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APPENDIX

Appendix 4.1 Dry matter intake, liveweight gain, feed conversion ratio and wool growth of lambs fed a basal diet of oaten chaff and supplemented with casein, formaldehyde treated casein (FC) or FC plus urea (FCU). The oaten chaff was fed *ad libitum* (AL) or 80% AL (R).

	Intake (gDM/d) Chaff	Total	Lwt Gain (g/d)	FCR (g/g)	Wool Growth (g/d)
TREATMENTS					
Level of Intake					
R	67	728[a]	56.8	15.2[a]	5.1
AL	824	885[b]	90.1	10.2[b]	6.0
SEM	10***	10***	3.1***	1.1**	0.21**
Supplement					
Nil	734[a]	751[a]	55.0[a]	15.7	4.5[a]
Casein	709[a]	782[a]	66.9[a]	14.8	5.5[b]
FC	766[b]	839[b]	85.0[b]	10.2	6.0[b]
FCU	772[b]	855[b]	86.8[b]	10.2	6.1[b]
SEM	14**	14***	4.4***	1.5*	0.30**
INTERACTIONS					
nil x R	655	672	38.0	19.2	4.2
nil x AL	813	830	72.1	12.3	4.8
casein x R	635	708	44.2	19.9	4.9
casein x AL	783	856	89.7	9.8	6.1
FC x R	689	762	71.3	11.0	5.8
FC x AL	842	915	98.8	9.3	6.3
FCU x R	689	772	73.8	10.8	5.5
FCU x AL	856	939	99.8	9.6	6.7
SEM	19ns	19ns	6.3ns	2.1ns	0.64ns

SEM standard error of the mean and significance level of the overall treatment effect

Appendix 4.2 Dry matter intake, liveweight gain, feed conversion ratio and wool growth of lambs fed a basal diet of oaten chaff and supplemented with urea, lupins or formaldehyde-lupins (FL) or FC plus urea (FCU). The oaten chaff was fed either *ad libitum* (AL) or 75% *ad libitum* (R).

	Initial Lwt (kg)	Intake (g DM/d) Chaff	Total	Lwt Gain (g/d)	FCR (g/g)	Wool Growth (g/d)
TREATMENTS						
Level of Feeding						
AL	24.4	709	798	105	8.0	5.6
R	23.8	529	618	58	12.2	5.0
SEM	0.3	11***	11***	6***	0.7***	0.18*
Supplements:						
Urea	23.6	610^{ab}	637^{a}	71	11.2	4.7^{a}
Lupins	24.2	596^{a}	703^{b}	84	9.4	5.2^{a}
FL	24.6	612^{ab}	718^{b}	81	10.8	5.1^{a}
FCU	24.0	656^{b}	773^{c}	90	9.1	6.3^{b}
SEM	0.5	16†	16***	6ns	1.0ns	0.26***
INTERACTIONS						
AL x Urea	24.1	711	738	99	8.1	4.7
R x Urea	23.0	509	537	44	14.2	4.6
AL x Lupins	24.9	682	789	106	7.9	5.4
R x Lupins	23.9	510	617	61	10.9	5.0
AL x FL	24.5	692	799	107	8.1	5.2
R x FL	24.7	531	638	56	13.5	4.9
AL x FLU	24.3	749	865	109	8.0	7.0
R x FLU	23.8	564	680	72	10.2	5.6
SEM	0.7	22ns	2.41ns	8ns	1.5ns	0.36ns

SEM standard error of the mean and significance level of the overall treatment effect

Appendix 4.3 Concentrations and proportions of VFA in sheep fed a diet of oaten chaff and supplemented with urea, lupins, formaldehyde treated lupins (FL) or FL plus urea (FLU). Oaten chaff was fed at either *ad libitum* (AL) or 75 % *ad libitum* (R). Data are before feeding.

	Total Conc. VFA (mmol/l)	Molar Proportions of VFA (%)						
		Acet	Prop	But	Ibut	Ival	Val	G/E
TREATMENTS								
Main Effects								
AL	59.7	75.4	16.3	6.0	0.7	1.2	0.4	0.23
R	71.1	72.0	18.9	6.4	0.9	1.4	0.4	0.26
SEM	4.60†	1.07*	1.20ns	0.30ns	0.07ns	0.16ns	0.04ns	0.014ns
Supplements								
Urea	68.4	75.5	16.5	5.9	0.7	1.1	0.4	0.24
Lupins	55.3	73.6	16.7	6.6	1.0	1.7	0.4	0.24
FL	70.3	73.5	18.2	6.1	0.7	1.1	0.5	0.26
FCU	67.6	72.1	19.0	6.3	0.8	1.3	0.4	0.26
SEM	6.49ns	1.51ns	1.70ns	0.43ns	0.10ns	0.23ns	0.06ns	0.02ns
INTERACTIONS								
AL x Urea	53.4	76.9	15.0	5.9	0.7	1.1	0.5	0.22
R x Urea	83.3	74.1	17.9	5.9	0.8	1.0	0.3	0.25
AL x Lupins	59.2	75.2	16.2	6.1	0.8	1.3	0.4	0.23
R x Lupins	51.2	71.9	17.2	7.2	1.1	2.1	0.5	0.24
AL x FL	68.8	74.2	17.1	5.8	0.6	0.9	0.4	0.25
R x FL	71.8	72.7	18.3	6.4	0.8	1.3	0.6	0.26
AL x FLU	57.3	75.1	16.0	6.3	0.8	1.4	0.5	0.23
R x FLU	78.0	69.1	22.0	6.3	0.8	1.3	0.4	0.29
SEM	9.18ns	2.14ns	2.41ns	0.60ns	0.14ns	0.32ns	0.08ns	0.029ns

SEM standard error of the mean and significance level of the overall treatment effect

Appendix 4.4 Concentrations and proportions of VFA in lambs fed a basal diet of oaten chaff and supplemented with urea, lupins, formaldehyde lupins (FL) or FL plus urea (FCU). Oaten chaff was fed *ad libitum* (AL) or 75% *ad libitum* (R). Data are for 4 hours after feeding.

	Total Conc. VFA (mmol/l)	Molar Proportions of VFA (%)						
		Acet	Prop	But	Ibut	Ival	Val	G/R
TREATMENTS								
Main Effects								
AL	94.0	67.6	22.0	9.1	0.2	0.5	0.6	0.29
R	100.4	66.7	21.7	10.5	0.2	0.4	0.6	0.28
SEM								
Supplements								
Urea	100.3	68.4	20.9	9.5	0.2	0.5	0.6	0.28
Lupins	94.6	65.9	22.1	10.6	0.2	0.5	0.7	0.29
FL	99.4	67.2	22.1	9.6	0.2	0.4	0.5	0.29
FLU	99.0	66.9	22.4	9.5	0.2	0.5	0.6	0.29
SEM	3.07ns	0.88ns	0.94ns	0.64ns	0.02ns	0.05ns	0.03**	0.12ns
INTERACTIONS								
AL x Urea	90.8	68.9	19.9	9.9	0.2	0.5	0.7	0.27
R x Urea	109.8	67.9	21.9	9.2	0.1	0.4	0.5	0.29
AL x Lupins	96.3	67.1	22.5	8.9	0.2	0.5	0.8	0.30
R x Lupins	92.8	64.8	21.6	12.3	0.2	0.5	0.7	0.28
AL x FL	91.5	67.4	22.9	8.6	0.2	0.4	0.6	0.28
R x FL	98.2	67.0	21.3	10.5	0.2	0.4	0.6	0.28
AL x FLU	97.5	66.9	22.7	9.0	0.2	0.5	0.6	0.30
R x FLU	100.7	66.9	22.1	9.9	0.2	0.4	0.6	0.30
SEM	2.17†	1.24ns	1.33ns	0.91ns	0.03ns	0.036ns	0.05*	0.017ns

SEM standard error of the mean and significance level of the overall treatment effect

Appendix 4.5 Effects of supplementation with HCHO-Casein, sodium propionate or sodium acetate on the cottonseed hull (CSH) intake, total dry matter intake (TDMI), liveweight change, feed conversion ratio (FCR) and wool growth of lambs fed a basal diet of cottonseed hulls.

	Intake (gDM/d)		ΔLwt	FCR	Wool
	CSH	TDMI	(g/d)	(g/g)	(g/d)
TREATMENTS					
HCHO-Casein					
0g	950	1022	87	13.3	5.9
50g	1003	1111	139	8.0	9.0
SEM	35ns	35†	8***	1.1**	0.3***
Propionate					
0g	922	1008	106	11.6	7.6
20g	1031	1125	120	9.8	7.3
SEM	35*	35*	8ns	1.1ns	0.3ns
HCHO-Casein + Propionate					
0g+0g	898	966	75	15.5	6.1
50g+0g	946	1050	138	7.6	9.1
0g+20g	1001	1077	99	11.2	5.7
50g+20g	1060	1172	141	8.3	8.8
SEM	50ns	50ns	11ns	1.6ns	0.4ns
Propionate					
40g	932	1016	84	12.4	5.9
SEM	47ns	47ns	11ns	1.6ns	0.4ns
Acetate					
58g	976	1061	95	12.9	5.8
SEM	47ns	47ns	11ns	1.6ns	0.4ns

SEM standard error of the mean and significance level of the overall treatment effect

Appendix 4.6 Effects of supplementation with formaldehyde treated casein and sodium propionate on the glucose entry rate (GER), glucose pool size (GP) and the half time ($t_{1/2}$) for acetate in the blood of lambs fed a basal diet of cottonseed hulls.

	Mean Plasma Gluc.Conc.(mg/100ml)	GER g/d	GP g	Acetate $t_{1/2}$
TREATMENTS				
Treated Casein				
0g	62.5	89.8	4.9	26
50g	64.1	99.7	5.5	24
SEM	1.2ns	4.5ns	0.2*	2ns
Propionate				
0g	62.2	92.4	5.1	26
20g	64.4	97.1	5.3	24
SEM	1.2ns	4.5ns	0.2ns	2ns
Treated Casein and Propionate				
0g + 0g	62.0	88.6	4.9	27
50g + 0g	62.4	96.2	5.3	25
0g +20g	62.9	91.0	5.0	25
50g +20g	65.8	103.0	5.6	23
SEM	1.7ns	6.4ns	0.3ns	2ns
Propionate				
40g	62.4	99.0	5.1	23
SEM	1.6ns	5.5ns	0.2ns	2ns
Acetate				
58g	65.3	92.1	5.0	30
SEM	1.6ns	5.5ns	0.2ns	2ns

SEM standard error of the mean and the significance level of the overall treatment effect

Appendix 4.7 Concentration of VFA and molar proportions of individual VFAs in lambs fed a basal diet of cottonseed hulls and supplemented with formaldedhyde treated casein (Treated Casein), sodium propionate or sodium acetate. Data are for before feeding.

	Total VFA	Molar Proportions of VFA (%)						Ammonia	G/E
	Conc (mmol/l)	Acet	Prop	IBut	But	Ival	Val	(mgN/l)	
TREATMENTS									
Treated Casein									
0g	59.3	80.2	14.4	0.25	4.3	0.27	0.57	19	0.21
50g	51.0	74.5	13.3	0.31	3.8	0.27	0.67	34	0.21
SEM	4.8ns	4.2ns	1.5ns	0.05ns	0.3ns	0.06ns	0.04ns	3***	0.02ns
Propionate									
0g	55.9	74.3	13.6	0.25	4.0	0.28	0.55	26	0.21
20g	54.4	80.4	14.1	0.31	4.1	0.26	0.69	27	0.21
SEM	4.8ns	4.2ns	1.5ns	0.05ns	0.3ns	0.06ns	0.04*	3ns	0.02ns
Treated Casein and Propionate									
0g+0g	61.7	79.8	14.7	0.24	4.4	0.32	0.55	18	0.21
50g+0g	50.0	68.7	12.5	0.27	3.5	0.24	0.54	34	0.21
0g+20g	56.8	80.6	14.1	0.27	4.2	0.23	0.59	19	0.21
50g+20g	52.0	80.2	14.1	0.36	4.0	0.30	0.79	34	0.21
SEM	6.8ns	5.9ns	2.1ns	0.07ns	0.4ns	0.09ns	0.06ns	4ns	0.02ns
Propionate 40g									
	53.4	82.0	13.2	0.20	3.8	0.21	0.54	19	0.19
SEM	6.1ns	4.9ns	1.8ns	0.06ns	0.4ns	0.08ns	0.06ns	4ns	0.02ns
Acetate 58g									
	63.3	79.3	14.7	0.20	5.0	0.15	0.61	23	0.21
SEM	6.1ns	4.9ns	1.8ns	0.06ns	0.4ns	0.08ns	0.06ns	4ns	0.02ns

SEM standard error of the mean and the significance level of the overall treatment effect

Appendix 4.8 Effects of supplementation with formaldehyde treated casein and sodium propionate on the total concentration of VFA and molar proportions of individual VFAs in the rumen of lambs fed a basal diet of cottonseed hulls, 50g/d lucerne chaff and vitamins/minerals. Data are for 4h after feeding.

	Total VFA	Molar Proportions of VFA (%)						NH_3	G/E
TREATMENTS	**Conc (mmol/l)**	**Acet**	**Prop**	**IBut**	**But**	**Ival**	**Val**	**(mgN/l)**	
Treated Casein									
0g	65.1	71.4	23.8	0.07	4.0	0.11	0.63	218	0.33
50g	61.5	65.2	23.3	0.11	3.4	0.09	0.71	170	0.34
SEM	4.2ns	3.9ns	1.3ns	0.02†	0.2†	0.04ns	0.05ns	19†	0.01ns
Propionate									
0g	58.3	70.2	18.0	0.10	3.9	0.14	0.57	204	0.28
20g	68.2	66.4	29.1	0.08	3.5	0.07	0.77	184	0.34
SEM	4.2ns	3.9ns	1.3***	0.02ns	0.2ns	0.04ns	0.05**	19ns	0.01***
Treated Casein and Propionate									
0g+0g	60.9	75.8	19.1	0.08	4.3	0.16	0.57	250	0.27
50g+0g	55.8	64.6	16.9	0.12	3.5	0.11	0.57	157	0.28
0g+20g	69.3	66.9	28.6	0.05	3.7	0.07	0.69	187	0.39
50g+20g	67.2	65.9	29.7	0.10	3.3	0.08	0.85	182	0.40
SEM	6.0ns	5.5ns	1.9ns	0.02ns	0.3ns	0.05ns	0.07ns	26ns	0.01ns
Propionate									
40g	75.1	58.9	37.3	0.06	3.0	0.08	0.66	187	0.49
SEM	5.3ns	4.5*	1.6***	0.02ns	0.3*	0.04ns	0.06ns	24ns	0.01***
Acetate									
58g	84.7	82.2	13.7	0.05	3.7	0.05	0.39	229	0.20
SEM	5.3*	4.5ns	1.6ns	0.02ns	0.3ns	0.04ns	0.06*	24ns	.01ns0

SEM standard error of the mean and the significance level of the overall treatment effect

Appendix 5.1 Partitioning of the temperature sums of squares into components of temperature 1 (T1) versus temperature 2 (T2) on 1 degree of freedom (1 d.f) and the pooled (T1+T2) versus temperature 3 on 1 df.

Source	d.f		d.f	Sum of Squares			Mean Square			F
1. Liveweight Gain										
Temperature	2	T_1 *v* T_2	1	2016.08	-	203.06	1008.04	-	203.06	2.52 -<1ns
		(T_1T_2) *v* T_3	1		-	1813.02		-	1813.02	-4.54*
Error	18			7173.25			398.51			
2. Feed Conversion ratio										
Temperature	2	T_1 *v* T_2	1	7.5901	-	1.918	3.795	1.918		3.14-1.58ns
		(T_1T_2) *v* T_3	1		-	5.672		5.672		4.69*
Casein x	2	C*x*(T_1 *v* T_2)	1	10.3737	-	7.1289	5.187	7.1289		4.28-5.89*
Temperature		C*x*[(T_1+T_2) *v* T_3]	1		-	3.245		3.2448		2.68ns
Error	18			21.784			1.210			
3. Wool Growth										
Temperature	2	T_1 *v* T_2	1	0.7449	-	0.504	3.795	0.504		0.36-1.45ns
		(T_1T_2) *v* T_3	1		-	0.241		0.241		0.69*
Casein x	2	C*x*(T_1 *v* T_2)	1	1.769	-	0.4624	0.885	0.462		2.54-1.33ns
Temperature		C*x*[(T_1+T_2) *v* T_3]	1		-	1.3066		1.307		3.76*
Error	18			6.254			0.347			
4. TDMI (gDM/$W^{0.75}$/d)										
Temperature	2	T_1 *v* T_2	1	212.25	-	20.25	106.13-20.25			4.8-0.92ns
		(T_1T_2) *v* T_3	1		-	192.0		192		8.77**
Error	18			394.25			21.9			
5. CSH (gDM/$W^{0.75}$/d)										
Temperature	2	T_1 *v* T_2	1	187.72	-	14.5	93.86-14.5			3.9 -0.61ns
		(T_1T_2) *v* T_3	1		-	173.22		173.22		7.28**
Error	18			428.16			23.7			

Appendix 5.2 Effects of supplementation with formaldehyde treated casein on liveweight gain (Lwt gain), feed conversion ratio (FCR), dry matter intake and wool growth of lambs fed a basal diet of cottonseed hulls and kept at 25, 27 or 37 °C.

	Lwt Gain (g/d)	FCR (g/g)	Intake (gDM/d) CSH	Intake (gDM/d) Total	Wool (g/d)
TREATMENTS					
Temperature					
T1	118	9.3	955	1044	3.6
T2	126	8.6	966	1055	3.9
T3	104	10.0	927	1015	3.6
SEM	7ns	0.4†	20ns	34ns	0.2ns
Treated Casein					
0g	100	10.2	940	1005	3.1
50g	132	8.4	959	1071	4.3
SEM	6***	0.3***	28ns	28ns	0.2***
Temperature x Treated Casein					
T1x0g	91	11.1	941	1006	3.0
T1x50g	146	7.4	969	1082	4.1
T2x0g	116	9.1	979	1045	3.1
T2x50g	136	8.1	953	1065	4.8
T3x0g	93	10.4	899	964	3.3
T3x50g	114	9.6	955	1067	3.8
SEM	10ns	0.6*	48ns	48ns	0.3ns

SEM standard error of the mean and the significance level of the overall treatment effect

Appendix 5.3 Effects of supplementation with formaldehyde treated casein on the molar proportions and total concentration of the VFAs and ammonia levels in the rumen of sheep fed a basal diet of cottonseed hulls and kept at 25, 27 and 37 °C. (Data are for before feeding).

	Molar Proportions of VFA (%)						Total VFA (mmol/l)	Ammonia (mgN/l)
	Acet	Prop	But	IBut	Val	Ival		
TREATMENTS								
Temperature								
25 °C	81.0	11.5	6.6	0.36	0.37	0.25	80.5	44
27 °C	82.7	11.1	5.4	0.25	0.34	0.27	93.8	48
37 °C	83.0	11.4	4.8	0.30	0.29	0.26	77.4	38
SEM	0.7ns	0.5ns	0.4*	0.03†	0.03ns	0.04ns	3.7*	6ns
Treated Casein								
0g	81.5	11.8	6.0	0.28	0.25	0.23	11.1	24
50g	82.9	10.8	5.2	0.32	0.41	0.29	13.5	63
SEM	0.6†	0.4†	0.3†	0.02ns	0.02***	0.04ns	3.0**	5***
INTERACTIONS								
Temperature x Treated Casein								
25 °C x 0g	80.4	11.7	7.1	0.33	0.29	0.22	72.9	28
25 °C x 50g	81.6	11.2	6.1	0.39	0.45	0.28	88.1	60
27 °C x 0g	81.8	11.6	5.8	0.25	0.25	0.25	86.4	30
27 °C x 50g	83.5	10.6	5.0	0.24	0.43	0.28	101.2	67
37 °C x 0g	82.2	12.1	5.0	0.27	0.21	0.21	69.7	14
37 °C x 50g	83.8	10.6	4.6	0.34	0.36	0.32	85.1	62
SEM	1.0ns	0.7ns	0.5ns	0.04ns	0.04ns	0.06ns	5.2ns	9ns

Appendix 5.4 Effects of supplementation with formaldehyde treated casein on the molar proportions and total concentration of the VFAs in the rumen of sheep fed a basal diet of cottonseed hulls, vitamins and minerals and kept at 25, 27 and 37 °C. Data are for 4h after feeding.

	Molar Proportions of VFA							
	Acet	**Prop**	**But**	**IBut**	**Val**	**Ival**	**Total VFA (mmol/l)**	**Ammonia (mgN/l)**
TREATMENTS								
Temperature								
25°C	80.7	12.7	5.9	0.17	0.39	0.12	93.4	237
27°C	81.5	12.5	5.3	0.13	0.41	0.13	104.1	271
37°C	82.3	12.2	4.9	0.16	0.34	0.14	87.0	205
SEM	0.5ns	0.4ns	0.3†	0.03ns	0.03ns	0.02ns	4.6†	15*
Treated **Casein**								
0g	81.2	12.7	5.6	0.07	0.31	0.08	89.6	219
50g	81.8	12.2	5.2	0.23	0.45	0.18	100.2	256
SEM	0.4ns	0.3ns	0.3ns	0.02***	0.02***	0.02**	3.8†	12*
INTERACTIONS								
Temperature x Treated Casein								
25°Cx0g	80.5	13.0	6.0	0.05	0.30	0.06	91.5	217
25°Cx50g	80.9	12.3	5.8	0.28	0.48	0.18	95.4	258
27°Cx0g	80.9	12.7	5.9	0.09	0.37	0.11	99.7	247
27°Cx50g	82.1	12.4	4.7	0.18	0.45	0.15	108.4	294
37°Cx0g	82.3	12.4	4.9	0.08	0.26	0.08	77.5	194
37°Cx50g	82.3	11.9	4.9	0.23	0.42	0.21	96.8	215
SEM	0.7ns	0.5ns	0.5ns	0.04ns	0.04ns	0.03ns	6.5ns	21ns

Appendix 5.5 Effects of supplementation with formaldehyde treated casein and propionate on straw, total dry matter and digestible energy (DEI) intake, liveweight change (g/d) and wool growth (g/d) of lambs fed a basal diet of ammoniated barley straw and kept at 25°C or 37°C.

	Intake (gDM/d) Straw	Total	DEI (kJ/d)	Lwt change	Wool Growth
TREATMENTS Temperature					
25°C	657	750	7029	39.5	5.0
37°C	525	619	6037	-2.9	4.1
SEM	16***	16***	140***	4.1***	0.2**
HCHO-casein					
0g	590	660	5986	3.1	3.5
50g	591	708	7081	33.5	5.6
SEM	16ns	16*	140***	4.1***	0.2***
Propionate					
0g	620	706	6664	21.3	4.5
20g	561	663	6402	15.	4.63
SEM	16*	16†	140ns	4.1ns	0.2ns
HCHO-casein + propionate					
0g+0g	609	671	6007	0.8	3.1
50g+0g	632	741	7322	41.7	5.8
0g+20g	572	650	5965	5.3	3.8
50g+20g	551	676	6839	25.3	5.3
SEM	23ns	23ns	199ns	5.7†	0.2*
INTERACTIONS#					
Temperature x HCHO-casein					
25°C x 0g	637				3.6
25°C x 50g	676				6.3
37°C x 0g	544				3.3
37°C x 50g	506				4.9
SEM	23†				0.2*
Temperature x Propionate					
25°C x 0g	658	744	6972		
25°C x 20g	655	756	7086		
37°C x 0g	582	668	6357		
37°C x 20g	468	569	5718		
SEM	23*	23*	199†		
Temperature x HCHO-casein + Propionate					
25°C x 0g + 0g			6447	21.7	
25°C x 50g + 0g			7497	53.5	
25°C x 0g + 20g			6401	26.1	
25°C x 50g + 20g			7771	56.7	
37°C x 0g + 0g			5567	-20.1	
37°C x 50g + 0g			7147	30.0	
37°C x 0g + 20g			5529	-15.5	
37°C x 50g + 20g			5907	-6.1	
SEM			281†	8.1†	

SEM standard error of the mean and the significance level of the overall treatment effect

only significant interactions are presented

ADDENDUM

One of my examiners criticised the lack of comparisons between predicted liveweight gains from standards (eg. MAFF 1933) and actual growth rate of sheep. The point was repeatedly made in the thesis that the actual growth rates in the presence of protein were always much greater than that predicted, throwing doubt on the validity of such standards for prediction in sheep fed forage based diets. The following table shows a comparison of actual liveweight gains of lambs with predicted gains.

With or without supplements, considerable variation from the predicted levels of growth were seen throughout these studies. A comparison between actual and predicted liveweight gains from sheep considered to have an efficient microbial fermentation was 59 g/d ± 13.6 and 32 g/d ± 7.6, and for animals also supplemented with bypass protein was 91 g/d ± 11.1 and 43 g/d ± 5.1 respectively. This indicates that whilst the predicted and actual results were close for the group with an efficient rumen system, there was a large error in predicted growth rates when protected or bypass protein was present in the diet. The underestimates of production as predicted by standards where it was statistically sound to make such comparisons were 21 g/d or 80% higher than predicted, and 47 g/d or 110% higher than predicted for the no protein and the plus protein group respectively. This clearly supports the main thrust within the discussion of the thesis.

Comparison of actual liveweight gain of sheep with predicted values derived from the MAFF Bulletin 33 (1975).

Treatment		Liveweight gain (g/d)		
		Actual	Predicted	Difference
1. From Table 4.1*				
Nil	- restricted	38	3	35
	- *ad libitum*	72	68	4
Casein	- restricted	38	15	23
	- *ad libitum*	90	68	22
FC	- restricted	71	25	46
	- *ad libitum*	99	68	31
FCU	- restricted	74	25	49
	- *ad libitum*	100	59	41
2. From Table 4.3				
Urea	- restricted	44	3	41
	- *ad libitum*	99	43	56
Lupins	- restricted	61	37	24
	- *ad libitum*	106	69	37
FL	- restricted	56	42	14
	- *ad libitum*	107	69	38
FLU	- restricted	72	43	29
	- *ad libitum*	109	75	34
3. From Table 4.5				
Nil		75	15	60
P20		99	28	71
P40		84	17	67
FC		138	35	103
FC/P20		141	46	95
Acet		95	20	75
4. From Table 5.1				
Nil	25°C	103	34	69
	37°C	93	29	64
FC	25°C	141	47	94
	37°C	114	47	67
5. From Table 5.4				
Nil	25°C	22	17	5
	37°C	-20	1	-21
FC	25°C	54	35	19
	37°C	30	32	-2
P20	25°C	26	15	11
	37°C	-15	-1	-14
FC/P20	25°C	57	40	17
	37°C	-6	6	-12

*The reader is referred to the Tables given in the thesis.