg of P each year. Over the last 18 years we have averaged an application of 5.8 kg of P per year. So we are applying about 20% of the P needed for growth. The majority of the P used each year comes from P cycling out of the organic pool (old plant material) and the inorganic pool (soil particles). Biological activity is responsible for this cycling from the organic pool. If we did not have an active biological population this paddock would have crashed many years ago. Biological activity is driven by the food source of the soil microbes, ie organic material. The more pasture grown the bigger the food source and hence the bigger the soil microbial population.

The no super paddock treatment ended in 2010 when annual super applications of 90kg/ha started.

Comments from Years

May 2010 -

The ewes were set stocked @ 6.84 head/ha and have been run on the paddock since the beginning of 2007. So the reproductive performance achieved this year is reflective of the paddock. That is, they did not build up fat score in another paddock before being joined. Lambing started 1st August,

The weaning percentage 110% is the best ever achieved on the site and is well above the district average. There were no “bad” weather events during lambing which was very beneficial.

The paddock showed the impact of 3 poor springs on annual grasses seed set, especially in winter. The annual grass content was low, bare ground (10% in June) instead of grass and this reduced pasture winter growth rates. This year had very good clover germination and the spring production from clover was the best seen in years. There was also a good seeding of annual grasses. This is promising for next year’s production.

The lambs were weaned, 12 weeks average age, on the 2nd November and moved off the paddock. A value of $1.60/kg live weight was used to value them (current market rates).

The maintenance fertiliser rate of 70 kg /ha has held the soil P level and lowered the impact of higher fertilizer prices. The price at the times of spreading in Feb 2010 was $350/t. This dropped to $300/t by autumn.

The shearing cycle has changed from November to May. The report for the year above uses lambs born August 2009 and wool shorn May 2010. Most of the pregnancy is part of the shearing cycle so provides a solid data set.

July 2012 -

This site has grown grass in all months since April 2009. Some months the amount has been low but growth has occurred. This has presented a new set of problems, too much feed in the paddock during late winter and lambing leading to increased problems with the feet (abscess).

Due to the good pasture conditions the ewe stocking rate was increased to 9 ewes/ha at weaning in October 2011. Even with this increased rate there was still a need to use a mob of 500 ewes to grazing in early autumn, to get rid of the summer overburden of grass, to set up the winter pasture production. This year the lambing potential is 151% for the merino to merino joining.

2015 -

The low lambing percentage in 2014 was a ram problem at joining. The ewes were in good condition. This explains the increase in fleece weight for the May 2015 shearing.

2016 -

After scanning in autumn 2015, 8 dry ewes were removed due to the tight season. This brought the number back to 43 ewes or 7.5 ewes/ha. Some feeding was done in late pregnancy. There was also some feeding in April 2016 but the amount that needed to be fed was well below the district average and this is in the yearly costings.

Major Points after 25 Years

- At this stage I have not been able to detect any substantial decrease in native perennial species. The figures do vary from year to year, but no trend is evident. 25 years' experience has shown that this is a very hard factor to measure. In a good clover year we record lower perennial grasses and vice versa. The perennial species do not come and go but the methods we use for measurement are influenced by dominant species. In February 2005 the area of ground covered by native perennial species was measured at 43% in the super paddock. This was taken after rain so the perennial species were green but before the annuals had germinated. The end point data collect in August 2005 gave a figure of 30%.

- Using measured data from other sites within the area and on similar pastures, I'm confident that improvement has been made in water runoff quality and water usage within the profile.

- At the beginning of the demonstration soil P (Colwell) hovered around 7. After applying 875 kg/ha super (over a 6 year period) the soil P (Colwell) level on the supered side was raised to 20. Research work on site has convinced me that a soil P (Colwell) of 24 to 28 is the correct soil P (Colwell) target for these pasture and soil types. We have achieved high production and maintained pasture stability. The pasture stability issue is just as important as the production increase. These pasture types have adapted to shallow acidic soils, so maintenance of them across the landscape is important. Sowing introduced species on these soils is expensive with a question mark about their longevity.

- Internal parasite burdens have never differed between paddocks.

- The favourable economic result, for the supered paddock is applicable to other livestock enterprises. Utilisation of the feed on offer determines the level of profitability. This is a pasture management skill, and hence is in your hands.

13 Year Wether Production Data and Averages

SUPER	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	13 YEAR AVGE
Wethers/ ha	11.05	10.70	11.20	12.80	13.20	14.00	14.90	14.90	14.60	12.60	14.50	15.10	15.10	13.43
Total Clean Wool kg/ha	35.30	39.90	41.30	39.90	43.60	50.20	53.60	56.00	43.50	31.60	34.00	41.50	35.40	41.98
Total Wool Income $/ha	462.43	251.37	255.73	374.66	218.44	347.43	701.41	574.56	581.16	285.35	311.58	341.13	415.95	393.93
Total Cost $/ha	258.32	225.97	217.28	248.73	251.09	228.96	281.51	297.64	289.89	392.99	344.11	333.48	321.06	283.92
Operating Profit $/ha	204.11	25.40	38.45	125.93	-7.33	136.01	419.90	276.92	291.27	-107.64	-32.53	7.65	94.89	113.31
Difference Super-No Super $/ha Profit	***94.90***	***5.07***	***23.86***	***72.04***	***15.24***	***124.31***	***287.63***	***209.04***	***123.67***	***-41.65***	***-9.65***	***40.67***	***78.82***	***78.76***
Cost of Production c/kg Clean	7.32	5.66	5.26	6.23	5.76	4.56	5.25	5.32	6.66	12.44	10.12	8.03	9.07	7.05
NO SUPER	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**13 YEAR AVGE**
Wethers/ ha	6.30	6.30	6.30	6.30	6.30	6.30	6.10	6.10	6.30	6.10	5.80	5.30	5.80	6.10
Total Clean Wool kg/ha	19.50	22.90	22.20	19.50	19.50	23.80	22.90	22.50	22.10	15.60	15.60	15.50	14.10	19.67
Total Wool Income $/ha	253.50	151.83	138.46	191.30	116.22	149.94	288.08	225.00	333.05	158.50	151.32	122.76	178.08	189.08
Total Cost $/ha	144.29	131.50	123.87	137.41	138.79	138.24	155.81	157.12	165.45	224.49	174.20	155.78	162.01	154.53
Operating Profit $/ha	109.21	20.33	14.59	53.89	-22.57	11.70	132.27	67.88	167.60	-65.99	-22.88	-33.02	16.07	34.54
Cost of Production c/kg Clean	7.40	5.74	5.58	7.05	7.12	5.81	6.80	6.98	7.49	14.39	11.16	10.05	11.49	8.23

Ewe data – year is from May to May

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Weaning %		97	110	85	100	104	98	58	102	95	
Ewes/ha	7	5.8	6.9	6.9	6.9	8.8	8.8	9.1	7.9	7.5	7.2
Operating Profit $/ha			$266	$289	$380	$365	$441	$374	$368	$442	$631

13 YEAR WETHER WOOL DETAILS

Shearing Date	Flc/Pcs Kg	Fibre Diameter	Yield %	Length mm	Strength N/K Tex
Nov 1994					
Super	4.0	19.2	71.3	90	40
No Super	3.9	19.2	70.7	87	35
Nov 1995					
Super	4.7	20.2	72.1	92	27
No Super	4.7	20.3	70.8	92	39
Nov 1996					
Super	4.4	20.0	75.1	94	45
No Super	4.3	19.7	74	94	37
Nov 1997					
Super	3.8	19.4	71.4	86	35
No Super	3.8	19.1	70.5	90	36
Nov 1998					
Super	4.1	19.7	72.4	87	23
No Super	3.9	19.2	72.4	88	27
Nov 1999					
Super	4.5	19.9	71.1	94	41
No Super	4.7	20.1	72.3	91	37
Nov 2000					
Super	4.5	18.7	71.9	91	48
No Super	4.6	18.8	72.7	94	50
Nov 2001					
Super	4.6	18.5	72	91	41
No Super	4.4	18.6	73	90	44
Nov 2002					
Super	3.81	17.7	67.7	81	35
No Super	4.37	17.7	70.1	93	47
Nov 2003					
Super	3.16	17.9	68.6	85	38
No Super	3.17	17.5	69.2	84	42
Nov 2004					
Super	3.15	18.0	69.4	76	26
No Super	3.63	17.6	70.0	85	23
Nov 2005					
Super	3.38	17.5	69.3	86	31
No Super	3.58	17.7	69.8	90	28
Nov 2006					
Super	2.83	16.3	70.4	76	34
No Super	2.99	16.3	69.6	79	39

Ewe wool	Flc/Pcs Kg	Fibre Diameter	Yield %	Length mm	Strength N/K Tex
Nov 2008					
Super	4.94	18.6	68	94	35
May 2009					
Super	2.46	6 mths flc			
May 2010					
Super	5.67	18.3	68	93	38
May 2011					
Super	5.6	18.5	72	91	40
May 2012					
Super	4.95	18.1	77		
May 2013					
Super	5.28	18.5	70	95	45
May 2014					
Super	4.92	18.2	72	85	50
May 2015					
Super	6.9	19.5	68		
May 2016					
Super	5.7	18.1	70	101	42
May 2017					
Super	5.46	18.2	71.5	110	48

Pasture growth rates - Yass district
(kg DM/ha/day)

Collected at Bookham at 520m by Phil Graham and Fiona Leech

Year	Paddock	J	F	M	A	M	J	J	A	S	O	N	D
2017	**Super**	**0**	**0**	**Some G**	**22**	**17**	**14**	**10**					
2016	**Super**	**G**	**G**	**Some G**	**1**	**30**	**15**	**11**	**15**	**26**	**36**	**89**	**0**
2015	**Super**	**0**	**G**	**G**	**25**	**16**	**7**	**8**	**17**	**31**	**58**	**67**	**17**
2014	**Super**	**0**	**Late G**	**33**	**33**	**25**	**15**	**5**	**20**	**G**	**G**	**G**	**G**
2013	**Super**	**G**	**0**	**14**	**5**	**15**	**18**	**9**	**16**	**35**	**54**	**0**	**0**
2012	**Super**	**G**	**25**	**40**	**18**	**11**	**7**	**9**	**9**	**32**	**55**	**24**	**0**
2011	**Super**	**G**	**G**	**37**	**31**	**10**	**8**	**9**	**16**	**33**	**55**	**G**	**G**
2010	**Super**	**G**	**48**	**79**	**10**	**-10**	**10**	**11**	**15**	**31**	**50**	**68**	**68**
2009	**Super**				**17**	**10**	**11**	**8**	**12**	**33**	**78**		
2008	**Super**	**G**			**11**	**13**	**12**	**7**	**9**	**15**	**47**	**38**	**18**
2007	**Super**			**G**	**G**	**20**	**9**	**7**	**15**	**26**	**33**	**20**	
2006	**Super**						**15**	**15**	**15**				
	No Super						*7*	*7*	*8*				
2005	**Super**				**5**	**0**	**14**	**15**	**19**	**26**	**45/70**		
	No Super				*3*	*0*	*7*	*8*	*8*	*12*	*32*		
2004	**Super**						**15**	**15**	**19**	**26**	**84**	**77**	
	No Super						*7*	*6*	*7*	*13*	*33*	*35*	
2003	**Super***			**G**	**6**	**9**	**10**	**13**	**16**	**25**	**46**	**70**	
	No Super				*2*	*4*	*6*	*4*	*7*	*10*	*15*	*30*	
2002	**Super***		**G**	**8**	**4**	**18**	**13**	**15**	**15**	**18**			
	No Super			*0*	*-2*	*11*	*8*	*7*	*7*	*10*			
2001	**Super**		**G**	**G**	**21**	**5**	**16**	**15**	**14**	**29**	**27/84**		
	No Super			*G*	*0*	*0*	*7*	*8*	*7*	*15*	*18*		
2000	**Super**			**G**	**28**	**22**	**16**	**17**	**19**	**28**	**53**	**83**	
	No Super			*G*	*16*	*13*	*3*	*7*	*7*	*16*	*27*	*52*	
1999	**Super**		**G**	**G**	**24**	**20**	**16**	**17**	**23**	**34**	**60**	**60**	**52**
	No Super			*G*	*14*	*7*	*9*	*5*	*11*	*16*	*26*	*31*	*25*
1998	**Super**				**G**	**G**	**14**	**19**	**22**	**37**	**69**	**63**	
	No Super					*G*	*6*	*7*	*9*	*12*	*19*	*27*	

This data is collected from grazed pastures; no pasture cages have been used. Pasture grub had an impact in **2002 and 2003** on autumn growth in supered paddock. There might have been some green in the paddocks in the blank months but the amount was too small to be able to measure. This applied mostly in autumn. In later years this has been recorded with a G. In 2001 and 2005 for October there are 2 figures, temporary electric fencing was used, the higher figure is for the ungrazed part and the lower figure for the grazed area.

Comments about the years and the impact on the growth rates:

1998 – Rain in early April then dry until early June rain.

1999 – A wet year with good rain in January and March and kept raining through to December.

2000 – A March break with good rain through to November.

2001 – The Supered paddock was sub divided in October with all stocked grazed on a small area to keep the herbage mass around 800kg DM/ha. This resulted in a growth rate of 27 kg DM/ha for the grazed area and the ungrazed area grew at 84 kg DM/ha. This shows the impact of a higher leaf area when growing conditions are good. But the higher growth rate meant that this area of the paddock dried off first.

2002 – January rain gave green in February then it dried off leading to low autumn growth.

2003 – Same pattern as 2002.

2004 – Late May break.

2005 – Dry summer /autumn with the breaking rains arriving in first week of June.

2006 – Late May break with the last decent rain event at the end of July.

2007 - Useful rain events during March and April but not enough to give a break. The winter growth rates were lower than usual due to the lack of annual grass resulting from the very dry spring of 2006 lowering seed set. This highlights the importance of annual grass for winter growth.

2008 – 100 mm in Jan then a dry February/March. Still some impact from the 2006 spring on the amount of annual grass present in winter.

2009 – Late March early April rains.

2010 - Big rain at the start of January and the big rain events continued. Massive March growth which was frosted off in May leading to a negative growth (the amount of green in the paddock decreased at a rate greater than animal consumption). Herbage moved from the green pool to the dead pool.

2011/12 – A period of consistent rains spread throughout the year. There was consistent green herbage for a period of 35 months. This had an impact on winter growth rates via a competition from carryover frosted summer growth and a lack of nitrogen by winter. At the end of May 2011 35% of the paddock was covered by clumps of dead grass so the remaining 75% had to carry the stock, increasing stocking pressure and decreasing leaf area of the green pasture.

2013 – Break in late February but then a dry autumn with the rains cutting out at the end of October.

2014 – February break with a wet autumn.

2015 - Late 2014 was very wet so 2015 started with a full profile of soil moisture so small rain events in autumn drove period of growth.

2016 – Similar story to 2015 good soil moisture meant there were some growth events during summer keeping some green in the pasture over summer until the break at the end of April.

2017 - Dry summer with a break at the end of March.

Pasture Composition for the Bookham site

The following tables are the end point data collected each August for the 2 paddocks.

No Super Paddock

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2007	2008	2009
Danthonia	12.0	25.0	17.0	8.0	12.0	19.0	24.0	12.5	12.9	12.2	15.7	23.0	25.6	15.2
Microlaena	15.0	26.0	23.0	13.0	20.0	23.0	20.0	27.7	13.9	16.8	11.5	14.0	18.2	17.1
Yorkshire Fog		7.0				9.0	2.0					1.0	0.6	1.2
Annual Grasses	19.0	12.0	15.0	19.0	31.0	18.0	23.0	26.0	9.2	13.6	27.2	16.0	8.3	23.4
Legumes	27.0	5.0	6.0	26.0	15.0	15.0	3.0	5.0	25.9	11.4	8.4	7.0	10.8	5.7
Weeds	19.0		6.0	28.0	13.0	14.0	6.0	9.7	21.2	30.9	24.4	30.0	28.0	30.4
Bare	7.0	4.0		3.0	4.0		1.0		12.0	10.4	9.1	8.0	5.9	1.9
Litter	1.0	21.0	33.0	3.0	5.0	2.0	21.0	16.0	4.6		4.6	1.0	2.6	5.1

Supered Paddock

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2007	2008	2009
Danthonia	13.0	25.0	8.0	10.0	16.0	14.0	11.0	16.2	11.8	11.4	16.1	7.0	10.1	13.8
Microlaena	17.0	34.0	11.0	15.0	30.0	26.0	11.0	25.0	10.9	14.3	14.3	4.0	25.0	23.9
Yorkshire Fog		17.0				12.0	6.0							2.5
Annual Grasses	5.0	13.0	30.0	11.0	18.0	25.0	34.0	10.8	16.6	21.9	14.7	1.0	6.5	7.5
Legumes	53.0	1.0	25.0	54.0	22.0	21.0	23.0	31.7	48.6	14.7	25.0	52.0	43.0	33.3
Weeds	10.0	2.0	1.0	10.0	10.0	2.0	5.0	5.4	5.2	27.6	21.9	15.0	5.7	11.9
Bare	1.0	1.0			1.0		3.0	2.7	4.3	7.0	3.4	18.0	7.3	1.2
Litter	1.0	7.0	25.0		3.0		7.0	2.0	2.2	2.4	4.3	3.0	2.4	5.6

Pasture Composition for the Bookham site continued

The following tables are the end point data collected each August for the 2 paddocks.

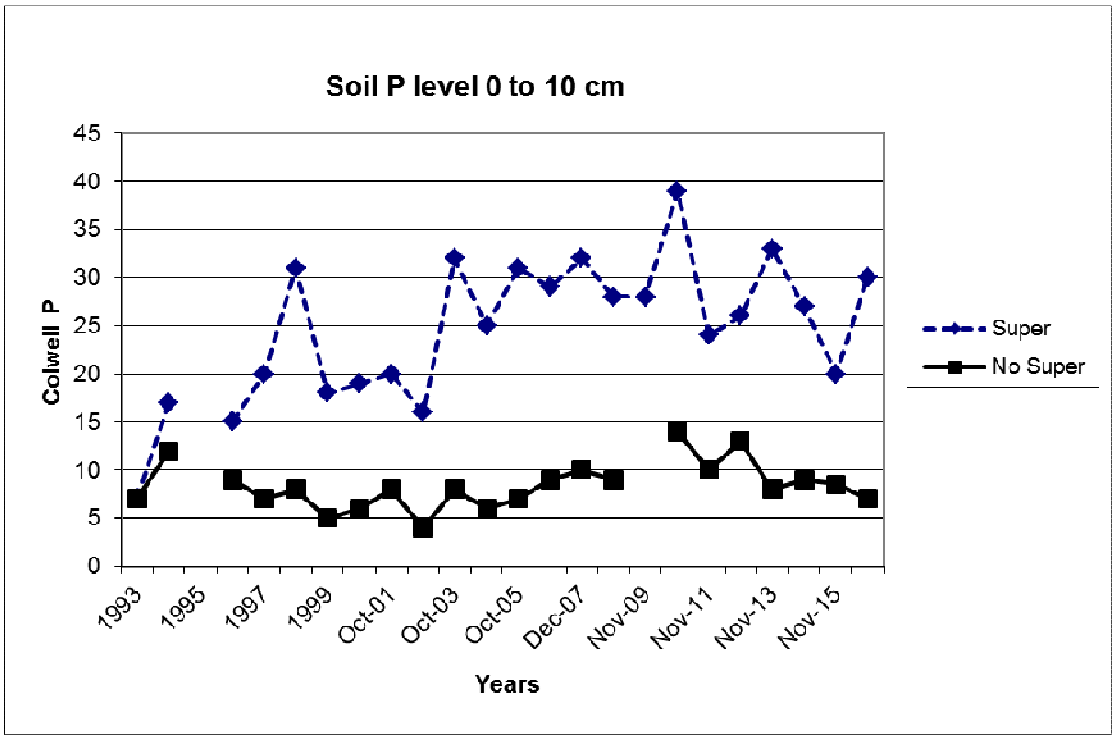
No Super Paddock - this paddock starting receiving 90 kg single super /ha in Feb 2010

	1995	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	
Danthonia	12	24	8	4	12	7	1.2							
Microlaena	15	12	7	9	19	17	18.5							
Yorkshire Fog		1	10	9	4	2								
Annual Grasses	19	22	25	36	37	19	39.5							
Legumes	27	20	8	9	9	44	19.1							
Weeds	19	16	1	12	11	10	12.4							
Bare	7	2	1	2			3.7							
Litter	1	3	40	19	7	1	5.6							

Supered Paddock

	1995	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	
Danthonia	13	3	14	4	12	15	4	6						
Microlaena	17	20	14	12	33	25	13.3	24						
Yorkshire Fog		10	13	14	5	1	7.3							
Annual Grasses	5	18	14	31	23	34	38	47						
Legumes	53	41	7	29	15	23	25.3	19						
Weeds	10	4	0	5	10	1	2.7	3						
Bare	1	0	0	1	1		2.7							
Litter	1	4	38	4	2		6.7	1						

Graph of soil P levels



Graph of soil pH